BEFORE THE ILLINOIS POLLUTION CONTROL BOARD OF THE STATE OF ILLINOIS

IN THE MATTER OF:	)	
	)	
PROPOSED AMENDMENTS TO DISSOLVED OXYGEN STANDARD 35 ILL. ADM. CODE 302.206	)	R04-25

TRANSCRIPT OF PROCEEDINGS held in the hearing of the above-entitled matter, taken stenographically by Maria E. Shockey, CSR, before Richard R. McGill, Jr., Hearing Officer, at the James R. Thompson Center, Room 11-512, Chicago, Illinois, on the 29th day of June, A.D., 2004, scheduled to commencing at 10:00 a.m.

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

ILLINOIS POLLUTION CONTROL BOARD
James R. Thompson Center
100 West Randolph Street
Suite 11-500
Chicago, Illinois 60601
(312) 814-6983
BY: MR. RICHARD R. McGILL, Hearing Officer
MR. ANAND RAO
MS. ANDREA S. MOORE
MS. ALISA LIU
MR. THOMAS E. JOHNSON

GARDNER, CARTON & DOUGLAS,
191 North Wacker Drive
Suite 3700
Chicago, Illinois 60606-1698
(312) 569-1441
BY: MR. ROY M. HARSCH and
MS. SHEILA H. DEELY

Appeared on behalf of the Illinois Association of Wastewater Agencies;

ENVIRONMENTAL LAW & POLICY CENTER,
35 East Wacker Drive
Suite 1300
Chicago, Illinois 60601
(312) 795-3707
BY: MR. ALBERT ETTINGER

Appeared on behalf of the Sierra Club, Prairie Rivers Network.

PANEL MEMBERS:

MR. JAMES E. GARVEY
MR. DENNIS STREICHER
MR. JOHN M. CALLAHAN

HEARING OFFICER McGILL: Good morning. My name is Richard McGill. I'm the hearing officer in this rulemaking, R04-25. We're going on the record briefly now just to note that the hearing room we have here is not large enough to accommodate the turnout we've today and so we're going to briefly recess and move to another location just outside of this hearing room that should accommodate the crowd we've got here today. So with that, we'll recess for five or ten minutes and go off the record. Thank you.

(Whereupon, a short recess was had.)

HEARING OFFICER McGILL: Good morning. Welcome to the Illinois Pollution Control Board. We went on the record at 10:00 and recessed so that we could set up in a hearing room that could accommodate the large turnout we've had today. So it's about 10:22 and we are now back in session, and, again, I just wanted to welcome you.

My name is Richard McGill. I'm the hearing officer in this rulemaking docketed as R04-25. The rulemaking proceeding is entitled Proposed Amendments to Dissolved Oxygen Standard,

35 Illinois Administrative Code, Section 302.206.

The Board received this rulemaking proposal on April 19, 2004 from the Illinois Association of Wastewater Agencies or IAWA. On May 6th, the Board accepted the rulemaking proposal for hearing. IAWA seeks to amend the Board's rules establishing general use of water quality standards for dissolved oxygen.

Today is the first hearing. We have a second hearing scheduled for August 12, 2004 in Springfield. Also present today on behalf of the Board, to my far left is Board member Tom Johnson. To my immediate left, Board member Andrea Moore, she's the lead Board member on this rulemaking; and to my right, the two members of our technical unit, to my far right, Alisa Liu and to my immediate right, the head of the technical unit, Anand Rao.

I'd also like to welcome members of the general public and representatives of the many number of organizations that we have here today. I see representatives from the Governor's office, Illinois Environmental Protection Agency, Prairie Rivers Network, Sierra Club, Farm Bureau -- great turnout today -- USEPA. We really appreciate

everyone's interest in this rulemaking proceeding. I'm sure I've left out some organizations, but you're all welcome.

Today's proceeding is governed by the Board's procedural rules. All information that is relevant and not repetitious or privileged will be admitted into the record. We'll begin today's proceeding with the IAWA's testimony followed by any questions the Board or members of the audience may have for the IAWA's witnesses.

Please note that any questions posed by the Board are designed solely to help develop a complete record for the Board's decision and they do not reflect any bias for or against the proposal. After the questioning period for the IAWA, anyone else may testify on the proposal, time permitting. Like all witnesses who testify today, you'll be sworn in and you may be asked questions about your testimony.

For the court reporter, I would ask that you please speak up, especially in this room. We've got fans going. It's kind of a long room and it's going to be hard to hear, so I would ask all of the witnesses or people asking questions

to speak up. And also, try not to talk over one another so we can get a clear transcript.

Are there any questions about the procedures we'll follow today?

MR. FISCHER: Will a transcript be made available to the participants? And my name is Michael Fischer, F-I-S-C-H-E-R. I'm the policy advisor for the Lieutenant Governor, Pat Quinn.

HEARING OFFICER McGILL: Yeah. The transcript of today's proceedings will be available to the public. It will be posted on our web site. How quickly that happens is going to depend in part on the duration of our hearing today. I'm anticipating that it will be a pretty full day.

My best guess would be probably in ten days or so we should receive that transcript and be able to post it on our web site and it will be available in our Clerk's office. But at the end of the day, our court reporter will probably have a more precise idea of how long it will take to turn this around.

MR. FISCHER: Thank you, Richard.

HEARING OFFICER McGILL: Sure.

One other preliminary item: The IAWA moved to replace the written testimony of Dr. James E. Garvey due to a formatting error in the prefiled testimony. Having received no objection to that motion, I grant the IAWA's motion.

With that, would the court reporter go ahead and swear in the IAWA's witnesses and the IAWA's attorney collectively at this time?

THE REPORTER: Sure.

(Witnesses sworn.)

HEARING OFFICER McGILL: Thank you.

At this point, I'll turn it over to the IAWA's attorney, Roy Harsch, to begin the presentation on behalf of the rulemaking proponent.

MR. HARSCH: Good morning. My name is Roy Harsch. I'm here today with Sheila Deely from my firm. We represent the Illinois Association of Wastewater Agencies. We would like to thank the Pollution Control Board for timely accepting the rule petition the IAWA has filed.

We will have three witnesses today, Dennis Streicher, John Callahan, and Jim Garvey. We will also have six exhibits. They are the prefiled exhibits that we have filed with

the Pollution Control Board previously. We have provided the hearing officer with marked copies.

The first exhibit is entitled An Assessment of National and Illinois Dissolved Oxygen Water Quality Criteria, Dr. James E. Garvey and Dr. Matt R. Whiles of Southern Illinois University. That was filed with the original Board rulemaking proposal.

Exhibit No. 2 is the United States Environmental Protection Agency's National Criteria Document, NCD, for dissolved oxygen from 1986. The third exhibit is the resume of Dennis Streicher. The fourth exhibit is copies of letters that Mr. Streicher has sent to various organizations concerning the proposed rulemaking.

Exhibit No. 5 is the resume of Dr. Garvey, and No. 6 is the resume of Dr. Matt Whiles, who's the co-author of Exhibit No. 1. We have previously marked them and provided copies to the court reporter. And I would move their acceptance at this time if there's no objection.

HEARING OFFICER McGILL: Okay. So at this point, we have a motion to enter six hearing exhibits. Again, they would be numbered 1 through

6, as Mr. Harsch has indicated. The first one is An Assessment of National and Illinois Dissolved Oxygen Water Quality Criteria by Dr. James Garvey and Dr. Matt Whiles of Southern Illinois University. Is there any objection to entering that into the record as a hearing exhibit?

(No response.)

Seeing none, that will be Hearing Exhibit No. 1. The second document is a USEPA National Criteria Document for Dissolved Oxygen. Any objection to entering that as a hearing exhibit?

(No response.)

Seeing none, that will be Hearing Exhibit No. 2. Hearing Exhibit No. 3 is a resume of Dennis Streicher.

(No response.)

Seeing no objection, that's entered as Hearing Exhibit No. 3. What would be Group Hearing Exhibit No. 4 would be copies of letters from Dennis Streicher to various organizations concerning the proposed rulemaking. Is there any objection?

(No response.)

Seeing none, that will be Group Hearing Exhibit No. 4. And the last two hearing

exhibits, Hearing Exhibit No. 5, a resume of Dr. Garvey, seeing no objection, I'll enter that as Hearing Exhibit No. 5, and then Hearing Exhibit No. 6, the resume of Dr. Whiles, seeing no objection to entering that into the record as a hearing exhibit, that will be Hearing Exhibit No. 6.

MR. HARSCH: Thank you.

The IAWA, as will be testified to today by Mr. Streicher and Mr. Callahan, recognize the importance of the dissolved oxygen water quality standard and the need for the revision of that water quality standard and started the process that gave rise to the technical assessment that was prepared by IAWA's consultants, which is Exhibit 1 in this proceeding.

Under the Clean Water Act, Section 33 U.S., Code 1313(c): States are required to revise water quality standards within three years of the adoption of national criteria by USEPA. In 1984, USEPA formally adopted a revised dissolved oxygen water quality criteria, and to date, the Illinois Environmental Protection Agency or Pollution Control Board or any other party does not come forward with any revision to the Illinois

standard.

It is for that reason and the belief that the standard is in fact one that's on the books not supported by scientific evidence that IAWA has started this proceeding. This proposal is intended to be a start. We look forward to the comments and addressing the comments that we've received to date and will continue to welcome any comments or questions on the record or after the close of today's hearing prior to the next hearing and will attempt to respond to those comments and questions as we move forward.

At this point, I would like to present the first witness, Dennis Streicher.

HEARING OFFICER McGILL: Okay.

MR. HARSCH: Mr. Streicher, would you state your name for the record?

MR. STREICHER: My name is Dennis Streicher.

MR. HARSCH: And where are you currently employed?

MR. STREICHER: I am employed by the City of Elmhurst as director of water and wastewater.

MR. HARSCH: Is Exhibit No. 3 a true and accurate copy of your resume?

MR. STREICHER: Yes.

MR. HARSCH: And have you prepared written testimony for today's hearing?

MR. STREICHER: I have.

MR. HARSCH: At this point, I would like the witness to please read that prefiled testimony.

HEARING OFFICER McGILL: Go ahead.

MR. STREICHER: Thank you. My name is Dennis Streicher. I'm director of water and wastewater with the City of Elmhurst, Illinois. I've been employed by the City of Elmhurst at the wastewater treatment plant since 1972. I began my career in Elmhurst as a chemist, graduated with a biology degree.

I worked in the lab for approximately 15 years and was promoted to plant superintendent, assistant director of public works, then to director of a newly created department of water and wastewater. My responsibilities include, in addition to the operation of the wastewater treatment plant, operation of the public water

supply and of all storm and sanitary pumping utilities in the city.

I hold an Illinois EPA Class 1 Operators license and an Illinois EPA Class A Potable Water Operators license. A copy of my resume, as Roy said, is attached. I come before you today, however, representing the Illinois Association of Wastewater Agencies as a committee chair for dissolved oxygen standards in Illinois. I'm also the current vice president of IAWA. The IAWA is a professional association representing the major wastewater treatment plants in the state of Illinois.

We have over 100 members and affiliate members, which include approximately 55 districts and municipalities throughout the state. These agencies operate dozens of publicly owned treatment works. In addition to these POTWs, water reclamation districts and municipalities, the largest Illinois private wastewater treatment utility which operates 12 plants is also a member.

The representatives of these organizations are public officials and include both elected and appointed trustees of districts and

appointed officials at municipalities throughout the state. Our constituents are the citizens and taxpayers of Illinois and are the same constituents as any other state or public agency.

My goal today is not to present the technical aspects of the proposed rule change; Dr. Garvey is the expert in that area. My hope is to present the IAWA perspective on the existing dissolved oxygen regulations in Illinois and why we feel it's time to update those standards.

The managers of the POTWs in Illinois have two interests in mind: One is the integrity of the environment in which they work and the second is to responsibly represent their constituents and charge reasonable rates for our service. Our jobs as managers of the state's POTWs are the real application of the water quality standards as promulgated in Illinois to the operation of sometimes large but always complex water treatment facilities.

These POTWs have an excellent record of producing treated effluent in conformance with applicable NPDES permit limitations due in large part to the investment of public dollars to

construct and upgrade the facilities and the experience and dedication of those that operate and maintain the plants.

This proposed rulemaking is consistent with IAWA's purpose and past practice to ensure that the standards by which it operates are based on sound science and to take action to update standards where scientific information supports such a change.

IAWA has engaged the highest qualified experts consistent with its purpose and has performed a variety of assessments that have been used by the Illinois EPA and the Board to assess Illinois standards governing the discharges of its members.

IAWA proposed the rulemaking that resulted in revision of certain water quality standards governing ammonia nitrogen in R02-19, and the Board adopted a revised rule in 2002. IAWA had participated in a prior rulemaking brought by the Illinois EPA to revise the ammonia regulations.

During the pendency of that rulemaking, USEPA revised the National Criteria Document for ammonia. After discussing this

revision with the representatives of the Illinois EPA, it became apparent that the Illinois EPA did not have the interest or resources to initiate rulemaking to again revise the ammonia regulations.

Because of the impact that the recently adopted ammonia regulations had on wastewater treatment plants and because the regulations were in fact based upon outdated science, IAWA initiated and saw to completion the rulemaking in R02-19 and ultimately the accompanying Illinois EPA implementation regulations to ensure that Illinois' ammonia effluent limits were consistent with USEPA's National Criteria Document and based upon sound, current science.

The managers and officials who operate wastewater treatment plants and who needed to invest in upgrades for their facilities were able to make the case to their respective district boards and city councils for authorization for the necessary dollars to meet an appropriate and justifiable ammonia standard.

IAWA is committed to following the same course of action as it did in the ammonia rules whenever it is apparent that effluent limits and

water quality standards that have a significant impact on POTWs are in need of revision, and the Illinois EPA does not have the resources or the inclination to initiate the appropriate evaluation and ultimate regulatory proceedings. This dissolved oxygen rulemaking is IAWA's second such effort.

Various IAWA members were involved in a series of discussions with representatives of the Illinois EPA and other regulators, many of whom had publicly stated that the existing Illinois dissolved oxygen water quality standard found at 35 Illinois Administrative Code, Section 203 was not based on sound science, was inconsistent with USEPA's National Criteria Document and was too stringent.

At the same time, IAWA was aware that many water bodies throughout Illinois were not in compliance with the existing dissolved oxygen water quality standard or would not be found to be in compliance if dissolved oxygen measurements were taken early in the morning due to the naturally occurring diurnal dissolved oxygen fluctuation cycle. IAWA decided to undertake a scientific assessment of the dissolved oxygen standard almost

three years ago.

In 2002, IAWA engaged Dr. James Garvey and Dr. Matt Whiles, who concluded that the Illinois standard was too rigid and not consistent with the USEPA's National Criteria Document for dissolved oxygen. Dr. Garvey and Dr. Whiles have done an excellent job in putting together a review of data that has been generated since the 1980s, have applied their knowledge and skills and training to their understanding of all of the data generated since that time, and have made recommendations that the IAWA feels are reasonable and accurate.

Because revision of the dissolved oxygen standard was not a priority of Illinois EPA, the IAWA elected to itself bring this petition to the Illinois Pollution Control Board. The IAWA is very concerned that the existing dissolved oxygen standard is triggering other legal requirements that are not warranted by scientific information.

The Illinois EPA is currently insisting on the imposition of a dissolved oxygen water quality effluent limitation in NPDES permits of a six-milligram per liter standard to be met continuously. It is IAWA's understanding that this

effluent limitation is being placed in NPDES permits to ensure that the existing water quality standard is not violated.

In instances where POTWs are unable to comply with this limitation, the Illinois EPA has granted construction schedules requiring investment of public dollars to meet it. Illinois EPA is required by Section 305(b) of the Clean Water Act to assess the water quality of Illinois waters and prepare a report commonly known as the 305(b) Report.

Based on this report, Illinois EPA is additionally required by Section 303(d) of the Clean Water Act to develop a list of impaired waters in Illinois commonly known as the 303(d) list. The draft 2004 303(d) list of impaired stream lists over 300 stream segments in Illinois as impaired for dissolved oxygen.

The 305(b) and 303(d) reports are then used to determine the waters and parameters for which total maximum daily loads or TMDLs will be established, establishing load limits for dischargers to each listed waterway. All of these requirements adhere to the current standards even if

those standards are not scientifically based as we believe to be the case with the Illinois dissolved oxygen standard.

This can only result in unrealistic and unwarranted permit limits requiring expensive capital improvements and modifications to wastewater treatment facilities at taxpayer expense or unjustified reasons for plant expansions.

In my position at the City of Elmhurst, I, together with other IAWA member agencies, have watched and participated with great interest in the Illinois EPA's efforts to establish TMDLs for the West Branch of the DuPage River, the East Branch of the DuPage River, and Salt Creek basins. These three TMDLs mark the first effort by the Illinois EPA to develop TMDLs in urban areas with significant potential impact from POTWs, combined sewer overflows, storm sewer discharges, and other urban impacts.

In the initial drafts, the TMDLs for the East Branch of the DuPage and Salt Creek would have required limitations on CBOD and ammonia because these streams were listed as impaired under the existing standard for dissolved oxygen. The

potential for the TMDLs to be finalized with an ultimate requirement for more restrictive CBOD and ammonia limitations in existing NPDES permits could have a significant impact on POTW discharges to those basins.

Either expensive capital investment would be required with increased operational expenses or a loss in the existing treatment plant capacity that has been built to service future growth may be required. Additional efforts were discussed as well, including stream re-aeration and dam removal as additional potential means for meeting the existing dissolved oxygen water quality standard.

The IAWA and I believe that these consequences of failure to meet the standard should only result if there is an actual environment problem applying a scientifically sound dissolved oxygen water quality limitation. Let me illustrate with a description of what is happening today in the Salt Creek basin. The plant that I manage discharges to Salt Creek in DuPage County.

As I said, the Illinois EPA has or is about to submit a completed TMDL on Salt Creek to

USEPA. That TMDL has found Salt Creek to be impaired for dissolved oxygen and had recommended that significant additional effluent limits on CBOD and ammonia be imposed on POTWs in the watershed, the TMDL estimated costs for those improvements to be about $18 million. These are costs that the POTWs will bear alone.

At this time, stakeholders in the basin, and I'm one of them, are deeply involved in an effort to form a watershed committee. One of the goals of the committee will be to attempt to develop more meaningful data, including biotic data, to further refine the TMDL study and hopefully mitigate the future costs. There is no guarantee that will be successful. The cost of this effort in time and dollars, however, certainly will be significant.

The IAWA believes that given the large number of water body and stream segments that are listed as non-compliant with the current dissolved oxygen standard or impaired for dissolved oxygen reasons, Illinois should ensure that the existing dissolved oxygen water quality standard is an appropriate standard based upon sound science and consistent with USEPA's National Criteria Document.

The costs now being incurred on the Salt Creek and East Branch of the DuPage River basin could be multiplied by each of those additional basins identified as impaired for dissolved oxygen using the existing inappropriate standard.

IAWA believes this proposed dissolved oxygen rulemaking is consistent with Section 303(c) of the Clean Water Act, 33 U.S.C. 1313(c), which requires the states' review and re-evaluate existing water quality standards within three years of adoption of revised national criteria by USEPA.

To date, despite the acknowledgment by many within the Illinois EPA that the existing dissolved oxygen water quality standard is out of date and inconsistent with the NCD, Illinois has not undertaken such a review.

Dr. Garvey points out in "An Assessment of National and Illinois Dissolved Oxygen Water Quality Criteria" that dissolved oxygen concentrations fluctuate in natural systems. Dissolved oxygen has a diel fluctuation, it has a seasonal fluctuation, and concentrations could be

different through the water column. Animals living in those conditions have evolved a tolerance for those fluctuations.

The current regulation does not take into account seasonal fluctuations. My own career began at the same time as the development of many of today's water quality regulations. I have been able to observe that development from the inception of the Clean Water Act to today.

I observed the infant Illinois EPA and the Illinois Pollution Control Board struggling with the proposal and adoption of water quality standards and were faced with the almost insurmountable demands to develop them quickly. At that time, there was a rash of new standards being developed with the aim of quickly attaining water quality goals. Many of the standards are still in effect today.

The dissolved oxygen standard used in Illinois was promulgated during that initial period almost three decades ago and has not been revised since. When the work of Dr. Garvey and Dr. Whiles and the proposed regulation were completed, I was excited to volunteer to represent

the IAWA in an effort to see this study through rulemaking of the Pollution Control Board and to be a part of the process to develop realistic dissolved oxygen standards in Illinois.

As part of this effort, I contacted and shared the report with a number of other groups within the state to look for their support and for their comments on the study. I sent letters to the Illinois Department of Agriculture, the Illinois Farm Bureau, the Illinois Environmental Regulatory Group, and the Illinois State Water Survey.

I personally spoke to members of all of those agencies that I mentioned and asked them for their thoughts and if they had concerns, to let me know and to follow-up on my letters sent to them. Those letters are submitted as IAWA's Exhibit 4. In every single instance, the persons I spoke to expressed support and a hope that the Board would adopt this rule.

I also copied many of the citizen advocacy groups such as the Sierra Club, Prairie Rivers Network, The Salt Creek Watershed Alliance, the DuPage Conservation Foundation, and

Environmental Law and Policy Center. Our goal was to offer those folks an opportunity to comment as well. The goal of IAWA was to be as inclusive as possible.

In summary, it is commonly known throughout the state that the current dissolved oxygen regulation is not scientifically justifiable. Because of its importance in the regulatory regime in Illinois, an accurate and realistic dissolved oxygen standard is critical. IAWA has spent considerable time and incurred a significant expense to ensure that it has the most recent and strongest scientific data to support its rulemaking.

I urge the Board to proceed with the rulemaking as proposed by the IAWA. Thank you for the opportunity to address this issue before the Board.

HEARING OFFICER McGILL: Thank you.

MR. HARSCH: I just have just a couple of follow-up questions if I might.

HEARING OFFICER McGILL: Go ahead.

MR. HARSCH: At the time -- on or about the time that IAWA filed the proposal with the Board, did the president of IAWA also send a copy of

the proposal and the documents prepared by Drs. Garvey and Whiles to USEPA?

MR. STREICHER: Yes, he did.

MR. HARSCH: And on June 18, did representatives of IAWA, USEPA, and IEPA have a meeting to discuss this proposal?

MR. STREICHER: Yes, we did.

MR. HARSCH: And did we have a meeting yesterday with representatives of the Illinois Department of Natural Resources, various offices within that department, and the environmental groups that you listed in your written testimony?

MR. STREICHER: Yes, all of those groups were present.

MR. HARSCH: At this point in time, I'd like to ask Mr. Callahan to testify.

HEARING OFFICER McGILL: Okay. I'm just going to take a moment to explain the questioning process: Once these three witnesses for IAWA have finished testifying, then they'll be subject to questions from anyone present here. So right now, we're going just to proceed with that testimony.

Counsel for the IAWA may have some

follow-up questions after each person testifies, but once the three of them have testified, they will be available as a panel to answer questions from anyone present here today. Thanks.

MR. HARSCH: Mr. Callahan, would you state your name for the record?

MR. CALLAHAN: My name is John Michael Callahan.

MR. HARSCH: And are you currently employed?

MR. CALLAHAN: I am employed as the executive director of the Bloomington and Normal Water Reclamation District of McLean County, Illinois.

MR. HARSCH: Have you prepared written testimony for today's proceeding?

MR. CALLAHAN: Yes, I have.

MR. HARSCH: Mr. Hearing Officer, I'd like the witness to have permission to read that written testimony.

HEARING OFFICER McGILL: Go ahead.

MR. CALLAHAN: Good morning. In my testimony, I would like to introduce some of the history of IAWA's involvement in this proceeding.

I've been in the employment of the BNWRD for thirty-one years during which time I've held positions of increasing responsibility from that of chemist to my current position of executive director.

I've received a B.S. degree from Illinois State University with double majors in biological sciences and environmental health. I have a master of arts degree from the University of Missouri in ecology with an emphasis on nutrient cycling. I pursued doctoral studies in biological sciences at Illinois State University, again, with an emphasis on nutrient cycling.

I hold an Illinois Environmental Protection Agency Class 1 Wastewater Treatment Plant Operator license. I have been a member of the Phi Sigma National Biological Honor Society for 30 years and a member of the Sigma Xi Scientific Research Society for 23 years. I've been actively involved in professional organizations representing various aspects of the wastewater treatment industry and have held positions of leadership in such organizations.

These organizations include the

Illinois Association of Wastewater Agencies, the Illinois Water Pollution Control Operators Association, and the Central States Water Environment Association. I have been a member of the Water Environment Federation for more than 25 years.

During my career, I've served on several stakeholder groups organized by the Illinois Environmental Protection Agency to assist in the formulation of standards and policies concerning both Illinois water quality and various issues regarding wastewater treatment within the state.

I have published and/or presented numerous papers on various aspects of wastewater treatment throughout my career. It has been my privilege to previously appear before the Illinois Pollution Control Board to offer input on key issues of widespread importance to our state. I thank the Illinois Pollution Control Board for the opportunity to appear again today to discuss the need for a re-evaluation of the Illinois dissolved oxygen water quality standard.

I am offering testimony on behalf of the IAWA and in support of Mr. Dennis Streicher,

who is directing the IAWA initiative. The need for a revised Illinois dissolved oxygen standard has existed for some time, however, two relatively new initiatives in water quality improvement within the state have mandated that the issue of revising the dissolved oxygen standard be undertaken at this time.

These mandates are in response to the need to develop scientifically derived nutrient standards and to more precisely direct the adoption of total maximum daily load allocations to Illinois water listed as not attaining designated use support. Since its inception approximately four years ago, I have been a member of the IEPA Nutrient Science Advisory Work Group.

This work group was assembled by IEPA to develop a strategy for scientifically deriving water quality standards for nitrogen and phosphorus. Historically, the work group was chaired by Mr. Robert Mosher of IEPA. Recently, Mr. Paul Terrio of the U.S. Geological Survey has replaced Mr. Mosher as work group chair.

The water quality degradation ascribed to phosphorus and nitrogen is a phenomenon

called eutrophication. Eutrophication is a condition which develops when the naturally limiting nutrient of an ecosystem is increased to the extent that the overall balance of ecosystem dynamics is upset. The limiting nutrient of most freshwater ecosystems is phosphorus. Degrading concentrations of phosphorus effectively over fertilize the fresh water aquatic system and result in enhanced algal growth. Such algae are aerobic organisms.

During daylight hours, algae photosynthesizes. A byproduct of photosynthesis is oxygen. As a result of this photosynthesis during early stages in the development of eutrophication, daytime dissolved oxygen levels can be maintained such that little negative effect is realized in an aquatic system. However, during the night when no sunlight is present to power photosynthesis, the increased algae population must continue cellular respiration as must the remaining aerobic biota of a freshwater ecosystem.

Ultimately, the total oxygen demand required by these respiring organisms exceeds the ambient nighttime re-aeration capability of a water body. Consequently, oxygen-sensitive species

are put at stress and population levels of such organisms may significantly diminish.

A self-perpetuating downward spiral of aquatic organism diversity can thus easily develop as eutrophic conditions continue to persist. The IEPA Nutrient Science Advisory Work Group immediately recognized the determination of the concentration of phosphorus at which the eutrophication cycle begins to cause problematic dissolved oxygen depletion to be one of the first essential steps in developing an effective and scientifically derived phosphorus standard.

Regrettably, it was also recognized that this critical concentration of dissolved oxygen was not known. However, many professionals throughout Illinois agreed that the current Illinois dissolved oxygen water quality standard does not represent the dissolved oxygen concentration which is critical to preventing the onset of eutrophication.

In fact, there exists general agreement among professionals that the ambient dissolved oxygen concentrations of the waters of Illinois frequently naturally fall beneath the

existing dissolved oxygen water quality standard. Mr. Mosher, as chair of the work group, was one of the individuals that initially suggested a re-evaluation of the Illinois dissolved oxygen water quality standard was a timely consideration.

Although there existed widespread agreement several years ago within the work group that a reassessment of our state's dissolved oxygen water quality standard was warranted, IEPA indicated the agency did not have the resources or manpower to undertake such an effort at that time.

Realizing this need and the lack of available resources, I asked Mr. Mosher if IEPA would be receptive to and supportive of a third-party investigation into the issue of the dissolved oxygen standard. Such action was not unprecedented, as Mr. Streicher indicated.

The IEPA had supported the IAWA in a previous issue brought before the Illinois Pollution Control Board involving the ammonia nitrogen water quality standard. I was advised that IEPA would support such an undertaking, but definitely wanted input into the design of the research investigation.

I then approached the IAWA membership asking if sufficient interest existed for IAWA to fund a third-party analysis of both the existing Illinois dissolved oxygen standard as well as an investigation that would provide a recommendation for an appropriate dissolved oxygen standard for Illinois.

The IAWA membership readily agreed to fund such work and directed me to investigate both the methods by which such a research study could be undertaken as well as the willingness of qualified professionals within Illinois to undertake the study.

I initially contacted Dr. Matt Whiles of the Southern Illinois University Fisheries Research Laboratory to both inquire of his possible interest in undertaking such work as well as his recommendation of any other qualified individuals of which he was aware that might be interested in the research.

Dr. Whiles indicated that he was quite interested in the project and that he thought a colleague of his, Dr. James Garvey, would be very interested in assisting him with the work. I

reported back to the IAWA membership that Dr. Whiles and Dr. Garvey had expressed considerable interest in undertaking the project. The IAWA membership then unanimously voted to retain the services of the two gentlemen.

This agreement was reached in the summer of 2002. On September 30, 2002, Dr. Whiles and I met with Mr. Mosher, Mr. Greg Goode, and other IEPA staff to discuss aspects of the issue that IEPA felt were critical to the investigation such that a technically justifiable dissolved oxygen standard supportable by sound science could be developed.

Agreement was reached among those in attendance on the key issues which Dr. Whiles and Dr. Garvey should investigate to satisfactorily address all concerns. I had previously suggested to the IAWA membership that the conclusions of the work done by Dr. Whiles and Dr. Garvey should not be released publicly until both the IEPA and the IAWA had an opportunity to review them.

The IAWA readily agreed to this qualification. I advised those in attendance at the IEPA meeting that such was the qualification IAWA had placed on the work to be done by Dr. Whiles and

Dr. Garvey. Again, this was the procedure previously agreed upon between IEPA and IAWA during the ammonia nitrogen water quality standard development.

The IEPA representatives were appreciative of this consideration. Dr. Whiles and Dr. Garvey presented their initial draft report on this investigation to me in early January of 2004. I immediately circulated copies of the report to the IAWA executive committee and the IAWA Nutrient subcommittee as well as to IEPA.

It was at this point in the proceedings that I withdrew from a lead role in the development of the standard, and Mr. Streicher volunteered to coordinate the upcoming rulemaking proposal. The previous discussion presents the need for a sound understanding of dissolved oxygen dynamics in the waters of our state such that meaningful and technically justifiable nutrient standards can be developed.

Addressing either water quality parameter, nutrients or oxygen without consideration and a sound understanding of the other will not result in a comprehensive and effective resolution

of the eutrophication problem. I personally find it quite surprising and very sad that we know no more about the interaction of these parameters than we presently do, however, such is indeed the situation.

I assure everyone present that the cost of addressing the nutrient issue in Illinois will be extreme, however, I suggest that we look beyond the actual monetary cost of such requirements. A statistic I've often heard quoted regarding the wastewater treatment industry states that for every pound of carbonaceous waste we currently remove from wastewater, four pounds of carbon in the form of carbon dioxide are released to the atmosphere through the energy generation required for removal of that pound of waste.

Nutrient removal will only add to this energy requirement. A thorough understanding of the dynamics and interaction of nutrients and oxygen is absolutely essential for effective and efficient stewardship which addresses this issue. A valid and scientifically based dissolved oxygen standard is fundamental to this understanding.

The second mandate involving the need for a current reassessment of the dissolved

oxygen standard to which I earlier referred involves the effort currently under way to develop total maximum daily load allocations for waters of the state which are determined not to be achieving full use designations.

The TMDL procedure evaluates a watershed in an attempt to determine what the assimilation rate of that watershed is for various parameters. Hypothetically, both point source and non-point source contributions of various parameters are considered in determining the reduction in loading necessary to realize use attainment for each parameter of concern.

However, there regrettably exists little apparent regulatory control other than voluntary best management practices that can force non-point contributions of various parameters to be reduced to levels which are not detrimental to a watershed. The readily controlled and regulated contributions to a water body come from point sources.

There may or may not be effective additional controls which can be applied to point sources that will assist in achieving full use

attainment. I believe that a specific solution for a specific location will not universally solve the problems experienced by all use impaired waters across the state.

The dynamics and physical conditions of each water body must be assessed and considered as unique to that particular location. However, inadequate dissolved oxygen is listed on the IEPA draft 303(d) list as a fairly universal parameter contributing to non-use attainment and subsequent inclusion of water bodies on that list.

The draft 2004 303(d) list contains approximately 300 water body segments in Illinois listed as impaired, at least in part, by inadequate dissolved oxygen concentrations. Approximately 800 water bodies are listed on the list; therefore, approximately one-third of the water bodies listed on the draft 303(d) list are listed in part because of a dissolved oxygen standard which many professionals have indicated is overly protective and not specific to the needs of the waters of Illinois.

This dissolved oxygen contribution to non-attainment is based on the current Illinois

dissolved oxygen water quality standard, which, as previously discussed, has long been considered to be a questionable validity. Some point dischargers are now having a minimum dissolved oxygen limit included in their NPDES permits.

In many situations, I believe that compliance with an effluent dissolved oxygen permit limit of six milligrams per liter will have virtually no effect on improving receiving stream dissolved oxygen concentrations when the naturally occurring ambient diurnal dissolved oxygen minima of that stream might easily be 4.5 milligrams per liter.

One might speculate that over protection is not necessarily unwarranted in its own right. However, I again, respectfully, remind the Board that compliance with a standard, over protective or not, has a cost inherently associated with it. Increased dissolved oxygen concentrations in effluents require that air be supplied to these waters before discharge.

This air comes from blowers, which are powered by electricity. As I mentioned previously, a rule of thumb in our industry

currently estimates one pound of carbonaceous waste removed results in four pounds of carbon in the form of carbon dioxide released to the atmosphere.

Are we as a society through the TMDL program going to require that we aerate treatment plant effluents or provide additional treatment within our plants to comply with a flawed dissolved oxygen standard and thereby perhaps contribute another pound or two of carbon dioxide to the atmosphere for the energy required to do so on a per unit basis?

I certainly hope that our society chooses not to follow that path, rather, I strongly encourage the Board to adopt the dissolved oxygen standard being proposed in this proceeding. It has been developed by professional aquatic biologists in consideration of the requirements of the aquatic biota of our state. The proposed standard is based upon and more conservative than the USEPA recommended guidance for development of dissolved oxygen standards.

Thank you for this opportunity to again provide testimony and appear before the Illinois Pollution Control Board. Thank you.

MR. HARSCH: At this point in time, I'd like to call Dr. Garvey to testify.

HEARING OFFICER McGILL: Go ahead.

MR. HARSCH: Dr. Garvey, would you state your full name for the record?

MR. GARVEY: James Edward Garvey.

MR. HARSCH: Where are you currently employed?

MR. GARVEY: Southern Illinois University for the Fisheries and Illinois Aquaculture Center as an assistant professor.

MR. HARSCH: Have you prepared a resume, which is found as Exhibit 5 in this proceeding?

MR. GARVEY: Yes, I have.

MR. HARSCH: Are the statements contained in there true and accurate?

MR. GARVEY: Yes, they are.

MR. HARSCH: And were you the co-author, along with Dr. Whiles, of what is Exhibit 1 in this proceeding?

MR. GARVEY: Indeed.

MR. HARSCH: Would you please read your written testimony today?

MR. GARVEY: I am Dr. James Garvey, assistant professor in the Fisheries and Illinois Aquaculture Center at Southern Illinois University in Carbondale. I have been engaged by the Illinois Association of Wastewater Agencies, along with my colleague, Dr. Matt Whiles, to scientifically evaluate the current State of Illinois dissolved oxygen standard and to provide recommendations about how the Illinois standard might be revised and updated if warranted by our scientific evaluation.

Both Dr. Whiles and I are broadly trained in aquatic ecology. My specialty is the ecology of fishes with much of my research focusing on how environmental conditions affect fish physiology, abundance, and distribution. My short curriculum vitae has been submitted as IAWA's Exhibit No. 5.

Dr. Whiles, a professor in the department of zoology, is an expert on the ecology of aquatic invertebrates and their role in streams and lakes. His resume has been submitted as IAWA's Exhibit 6. Our combined experienced qualified us to provide an objective assessment of the current state of knowledge about how dissolved oxygen affects

aquatic organisms and to evaluate the current statewide one-day minimum standard of five milligrams per liter.

We did not intensively evaluate the application of the state standards to Lake Michigan, and IAWA has not proposed to revise that standard. Dr. Whiles and I began our assessment by reviewing published, typically peer-reviewed research on how dissolved oxygen affects aquatic organisms and how dissolved oxygen varies in lakes and streams.

We also reviewed the National Ambient Water Quality Criteria Document for Dissolved Oxygen, NCD, published by the United States Environmental Protection Agency in 1986, and that is submitted as IAWA's Exhibit 2. We evaluated the current monitoring of water quality in Illinois and conferred with the Illinois EPA concerning the scientific basis for the current Illinois dissolved oxygen standard. We then prepared a written report of our findings, which is submitted as IAWA Exhibit No. 1.

In the final report, Dr. Whiles and I emphasize that using biological and habitat

quality criteria to evaluate the suitability for aquatic life use in the surface waters of Illinois is of paramount importance and should be continued to be emphasized in monitoring programs. It is unlikely that any one water quality parameter, such as dissolved oxygen concentration, will capture the capacity of a stream or lake to support aquatic life.

Although our recommended dissolved oxygen standards are sufficiently protective of aquatic life in Illinois, we recommend that the regulators strive to maintain dissolved oxygen concentrations well above these minima when possible.

We agree with the concerns voiced by some colleagues that the state should move toward a region-specific set of water quality criteria and aquatic life goals, although, comprehensive regional data to guide these decisions for Illinois are not yet available.

As the NCD suggests, dissolved oxygen concentrations in lakes and streams fluctuate diurnally. During warm summer months, dissolved oxygen concentrations decline due to water's reduced

capacity to hold oxygen at elevated temperatures and the high respiratory demand of aquatic communities.

A single dissolved oxygen standard such as that in Illinois does not realistically capture these diurnal and seasonal fluctuations. Although comprehensive surface water data are lacking for the state, many pristine aquatic systems largely unaffected by agricultural runoff or municipal discharges most likely experience occasional nonlethal declines in dissolved oxygen below the state's current minimum of five milligrams per liter.

Our recommendations in the report include seasonally appropriate means and minima that more realistically account for natural fluctuations in dissolved oxygen concentrations while remaining sufficiently protective of aquatic life. These recommendations are based largely on potential responses of all life stages of native Illinois fishes that fall in the NCD's non-salmonid category.

As with the NCD, we define these as typically warm water fishes, although, much variation in temperature and oxygen tolerance occurs among taxa in this group. Research summarized in

the 1986 NCD was used to set our recommended dissolved oxygen standards above those concentrations expected to slightly impair production of fishes.

Research conducted since publication of the report generally confirms that the seasonal standards we recommend are sufficiently protective of fishes and other aquatic organisms in Illinois surface waters.

During spring through early summer, most early life stages of fishes and other aquatic organisms are produced. These early reproducing organisms are typically the most susceptible to low dissolved oxygen concentrations and thus require the most stringent protection.

Our reanalysis of data within the NCD and our review of the literature led to the development of a standard proposed to be applicable during March 1 through June 30, which specifically protects these early life stages and includes both a one-day minimum identical to the current Illinois standard of five milligrams per liter and a seven-day mean of six milligrams per liter.

During warmer productive months

throughout the remainder of the year when species with sensitive early life stages have largely completed reproduction, we recommend a one-day minimum of 3.5 milligrams per liter and a seven-day mean minimum of four milligrams per liter, which is a more realistic general expectation for Illinois surface waters than the current minimum standard of five milligrams per liter.

Our recommended standards are based on our current understanding of the short and long-term responses of aquatic organisms to low dissolved oxygen. In most natural aquatic systems, habitat use by juvenile and adult fish is largely unaffected by dissolved oxygen until concentrations decline below three milligrams per liter.

Acute lethal effects on post larval warm water fishes do not occur until concentrations decline below two milligrams per liter. As we note in the report, chronic effects of long-term exposure to low dissolved oxygen concentrations are not well understood. See IAWA's Exhibit 1 at Page 18. Some impairment of growth likely occurs in many warm water species when dissolved oxygen concentrations are chronically

below four milligrams per liter, which none of our recommended standards allow.

Initially, Dr. Whiles and I summarized our findings and outlined our recommendations in a draft report that was distributed to IAWA and the Illinois Department of Natural Resources, IDNR. Dr. Whiles also presented our findings to a special meeting of IAWA this spring where representatives from Illinois EPA -- IEPA, and Prairie Rivers Network were present.

During this time, I also distributed the draft report to the U.S. Fish and Wildlife Service, Region 3; Carterville Fisheries Resource Office, U.S. Fish and Wildlife Service, Region 3; Ecological Service Sub Office, the IDNR, Office of Resource Conservation, the IDNR Office of Realty and Environmental Planning, Division of Natural Resource Review and Coordination, the Illinois Natural History Survey/USGS, Long-Term Resource Monitoring Program, Great Rivers Field Station, and the Illinois Chapter of the American Fisheries Society, ILAFS.

On June 10, 2004, I met with the extended executive committee of the ILAFS to discuss

the report. Questions voiced by many of the participants of the IAWA meeting held this spring were answered in the final draft of the report. After circulating the draft, I received informal comments from the IDNR Office of Resource Conservation, which also were addressed in the final draft.

The IDNR Office of Realty and Planning informally found the science to support the recommended changes. During my recent meeting with the executive committee of the ILAFS, I answered questions about the report and the proposed changes to the current Illinois standards. I agreed with the primary conclusion of the group that a set of regional standards are needed for Illinois. The other groups have provided neither informal nor formal feedback to me to date.

A letter dated 28 May 2004 written by Ms. Beth Wentzel of Prairie Rivers Network to the division of Water Pollution Control, ILEPA, raised several specific concerns about our report. Ms. Wentzel noted that our report was not entirely consistent with the NCD. Although the NCD recommends adopting the most conservative standards

for all early life stages of fish through 30 days post hatching, whenever these life stages occur, our report only recommends adopting these conservative standards through June.

Of the 48 fish taxa in Illinois that we surveyed, 40 taxa are likely to complete the reproductive portion of their life cycle by the end of June or earlier throughout Illinois. Given that fluctuating oxygen concentrations occur naturally in Midwestern streams and lakes during summer, the remainder of species that continue to reproduce during these months must have adaptations that allow them to persist when ambient oxygen concentrations occasionally approach our recommended summer minimum.

However -- or hence, our report indeed departs from the NCD in that it attempts to generate more realistic expectations for dissolved oxygen concentrations and the responses of native aquatic life in Illinois. Another criticism voiced by Ms. Wentzel was that we failed to address the responses of cool water species, such as smallmouth bass, in our recommended criteria. This is untrue.

These species were generally

grouped under our warm water categorization because temperature requirements of non-salmonid fishes are not well delineated, rather, species-specific temperature needs vary widely along a gradient from cool to warm water among fish in the Midwest.

Although cold water salmonids can be categorized by their high oxygen and low temperature requirements, I know of no specific research that identifies Midwestern cool water fishes as having substantially different oxygen requirements during non-reproductive periods than warm water counterparts.

The main difference between species with cool and warm water requirements appears to be their temperature-dependent growth optima and lethal maximum temperature requirements, which is a separate issue regarding the interactions between habitat quality and temperature.

Interestingly, although smallmouth bass is specifically listed in the NCD as a sensitive, cool water fish, it has similar temperature requirements as many conventional warm water fishes. Further, smallmouth bass adults have a minimum lethal dissolved oxygen limit of

1.2 milligrams per liter and you can see table 1, IAWA Exhibit 1, which is well below our recommended Illinois minimum standard.

Ms. Wentzel noted that we omitted a 30-day mean standard from our recommendations, although such a long-term moving average is recommended in the NCD. In our view, fishes and other aquatic organisms will respond at a much shorter time scale to declining oxygen than 30 days requiring a more frequently updated moving average of seven days. A 30-day mean may erroneously miss periods of chronically low dissolved oxygen if high concentrations occur during the remainder of the 30-day monitoring period.

Another argument made against our report's validity is that it focuses primarily on fish. Fish were selected as the regulatory focus because they were the model in the NCD and as it was in 1986, most research on dissolved oxygen is available for this group. Fish are also of recreational and economic importance.

Although the data for other taxa are indeed quite limited, we did address the influence of dissolved oxygen on other organisms,

specifically mussels and aquatic insects and have found a pattern that appears to be consistent with that for fish. As we outline in the report, species that have high oxygen requirements tend to inhabit areas of consistently high and environmentally predictable dissolved oxygen concentrations.

In a stream, this would be a riffle habitat in which high gaseous exchange occurs between the water and the atmosphere. In our report, we recommend quantifying oxygen in areas and during times when dissolved oxygen concentrations are expected to be lowest such as a stream pool before dawn.

These locations should be more susceptible to declining oxygen than areas in which high exchange elevates oxygen concentrations and typically harbors the most sensitive species, such as darters and mayflies. We take issue with Ms. Wentzel's supposition that our recommendations would render Illinois' dissolved oxygen standards the weakest in the nation.

I have assessed the standards for our peer State of Ohio. From what I understand, Ohio has various aquatic use designations that are

similar to but more specific than those recommended for Illinois. Each of these specific designations has a different daily minimum and one-day average dissolved oxygen concentration.

Probably the most common designation for surface waters in Ohio is warm water, which includes a daily minimum of four milligrams per liter and a one-day average of five milligrams per liter which appears, in my view, to apply to the entire year.

Clearly, Ohio's general standard is less conservative than our recommended statewide standard during the spring, because its minimum of four milligrams per liter is one milligram per liter less than our proposed minimum standard.

And Ohio's minimum is not significantly different than our proposed minimum standard of 3.5 milligrams per liter during the remainder of the year. Ohio's seasonal salmonid and cold water designations are analogous to the Lake Michigan standards, which we do not recommend modifying.

In my assessment, the largest difference between current standards within Ohio and

Illinois is that Ohio has developed more regional-specific criteria to protect waters that they deem important. Ohio's exceptional warm water criteria are very similar to those that Illinois currently has adopted for the entire state where Ohio's daily minimum is five milligrams per liter and its one-day average is six milligrams per liter.

Given that all the surface waters in Illinois would certainly not be categorized as exceptional, it is clear that the current general aquatic use of Illinois dissolved oxygen is too strict. Our recommended standards do provide similar protection as Ohio's exceptional waters during the critical peak reproductive times of the year.

During my conversations with other scientists, resource managers, and water regulators, I have received many comments about how the recommended standards are based on sound science and needed in the state. I recognize and somewhat understand the perception by some individuals that our recommendations would weaken the Illinois standards.

However, the weight of information

available for aquatic organisms suggests that the proposed standards set more realistic expectations for surface waters in Illinois and will not degrade the biological integrity of these systems. I agree that more research is needed in many areas and hope that the proposed standard changes will be viewed as one step in a dynamic, continuing process.

It is my view that the state should move toward developing region-specific biotic integrity, habitat quality, and water quality criteria as credible long-term data sets become available.

MR. HARSCH: I have some general follow-up questions.

HEARING OFFICER McGILL: Go ahead.

MR. HARSCH: Dr. Garvey, at our recent meeting with USEPA and Illinois EPA, did you become aware of certain DO water quality data?

MR. GARVEY: Yes, I did.

MR. HARSCH: And have you made arrangements since that meeting to obtain that data from the survey and the data that was prepared on the Fox River?

MR. GARVEY: Yes, I have.

MR. HARSCH: And will you be reviewing that data prior to the next hearing?

MR. GARVEY: Yes, I will.

MR. HARSCH: What is your general understanding that that data shows in terms of the waters in Illinois complying with the existing standard and the proposed standard?

MR. GARVEY: I've personally had a very cursory look at these data, and as a scientist, I'm very reluctant to make any conclusions until I've had a chance to look at these data more closely. But on occasion, they do appear to decline below the state standard of five milligrams per liter and that they probably do not violate the 3.5 milligrams per liter standard that we recommend. Again, I want to take a look at the data before I go from that point.

MR. HARSCH: Is that conclusion supported by the field work that you have personally performed on various Southern Illinois waterways?

MR. GARVEY: Yes, it has. I've worked in seven tributaries of the Ohio River and have taken essentially water quality data during midday, including dissolved oxygen, and in addition to that,

we've done fish surveys essentially using electrofishing and a variety of other gears.

And essentially what we found is approximately 13 to 15 percent of the time, just when we were going out doing spot estimates of dissolved oxygen, you would essentially have readings that were below five milligrams per liter. Just taking a look at the data and comparing it to the 3.5 milligrams per liter standard, that would likely reduce the violation of that standard down to maybe two or three percent of the time.

MR. HARSCH: And these are the streams that you included in your description of your work in your report?

MR. GARVEY: That was not included in the report. That was data that we had analyzed after the fact, after several conversations with colleagues and agencies asking questions about what about streams. In our report, we talk specifically about dissolved oxygen concentrations in stratified lakes within Illinois.

MR. HARSCH: Okay. If I understand your comment on the warmer water -- the species that continue reproducing into the months of July and

beyond, to put it in layman's terms, if bluegills spawn throughout the year, they must have adapted to be able to reproduce when naturally occurring dissolved oxygen concentrations would routinely fall below the current standard?

MR. GARVEY: That would be my belief at this stage. Looking at data that are available for fishes that tend to spawn in a protracted fashion throughout the season -- and what I'm talking about is protracted through the growing season, through July, August -- typically fall into three groups.

The first groups are the species that we've considered to be lentic or of a non-flowing water, those are usually the lopomas, the centrarchids. These species must have adaptations because we know that they occupy systems that typically decline in oxygen.

There's another group of species that do tend to inhabit constantly flowing water and in those situations we wouldn't expect dissolved oxygen to decline to the point that we might expect it to decline in more quiescent, non-flowing areas. So those species are adapted, as I say in my

testimony, to systems that have never experienced interruptions in flow. They're adapted to constant systems where oxygen is always expected to be constant.

And then the third group are what we would consider to be species that tend to have protracted spawning. But the reason they do that is because they typically live in environments that are disturbed and these are environments, of course, we'd expect to be low oxygen conditions. And they basically just keep spawning over and over and over again to ensure that perhaps one clutch can possibly be produced.

So those are the three general groups of species that we would expect to continue spawning throughout the summer during the times when we would expect dissolved oxygen to occasionally decline.

MR. HARSCH: This is a question I suppose for Mr. Callahan. Mr. Callahan, what do you believe will be the impact on individual publicly owned treatment works if the standard is enacted by the Board and approved by USEPA?

MR. CALLAHAN: As plants are currently

operated, probably not much. We don't actively regulate or adjust the dissolved oxygen concentration of our discharges. Based upon various stages of treatment in the cascading action from one to the other as well as the necessity to aerate as a mixing tool disinfection units in these plants, routinely the water that leaves our plants is probably somewhere between five and a half of spheric saturation milligrams per liter.

So I don't think there would be much in terms of actual plant operation that would be impacted by changing the regulation. We certainly wouldn't be turning anything down from what we're doing right now unless, of course, we add a permit limit of six, which has recently begun to be I think presented at dischargers across the state. Under those circumstances, it might be necessary to aerate continuously.

MR. HARSCH: Then what -- apart from the state's ultimate development of a phosphorus standard, is the most likely impact then going to be through the TMDL process if the discharger discharges to a segment listed on the 303(d) list?

MR. CALLAHAN: At this point, yes, I

think so. That's one of the issues that is immediately before us. The nutrient standards presumably will be enacted in 2007, 2008, although, I believe there will be an interim standard presented to the Board later this summer. The immediate thing before our industry is the 303(d) listing and the accompanying TMDL requirements that have to go along with that.

And I'm not at all apprehensive about a standard here being developed along the guidelines advocated by Dr. Whiles and Dr. Garvey. I believe that most all of our existing waters where we would want to maintain assurances that we are not contributing to further degradation are already protected by anti-degradation regulations that are in place for dischargers.

Any existing discharge that would be permitted for increased capacity for growth, we have to address these loadings through the anti-degradation process, and I think that will be protective in terms of TMDL and so on and so on.

MR. HARSCH: And currently, treatment plants control and are regulated with effluent limitations in their NPDES permits that are based

upon the technology-based effluent requirements found in the Board's regulations?

MR. CALLAHAN: That is correct, and to some extent their water quality based effluence as is the case with ammonia and many other toxins and metals that were regulated.

MR. HARSCH: This is a question I guess for both Mr. Callahan and Mr. Streicher. Is it your understanding that if the water segment is currently listed on the 303(d) list because of poor MBI scores, habitat modification, nutrient impairment and dissolved oxygen impairment, that if IEPA were to perform a TMDL for that segment, the only parameter that would actually be evaluated for which a load allocation would be set would be dissolved oxygen?

MR. STREICHER: At this point in time, there is no water quality standard for nutrients, so dissolved oxygen would be the only water quality standard in place that a TMDL would be listing in a stream segment.

MR. HARSCH: Is that your understanding also, Mr. Callahan?

MR. CALLAHAN: Yes, it is. I'm not

aware that there are any habitat considerations that would be taken.

MR. HARSCH: There has been discussion in the testimony by Dr. Garvey regarding the advisability or the preference to establish regional-base standards. Has IAWA given any thought to that effort?

MR. STREICHER: IAWA has formed a subcommittee to develop use attainability and use designations. We're looking at this throughout the state with the goal of identifying those segments that would have high quality waters or perhaps the stream that I discharge to, which is an urban effluent-dominated water that would have a different use attainability or a different use designation.

We haven't gotten so far yet as to identify all the possible use designations throughout the state, but we're addressing that. We're looking into it closely.

MR. HARSCH: In fact, that's the current step that the committee is trying to identify, the stream use?

MR. STREICHER: That's right.

MR. HARSCH: Would IAWA welcome the

participation of environmental groups and the various parts of DNR that we've met with and the Illinois Protection Agency in this effort?

MR. STREICHER: We're already reaching out to just those very groups. We want to participate with them and develop a reasonable use attainability or use designation.

MR. HARSCH: Okay. In the report prepared, which is Exhibit 1, there was some reference to the preferred method of dissolved oxygen sampling being continuous data loggers or semi-continuous data loggers. Are you aware of IAWA members that are currently in the process of installing continuous dissolved oxygen samplers?

MR. STREICHER: There are several districts across the state. The Wheaton Sanitary District I know is looking into this. The Water Reclamation District of Chicago already has these data loggers in place.

MR. HARSCH: Is the Fox River and Fox Metro Water Reclamation --

MR. STREICHER: Right. I was just going to say the Fox River study group with those two districts involved are also placing continuous

loggers. The watershed committee that I mentioned in my testimony is on the verge of purchasing data loggers to install on the East Branch and Salt Creek basins as well.

MR. HARSCH: Now, the work by Fox Metro and Fox River Water Reclamation Districts, that would be upstream and downstream of Elgin and upstream and downstream of Aurora and the Fox River?

MR. STREICHER: Yes.

MR. HARSCH: At the point in time, I would tender the witness's examination to the Board.

HEARING OFFICER McGILL: Thank you.

Let's go off the record for a moment.

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

HEARING OFFICER McGILL: Before we begin questions posed by members of the public or the Board here for the IAWA's witnesses, I just want to know -- we sent around a sign-in sheet for those who care to indicate their presence today.

And in addition to the groups I mentioned earlier, we have representatives from the Lieutenant Governor's Office, the Illinois

Department of Natural Resources, the Illinois Environmental Regulatory Group as well as individual members of the IAWA and still others, so, again, all are welcome and we thank you for turning out today.

The Board has a number of questions they would like to pose, but we're going to open it up first to the members of the public to pose any questions they may have for the IAWA's witnesses. Everyone is welcome to ask questions.

Albert Ettinger is here up front. He needed some room to spread his materials out. He's representing the Sierra Club, Prairie Rivers Network, and Environmental Law and Policy Center. We're going to start with his questions, but everyone is welcome to pose a question.

Anyone present here today, if you have a question for these witnesses you'll have a chance to ask that question, and they'll be answering questions, all three witnesses, as a panel.

(Brief pause.)

Anand Rao of our technical unit makes a good point. We have a series of questions that we have put together. If Mr. Ettinger is on a

particular subject matter that we have a follow-up question on, for continuity of the record in terms of subject matter, we may jump in with a question there and the transcript will just read a lot more coherently if we do that.

Are there any questions about the procedure we'll follow here with cross-examination of witnesses?

(No response.)

Seeing none, I'll turn it over to Mr. Ettinger.

MR. ETTINGER: Actually, my first question is for Roy Harsh. You indicated at the end of Dr. Garvey's questioning that he was going to look at some more material that he would report at the -- he was going to report. Does that indicate that Professor Garvey is going to be back at the next hearing?

MR. HARSCH: Yes, all three of the witnesses will be present at the next hearing.

MR. ETTINGER: Thank you.

I'm going to proceed in a very unimaginative manner, which is my normal course of life, and just pretty much go through Exhibit 1 and

ask a question, so I'm going to start with Dr. Garvey.

First, you're at SIU?

MR. GARVEY: Yes.

MR. ETTINGER: Did you know Dr. Sheehan?

MR. GARVEY: Yes.

MR. ETTINGER: Did you replace Dr. Sheehan?

MR. GARVEY: No. Actually, we overlapped for a couple of years.

MR. ETTINGER: Did you work with Dr. Sheehan?

MR. GARVEY: Yes. We interacted quite a lot on latter projects.

MR. ETTINGER: Did you have a high respect for the quality of his work?

MR. GARVEY: Yes.

MR. ETTINGER: Looking first at Page 7 of your assessment document --

HEARING OFFICER McGILL: This is Hearing Exhibit 1. Sorry to interrupt.

MR. ETTINGER: Hearing Exhibit 1, yeah. I wasn't clear. Was the prefiled testimony

marked as an exhibit or as --

HEARING OFFICER McGILL: No. Because they read the prefiled testimony into the record, the prefiled testimony itself is not a hearing exhibit.

MR. ETTINGER: Okay. Thank you.

Looking at Hearing Exhibit No. 1, you speak here -- it's the first topic it says: Anthropogenic influences on oxygen and freshwater habitats in particular the addition of nutrients. Nutrient enrichment and eutrophication leads to reduced oxygen concentrations because of increased productivity and biochemical oxygen demand.

What nutrients are you talking about.

MR. GARVEY: Primarily nitrogen and phosphorus.

MR. ETTINGER: Have you studied the effect of anthropogenic phosphorus and nitrogen on the systems that you've looked at?

MR. GARVEY: Are you talking about the ones in the Ohio River or are you talking in general in my research?

MR. ETTINGER: Why don't you answer

both questions?

MR. GARVEY: In my general research, yes. I've been involved in quite a bit of work particularly in Midwestern reservoirs looking at primarily phosphorus which is usually a nutrient -- the limiting nutrient within a lot of these particular systems. Nitrogen tends to be so high that it makes phosphorus a limiting factor. So, yes, in my research I have done a fair amount of looking at the responses to nutrient effects on particular systems.

Now, in terms of the particular streams that I talk about when I talk about the seven systems that we've worked in that are tributaries of the Ohio River, no, I don't really know much about chlor filet, which is usually -- typically can be correlated with changes in the phosphorous and nitrogen systems. I don't know.

MR. ETTINGER: How is chlor filet correlated with changes?

MR. GARVEY: Chlor filet is basically an estimate of the pigment that's associated with the production of the phytoplankton, which is one of the most likely groups of organisms to respond to

fluctuations of phosphorus in particular and so we usually use chlor filet as our way of sort of estimating the amount of plankton, phytoplankton that are out there.

MR. ETTINGER: Have you seen streams in southern Illinois that had a lot of chlor filet in it?

MR. GARVEY: Sure, and I'm aware of that too, yeah. And that typically is one of the things that are -- you know, if you take a look at folks looking at the impairment of a stream, if you focus on things like chlor filet, it's going to give you some indication of the eutrophic status of that particular stream.

MR. ETTINGER: What does chlor filet do to a stream?

MR. GARVEY: Chlor filet in itself doesn't do anything to the stream. It's just an index of the amount of phytoplankton that are in that particular stream. If you're talking about what chlor filet are associated with phytoplankton, phytoplankton, as Dr. Callahan talked about in his testimony, essentially are responsible for a great deal of the oxygen production during the day because

they're abundant and are producing oxygen.

But at night, they're also responsible for a great deal of the respiration within a particular stream, often the majority of it, and they suck the oxygen out. And typically, predawn is when you would expect the greatest oxygen sag to occur in a flowing water or non-flowing water system.

MR. ETTINGER: Does this, the phytoplankton and the chlor filet, have any effects in terms of recreational use of the water?

MR. GARVEY: Most certainly. I mean, I think people like clear water, right, because it makes the water look pretty. However, there are also responses that if there are -- lots of research has been done looking at fishery responses to productivity in that there's usually a direct link between increases in total phosphorus, increases in phytoplankton, increases in chlor filet, and increases in fish growth.

So there's a bit of a tradeoff between how much nutrients you have in a particular system and fish growth, but also it affects water clarity in a negative fashion, which recreational

swimmers, recreational jet skiers, things like that, do not like typically water that's kind of green and mucky.

MR. ETTINGER: And so -- I think you've alluded to it, but how does the increase in the nutrients then lead to reduced oxygen concentrations?

MR. GARVEY: Basically, the increase in community respiration typically associated with the phytoplankton, with the algae, the macro algae, that kind of thing that grows on the aquatic plants, all of that, obviously, produces oxygen during the day and uses oxygen at night. And the more biomass you have out there, the more of an oxygen demand you'll have in a particular system.

MR. ETTINGER: And it leads to low oxygen levels at night?

MR. GARVEY: Typically, yes.

MR. ETTINGER: And typically higher oxygen levels during the day?

MR. GARVEY: Right, so that the magnitude and the amplitude of diel or diurnal oxygen fluctuations will likely increase, so there aren't a lot of data out there to sort of -- this

would just be a supposition on our part -- that would suggest that that should increase with any increase in nutrient loading, increase of biomass and so on and so forth.

MR. ETTINGER: Is there any way now to predict the level of fluctuation based on the amount of phosphorus that you have in the water?

MR. GARVEY: You know, for streams it's notoriously difficult because you have an incredible number of competing factors, ground water inundations, flow, temperature, all those sort of factors that are going to make it really tough from all of that. There are some very good models out there predicting oxygen dynamics in lakes. They're a little bit easier to sort of get a handle on all the physical processes that are influencing oxygen.

MR. ETTINGER: Well, for instance, let's say you had a data point at 2:00 in the afternoon in a lake, would you then be able to predict what the oxygen level might be at 1:00 at night?

MR. GARVEY: Well, I would say and, of course, if I was to model it and I needed to give you a model on that, I wouldn't be as -- in a lake

system, I would feel fairly confident. In a stream system, I would say that a model is not going to give you a decent number that you can really trust, however, the assumptions based on our conceptual understanding of systems, yeah, it's going to be lower.

MR. ETTINGER: But you don't know how much lower?

MR. GARVEY: I don't know how much lower.

MR. ETTINGER: Getting back to fish, are you aware of any research on the fluctuations themselves having an affect on fish?

MR. GARVEY: There's a few studies out there that have looked at oxygen fluctuations and typically -- and I need to go back and look at my literature -- typically, it's inconclusive. It suggests that oxygen fluctuations -- you know, the hypoxic effects is sort of related to the lower point of the oxygen in that particular sinusoidal change in the times.

MR. ETTINGER: But you're not aware of any studies that show that the fish might be better off if they have a constant level of, say, six and

then half the time eight and half the time four?

MR. GARVEY: No. In our report we mention that that is the type of research that needs to be better worked out for particular systems because if fish are exposed to low oxygen conditions, what will typically happen is that some stress hormones will increase.

Those stress hormones essentially are to help the fish increase its respiration, which will increase the oxygenase tissue, you know, basically expedient respiration. When that stressor goes away, the stress hormones will remain for a while until they've metabolized it off and there might be some probably deleterious effects in terms of probably growth, however, we don't understand those chronic long-term effects very well.

MR. ETTINGER: I'm running out of time before noon, but I wanted to wrap this up a little bit. Is there a natural diurnal swing in streams that don't have any anthropogenic nutrients in them?

MR. GARVEY: That's going to be a difficult one to say because the reality is that most streams probably have some anthropogenic influences and so that begs the question as to what

is a pristine system and what is, you know, a natural condition.

MR. ETTINGER: So we really don't know what a natural diurnal swing is in Illinois?

MR. GARVEY: I think we can probably find some streams that might give us some indication of what to expect. But, of course, there are those streams probably in Illinois that have not been affected by a human at some level.

MR. ETTINGER: Have you looked at specific studies of any streams that would give us what a natural diurnal swing is?

MR. GARVEY: I'd love to, but unfortunately, those data are currently being collected in the state, but have not been disseminated widely yet. There's a current set of projects associated with SFAR where those kinds of data are being collected, and as we've noted, there are data that are available currently in the state that hopefully I'll be able to take a look at in the next couple of months before the next hearing to have a better idea of what kind of fluctuations we expect to see in systems that are along a gradient, probably human impacts.

MR. ETTINGER: Do you know when we're expecting to see those results?

MR. GARVEY: The SFAR results probably within the next two years you should start seeing the dissemination of those results and reports. The data that I will take a look at, I'll take a look at this summer. Again, it's not going to be a comprehensive conclusive -- it will be for particular systems that I have in front of me, but yeah, I'll have an opportunity at least to have what will probably be a reflection of what the SFAR project will produce.

MR. ETTINGER: The data you have in front of you, are those tributaries of the Ohio River?

MR. GARVEY: They'll actually be data that are available for -- I'm not exactly sure how many stream segments that I'll get from the USGS, but they did do a fairly intensive study looking at diel oxygen fluctuations is my understanding.

HEARING OFFICER McGILL: It's shortly after noon. We're going to recess now for lunch and we will start up again at 1:00 sharp, so please try to be back by then. There are restaurants

downstairs here in the building all around, so you've got a lot of choices. With that, we'll go off the record.

(At 12:02 p.m. a lunch recess was taken to 1:00 p.m.)

HEARING OFFICER McGILL: Good afternoon. It's 1:00. I'm just going to go on the record for a moment to reflect that we are reconvening in a new hearing room. This is Room 503 on the 16th Floor of the Thompson Center. We have posted signs throughout the Illinois Pollution Control Board offices indicated the change of our location, and staff is directing participants up to this new hearing location.

To allow people time to get up here, we're going to recess for 15 minutes. We'll start the afternoon session at 1:15. Thanks. Let's go off the record.

(Whereupon, a short recess was had.)

HEARING OFFICER McGILL: We're back on the record. This is RO4-25. For our afternoon session we have reconvened here in Room 503 on the 16th floor. The posted sign is back on the 11th

Floor directing all participants up here for the afternoon session. Before we continue with Albert Ettinger's questions for the IAWA's witnesses, on my own motion, I'm going to enter into the record as Group Hearing Exhibit No. 7 two documents.

These are two documents from a separate rulemaking proceeding before the Board, which is R02-19 entitled Proposed Amendments to Ammonia Nitrogen Standards. These two documents were entered as Exhibits 3 and 4 in that rulemaking proceeding, R02-19, and they are the written testimony of Dr. Robert Sheehan as well as a Table 1 entitled Spawning Periods for Fishes in Illinois. That will now be Group Exhibit No. 7 for this rulemaking proceeding, RO4-25.

And we may have some questions related to those documents. We wanted to be able to refer to those and make it easy for everyone to have access to those documents and the best way to do that is to go ahead and make it a hearing exhibit for purposes of this proceeding. Is there any objection to doing that?

MR. HARSCH: No, sir.

HEARING OFFICER McGILL: Seeing none, that will now be entered as Group Exhibit No. 7. Thank you.

And with that, I'll turn it over to Albert Ettinger to continue the questioning period. Thank you.

MR. ETTINGER: Going back to Hearing Exhibit No. 1, Page 8, the first full sentence on the page says: Most frequently associated monitoring activities focus on daily minimum levels often quantified predawn or average over a period of time, what do you mean by that?

MR. GARVEY: Actually, when I read it and after subsequently talking with various agency folks, you know, the reality is is that I don't know if monitoring activities actually do focus on a minimum level taken predawn. As far as I understand, most of the time people take it when they're out collecting a biotic index or some other sort of data and just happened to stick a DO meter into the water at that particular period of time.

So in a way, I think that this might be the way a lot of agencies would like to collect dissolved oxygen data, but they have not. I

don't know a way to quantify that.

MR. ETTINGER: And so you don't know whether we have any predawn data in Illinois?

MR. GARVEY: Yeah. I don't know of really any study where there are predawn data. I do have access to the continuous data. I mean, I haven't looked at it yet, but in the next two months, hopefully I'll have some continuous dissolved oxygen data available to me.

MR. ETTINGER: And your understanding is that that's the USGS's data that was taken at those, I believe, eight sites recently?

MR. GARVEY: Yeah, that's my understanding.

MR. HARSCH: It's also the data that was taken on the Fox River by Mr. Santucchi. He also had that data available.

MR. ETTINGER: Okay. So you had the Santucchi data and the USGS data?

MR. GARVEY: I presume I'll have those data available to me before the second hearing to talk about that and hopefully get input from other groups as well.

MR. ETTINGER: Okay. But at that time

you wrote this --

MR. GARVEY: No.

MR. ETTINGER: -- you were not aware of the predawn data?

MR. GARVEY: No.

MR. ETTINGER: Okay. Thank you.

When you went out and did your studies of these Ohio River tributaries, how early in the morning did you get up?

MR. GARVEY: Typically, yeah, it's the same thing. We basically went out when we were doing electrofishing surveys and when we went to each site typically during mid-morning to midday, took our hydrolab or our YSI DO meter and took a reading.

Typically, the data that I've shown you are for the surface, so probably at a half meter or less of depth. We did on occasion take DO readings near the bottom and they were very low and so I did not include those in my analysis that I've talked to people about.

MR. ETTINGER: Okay. I might as well pursue that. Do you have an analysis written up of this data that you collected in the Ohio River

tributaries?

MR. GARVEY: One of the papers is currently submitted to the transactions of the American Fishery Society, which is a peer-review journal, and hopefully we'll be getting comments back from the peer-review process fairly soon.

The remainder of the data are actually incorporated into master's theses projects that students have ongoing, and they should be finishing up their research in the next hopefully six months or so, and they will at least be published in theses and we do plan to disseminate all those data in the peer-reviewed literature as well.

MR. ETTINGER: Okay. So we'll hope to have that data in six months?

MR. GARVEY: That would be the hope, that the data will be in a form that I feel comfortable with the analysis. It will be far more astringent than what I've done. I mean, obviously, I trust the information that I have provided to you, but we'll have a better understanding of the mechanisms underlying the processes associated with the fish in those particular areas and relating that

back to the field.

MR. ETTINGER: And these master theses are all by SIU students?

MR. GARVEY: Each one of them is my graduate student. The research was funded by the Army Corp. of Engineers.

MR. ETTINGER: And did they all look at Southern Illinois streams or did some of them look at streams outside of Southern Illinois?

MR. GARVEY: All these streams as a project were actually focusing on fish use, habitat use within the Ohio River and associated tributaries, so just the Southern Illinois tributaries.

MR. ETTINGER: Okay. Thank you.

Turning now to Page 9 of Exhibit 1, it states: With the exception of the Lake Michigan system, most inland waters in Illinois are dominated by warm water non-salmonid faunal assemblages.

What inland waters are not dominated by warm water assemblages other than Lake Michigan.

MR. GARVEY: That's a good question,

and honestly, I think after conversations with many folks in Illinois, both scientists and agency folks, we would suggest that those systems probably are clustered in the northern part of the state.

And in terms of actual quantification of that, I can't give you a number, but I would say that southern Illinois, certainly in the central portion of Illinois can probably be safely classified as relatively low gradient warm water associated systems.

MR. ETTINGER: But there are some in northern Illinois that would fall into the same category as Lake Michigan?

MR. GARVEY: Well, honestly, I don't know of any systems and this is through my conversations with Dr. Brooks Burr, the resident at Southern Illinois University. I did ask him if there were any classic cold water systems where trout might have been found pre-establishment of European settlers and he said that he had no evidence in his experience of that and so I safely can say that probably no systems had cold water fish in them.

Now, cool water fish and low --

fish that are intolerant of this low dissolved oxygen, I don't know what the answer to that is.

MR. ETTINGER: Are salmonids the only cold water fish?

MR. GARVEY: You know, in North America, cold water fish can be characterized by fish that essentially have a temperature tolerance that's very low, typically between 10 or 15 degrees celsius, whatever that translates to Fahrenheit, and that's where the growth optimum is. Essentially they would seek out those in areas through their entire life if they could because for every parcel of food that they consume, it would ensure that they grow the best.

In terms of cool water to warm water, the establishment of those characteristics, probably the best paper was done by a guy name John Magnuson back in '79 and his colleagues, and it's very difficult to establish really what a cool water versus a warm water fish is because, as I said in my testimony, it's more of a continuum. It's really hard to pinpoint whether a fish is either a cool water fish or a warm water fish.

MR. ETTINGER: Have you looked at data

on dissolved oxygen effects on mussels?

MR. GARVEY: After Beth made some comments to Matt Whiles at the meeting with IAWA in the spring, we did look at some of the studies that have been done on mussels, yes.

MR. ETTINGER: And what did you learn about that?

MR. GARVEY: We typically found that the patterns are relatively similar to what we would see with stream fishes or various fishes. Species that tend to be more riffle-dwelling species, that would be an area where there's constant flow, fairly continuous flow, relatively stable system, tend to be less tolerant of low DO.

And systems where species that exist in the bottom of lakes and things like that tend to be more tolerant of low DO, which is to be expected.

MR. ETTINGER: Okay. I guess this is what you're saying here, it says that freshwater mussels are far less tolerant of prolonged exposure to the hypoxic conditions than most fish?

MR. GARVEY: What page is that on?

MR. ETTINGER: Page 10.

MR. GARVEY: Let me take a look.
HEARING OFFICER McGILL: You're referring to Hearing Exhibit 1?
MR. ETTINGER: Yes. I'm going to be proceeding through 1.
HEARING OFFICER McGILL: Okay.
MR. GARVEY: And just to qualify, on Page 9 there's the word "some" preceding the rest of that sentence, so it says: Some macro invertebrates such as burrowing mayflies and freshwater mussels are far less tolerant of prolonged exposure to hypoxic conditions than most fish.
So "some" is again the fuzzy language we put in there for we're not 100 percent sure what the percentage is.
MR. ETTINGER: Do you know whether there's any studies of dissolved oxygen requirements of the federally endangered mussel species in Illinois?
MR. GARVEY: I'm not aware of any studies that have been done.
MR. ETTINGER: You state here: Riffles have a high dissolved oxygen flux. What does that mean?

MR. GARVEY: It means that essentially they're constantly being aerated by the movement of the water across the gravel or the cobble in that particular system. So if we were to take a DO reading, even if the systems were fairly enriched with nutrients and might otherwise be fairly low in dissolved oxygen, it might have an artificially high dissolved oxygen concentration because it's basically being replenished with oxygen as quickly as the phytoplankton take it out or the epiphyte, and those things.

MR. ETTINGER: Are you aware of any studies in which they've actually taken DO readings of those sorts of waters?

MR. GARVEY: The knowledge on the heterogeneous nature of oxygen in freshwater systems is sparse at best and in streams in particular.

MR. ETTINGER: So we don't have any studies in which they've actually taken that reading in the riffles?

MR. GARVEY: It needs to be done.

MR. ETTINGER: Looking now at Page 13 towards the end of the page, it says: No standardized methods for conducting acute tests with

dissolved oxygen yet exists. What do you mean by that?

MR. GARVEY: Okay. In typical toxicology studies what you will do is a test where you have a highly replicated design where you basically look for the 50 percent concentration typically of a toxin that causes 50 percent mortality or 50 percent of some sort of negative effect, it could be if an organism passes out or something like that, and essentially, that test, what you would do is you would replicate each concentration in that particular study and look for that 50 percent point.

Typically, most oxygen studies that have been done to date can be taking an organism, you start reducing oxygen in its environment, and you wait until it basically dies and that's maybe not the appropriate way because what you want to do is essentially expose each organism under a relatively constant environment to which it's been acclimated to really get a good view as to what that effect will be and that LC50 is probably the best way in dealing with that kind of situation.

MR. ETTINGER: Your chart -- I think you have a chart in the back of your testimony here, Table 1?

MR. GARVEY: Yeah.

MR. ETTINGER: Is that -- those are LC50s for adult fish in a lab?

MR. GARVEY: You're talking from Smale and Rabeni?

MR. ETTINGER: Yes, on Page 54.

MR. GARVEY: Yeah. Yeah, that study was done. Essentially what they had was a series of flasks and what they did is they took the test organisms to test fish in those particular flasks, no flow, okay, in those situations, there was no flowing waters, and most of these are stream species, so they are adapted to being in a flowing water situation.

And then what you did is you slowly crank down the amount of oxygen that was reaching them in that particular water and then at the concentration at which that fish died, essentially stopped ventilating I think is what their cessation point was, they would measure the lethal concentration, so that was not conducted in

an LC50 standpoint.

MR. ETTINGER: So is that the type of study that you were talking about for which there isn't a standardized test?

MR. GARVEY: Still not the standardized test that's out there. It's the best that we have. It's probably more conservative in a lot of respects because, one, we didn't allow the organism to acclimate to its condition before we can -- well, before they put it under those particular conditions, and the second is that it didn't experience the flow that a lot of times it should experience.

MR. ETTINGER: There's a Smale and Rabeni -- is that how they --

MR. GARVEY: Smale and Rabeni.

MR. ETTINGER: Smale and Rabeni?

MR. GARVEY: Yeah, I guess that's how he pronounces his last name.

MR. ETTINGER: I don't know either.

Did -- they conducted this test and they also wrote a report, Influences in Hypoxia and Hypothermia on Fish Species Composition in Headwater Streams that you refer to?

MR. GARVEY: Another paper, yes, another published paper. It's two published papers that they've looked at.

MR. ETTINGER: In that paper -- I'll go ahead and highlight this and use this as an exhibit and unfortunately, I don't have that many copies -- the language I'm interested in here is, it says: Dissolved oxygen requirements for long-term persistence of streamed fishes are typically much higher than those determined in laboratories of idle tests and there is a need to understand why this discrepancy occurs.

Are you aware as to any studies that have resolved the discrepancy that were done since 1995?

MR. GARVEY: No.

HEARING OFFICER McGILL: Mr. Ettinger, do you want to move to have that entered as a hearing exhibit?

MR. ETTINGER: First, I'll ask, Dr. Garvey, is this the paper you referred to in your report?

MR. GARVEY: It's one of the two, yeah, I believe so.

MR. ETTINGER: I'd like then to offer this as Hearing Exhibit -- whatever the next one is.

HEARING OFFICER McGILL: Eight.

MR. HARSCH: Is that the entire document?

MR. ETTINGER: I believe so, but if you'd like the witness to go through it --

MR. HARSCH: I just -- representation by you is fine.

MR. ETTINGER: I haven't tried to exclude anything in it.

MR. HARSCH: Okay.

HEARING OFFICER McGILL: This is -- I've been handed by Mr. Ettinger an article entitled Influences of Hypoxia and Hypothermia on Fish Species Composition in Headwater Streams by Martin A. Smale and Charles F. Rabeni.

MR. GARVEY: Is that in the introduction or is that in the discussion section of that paper? I don't remember.

MR. HARSCH: It's in the discussion section, but I'll --

HEARING OFFICER McGILL: Here's the pages, 711 through 725.

MR. ETTINGER: I'm sorry. Did you wish to see it again, Doctor?

THE WITNESS: Yeah. Do you mind? Thanks.

MR. HARSCH: Mr. Ettinger, will you provide him copies of that?

MR. ETTINGER: Certainly.

MR. HARSCH: Thank you.

MR. GARVEY: There's also a statement right after they make that point and they say: However, during the study, we never observed extensive fish kills even at the most hypoxic sites, all right, so they kind of contradict themselves after they make that initial statement.

I also would like to qualify with the studies that they did, depending on what -- using the data they use in Table 1, they developed what was called a hypoxia criterion index or something like that and essentially what they did was a way to make predictions about what fish they should see in the streams based on the lower incipient dissolved oxygen concentration they calculated and they actually found a very strong relationship between the stream assemblages that

they saw and their hypoxia index that they came up with the data from Table 1, so it was predictive of the fish assemblages that they did see.

So when I said no, the reality is is that, yes, there are probably long-term and chronic effects, which I'm not 100 percent sure of, but the reality is that their index did do a pretty good job of predicting that, and in the report, we do recommend developing a similar sort of index for the state, so I just wanted to make that point.

HEARING OFFICER McGILL: Okay. Thank you.

MR. GARVEY: Sure.

MR. ETTINGER: I'm sorry. You recommend developing what kind of index for the state?

MR. GARVEY: It's a hypoxia index. What this is -- what they did is they took these numbers, this critical mean dissolved oxygen concentration, which was pretty much the highest for Brook Silverside, which means that they're the least tolerant of -- they croak the first and then the yellow bullhead, which croak the last at half a milligram per liter or whatever, and then if I

understand how they did it, they basically went out and looked to see what species were present in the particular stream and multiplied the relative frequency within the distribution against what that critical number was and then they used that to create a hypoxic index essentially to see if that index gave them an estimation of what fish were actually in that stream at that time.

They found that it worked pretty well. It's the first study in the history of humankind, I think, that actually attempted to take the laboratory-estimated number, the lower number, and use that to make some predictions about fish that are out there. Is it a perfect study? Uh-uh. But it's the best that we have so far.

HEARING OFFICER McGILL: Just so I can get this into the record, is there any objection to entering the Smale/Rabeni report we've been referring to as Hearing Exhibit 8?

(No response.)

Seeing no objection, that will be entered into the record as Hearing Exhibit 8. Thank you.

MS. LIU: Dr. Garvey, if I might --

MR. GARVEY: Yeah.

MS. LIU: -- the hypoxia tolerance index that you were referring to, you defined in your report as the critical oxygen minimum for each species multiplied by its frequency of occurrence --

MR. GARVEY: Yes.

MS. LIU: -- did you define what the critical oxygen minimum was?

MR. GARVEY: Yeah, it's the numbers that are in this Table 1. Essentially what it was was the dissolved oxygen concentration, the mean, by which they reduced it in that Erlenmeyer flask that that fish was sitting in at the point when it died, all right?

And so the assumption is that if it's high, that fish has a fairly low tolerance to low oxygen, and if it's fairly low, that fish can tolerate, you know, basically sucking all the oxygen out of the Erlenmeyer flask and it doesn't die until it's very, very low, and then they multiply that by the frequency of occurrence.

MS. LIU: Thank you.

MR. GARVEY: Sure.

MR. RAO: Dr. Harvey, while you're at

it, could you also explain for the record what these terms hypoxic and normoxic mean in the Assessment?

MR. GARVEY: That's a good question. And actually, I guess I should be fairly careful about using those terms because it is -- from a physiological sense, it's used relative to what that organism needs to be successful in its environment. If it's a burrowing mayfly, that's an extremely pristine fast-flowing, clear environment. That might be five milligrams per liter. And it you take that away from it, it's going to die, so that's normoxic.

And hypoxic would be anything below that. If it's a yellow bullhead, according to what Rabeni and Smale have found out, you know, it's going to be a much lower number. So we have to be real careful about using normoxic and hypoxic as being an anoxic. I think anoxic we all know means there's no oxygen.

MR. RAO: Yeah.

MR. GARVEY: So, yeah, I apologize if it was relatively used as a jargon term. We probably should be real careful about our definitions with that.

MR. RAO: Thank you.

MR. ETTINGER: Looking now at Page 16, you have a study that was done on fish larvae and embryos that you speak of that was adopted from Chapman in 1986, which I think also has been referred to as the National Criteria Document study?

MR. GARVEY: Yes.

MR. ETTINGER: Looking at -- and what goes with that is Page 60 of this --

MR. GARVEY: The graph, yeah.

MR. ETTINGER: -- the graph that you do. Could you -- looking at the intolerant species here on this graph, this is on fish larvae and embryos, correct?

MR. GARVEY: Right.

MR. ETTINGER: How long were they held in this water?

MR. GARVEY: You know, these data are derived from a variety of different studies. What Chapman did is essentially took each of these data points from particular studies that have been done and I could go back and look and see which studies correspond to which points, but it's not very well controlled.

None of these points really come from anything that was what we considered to be a well-done LC50 test and, hence, the reason why our analysis had to be the way it was. So to tell you the honest truth, I'm not sure how many of these fish were acclimated to the conditions prior to the, you know, declination of the oxygen and how it affected mortality.

This is really more or less just a mishmash of studies and data that have been collected by Chapman, and we reanalyzed with a little bit more modern techniques I guess.

MR. ETTINGER: Now, as intolerant species, they included northern pike, channel catfish, walleye, and smallmouth bass?

MR. GARVEY: Indeed. Yeah, right.

MR. ETTINGER: Now, maybe my eyes are getting bad, but as your report indicates, the early life stages of intolerant species begin to decline at 4.3 milligrams per liter; is that what the report says?

MR. GARVEY: Yes, right. At 4.3 is when you begin to see a lot of scatter in the results among the various studies that have been

done where in some studies there were no mortality and in other studies there was a lot of mortality in those species.

MR. ETTINGER: Well, just looking at the line you drew, doesn't that begin to sink at around 6.3?

MR. GARVEY: Well, it depends on your analysis, okay? If we want to do something that's somewhat similar to the LC50 test -- the LC50 is the point where there's a 50 percent mortality, it's sort of the way of coming up with sort of the middle where at that point 50 percent of the organisms have a high probability of surviving and 50 percent have a low probability of surviving. It's kind of, you know, you've got to take that --

MR. ETTINGER: It's a test that kills off 50 percent and --

MR. GARVEY: Yeah. You've got a 50/50 probability and it's because in a lot of these -- a lot of mortality studies done tox, it's a sinusoidal relationship. It's a -- you know, it goes (sound) and then it jumps up, you know, and it's a real fast change.

Now, the two analyses that we

did -- the first analysis, we used what's called a two-dimensional Kolmogorov-Smirnov Test, which is essentially a test that looks for a major change in the variance within the data set. It's kind of similar superficially to a 50 percent test; that was 4.3.

And then the other tests that we did kind of gave us what was the equivalent of an LC50 and kind of a -- you know, with the data that we have. Again, it was around four or 4.3, somewhere in that vicinity, all right.

Now, if you want to be completely conservative and ensure that the organisms have 100 percent chance of surviving, according to this, yeah, probably if you take a look at it statistically, probably -- if you ever go below six -- between six and five, I guess, if you take a look at this, you know, you're going to drop off considerably after that point.

MR. ETTINGER: Well, I did get some new bifocals, but I see one square here that is for intolerant fish, and unless I'm seeing it wrong, it looks like the percentage survival here is something under 60 percent?

MR. GARVEY: Right. It's one square out of 12 squares so that, you know, who knows what will cause that one square to drop at the five millimeters per liter.

MR. ETTINGER: So we have one study, though, that does seem to show that you can lower 40 percent of the larvae at five milligrams per liter?

MR. GARVEY: Yeah, that cluster before it drops dramatically at four, all right? So, yeah, I mean, there's a big cluster up there. I don't know of any analytical techniques that are out there -- I mean, there probably are -- that would allow me to figure out where we are at the plateau and then when it drops dramatically, hence, the reason why toxicity folks usually -- toxicologists look at LC50 and EC50.

MR. ETTINGER: And that's based, though, on I'm assuming you're going to kill off 50 percent of the organisms?

MR. GARVEY: Yeah. I mean, that's -- yeah.

MR. ETTINGER: As a biologist, do you think it would be tolerant for us to adopt standards

that would kill off 50 percent of the organisms?

MR. GARVEY: Well, that occurs at about four, and what we do is we recommend no less than five for when we expect most of the early-life stages of species to be out there.

MR. ETTINGER: Most of the early-life species?

MR. GARVEY: To qualify, I have to say most.

HEARING OFFICER McGILL: I just want to make clear if we haven't been, you're referring to Page 60 in Hearing Exhibit 1?

MR. ETTINGER: Yes. I'm sorry. Page 60 of Hearing -- I've been discussing Page 16, which also discusses Page 60, and Page 60 is Figure 1, which is referenced on Page 16.

HEARING OFFICER McGILL: Thank you.

MR. ETTINGER: I'm sorry if I wasn't clear.

On Page 17, you discuss various growth studies. How do they do those studies?

MR. GARVEY: Again, it's a total amalgam of studies that JRB Associates summarized using data from various peer-reviewed published

studies. Typically, what happened is is they didn't control any of the variables very well and looked at oxygen -- DO in the environment and then tried to correlate that with changes in growth.

Unfortunately, there's a lot of other factors that are occurring particularly in a natural environment on growth that will also correlate with oxygen changes, so it's very difficult for that particular group of studies where we saw differences that might occur between four and five to be -- I don't know. If I would have to put a lot of confidence in that data, I wouldn't.

MR. ETTINGER: Well, do we have any good studies we're relying on here or do they all have problems?

MR. GARVEY: I think all studies have problems, however, I do believe that the majority of data that we're basing our lethal estimates on are pretty good. The chronic data -- as we say in the report and as I said in my testimony, chronic data are lacking.

MR. ETTINGER: Okay. Further on in the same page it says: Brake -- I don't know what Brake's first name was -- found that the growth of a

largemouth bass was reduced by as much as 34 percent of dissolved oxygen concentrations, four to five milligrams per liter that had little effect in the laboratory.

Have you heard any studies that contradict the implications of that since then?

MR. GARVEY: Again, the problem is that it's just not well controlled because we don't know what other covariant factors are occurring in the environment to affect those growth results. Temperature could be a totally logical one of those factors because as temperature increases, dissolved oxygen concentration declines.

MR. ETTINGER: I'm sorry, what did you say, as temperature --

MR. GARVEY: Increases typically dissolved oxygen declines. It also negatively affects fish in terms that if they're reaching what would be their maximum limit for tolerance of temperature. We're not sure if it's a temperature affect or a dissolved oxygen affect that's affecting the growth results in those particular studies.

It's very difficult to basically do these studies. That's one of the reasons why

they just -- chronic studies have not been done.

MR. ETTINGER: Is it safe to say that if you have high temperatures, that you would be more concerned about dissolved oxygen levels?

MR. GARVEY: No. I would be more concerned about the effect of the high temperature on the fish. I mean, I would assume that there might be a relationship between the two, but I'm not 100 percent sure I can tell you what those are because the temperature itself is going to have a negative effect on fish if you go past what they have as their optimal temperature for growth.

MR. ETTINGER: Well, unfortunately, we're not going to be able to be 100 percent sure here.

MR. GARVEY: Right.

MR. ETTINGER: All things -- other things being equal, if you had a set of fish that you knew were getting close to their temperature tolerance limit, would you be more concerned about dissolved oxygen than otherwise?

MR. GARVEY: Typically, if the system is aerated and dissolved oxygen is relatively high, it will be fine; however, if the temperatures are

high, what will happen in that system? The capacity of that system to hold dissolved oxygen will decline by a large amount and so you have the covariant environmental effect of temperature on dissolved oxygen that you have to contend with.

MR. ETTINGER: Well, I'm still confused. You told me the Brake study might be defective because they hadn't controlled for heat. Are you telling me that they failed to control for heat at where are known to be lethal heat levels?

MR. GARVEY: I have no idea if it was near lethal levels, but it might have been at a level that they weren't forging enough food to basically offset the metabolic cost of being at a high temperature. The thing is is that I'm not sure, because I honestly don't know all the parameters that basically were involved in that particular study, hence, the reason why it's out there.

But if I say that, you would ask me to come up with a chronic study that I trust at this stage in the game. I don't think there are any out there honestly. It needs to be done, but it hasn't been controlled well.

MR. ETTINGER: So there are no chronic studies of dissolved oxygen that you can trust?

MR. GARVEY: I think at this stage of the game, I would be very cautious about interpreting chronic data.

MR. ETTINGER: And there's no standardized acute studies at this point?

MR. GARVEY: Yeah, but I would still trust the acute data better than I would trust the chronic data because there is at least some modicum of control in the studies that were done. They were either done -- conducted at temperatures that were done in a fairly controlled situation. And the Rabeni study has pretty good merit because it did give us a fairly decent estimate of fish associations in the environment.

MR. ETTINGER: Okay. Let's go back and talk about your Ohio tributary --

MR. GARVEY: Sure.

MR. ETTINGER: -- observations again.

You've got isolated dissolved oxygen data that was taken when you went out in the field; is that correct?

MR. GARVEY: Right.

MR. ETTINGER: You don't have anything like continuous dissolved oxygen data for those studies, do you?

MR. GARVEY: No, we do not.

MR. ETTINGER: Was it taken more than once in a day?

MR. GARVEY: Yeah. It was typically taken -- it was a one-point estimate taken at the surface when we were out sampling fish at that particular area.

MR. ETTINGER: And dissolved oxygen levels can vary between the surface and the --

MR. GARVEY: Oh, they do and they're much lower on the bottom. The problem is my students didn't take an intermediate level, which is -- you know, we recommend in the report it's about 66 percent depth. That would be the most appropriate place, probably the most accurate assessment of what oxygen is really doing in that particular stream.

MR. ETTINGER: Now, these streams that you studied in this Ohio tributary study, are these pristine streams?

MR. GARVEY: You know, I would

consider them, some of them -- Lusk Creek, for example, is one stream that is believed to be a pretty nice stream and one that the state does tout as being -- I wouldn't call it pristine, but a stream that's pretty well regarded. Big Creek is another one that folks regard.

So yeah, I mean, I guess the majority of the streams would be considered relatively unaffected by what we would consider to be negative effects of humans. A lot of these are in forested watersheds near the Shawnee National Forest. So yeah, I guess we would have to consider them to some extent being pristine.

MR. ETTINGER: And you have data showing the full assemblage of fish that are present in these streams?

MR. GARVEY: Not the full assemblage. Basically, the data that we have are for electrofishing, trap netting and -- two kinds of electrofishing, one that targets benthic fishes and one that targets fish near the surface. To get a real good estimate, you would have to go out probably with an electric seine. So are we picking up all the species? No, we're not.

MR. ETTINGER: Turning now to Page 20, it says here: These studies and other reviewed by Chapman, 1986, indicate a range of lethal minima from .6 for the midge -- and I can't pronounce the name -- for an ephemerellid mayfly and a dissolved oxygen 96-hour LC50 concentration of between three and five for about half of all insects examined.

MR. GARVEY: Yeah, it says three and four milligrams per liter.

MR. ETTINGER: I'm sorry. What did I say?

MR. GARVEY: Five, but, yeah, I understand.

MR. ETTINGER: So that's the LC50 you're saying is that -- the study is indicating that the LC50 for half of the insects is between three and four?

MR. GARVEY: Yes.

MR. ETTINGER: So at those dissolved oxygen levels, half of the insects die?

MR. GARVEY: Right. You have to take this into consideration of where these organisms live in the environment. Midges -- the midge that they're talking about, the .6 milligrams per liter,

is an -- would live in an environment that's typically low in oxygen. It would be a typically low-flow area and that's where they basically have their early life stages.

The mayflies typically will be found in riffle areas with high flow where we wouldn't expect to see low oxygen. And in our report, we recommend taking the oxygen measurements at the place where the midges would be, not where the mayflies would be, which we would consider to be the most conservative place to measure oxygen.

MR. ETTINGER: Okay. You recommend that. How do you expect that recommendation to be implemented?

MR. GARVEY: I hope the Illinois EPA will basically adopt that in their implementation guidelines. I mean, that's not my job. It's just a recommendation that Whiles and I made.

MR. ETTINGER: But you hope IEPA will do that?

MR. GARVEY: Well, if they're going to follow our report, sure.

MR. ETTINGER: Okay. Page 20 on the last sentence it says: Similarly, tolerance of

hypoxia ranges dramatically among freshwater mussels, a group that is of special concern because population declines are widespread and many species are now threatened or endangered.

Have you seen any studies that would enable us to estimate the dissolved oxygen needs of threatened or endangered mussels?

MR. GARVEY: You know, it's very -- obviously, working on pallid sturgeon, an endangered species. It's extremely difficult to do any physiological work. So typically what you have to do is find a surrogate species that's usually in the same genous and do the studies on that.

But the big finger-crossing that -- that genous is going to give you some estimate of what that endangered species needs. Studies that have been done out there -- and I'm not a mussel expert, so this would be more of Matt Whiles' side of things -- but the studies that have been done out there again suggest that, like it is for other macro invertebrates, the species that exist in high-flow environments are going to be the ones that are less tolerant of low dissolved oxygen concentration.

They're also very intolerant of siltation and other effects that are going to happen due to habitat degradation. It all revolves around flow. And the species that we would expect to find in the places where we would be taking dissolved oxygen concentrations probably are relatively tolerant of low DO.

MR. ETTINGER: What do you mean by we would be expecting to take?

MR. GARVEY: That would again be in a low-flow area within a stream, a cooler-run area.

MR. ETTINGER: So that's your recommendation?

MR. GARVEY: Our recommendation would be taking the dissolved oxygen continuous measurements in those areas with the belief that it would be the most conservative estimate of dissolved oxygen within that particular stream.

MR. ETTINGER: Is it your understanding that the proposal is limited to those areas, that only -- that the dissolved oxygen standards that we're talking about, three and five, in August would only apply to the bottoms of lakes and other areas that you would expect to have low DO

levels?

MR. GARVEY: The understanding is is that that would be the most conservative place to estimate oxygen because that would be the place -- and based on just our physical understanding of how stream systems work and, again, you know, we can talk with other experts in the field on this, Matt Whiles being one of them -- but the reality is that if oxygen is 3.5 milligrams per liter in that part of the stream, that would be the place we expect the greatest sag. It's going to be higher likely in other parts of the stream such as the riffle area where we have lots of oxygen exchange.

MR. ETTINGER: Right. But if I measured the riffle area and found that it had a reading of 3.6, would we have a dissolved oxygen violation under the standard that's being proposed?

MR. GARVEY: Well, I would hope that with the Illinois EPA's implementation procedures they wouldn't be measured there, because I think that the greater risk is going to that ripple area and finding an abnormally high -- not abnormally, but a high DO level when there's, in fact, an impairment in the stream.

If you went down the stream and found a low-flow area within that particular segment, that's where you're going to find the DO problem. You're probably going to miss in the riffle area because that's where you're going to have an artificially inflated value for the water. Matt Whiles and I went over that over and over again, believe me.

MR. ETTINGER: Turning now to Page 33, it states -- this is the last sentence in the first paragraph: Because the Illinois EPA designation process requires that biologists account for other site-specific factors such as habitat quality and biotic integrity indicators, the likelihood that a system would be considered impaired solely as a function of low dissolved oxygen concentration is low.

Is that your understanding of the IEPA regulatory process?

MR. GARVEY: Yes, limited as it may be. But yeah, I mean, I think that that was our understanding when we took a look at the various 305(b) documents that we read and we essentially -- that was our understanding, and it was based

primarily on IBI and MBI estimates in that particular stream.

And if it said that there was an impairment, then they would go and look to see if there's water quality parameters that have been exceeded and dissolved oxygen would be one of those.

MR. ETTINGER: And it's your understanding that typically water would not be listed as impaired simply because they found a low dissolved oxygen level if the stream otherwise had a healthy biotic integrity?

MR. GARVEY: You know, that's --

MR. HARSCH: That's a legal conclusion.

MR. GARVEY: Yeah. I'm not --

MR. ETTINGER: Well, it's his legal conclusion in the report.

MR. GARVEY: My conclusion is, and Whiles and I will state this over and over again and I've stated it in my testimony, we focus on the biotic integrity indices and not on water quality parameters.

MR. ETTINGER: I guess my question is just is it your understanding now that IEPA does

focus on the biotic integrity?

MR. GARVEY: It's my understanding, and I applaud the state for doing so.

MR. ETTINGER: On Page 35 you state: Our recommendations generally adopt the standards of Chapman for warm water systems with some modifications based on research that has been completed since this document; see Table 4.

Is Table 4 the research that was completed since this document?

MR. GARVEY: No. Table 4 is just an example of the calculations we use.

MR. ETTINGER: Okay. So what is the research that you're referring to there that was completed since the Chapman document?

MR. GARVEY: The research that's summarized in our report. I mean, I can go through and pick all the various studies that were there.

MR. ETTINGER: Oh, that's there, okay.

MR. GARVEY: Yeah. I mean, that was sort of our conclusions from our review heavily weighted on the Rabeni study being that it's probably the best comprehensive association between laboratory-derived and field data.

MR. ETTINGER: Okay. Now, you decide not to use the 30-day moving averages and why is that?

MR. GARVEY: Thirty days is not going to give us a good estimate of the fluctuations in oxygen that probably are meaningful to the organisms that live in a particular stream. And the example that I would give is the fact that if we looked at a 30-day running average and half the days we had very high dissolved oxygen concentrations and half the days we were near what would be the minimum, we would still get a very high 30-day mean.

It doesn't mean anything to the organisms because there was a chronic effect of oxygen for half of that period, 15 days, and so we kind of said 30 days just doesn't seem like it's particularly meaningful. If we have to have a seven-day average, which is a moving average through time, that's going to more reasonably capture the environment that that organism is experiencing.

MR. ETTINGER: The 30-day average, though, of 5.5 would be higher than your seven-day average that you're proposing?

MR. GARVEY: Right. But you can still

get a 5.5 where you still have half the day as being very low and half the day as being very high and so it just didn't seem as if it was a meaningful target, rather, we would want to have a more meaningful target of a seven-day average.

MR. ETTINGER: Well, you would agree, though, that if you had both the seven-day average and the 30-day average that Chapman suggests, that you would have an overall more stringent dissolved oxygen standard than you would have if you simply eliminate the 30-day standards?

MR. GARVEY: You know, I would argue that the 30-day standard still isn't meaningful. I mean, you can have it, but I don't think it's going to tell you anything about what the organisms are experiencing in the environment. So I guess the answer to your question is no, I don't think it's going to be any more stringent.

MR. ETTINGER: Because it's not meaningful?

MR. GARVEY: It's not meaningful.

MR. ETTINGER: I mean, you would agree mathematically if I have to hit an average that's higher than the other, that it is more stringent in

a sense?

MR. GARVEY: Mathematically because it's a higher average to go after?

MR. ETTINGER: Yeah.

MR. GARVEY: I can still see ways that you can violate it, so I don't know. I haven't thought about it.

MR. ETTINGER: Well, Chapman also has your seven-day minimum, doesn't he?

MR. GARVEY: The seven-day minimum, uh-huh.

MR. ETTINGER: Okay.

MS. LIU: Mr. Ettinger, would you mind if I followed up on your question?

MR. ETTINGER: (Indicating.)

MS. LIU: I was just wondering if you could explain what the drawbacks might be of having both the seven-day and 30-day together?

MR. GARVEY: Drawbacks?

MS. LIU: Uh-huh. Would it be more expensive to sample or --

MR. GARVEY: Yeah, I mean, I don't know what the -- I guess the thing is is that when we came up with it, we never thought about the

drawbacks. We just thought about the fact that it didn't seem as if it was meaningful from the perspective of giving us an idea.

I think that 30-day comes from 30 days post hatching as what they suggest as being meaningful for early life history stages, so I don't know. I wouldn't say that -- you know, I don't know what the drawbacks are.

MR. RAO: Just as a follow-up, does Chapman discuss why he recommended that?

MR. GARVEY: Any one of those standards?

MR. RAO: (Indicating.)

MR. GARVEY: It's usually related to trying to avoid either acute minimum where below that point we would expect to start seeing a great deal of mortality and that's how the mean -- the minimums for the daily on the daily basis. The 30-day and seven-day averages, again, we were more or less trying to target sort of the middle of what we would see in terms of the fluctuating oxygen on a daily or a weekly basis and then trying to target that to avoid any impairment of fish production, so more or less I think based on our understanding, as

limited as it is, of what chronic effects on growth and reproduction would be in these particular systems. It was limited data then and it still is limited.

MR. HARSCH: I might state for the record, in our meeting with Illinois EPA and USEPA, IAWA explained why it was that we did not propose a 30-day average as we did in the petition and indicated that if that were a major point of issue with USEPA, we would be happy to see it included in the proposal. But we, frankly, don't, based on our consultant's recommendations that you've heard today, believe it adds anything and would only unduly complicate the implementation of these regulations.

MS. LIU: Can you comment on how you think it would complicate the --

MR. HARSCH: I think how you would sample for it, that kind of parameter.

MR. ETTINGER: It would complicate the IEPA implementation regulations?

MR. HARSCH: Well, sure.

MR. ETTINGER: On Page 34 of the National Criteria Document, do you have that in

front of you?

MR. GARVEY: Yes, I do.

MR. ETTINGER: And that is -- I've forgotten what exhibit. That's one of your --

HEARING OFFICER McGILL: Hearing Exhibit 2.

MR. ETTINGER: Okay. Hearing Exhibit 2.

Another aspect of the National Criteria Document speaks under warm water criteria and it has early life stages -- do you see at the top -- and then there's a little footnote and the footnote says: Includes all embryonic and larval stages and all juvenile forms to 30 days following hatching.

MR. GARVEY: Yeah.

MR. ETTINGER: Does your proposed standard do that?

MR. GARVEY: I think, as I mentioned in my testimony, the reality is is that it is not entirely consistent with the NCD in this case.

MR. ETTINGER: Okay.

HEARING OFFICER McGILL: Which page of the NCD are you looking at now?

MR. ETTINGER: I'm sorry, Page 34.

HEARING OFFICER McGILL: Okay. Thank you.

MR. ETTINGER: Well, let's go to your prefiled testimony for a second. I've been working through this other stuff. But you speak there about your discussion with the ILAFS and you say: I agreed with the primary conclusion of the group that a set of regional standards are needed for Illinois.

What would a set of regional standards look like?

MR. GARVEY: I think a set of regional standards would have to depend on the input of various agencies in the state that have a lot of experience in their particular regions. There's an eco-region approach that could be used in that the state has been divided up into various eco regions based on sort of the biology of the biotic community, I guess, that you would expect to see in those particular parts of the state. That might be a reasonable starting point.

If you try to superimpose that on top of the geology and the geography of the state, sometimes they don't quite match up, but that might

be a good, good starting point. Obviously, there's a north/south gradient within the state that's going to affect temperatures and timing of spawning and that kind of thing. It will affect fish and other organisms. That's another way to think about it.

All those factors I think need to be taken into account from both at a regional-specific basis and also from the perspective that there might be various streams that you might want to have special protection for, not for just dissolved oxygen, but for the whole suite of water quality parameters that you basically want. And I think that Matt Whiles and I feel very strongly that that's where the state should be moving.

MR. ETTINGER: Could you elaborate on that a little? I mean, you said that you and Whiles say there should be special standards for what kind of streams? I'm sorry.

MR. GARVEY: Exceptional streams. And from the exceptional standpoint, these would be streams that probably have very little impact up to this point in that they should be afforded special status in terms of protection. Now, again, if you

were to ask me about dissolved oxygen within those particular systems and whether you would see them staying within what is the current state standard, I would probably argue that they probably still violate the current state standard.

But, again, until someone shows me data or I have the data in my hand, it's tough to tell you one way or the other.

MR. ETTINGER: Well, there are streams that get groundwater all the time, aren't there?

MR. GARVEY: Groundwater inundation is typically low in oxygen, very low, so you need to be real careful about that because that's actually a real problem for a lot of aquatic organisms.

MR. ETTINGER: Okay. Do you have an understanding of what site-specific standards would be?

MR. GARVEY: You know, I think that there's been some talk about finding various segments of stream, the various stream reaches and giving them a very -- you know, a designation based on I guess what the expectations are for aquatic use.

Again, I think we would need more

input from various folks, both environmental groups, agencies, scientists in the state to come up with a good goal, a good set of goals for doing that.

MR. ETTINGER: Well, have you made site-specific determinations as to what species are present in various waters in Illinois in connection with offering this study?

MR. GARVEY: I don't think those data are necessarily available in large proportion. I'm going to have access to that in the next two months, some of those data. But a comprehensive data set, it's not available in the state at this point in relation to dissolved oxygen. I could probably give you a species list of fishes in various stream segments based on EPA's Intensive Basin Survey.

And, of course, we have pretty good records with the Illinois Natural History Survey, but there's nothing superimposed on top of the habitat or water quality and that's the problem.

MR. ETTINGER: Okay. Turning now to Page 38 again of your assessment document --

HEARING OFFICER McGILL: It's Hearing Exhibit 1.

MR. ETTINGER: Yes, Hearing Exhibit 1.

You referred to this term earlier, but you talk here to -- you refer here to as manipulatable discharges?

MR. GARVEY: Right.

MR. ETTINGER: What is meant by manipulatable dischargers?

MR. GARVEY: I think we meant -- that means where there's a point discharge, probably from a wastewater or an industry or whatever, that is in that particular area in which the discharge -- the amount of discharge or the quality of discharge can be manipulated in some fashion.

MR. ETTINGER: And it says: As a result, two areas in proximity to manipulatable discharges should be monitored closely, e.g., continuously?

MR. GARVEY: Yeah. I definitely think you should have continuous monitoring in those particular areas.

MR. ETTINGER: Continuous monitoring in any manipulatable area?

MR. GARVEY: Yeah, I think that would be reasonable to ask.

MR. ETTINGER: How do you think that's

going to come about?

MR. GARVEY: You know, obviously, when Whiles and I put this together, we thought, let's just say it and see what happens. And then -- I don't know, you know. You can talk to the folks that I've talked with at IAWA and they seem to be very interested in complying with this particular set of suggestions.

MR. ETTINGER: Well, it's saying that, you know, this is a safe proposal. Are you counting or thinking that IEPA is going to set up implementation rules that are going to establish monitoring like this?

MR. GARVEY: I think that they should move toward that if they possibly can particularly in the areas where there's manipulatable discharges, if this isn't being accomplished by the dischargers themselves, which there seems to be compliance -- a suggestion of compliance already at this stage.

MR. STREICHER: Albert, in our meetings with USEPA and IEPA, we went so far as to suggest that that would be a likely NPDES permit addition or some parameter or some addition to our operating scheme at a plant.

MR. ETTINGER: Well, these standards would only be applicable in areas in which there was such continuous monitoring?

MR. STREICHER: Well, one of the suggestions was that enforcement was a concern and we felt that may eliminate those concerns.

MR. HARSCH: But your point is where there are two or more manipulative discharges. You have to establish the likelihood of in fact there being two manipulative discharges at a given location in close proximity. A POTW discharge is not in and of itself a manipulative discharge.

MR. GARVEY: Okay. That's where I'm kind of -- I mean, my understanding is of a discharge where you can manipulate the oxygen that's coming in that particular area. Is that -- I'm not sure if we're clear about --

MR. ETTINGER: Well, let's go on.

MS. LIU: Mr. Ettinger, could I follow-up along those lines?

MR. ETTINGER: Yes, please do.

MS. LIU: In your assessment, you do recommend that there be special restrictions for areas that do have manip -- I can't say the word --

discharges --

MR. GARVEY: Manipulatable. Yeah, it's hard for me too.

MS. LIU: (Continuing) -- and you suggest limiting the occurrences of daily minimum of 3.5 milligrams per liter to no more than three weeks per year or using a one-day minimum value of 4.0 milligrams per liter?

MR. GARVEY: Yeah, that's our suggestion, right. And we also suggest that the monitoring needs to be done in two areas below that manipulatable discharge, one at the mixing area and one at some area which we do not say. That would be up to the -- during the implementation of this to decide on where to take that next measurement below the zone of mixing where there isn't a lot of control over what DO is going to be doing at that area. It's going to be up to other factors, including the affect of that discharge upstream.

MS. LIU: I noticed that although you recommended those things, they didn't actually show up in the proposal. Is that something that you're planning to propose to the EPA to put into their implementation procedures?

MR. GARVEY: You know, Matt Whiles and I talked about this. I think -- our understanding is and that's, obviously, something to be discussed here is -- the belief would be that that would end up in the implementation of this, you know, when IEPA is figuring out how to do this. So our hope would be that this would be included.

MS. LIU: Is it IAWA's intent to propose something to the agency in terms of implementation procedures or are you relying on the agency to come up with --

MR. STREICHER: No. We were hoping to work with the agency when they developed those implementation procedures.

MS. LIU: Okay. Thank you.

MR. ETTINGER: Okay. That pretty much finishes another line I was going to do and it's very helpful.

So we have -- unusually large DO fluctuations are symptomatic of eutrophication and in these cases the minimum should be the focus of monitoring and assessment activities.

And my question was, what would cause unusually large DO fluctuations?

MR. GARVEY: It would basically be a situation probably in a highly productive system where you have a fairly high amount of phosphorus loading and there's a high biomass of -- going back to what you said at the very beginning of your questioning -- algae out there or aerophyte. Marcrophytes can do it too.

MR. ETTINGER: Okay. And that should be the focus of monitoring and assessment activities?

MR. GARVEY: (Indicating.)

MR. ETTINGER: Okay.

MR. RAO: I have a follow-up question.

MR. ETTINGER: Please do.

MR. RAO: In the petition of Page 3, there's a statement that says: With the structure of this proposed standard, more extensive DO monitoring will be required than with the existing standard and the monitoring requirements will be set up in Illinois EPA's implementation rules and this may require the use of continuous monitors.

Basically, I want to know, you know, what's the impact on IEPA in terms of their implementing these rules if the Board adopts these

standards, will there be a cost impact for them to upgrade their monitoring network?

MR. HARSCH: We believe, of course, there will be, but the best witnesses answer to that question are probably sitting here today, either Bob Mosher or Tobi.

HEARING OFFICER McGILL: Well, we can swear in an agency witness if you'd like to tackle that now or I think that the general understanding we had would be that the agency would present testimony at the August hearing.

MR. FREVERT: I have no problem answering.

HEARING OFFICER McGILL: Okay. Would you go ahead and state your name and position with the agency?

MR. FREVERT: Toby Frevert with the Illinois EPA, manager of Water Pollution Control.

HEARING OFFICER McGILL: Could you go ahead and swear in the witness, please?

(Witness sworn.)

MR. FREVERT: I guess I'd like to start with I'm a little bit confused in the last few minutes at your biological witnesses suddenly being

asked a lot of permitting, implementation, and enforcement type questions. I can try to rescue him from that. I don't think it's appropriate to ask him. I --

MR. RAO: Oh, I assumed the question was for the panel. It's not for just for Dr. Garvey.

MR. FREVERT: Well, I don't think it's appropriate to ask --

MR. GARVEY: And, Tobi, we did make those recommendations of the Assessment just to be fair, but, you know, that's based on sort of what our understanding is.

MR. FREVERT: Okay. That's fine. We're here to listen and learn what the issues are and figure how we can help the Board put together a complete record and make the best decision and in that regard, we'll get back to future hearings and try to address the things that we hear today.

But I want to make sure everybody understands, at least from my viewpoint, that the focus today and perhaps in the future ought to be primarily on what should the dissolved oxygen condition of the Illinois waters be. That's a

fundamentally different question in my mind than how are we going to make the day-to-day implementation and management and monitoring and enforcement decisions.

I mean, there's a lot of heavy lifting coming after that, but the ultimate purpose of the water quality standards is to define the condition of the rivers and lakes and streams and that's what's being proposed, the water quality standard. I don't believe they're proposing a mandatory operating practice on the agency or the Board.

So some of that's got to come in in terms of the economic impact, but I don't believe we're prepared to address that in detail today. I think what I want to hear today is as much of the fundamental biology and science of the standard itself and what the ideal conditions as best we understand it with today's science ought to be.

Once we know that, we can discuss the ramifications of the day-to-day practices a little more intelligently. And I think Roy came here with his experts focused on the biology and the science of what ought to be in the stream rather

than how it impacts 1021 North Grand Avenue East in Springfield, Illinois.

We'll get to that and help you deal with that later, but I'm not prepared to go into any detail today. My eyes are rolling and I'm thinking we're speculating about all sorts of exotic, expensive monitoring requirements and permitting conditions and other things that have incredible secondary and tertiary impacts, so don't ask me to answer that today.

MR. JOHNSON: Which they have to be answered eventually, Tobi.

MR. FREVERT: I'll get you there, Tom, as best as I can.

MR. RAO: Just to, you know, get it clear on the record, the only reason that question came up was they had some statements in their prefiled testimony and like you said, the Board needs economic information as to what the impact on this is if we allowed the standard. That's why I --

MR. FREVERT: Okay. And I'm not saying it's inappropriate. I'm just saying I'm not sure these are the right witnesses to get hit with those questions.

MR. RAO: Okay.

MR. ETTINGER: Well, I guess I have two thoughts on that: First of all, I do think it's totally inappropriate at this point to pick on Tobi because he, obviously, is hearing some of this for the first time and he probably hasn't thought out the cost of various things that are going on here.

However, although we do have one biologist here and others who have biologist expertise, there are elements of their testimony which go to the TMDL system, regulatory requirements, permitting, and so this isn't simply about biology. Moreover in the past, the Board has recognized that you have to consider an implementation of a standard in the context of the standard.

This was done in the GLI rules, this was done in the ammonia rules, this was done in the antidegradation rules, and so the idea that we can isolate the implementation from the standard is not something that the Board has ever accepted before or at least not in my more limited experience than Roy's.

But while they are developing very

interesting biology here, I don't think this is simply a scientific panel here to look at biology today. We're for better or worse looking at a wider range of topics and we've had to pursue some of those unless, you know, we'd like to pull all the portions of the testimony here that deal with regulatory matters, such as TMDLs and permit limits and other things like that, which are part and parcel of the justification for the proposal today.

MR. JOHNSON: Now it's time to swear in Albert.

MR. ETTINGER: No. That was a speech, not testimony.

MR. HARSCH: I would move to strike it then.

MR. FREVERT: I'm not opposed to addressing any and all of these issues in the course of the rulemaking, and I want to hear what the issues are and be prepared to deal with them. We will offer testimony at the right time. We will try to address everything that we can, but some of the questions I've heard asked of these witnesses, quite frankly, I would have to discuss with my own staff to give you what I think is a pretty knowledgeable

answer in being responsible to run this program.

For people that haven't run the program, to get hit with this cold, I'm not sure how beneficial this particular transcript is going to be other than identifying what those issues are so we can follow up on them.

HEARING OFFICER McGILL: Well, yeah, exactly, your latter point. If we can get the question on the record, that gives the agency a heads-up as to what we might be looking for in August. And as I understand it, I mean, IAWA is the rulemaking proponent here.

Mr. Harsch, you don't have any additional witnesses you were going to be offering; is that correct?

MR. HARSCH: Not today, but I would like -- since Albert made a little speech -- to respond a little bit.

IAWA has started this process. We have hired -- they've hired with their own funds, the recognized experts in the area, developed the report. We're bringing in witnesses. We've filed the proposal. We've had stakeholder meetings and will continue to do that.

We are beginning the process to amend the standard in conformance with 303(c) of the Clean Water Act and the points that Tobi has made are very good points. The questions that Albert is asking are important questions to the extent that they -- he has to address them to our witnesses because they're the only people testifying here today is fine.

I do agree that the -- some of those questions get beyond the expertise of these witnesses and probably are better suited to be responded to by IEPA. Frankly, we have started the dialogue. We expect that dialogue to continue and hopefully -- and continuing to work with IEPA, the environmental groups, DNR, USEPA, that are here today, that we can present a complete record to the Board to assist them in making its determination. This is the start of the procedure, long overdue. That's the IAWA's position.

HEARING OFFICER McGILL: Thank you.

MR. ETTINGER: I just have a few questions specifically directed to Dr. Garvey. These generally relate to biology, although, some of them relate directly to Dr. Garvey's report and I

would just like to ask those questions. And if it's you decided that that's -- that portions of your testimony were beyond your expertise, we'll just have to deal with that.

My first question -- or the next question has to do with Page 54 of Exhibit 1. You have a list of species here -- I'm sorry, 56 and 57 have a list of, I believe, 48 species of fish. How many species of fish are there in Illinois?

DR. GARVEY: That's a good question. I don't know if I'm actually going to be able to answer that at this stage of the game, probably something in the -- this list is not of species. It's a list of groups with some species in there, so to give you a number, I'm going to differ and say I'm not 100 percent sure of the total number of species that are in the state.

MR. ETTINGER: Once again, we can't be 100 percent sure unfortunately of anything these days.

MR. GARVEY: Yeah.

MR. ETTINGER: Just a ballpark, is this most of them, is this --

DR. GARVEY: This is going to cover

all the groups, but then when you get into the various cyprinid species that are in the state, you can get into large numbers of species that are -- and so, again, to give you a ballpark number, I'm not going to feel comfortable doing that right now.

MR. ETTINGER: Okay. Getting now to your prefiled testimony, I just had a few things I wanted to clean up with you. You discussed the Ohio standards on Page 8 --

DR. GARVEY: Right.

MR. ETTINGER: -- of your testimony and you state: Ohio's exceptional warm water criteria are very similar to those that Illinois currently has adopted for the entire state where Ohio's daily minimum is one milligram per liter and its one-day average is six milligrams per liter.

Given that all the surface waters in Illinois would certainly not be categorized as exceptional, it is clear that the current standard -- current general aquatic use standard -- I'm sorry, general aquatic use Illinois dissolved oxygen standard is too strict.

My question relating to that is,

are some Illinois waters exceptional?

DR. GARVEY: Yes.

MR. ETTINGER: I don't believe I have anymore questions for Dr. Garvey. Maybe we ought to let other people talk to him before we go on to other witnesses or --

HEARING OFFICER McGILL: Why don't we go off the record for a moment?

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

HEARING OFFICER McGILL: Mr. Ettinger has some additional questions for the other witnesses of IAWA, but right now I'd like to focus our questions -- any questions we have for Dr. Garvey. I'll throw it up into the audience and if you can just indicate by raising your hand if you have any questions you'd like to pose to Dr. Garvey.

Michael Fischer of the Lieutenant Governor's Office, go ahead.

MR. FISCHER: Good afternoon, Dr. Garvey. I just wanted to explore with you, Doctor, your classification on Page 9 of the report. This is Exhibit 1 of the testimony exhibits today. I'm reading under Systems in Illinois: With the

exception of the Lake Michigan system, most inland waters in Illinois are dominated by warm water, non-salmonid faunal assemblages.

If we set aside lakes and reservoirs and ponds and the such, basically distilled water ecosystems, would you change your characterization in light of streams, rivers, and creeks in Illinois as being dominated by warm water non-salmonid faunal assemblages or would you make a different delineation with regard to our littoral moving ecosystems?

DR. GARVEY: Well, first of all, historically all of the Midwest has flowing water. The reservoirs and lakes here except for maybe in the extreme northern portion of the state, which are glaciated, were flowing water. And so the reality is is that a warm water assemblage is one that exists in a flowing water environment and the ones that you see in reservoirs tend to be rivering fish that somehow got in a more lake-like situation.

And so when I talk about a warm water assemblage, it either is -- the cool water or warm water continuum is probably the better way to deal with it. The reality is when we're talking

about reservoirs, we're talking about one extreme of what would be a -- of a continuum of fast-flowing versus slow-flowing rivers and streams.

And so when I talk about this, I am talking ubiquitously about the majority and, again, we can get into semantics about which streams are not involved in this, but the majority of the streams and rivers within Illinois.

MR. FISCHER: You just described there being -- there is a warm water/cool water continuum yet isn't it accurate, especially in light of the -- now this is -- I'm referring to Exhibit 2. I'm referring to the USEPA's National Criteria Document. There's a discussion of warm water/cold water and cool water systems discussed on Pages 2 and 3.

So among the continuum, is it fair to -- is it fair for you to be able to characterize this system as not either being warm water or cold water, but isn't there an intermediate criterion cool water that has a typical fish population or -- well, not population, a typical fish species that you can identify as a cool water system that is in fact distinct from cold water such as Lake Michigan, oligotrophic lakes or a warm water system, like

shallower natural lakes or reservoirs?

DR. GARVEY: This has been, I guess, the big nugget in my brain that I keep trying to tap away at, and I actually think it's an interesting research question. My scientific opinion at this stage of the game is that flow and how these species are adapted to flow is going to be a far more useful way of designating oxygen tolerance than cool water or warm water designations at this stage of the game.

I think that they're relatively decouple. Again, the data out there are limited and I need to do a review on this, but I do believe that there's -- you've got to be careful about making a cool water species synonymous with DO intolerant because we have species such as channel catfish, which are relatively DO -- of low DO intolerance that we consider to be a warm water fish. It's kind of a surprising result.

Conversely, we have a small amount of bass populations in thermal cooling lakes that are doing quite well. Why is that? Well, you know, it's pretty warm, but there's probably plenty of oxygen in there because -- for whatever reason, but

the habitat is the thing that's basically important for the species and not necessarily the cool water or warm water or low flow or high flow factors. Was that clear? I kind of bounced back and forth.

MR. FISCHER: There clearly is a -- it's a gradation and there's clearly overlap species that you can find in what some refer to as a cool water system that are comfortable in a warm water system, the smallmouth bass --

DR. GARVEY: Yeah.

MR. FISCHER: -- being as you described one of those species. I guess taking the big picture overall, what would you describe as the top sporting species in the State of Illinois that are commonly pursued by recreational anglers?

MR. GARVEY: Well, obviously, largemouth bass is going to be your typical species, walleye in various systems. You know, the list is pretty much on the top of those species, so those are the typical ones that would come to mind. And personally, I like going for other kinds of fishes.

MR. FISCHER: When you just discussed walleye, you discussed walleye being in various systems. Clearly, walleye is among the perhaps more

temperature and dissolved oxygen sensitive species that is actually highly pursued and valued in Illinois.

In your academic opinion, would you consider walleye to be among the warm water fish species or is it actually more fair to classify walleye as being a cool water species typically living in cool water environments?

MR. GARVEY: Well, you know, walleye are fairly well distributed throughout the state due to the actions of the Illinois DNR. Usually, a lot of times --

MR. FISCHER: Just setting aside the planting among their natural range and among their natural --

MR. GARVEY: Well, you know, that's because they -- I mean, you get into zoogeographical arguments about whey they're up in the north and not in the south, that kind of thing. It's probably due to being landlocked glaciers, bla-bla-bla. And, again, remember, 10,000 years ago where all these cool water species are, it was glaciers, so they were all down, you know, mingled with all the other species that are around here.

In terms of walleye, I'd say that they're -- I don't know their growth optima off the top of my head. It's probably in the low 20-degree celsius. They probably don't tolerate very high extremes in temperature as well as other species. So yeah, I would probably call them more of sort of an intermediate, somewhere between cool, very cool water, and warm water, somewhere along that continuum.

In terms of oxygen requirements, they're relatively similar to a lot of other species, the same with sauger.

MR. FISCHER: What I'm basically trying to get at is perhaps more from a biologist's standpoint, is it perhaps more helpful to separate the discussion from the still-water ecosystem such as reservoirs or lakes to the extent they exist in the northern half of the state from a discussion about the different river ecosystems that may exist in the state?

Do you think that's helpful to maybe have a separate discussion or can we adopt a unified standard from a biologist's standpoint that would cover all the ecosystems we have to deal with

in our state?

MR. GARVEY: I'd say that probably the major focus of the DO standard -- if we are stuck with a single DO standard, that has to fit the entire state, which should be geared toward the most sensitive systems, which would be streams and rivers, and it should be geared toward the areas that are the most reservoir-like within those particular streams and rivers because those are the systems we're going to expect to see the potential sags in oxygen that would occur to BOD, you know, biological oxygen demand, biochemical oxygen demand in those particular systems. So, you know, I'd say that that's probably what we want to focus our goals on.

MR. FISCHER: I guess I just keep stumbling over the (unintelligible) the outside before you get to the discussion on the other parts that Illinois is dominated by warm water non-salmonid faunal assemblages because -- is there a greater variety in the assemblages when we are discussing streams and rivers?

Aren't there perhaps not a majority, but isn't there a significant percentage

of our streams and rivers in Illinois that based on its fish populations, sauger, walleye, yellow perch, based upon their water temperature and present dissolved oxygen levels?

Can't we describe a significant percentage, if not -- I'm not saying the majority, but a significant percentage of our streams and rivers as actually being cool systems and there is a delineation to be made between cold water and warm water?

MR. GARVEY: Again, I guess I would go back and just argue that instead of trying to do the cold water, cool water, warm water, flowing versus non-flowing and what's your expectations relative to habitat quality are going to be the most important expectations.

Again, I guess this is a bias, but I think the truth is habitat leads to water quality and leads to the assemblages that you see in those particular systems. And, you know, superimposed upon that are effects of things like nutrients and loading of that, but if the system is functioning normally, has good habitat, it's going to typically be able to handle those sort of effects.

MR. FISCHER: When you discuss habitat having the effect on the fish populations, could you go through the -- walk through how the habitat has the effect, is it perhaps the sufficient riparian vegetation will create an appropriate -- let's take a stream or a river as an example. Let's take a stream.

When you discuss habitat, like are you referring to such as riparian vegetation sufficient, foliage cover over the river to afford a typical amount of shade that would create a fairly standard temperature?

MR. GARVEY: Yeah, Ohio, actually. Ohio EPA -- let's go back to them -- developed what's called a qualitative habitat evaluation index, which there's no water quality in it. You just go out and you look at the stream, you look for undercut banks, you looks for riparian vegetation, you look for the percentage of sinuosity, you look for how riffley, how much imbeddedness you have, all that kind of stuff.

That gives you a really good estimate a lot of the time of the macro invertebrate diversity and the fish diversity in those streams.

It's got nothing to do with water quality. It has everything to do with habitat quality. Why is that? Well, the two go hand in hand and the reality is is that the habitat is able to provide the reproductive basis for those particular organisms.

It's going to provide the food base by which the food web is basically going to be anchored in that particular system. It's going to provide the ability for that system to deal with maybe occasional pulses of nutrients that come through from an upstream farm or, you know, discharge or whatever, and it can basically handle that.

Once you start to degrade that habitat and reduce riparian vegetation, poor land use, increased siltation -- and when I worked in Kansas, it was something as simple as having access of cattle to particular streams -- it could be an otherwise beautiful stream, wonderful riparian vegetation, but if you just had one area where the cattle was able to get in there, it was kind of like opening the door to Pandora's box, it would really hurt the stream. And so it's a far more complex issue than just focusing on a single water quality

index.

MR. FISCHER: Among the beneficial aspects, though, of good habitat -- and, again, without going through all the criteria of what would go into good habitat -- isn't part of the positive aspects of good river or stream habitat the fact that riparian vegetation helps provide an appropriate water temperature, which, in turn, helps establish a favorable dissolved oxygen level for the fish residences?

MR. GARVEY: I hate to be the devil's advocate and this is the reason why I'm sitting here in this situation. It is also that riparian vegetation increases the heterotrophic nature of the system which then increases system respiration, reduces the amount of light that gets in there, and you actually have a situation where you have a DO sag; it occurs.

It's a normally functioning stream of good riparian vegetation and it's -- the DO occasionally sags in the pool areas; it happens. Again, I mean, I don't know how else to answer that, but it happens.

MR. FISCHER: And I guess this whole

line of questioning is just going to is it actually difficult to put one label such as warm water or the like dominated by warm water on our systems, if we look at the rivers and streams as an example, it's -- perhaps there's much more diversity when looking at Illinois' rivers and streams and it's hard to sum up in maybe one label as dominated by warm water?

MR. GARVEY: You know, in personal conversations -- again, as I mentioned to Albert -- I think that there probably are ways that you can designate eco regions within the state. Often they don't superimpose with the geography and the geology.

It's more or less you're just sort of figuring out sort of what kind of faunal assemblages you see in those and that would probably be a useful starting point for designating streams as having specific requirements both habitat and probably water quality.

MR. FISCHER: That's my line of questioning. Thank you, sir.

MR. GARVEY: Sure.

MR. FISCHER: Thank you, Richard.

HEARING OFFICER McGILL: Thanks.

MR. JOHNSON: I've got just a quick one, Doctor.

MR. GARVEY: Sure.

MR. JOHNSON: There was some minimal testimony about dissolved oxygen standards in Ohio. Did you look at other states in the Midwest and compare?

MR. GARVEY: Yeah, we've taken a look at the whole variety of states, Minnesota, Iowa, Missouri, Kentucky, Tennessee, Indiana. You know, it varies from state to state. It's going to vary whether they have cold water salmonid assemblages in them or not. All of them hover at -- a lot of them have the five-milligram per liter minimum and it sounds very familiar to what Illinois has because I think in that early regulatory setting, five milligrams --

MR. JOHNSON: Currently?

MR. GARVEY: Currently, that's what I'm talking about. They still have five milligrams per liter. We don't understand what process they've gone through to modify it, but the suspicion is that probably they just have the same standard they had

30 years ago.

Other states like Ohio have been through a very, very stringent process of sort of coming up with regional use sort of standards, which seems to be kind of the state of the art and sort I think where we want to go with Illinois.

Other states, you know -- I think Indiana has a minimum of four milligrams per liter. I would have to go back to the list and see what was compiled but, you know, it varies from state to state. I think Missouri is five milligrams per liter as their minimum. Most of them still focus rather than on some sort of long-term running average, they focus on daily minimum and might have a daily average as well, so that's sort of what they've come up with.

Very few have seemed to have taken Chapman's NCD and done anything with it as far as I can tell, but, again, until we actually talk with the various folks who came up with that policy, I'm not 100 percent sure where a lot of those numbers came from.

MR. JOHNSON: But you do have the numbers?

MR. GARVEY: Yeah. I think I might even have it in my folder here.

HEARING OFFICER McGILL: From the other Midwestern states you're talking about?

MR. JOHNSON: Midwestern states, yeah.

HEARING OFFICER McGILL: Maybe you could provide us with that information.

MR. GARVEY: Yeah, I can get that for you.

MR. HARSCH: It's an extremely complicated review because it depends on the stream use classifications and how you apply the standards. In our meeting with IEPA and USEPA, that subject came up and we've asked for some guidance, and hopefully, we'll get additional guidance from USEPA. We've gotten -- they've been very gracious and provided us with the results of their work and that's what Dr. Garvey is referring to.

It is our understanding that probably if Dr. Garvey testified based on that meeting, that Ohio is the only state that probably has gone through -- at least that's the only one we were made aware of -- that have gone through the process of doing what we have started today with

this proposal.

HEARING OFFICER McGILL: You say USEPA has provided you information on the other states?

MR. HARSCH: On some that they've looked at; it's not complete. It's not every state and that's what Dr. Garvey, I think, is referring to.

MR. GARVEY: Right. It's just the states that we would consider the immediate region, so Minnesota, some of the northern states, but then Iowa, Kentucky --

HEARING OFFICER McGILL: I think we would just like to get a sense of where the other states were at and --

MR. GARVEY: Yeah. You're going to find it's heterogeneous at best.

MS. MOORE: And when did Ohio change their standards?

MR. HARSCH: I can't tell you exact date. I think it's in the last --

MS. MOORE: Last two years?

MR. HARSCH: -- three to four years if I recall.

MR. GARVEY: Yeah. I think the

current USEPA staff that we talked to had worked with them on that, so they have some understanding of it. It must have been fairly recent.

MR. HARSCH: We'll endeavor to find that out for the next hearing.

MR. GARVEY: Sure.

HEARING OFFICER McGILL: I think we do have some additional questions for Dr. Garvey. Does anyone in the audience have any questions for Dr. Garvey before we proceed with our questions?

(No response.)

Seeing none, I'll turn it over to Anand Rao of our technical unit.

MR. RAO: Dr. Garvey, we had some questions regarding how you came up with this time period for early life stages. I don't know if you're aware of, you know, Dr. Sheehan's testimony in a previous rulemaking and in that testimony he also had exhibits about different fish species in, I think, Illinois, and based on the information he had collected, IAWA proposed to the Board an early life stage time period from I think April through October.

And then the Board, when they

adopted the rule, it was changed from March through October. Could you explain in the context of the earlier testimony, you know, what's the rationale for charting the early life stages time period for dissolved oxygen, and specifically what's the difference between the ammonia toxicity and dissolved oxygen concentration?

MR. HARSCH: Earlier, we discussed this with the hearing officer and indicated that since Dr. Garvey really had not -- was not familiar with the written testimony of Dr. Sheehan, that maybe if you posed that question it might be appropriate to respond to that at the next hearing.

Dr. Garvey, if you can address that, that's find, but if you would like to --

HEARING OFFICER McGILL: You're welcome to consider it and respond at the next hearing. We have been referring to what has been entered as Group Hearing Exhibit 7, so everyone has access to that, and if Dr. Garvey would like to wait and follow up, he's welcome to or he can respond now and supplement later.

MR. RAO: You can do both. I mean, if you want to add more, you know, it's up to you.

MR. GARVEY: I consulted the same people that Dr. Sheehan consulted about the early life history stages and I'll be the first one here to admit that we do have fish spawning that occurs through October in the State of Illinois, okay, so we know that that's the case.

The tough issue here is that during the productive summer months, and this is what we mention in the report, there's a period of time that we know that dissolved oxygen concentrations decline below five milligrams per liter and we know that they, under a lot of circumstances, will decline far more than that, however, we still see the fish species present that spawn later on in the season.

And so essentially what we had to come up with was a way of rectifying that potential, I guess, conflict between what we see in the environment -- lopomas larvae, for example, lopomas being bluegill, the sunfish group -- continuing to spawn until very, very late in the fall. Well, why do they do that?

I published a few papers on this and it suggests widely for most fish species it's

almost inevitably the earliest spawned individuals within the population. The ones that spawn in the springtime during the period of time when we recommend having the perfected standards that will survive through the first winter of life and recruit or become -- they contribute to the population, all right.

The ones that spawn later on have a much lower probability of surviving typically due to the fact that they don't have as long of a growing season to grow up to a size where they can actually make it through the first winter of life. And essentially what we had to do was compromise between what we know happens in the environment, and we know when these fish spawn and July 1st seemed to be the right cutoff point for that.

Now, the reason why Bob suggested that you protect through the entire season is because ammonia and its effects on the environment and its relationship to temperature are not coupled with seasonal changes as dissolved oxygen is and so he can protect all the early life stages all the way through summer and not have to worry about rectifying that apparent contradiction between what

happens in the environment and basically what happens with the early life history stages of fish.

I don't know if I answered that clearly enough, but that was sort of what we had to rectify in the report.

MR. RAO: So it's not just the early life stages of the fish, but it's more to do with how the dissolved oxygen concentration affects the early life stages, is that what you're saying, as compared with ammonia?

MR. GARVEY: Well, what it is is the fact that all the species that essentially spawn in the summertime, okay, are either protracted spawners, which means that they spawn in the spring, but they continue to spawn throughout the summer.

And we know from much of the data that's out in the fisheries world that for those kind of species, the protracted spawners, the ones that spawn from spring throughout the summer, typically the individuals that contribute to the population are the ones that were spawn in the springtime.

The ones that are spawn in July through August just don't contribute much to the

populations, and I can point that out for all the centrarchids. So what we've done is basically taken care of that group of species. There's another group of species, the ones that spawn in the summer months, that tend to be in high flow, very highly predictable stream environments.

Those species have to basically have adaptations to deal with the summer environment. What is that adaptation? They live in environments that are always high flow, aerated, don't experience the kind of diurnal fluctuations or seasonal fluctuations that we see in other environments, all right.

And then the third group of species are what we call the opportunistic species. These are species that live in environments that are extremely disturbed. These are probably going to be DO tolerant species, and the reality is is that they just spawn throughout the year so that one clutch -- the mosquito fish are a perfect example of that. They spawn with small clutches throughout the year with just the expectation that some clutch is going to make it.

So basically our understanding of

the adaptations of these species rectifies why we should expect to see some spawning periods when we would expect oxygen to be low in the environment in the areas that we suggest sampling oxygen.

MS. LIU: Dr. Garvey, are you aware of any endangered or threatened species that have spawning periods outside of the time frame that you've proposed that might need extra protection because they might exist?

MR. GARVEY: State threatened, I can't give you anything off the top of my head. The one federally endangered species, the pallid sturgeon, will typically have finished its spawning and, again, this year we have data that suggests have already finished their spawning by the end of June and so essentially should be well protected by the standards that we suggest.

MR. RAO: A related question, and maybe this is for Mr. Harsch or Dr. Callahan, in the ammonia nitrogen rulemaking when this early life stages fact period was set, there was also a provision which allowed for a different, you know, time period protection if the agency had some specific information about a stream where there may

be some endangered species that needed, you know, additional protection. Is that something that you will be able to work with in this proposal?

MR. HARSCH: We would be happy to consider it. In large part, Dr. Garvey's time period is based from my understanding -- and Jim can confirm this please, is based on what has actually been observed in the natural system and where the fish are living and reproducing and we are getting DO levels that are below the five, six standard during those summer months and in conformance with what we are proposing.

So we kind of think that the natural system, the fish have adapted where we've pointed out they reside, in the aerated areas, the riffles, not the pool area where we're saying you should measure the DO to make sure that it's at that minimum.

Did I say that correct, Jim?

MR. GARVEY: Yes, Roy. You've interpreted me well.

MR. CALLAHAN: I'd like to add a point to that if I may. Rather than qualify this regulation on that or around that premise as we did

ammonia, I would rather advocate that we proceed vigorously with the development of redesignated streams where we can begin to assign specific ranging parameters to different water bodies perhaps on a different regional basis if we can come up with sufficient species composition differences.

So rather than qualify the DO regulation on that, I'd like to see us move forward with a more aggressive classification system that would offer a very high degree of protection where it was appropriate.

MR. HARSCH: And this is intended to be the starting point to adopt the appropriate essentially statewide general water quality standard. And I would echo on what Mr. Callahan is testifying to and that is that IAWA has started that process as well as would welcome the opportunity, as I've mentioned in my opening statement, to work with anybody that wants to proceed along that line. But developing an appropriate scientifically based general water quality standard is a starting point.

MR. RAO: Just a related question, earlier you mentioned about this new DO monitoring data that you will be presenting and maybe

discussing at the next hearing and also, you know, just now you've mentioned that some of the things that Dr. Garvey testified to was based on real data, is there any summary data you can provide into the record that we can take a look at?

MR. HARSCH: I would be happy to provide whatever we get from -- we've gotten copies and I have copied the computer disk in providing it to Dr. Garvey today on the work that was done on the Fox River that I talked about, and we have asked, as Dr. Garvey testified, IEPA for the data that's been collected to date from their continuous monitoring stations that I think were eight or 12 --

MR. MOSHER: Eight.

MR. HARSCH: Mr. Mosher says eight. I will take it at eight -- locations and that would include a number of differing water bodies and that that data is the data that Dr. Garvey will be looking at. We would be more than happy I guess to provide that if it's in any kind of usable form to the Board.

MR. RAO: If it is in a usable form and if it's not on paper, you know, if you could --

MR. HARSCH: Is a computer disk okay?

MR. RAO: Yeah.
MR. ETTINGER: We'd like to see any data you have too.
MR. HARSCH: Well, you've got this. I know you have Fox River stuff.
MR. ETTINGER: Other than -- we're talking about the Santucchi report and the USGS report?
MR. HARSCH: You have the Santucchi --
MR. ETTINGER: I understand that. I'm just saying as far as the DO data we've got, we're just talking about the Santucchi report and the USGS report?
MR. HARSCH: And the compilations that you've put together.
MR. ETTINGER: And then we're going to have the compilations of the Ohio River tributary --
MR. GARVEY: I'm sure I can do that.
MR. ETTINGER: -- observations?
MR. GARVEY: (Indicating.)
MR. JOHNSON: Doctor, you may have answered this question and I don't realize it, but the one thing I talked to the technical unit about that I was curious about is specifically the

designation in our ammonia rule, the early life stage period from March to October versus in the dissolved oxygen proposed amendment or rule, early life stage March through June, and I guess what I want from you is some specific -- or an answer as to whether or not there is a difference inherent between dissolved oxygen and ammonia that would make those early life stage periods that different?

MR. GARVEY: I think it all comes down to the understanding that in natural environments we are going to get sags in oxygen that occur in natural systems during the hot summer months when we have a lot of productivity, a lot of leaf cover over a particular stream that's going to cause what we call heterotrophic systems -- conditions which basically means that everything in the community is respiring and not producing a lot of oxygen.

And the only way to rectify that given the fact that we know that there is still assemblages in the state that are there is the fact that they must have adapted to the particular environment that they're in in order to survive, and, you know, the lopomas and the centrarchids are the perfect example of that situation, so the cutoff

there, you know, between June and July is somewhat artificial.

I can show you data to show that oxygen actually declines in systems in June, but, you know, I don't know where to make that actual cutoff, is it June 15 or is it July 1st? You know, July 1st sounds like it's a good point because we know that's when we're getting to the dog days of summer and we know for sure that that's when temperatures are going to be consistently warm, productivity is going to be consistently high, and we're going to basically see oxygen sags in these particular systems.

Reproduction is still going on. There are fish species that continue to persist under those conditions. There are also a lot of spring-spawning species that still for some reason spawn for a couple more weeks later on during the summer, but typically, we never see those late spawned individuals ever make it to the population. They just don't recruit.

Why do they keep spawning? That's actually a real persistent question that some of my research is trying to answer, and I have a couple of

papers that are published on that. But in general, it's usually the earlier spawned individuals in the spring prior to that July 1 that are going to make it for the spring spawners that are protracted into that period.

MR. JOHNSON: Thank you.

MR. HARSCH: I don't think there's any disagreement between what we've proposed and what Dr. Sheehan came up with in the earlier proceeding. If I understand what Dr. Garvey is saying, it really intuitively doesn't make sense to have a standard that says you have to protect early life stages when we have -- and then have an alternate where we have these in naturally occurring systems early life stages thriving and the dissolved oxygen -- and where we see the dissolved oxygen levels at the -- much below the lower number.

MR. GARVEY: Also, I'd like to qualify. So I'm talking about the spring spawners that are continuing in the summer, but then there are also another whole suite of species that continue to spawn in the summertime and they either have adaptations to deal with, occasional sags in oxygen, or there are species that exist in

environments where -- like riffle areas, a high flow area within a stream that if flow is interrupted, they've got a lot more problems than dissolved oxygen, because, obviously, that's going to negatively affect their ability to reproduce and survive within that particular environment.

MR. RAO: This is another follow-up to that. Do you have any fish population data in these low DO streams where these late spawners are thriving, you know, to support, you know, the statement that you're making? Are there, you know, any data available?

MR. GARVEY: Well, for example, if you go to Lusk Creek and you look at the fish assemblage that's there, we had occasional experiences and we have data, I hope, to show that's the case. Again, I'm not the kind of person to run around -- and if I'm proven wrong, you know, basically I'll come back and say after two months of looking at the data --

MR. RAO: No. I'm not asking you to prove you wrong. I'm just saying, you know --

MR. GARVEY: -- I'm proven wrong. But the point is we know these systems, at least in the majority of the systems in the state, there are

occasional declines to that 3.5 milligram per liter and still the populations do just find, they're persistent; they're are; we find them.

The only time that we see the populations decline or disappear is when there's a habitat alteration typically in effect, a reduction in riffle areas or the quality of the riffle areas or a reduction or a change in the flow regime.

That's going to be the important thing to be focusing, not the occasional dissolved oxygen fluctuation in that particular stream. And all you have to do is go out and basically look also at the fish data for the state and be able to make that inference.

MR. RAO: That's good enough.

MR. GARVEY: I mean, that's the point. I wish there were more data.

MS. LIU: I have one more question, but I'm not sure if, Dr. Garvey, you're the best person to answer it or maybe someone else with your panel today. There's been a lot of discussion about the impact of dissolved oxygen on aquatic organisms, but I was wondering in your research whether or not you found any information about the levels of

dissolved oxygen which might create a chemically-reducing environment in the water such that minerals in the sediment might solubilize and cause water quality problems for the drinking water system, iron and --

MR. GARVEY: Yeah. I mean, I only can think of -- I mean, that would have to be a chronic, almost an anoxic type of thing. I mean, I'm not a limnologist or a biochemist. That's got to be a situation that occurs like in the hypolimnion of a lake where oxygen is completely depleted and then you'll start seeing those severely reduced situations.

If we ever get to that point -- we've got a lot of other problems, so I don't think that's the issue. But that's, you know, based on my two cents worth on that.

HEARING OFFICER McGILL: I have two quick questions I just wanted to get on the record and then -- actually, let's go off the record for a second.

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

HEARING OFFICER McGILL: The Board

will just finish up with the question it has and then, Mr. Ettinger, if you want to follow-up on anything more with the IAWA witnesses, we can do that. And I'm not sure who the best person is to answer this, but I wanted to ask a question about the IAWA's proposing the rule language amendments to Board Rule Section 302.206.

I just had a couple of questions about the actual rule language that the IAWA is proposing, it says: Dissolved oxygen shall be determined on a monthly basis. What does that mean?

MR. HARSCH: In part, the standard is proposed to apply through various months of the year, so it would depend which month of the year you're in, what the actual standard is. Again, we're talking about a minimum value, seven-day mean minimums, but the numbers themselves break out depending on what month you're in.

HEARING OFFICE McGILL: So when it says shall be determined on a monthly basis, monthly in the sense of you need to look down into subsection A and B to figure out which standards apply?

MR. HARSCH: Yes.

HEARING OFFICE McGILL: It's not directing that tests be performed monthly?

MR. HARSCH: No.

HEARING OFFICER McGILL: And the other -- the word "should" appears in subsection A and subsection B, which is just not typical mandatory or regulatory language. Each subsection gives a definition, whether it's mean minimum or mean and then subsection A says the mean minimum should be based on a data recorder or representative grab samples and subsection B says mean should be based on data collected by semi continuous data loggers or estimated from the representative daily maximum and minimum values.

Is that just -- that's a suggestion? I'm just wondering about the word "should" and is this -- let me ask the first question. This is not mandatory, this is just a suggestion as to how those would be -- the mean minimum and mean would be determined?

MR. HARSCH: It's either going to be with a data recorder or representative grab samples. There's very little else. I'm not aware of any other method of determining what the dissolved

oxygen concentration is. It's either continuous semi -- actually, the technical word would be a semi-continuous data collector, logger, or a representative grab sample, so it's going to be one or the other.

HEARING OFFICER McGILL: Okay. So if it says "shall" or "must," that would not change your meaning?

MR. HARSCH: No.

HEARING OFFICER McGILL: And this is directed -- I mean, who's going to be doing the sampling, is this directed really at the agency?

MR. HARSCH: It could be anybody.

HEARING OFFICER McGILL: Any potential complainant possibly to bring --

MR. HARSCH: A complainant, Illinois EPA. There's requirements in NPD -- in some NPDES permits currently to do water quality analysis.

HEARING OFFICER McGILL: So it could be a discharger --

MR. HARSCH: Yes.

HEARING OFFICER McGILL: Okay. Thank you.

MS. LIU: Mr. Streicher or

Mr. Callahan, I was wondering if you can comment on whether or not the IAWA is aware of any of these dischargers who are having trouble because the DO standards aren't being met --

MR. STREICHER: With the dischargers having troubles with the DO in the stream?

MS. LIU: (Indicating.)

MR. STREICHER: Dischargers that are on streams that have TMDLs currently being published or being promulgated could or will be required to improve their treatment methods, treatment quality potentially to meet lower or more strict CBOD and ammonia standards. That's what's been proposed on the stream that I'm on and what is in the TMDL that's been published for Salt Creek.

MS. LIU: Could you describe what types of upgrades a plant might have to make in order to meet the DO?

MR. STREICHER: I could speak to what my plant would do. I meet -- the permit limit I have now is ten milligrams CBOD and a 2.3 milligram ammonia. The recommended standard would go to five for CBOD and one for ammonia. Typically, I meet those already, however, in my plant process,

there are times I may pop above that five parts.

What I would need to do is potentially in my plant put in tertiary filters, sand filters, that would remove further -- you know, lowering any material in the water that would contribute to BOD. Ammonia, it would be adding aeration capacity or modifying aeration methods, that sort of thing.

I don't know -- I couldn't -- I would be guessing at what the cost would be to that plant, but it would be significant.

MS. MOORE: Do you have excess capacity?

MR. STREICHER: I don't have excess capacity at my plant. Elmhurst is a sized-out community. We're not looking at any growth. We built a plant for the size of the community and that's where we're at now. We would have to add those treatment --

MS. MOORE: You would have to add additional capacity?

MR. STREICHER: Maybe not capacity, but ability to treat to that lower limit.

MR. JOHNSON: You testified,

Mr. Streicher, that there were about -- I think it was you -- that there are about 300 --

MR. STREICHER: Stream segments.

MR. JOHNSON: -- stream sites on the 303(d) list?

MR. STREICHER: Uh-huh.

MR. JOHNSON: If this proposed regulation were to become promulgated, how much would that number be decreased?

MR. STREICHER: That's a good question. In total numbers --

MR. HARSCH: Maybe I can address that a little better. Inquiring of IEPA as to how many exact stream segments that are listed and then it was the draft reports, no one really had a number. We had the numbers from previous years, but nobody counted up the segments. We went through and counted and there were 323 that we found that were listed as DO-impaired.

It is our understanding, and as Mr. Callahan and Mr. Streicher testified, that currently the Illinois EPA will list a segment if the biological indices are not adequate and then they'll look at what the causes are. If they have

data that's reliable and shows that there's the current standard of six and five as not being met, it's listed as DO-impaired and that's where the 320 comes from.

There are a number of segments when you go through the list and it's a public list, that are listed for MBI scores, habitat alteration, nutrient enrichment, and dissolved oxygen. I believe that it is the current IEPA policy, as testified by the witnesses because I've been to the same meetings where it's been presented, that if the IEPA does a TMDL on that segment, they would only be doing a modeling analysis to determine -- and to do a load allocation on dissolved oxygen.

So we would eliminate potentially all of those segments from requiring TMDLs if those segments actually meet the water quality standard we're proposing. Obviously, it would require the generation of data, if that data does not exist, to justify probably not doing a TMDL or removing -- because you're not going to be able to remove them from the list because they still have a macro -- the MBI would still be messed up.

But there is no parameter, no

water quality standard that would be in violation, so IEPA would not be doing a TMDL for those segments. I would very much like to know what the costs are and perhaps IEPA could provide that at the next hearing, but I believe that those costs in urban water segments are going to be upwards of $200,000 and plus to do those modeling analysis and probably upwards and in excess of $50,000 on rural water segments to go through that load allocation.

It's IEPA's position -- IAWA's position that that's really money that we could be wasting and maybe we ought to be spending those monies on habitat restoration through 319 grants or really focusing in where we actually have a water quality standard problem that's causing the -- whatever is causing the biology to be messed up. That's really what --

MR. STREICHER: Habitat restoration, you know, stream channel --

MR. JOHNSON: So it's not the existence -- the fact that you're on the 303(d) list that you're concerned about, it's the potential TMDL requirements that --

MR. HARSCH: That's correct. Now,

that doesn't -- you know, a lot of segments -- the data shows that Salt Creek and East Branch of the Dupage. Those are really the first two urban TMDLs that IEPA has tackled that we're aware of. If data showed that -- if you enacted this standard and it was approved USEPA, we would have to have data that would show it meets the current standard.

It still wouldn't take that segment off the TMDL list. There's a chloride issue with respect to water and there may be another issue, so a TMDL would still have to be done. But it's our understanding that the load allocation for BOD ammonia, et cetera, to get it to dissolved oxygen standards are really what's expensive to carry out. The modeling is difficult. Again, we're not the people that do it. We just -- my clients and myself go to those meetings and we hear IEPA talk about it.

But it's something that I believe USEPA has been talking about for ten, 12 years, that states need to get their water quality standards in order, make sure they're properly supported by scientific evidence before we go down the TMDL process or we would be wasting our time spending a

lot of public money doing the TMDLs and then coming up with a load allocation that's based on a computer model with an adequate margin of safety to comply with the standard that isn't scientifically based and that's why we're here in part.

MR. CALLAHAN: It would not be uncommon, I don't believe, to take a look at the list and find water segments that are listed that really don't have a chemical water quality parameter associated with it. Particularly down state there would be siltation, there's riparian bank modification, channelization, hydrology. There are a number of other factors just simply besides a chemical water parameter.

HEARING OFFICER McGILL: Mr. Ettinger, do you want to ask anymore questions?

MR. ETTINGER: If you had a number of 2.48 in a stream occurring in June, that would blow your standard, wouldn't it?

MR. HARSCH: Yes.

MR. ETTINGER: And we would still have to do a TMDL on that stream?

MR. HARSCH: Right.

MR. ETTINGER: Have we ever done a

study of how many of these 300-plus streams would violate your standard?

MR. HARSCH: (Indicating.)

MR. ETTINGER: Does the IAWA even have that data?

MR. HARSCH: Of course not.

MR. ETTINGER: It's all at IEPA?

MR. HARSCH: Or the survey.

MR. ETTINGER: Or the survey. We don't really know how many of these 300 listed streams are affected by this proposal?

MR. CALLAHAN: That wasn't our intent, Albert. Our intent was to come up with a good standard.

MR. STREICHER: Our intent is not to get streams off of the TMDL list, but to do the TMDL using a correct standard.

MR. ETTINGER: Well, that's an (unintelligible). The -- we have your testimony.

MR. HARSCH: Albert, in further response to your snide comment, this proposal is not intended to result in a degradation of the dissolved oxygen water quality across the State of Illinois.

It is intended to reflect what is

probably occurring across Illinois and gauge what should be the protective water quality standard based on scientific evidence that is necessary to support the aquatic life that we find here, right, Jim?

MR. GARVEY: Yeah.

MR. ETTINGER: Okay. Do you have any further things you want to say?

MR. HARSCH: No. Thank you.

MR. ETTINGER: Okay. Fine.

Mr. Callahan, you say you've been a member of the IEPA Nutrient Science Advisory Work Group?

MR. CALLAHAN: Uh-huh.

MR. ETTINGER: Did you ever discuss this proposal with the Nutrient Science Advisory Work Group?

MR. CALLAHAN: Not to my recollection. I --

MR. ETTINGER: Thank you. If you want to give a speech, we can go on, but I think we've had enough today.

MR. CALLAHAN: Well, I would like to if I may.

MR. ETTINGER: Go ahead.

MR. CALLAHAN: It was requested that we present it to the agency for their review before we presented it publicly to anyone. They helped us with the original design and conceptualization of it and shortly after that, it was presented publicly. I believe Ms. Wentzel was at our March spring conference. That was the public presentation of it at that time.

MR. ETTINGER: Are you aware of any studies that would enable us to trace particular nutrient levels to dissolved oxygen numbers?

MR. CALLAHAN: Qualitatively, probably; quantitatively, no. That's our problem. We know that in certain streams -- I think Mr. Mosher, this has been one of his principal quandaries, and the whole nutrient issue is that there are certain streams which reflect diurnal oxygen stress at a given concentration of phosphorus in this state and others at the same concentration don't, so --

MR. ETTINGER: Are you aware of any data that, for instance, would say that at, you know, .6 phosphorus that we can expect a DO level

of, you know, four, but at .8 we'll have a DO level of five or three or something?

MR. CALLAHAN: No.

MR. ETTINGER: Is the nutrient study group developing evidence like that?

MR. CALLAHAN: That's the principal concern of the SFAR funded work that's being done. This proceeding had its origins in that. We wanted to basically evaluate what was going to be necessary to afford DO protection early on in the work group's existence so that we would be able, once that relationship is established, to come up with an adequate phosphorus concentration.

MR. ETTINGER: Okay. I just have one more question. There's been various discussion about implementation rules. Prior to this meeting today, have you discussed with IEPA any sort of timetable for development of implementation rules?

MR. HARSCH: In general terms, yes, but in specifics, no. It's not surprising that Illinois EPA has asked USEPA to review the rule. That was part of the reason why we had a meeting. And I think IEPA would be hopeful that USEPA would provide some input and comment because I think it's

IEPA's normal position that they don't want the Pollution Control Board enacting a standard if USEPA is not going to approve it or at least recommend approval.

MR. ETTINGER: I asked a very simple question and I'm getting a whole lot --

MR. HARSCH: Well, what I'm getting to --

MR. ETTINGER: -- speculation as to what IEPA is thinking about what USEPA is doing.

HEARING OFFICER McGILL: Not to interrupt. It's late in the day and I think everybody is getting a little testy. Let's just try to maintain --

MR. ETTINGER: Right.

HEARING OFFICER McGILL: The question was, I think, is there a time frame for implementation of the IEPA implementation rules and I think the answer was that you discussed it him generally, but there wasn't any specific timeframe.

MR. HARSCH: Yeah. I think that that process would start when the Illinois EPA has a belief that this proposal isn't likely to proceed through adoption by the Board after IEPA has gauged

the response to what we've proposed, and I think that's a reasonable position to take.

So, Albert, you know, the quick answer is there's no set timetable. Do you and I expect to probably sitting down with IEPA in the next few months and beginning this process? I sure hope so.

MR. ETTINGER: So we're expecting a process to begin in the next few months that will lead to the development of implementation rules; is that correct?

MR. HARSCH: Correct.

MR. ETTINGER: Thank you. I think we've had enough from me for today.

HEARING OFFICER McGILL: Okay. I'll open it up one last time if anyone in the audience has any questions for the IAWA's witnesses, if you would please raise your hand.

MR. JOHNSON: I've got one question for John. I think you said -- or in the prefiled testimony it indicated that you were the one that initially selected Drs. Garvey and Whiles to do the report. Are they located close to you or you knew them from previous -- how did you go about picking

them to do your work for you?

MR. CALLAHAN: Southern Illinois University caught my eye as a repository of fish knowledge, because of Dr. Roy Haidinger, who 20 or 30 years ago did a great deal of work involving wastewater effluence and the lower gradient streams of down state Illinois, and it was through Dr. Haidinger that I met Dr. Sheehan who assisted us with the ammonia.

And, obviously, Dr. Garvey and Dr. Whiles I knew through Dr. Sheehan, so that was my place to start. I respect the integrity and the reputation of their fisheries laboratory as I think it is well-respected nationally, and I didn't have to look any further.

HEARING OFFICER McGILL: Okay. I don't think we have any other questions at this time for the IAWA's witnesses. I'll ask is there anyone else who wishes to testify today?

(No response.)

Seeing none, let's go off the record for a moment.

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

HEARING OFFICER McGILL: We just had a conversation about the availability of today's hearing transcript and the issues of the August 12th hearing and prefiled testimony. Right now we have a second hearing scheduled for August 12, 2004 at 1:00. Based on the large turnout we had today and what we expect in August, we're going to need to change the hearing room location.

It will still be in Springfield, but we will not be in the Board hearing room at 1021 North Grand Avenue East, and I'll put out a hearing officer order indicating the new room location and a target for prefiling testimony for the August 12th hearing, and there will in all likelihood be a prefiled testimony deadline of sometime in the week of August 2.

We know that it's kind of a tight timeframe, but we'd like to keep the August 12th date at least at this point and it's always very helpful and meaningful to be able to review testimony before the hearing date. I'll also mention that we are receiving written public comments and anyone may file written public comments on this rulemaking proposal with the Board.

If you would like to be on the notice or service list, you can contact me. The persons on the notice list receive Board orders and hearing officer orders. Persons on the service list would receive those orders as well as anything that's filed in this proceeding, prefiled testimony, public comments, things like that.

We're hoping to have today's hearing transcript in the Board's offices by the end of the week of July 5th, so probably by July 9th, and then we'll post it as quickly as we can on our web site. If anyone has any questions about any procedural aspects of our rulemaking, you can contact me at (312) 814-6983 or by e-mail at mcgillr@ipcb.state.il.us.

I would like to on the record thank everyone for their patience and flexibility today as we scrambled to find an appropriately -sized hearing room. I think we ended up doing well, but I appreciate everyone's cooperation and also the preparation that clearly went into getting ready for today. The questions and responses I think are helping to build a record, and I appreciate everyone's efforts.

Are there any other matters that need to be addressed at this time?

(No response.)

Seeing none, I'd like to thank everyone again and this hearing adjourned.

(Which were all the proceedings had in the above-entitled cause on this date.)

STATE OF ILLINOIS)
) SS.
COUNTY OF DUPAGE)

I, MARIA E. SHOCKEY, CSR, do hereby state that I am a court reporter doing business in the City of Chicago, County of DuPage, and State of Illinois; that I reported by means of machine shorthand the proceedings held in the foregoing cause, and that the foregoing is a true and correct transcript of my shorthand notes so taken as aforesaid.

_____
Maria E. Shockey, CSR
Notary Public,
DuPage County, Illinois

SUBSCRIBED AND SWORN TO
before me this ___ day
of _____, A.D., 2004.

_____
Notary Public