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Illinois Pollution Control Board:

I have attached testimony for the August 25th hearing on Illinois Pollution Control Board (IPCB) Proposal: R 2004-025; Proposed Amendments to Dissolved Oxygen Standard [35 Ill. Adm. Code 302.206] for general use waters in Illinois. I would appreciate the opportunity to present a summary of these comments to the Board at the hearing.

STATE OF ILLINOIS
Pollution Control Board

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Introduction

The rationale for this proposed amendment to the Illinois water quality (WQ) standards is to update them since there have been changes to the US WQ Standards. The current dissolved oxygen (DO) regulations have led to a marked—and in some ways a remarkable, improvement in the water quality in the rivers of Illinois. This improvement has had great benefits to the citizens of Illinois in improving the habitat for native aquatic species, in increased fishing and other recreational opportunities for residents of Illinois and of other states, and in lower treatment costs for users of Illinois waters.

It is time to continue this trend, to move Illinois streams to the fishable, swimmable goals of P.L. 92-500, the Water Quality Act of 1972 and its amendments, and to make the waters of Illinois more attractive to those who live on them, and to those who use them for recreational and commercial purposes.

It is unfortunate then that the proposal from the Illinois Association of Wastewater Agencies (IAWA) proposes less stringent regulations, regulations that will lead to increased pollution in Illinois' rivers and to a degradation of their water quality.

In support of the request to allow additional pollution in our rivers, the IAWA submitted an Assessment Document based heavily on the U. S. EPA's 1986 National Criteria Document on DO (Chapman, 1986; NCD).

Comments

The problems with the NCD and the Assessment Document (AD) are several and severe:

1. The NCD and the AD submitted by the IAWA both contain numerous disclaimers that *most of the data are based on laboratory studies that are not directly applicable to the natural situations. However, both documents then base their conclusions almost exclusively on the laboratory data.* In numerous places (see notes), the NCD points this out and qualifies their recommendations that *natural waters are significantly more complex, and that standards based on ambient measurements would be expected to be more stringent, e.g., more DO needs to be present to prevent harm.*

However, the *three field studies* discussed in the NCD, p. 19-20, *all show significant deleterious effects at DO concentrations below 5 mg/L.* The document concludes, "These three field studies all indicate that ... sites with dissolved oxygen concentrations *below 5 mg/L* have fish assemblages with increasingly poorer population characteristics as the DO concentration becomes lower." **The proposal before the IPCB is to permit a one-day minimum of 3.5 mg/L DO for eight months of the year!!**

Some of the additional problems well documented in the NCD with natural waters compared to lab studies are: 1) abundant food is *not* provided in the wild and the fish expend more energy foraging there; in passing additional water over their gills to obtain needed oxygen, fish expend more energy and are exposed to increased amounts of toxins; fish are at increased risk of disease; and when they are forced to move to the surface or other areas of higher DO levels they are at increased risk of predation. These and perhaps other causes result in lower growth rates at low DO levels.

The test endpoint in many of the studies is the death of the organism. There can clearly be many serious but less obvious deleterious effects in the fish that have not been quantified that may/probable occur at DO levels above the lethal limit. For instance, we know that in higher organisms one of the early effects of deprivation of oxygen is damage to nerve cells, and to

the brain in particular. No studies are quoted where the effect of exposure of fish to repeated DO levels above the lethal limits on brain and nerve function was determined.

2. The majority of the studies discussed in the NCD done on a relatively small number of fish species, the salmonids. In fact the document states, “More importantly, *data on the tolerance to low DO concentrations are available for only a few of the non-salmonid fish.*”
3. For DO, percent saturation and mg/L can be mathematically related to one another, but they are *not equivalent measures of the availability of oxygen* to indigenous organisms. While DO concentrations are often determined (chemical tests) and reported in mg/L, the availability of oxygen to organisms depends on its activity—its percent saturation or oxygen tension (electrochemical test). Thus, 3.5 mg/L of DO corresponds to 43% of saturation at 25°C, but only 24% of saturation at 0°C. *Thus, to permit DO levels less than 25% saturation in the cold months of the year as is proposed, can be expected to cause harm to fish and other aquatic organisms.* It could be noted that the oxygen tension at the summit of Mt. Everest – commonly referred to as the ‘dead zone’, is only 33% of the oxygen tension at sea level.
4. The DO standard recommended in the NCD is based on a curve fit to the data for about 20 species of fish. The curve then gives a best estimate of *the mean LC₅₀ level* for the species tested. *Since the LC₅₀ level for many fish is above this level, they are clearly NOT protected by the proposed lower standard*, and in fact several species studied had *LC₅₀s* above the NCD recommendations, including channel catfish and large mouth bass. It would be disastrous to aquatic fauna in Illinois rivers if only those species whose DO requirements were at or below the mean were afforded protection by Ill. WQ regulations.

The data in Fig 1 of the NCD show that while the young forms of most fish are not adversely affected by DO levels below 6 mg/L, the young forms of some fish some are, including warm water fish such as channel catfish, smallmouth bass and perhaps northern pike.

5. The IAWA Assessment does not claim that 5 mg/L will protect the young forms of all warm water fish or other aquatic organisms. Rather they make the **totally unsupported statement** that, “*Warm water species that spawn later during the summer should have adaptations for naturally occurring reductions in DO concentrations expected to occur during warm months.* (Executive Summary)”

Maybe these summer-spawning species evolved when warm waters in Illinois were close to *saturation* (see above) with dissolved oxygen *throughout* the year, when waters were uncontaminated with anthropogenic, oxygen demanding inputs. *Maybe undocumented, self-serving statements of the IAWA should not serve as the basis for Illinois DO regulations.*

6. A major problem with lowering the DO standards is that the proposed concentrations are much closer to levels that cause damage to indigenous organisms, increasing the risk that a violation of the standard will cause harm. The usual rule for environmental quality guidelines is to include a reasonable *safety margin* to prevent damage to the ecosystem from the unanticipated fluctuations that occur.
7. It could be that the proposed regulations will give sufficient protection to many of the organisms present in the warm, general use water in Illinois. The problem is whether the standards will be met—how frequently and to what extent will they be violated. The current diurnal, daily and weekly variability of the DO concentration needs to be determined before any change could be supported. How much does it vary and what are the normal and the

highest daily and weekly variation. With no change in the regulations, how often do current ambient conditions violate the proposed regulations?

8. In addition, the WQ standards are only the first issue. They can and should be written to be sufficiently protective of whatever species are deemed to require protection. Other important issues include how the regulations will be implemented, and how they will be enforced. What additional monitoring will be required and who will pay the costs; what procedures will be in place to respond to violations (identifying the causes; halting discharges; adding oxygen to the waters; *etc.*); what will be the procedures for identifying violators, and what will the penalties for violations of the regulations be. Addressing these questions will be much more important if the DO limits are lowered as proposed, narrowing the safety factor that should be part of all regulations.

Conclusions

- There are insufficient data presented in the IAWA Assessment Document to demonstrate that the proposed weakening of the ambient WQ DO regulations will be protective of indigenous organisms. Therefore only a tightening of these standards should be considered to hasten the recovery of our warm waters to fishable swimmable conditions ASAP. When our warm waters again maintain sustaining levels of all native flora and fauna, then perhaps the IPCB can discuss fine-tuning the DO regulations on those waters.
- WQ criteria need to be based on the oxygen availability—the percent saturation, and the DO concentrations should *not* be permitted to go below 33% saturation (≈ 5 mg/L at 0° C).
- Before considering changes in the DO regulations, the IPCB needs to determine current DO levels and their variability in Illinois' rivers and the DO requirements of native aquatic species, and base proposed changes on those data. What is the need to change the current DO regulations? These regulations have served Illinois well in improving the WQ in its rivers, why lower them?
- I do not think that the people of Illinois will support increased pollution of their rivers after so much time and so many resources have been spent in recent years in improving their quality to where they now contribute significant recreational and economic benefits to the state. Have we spent billions of dollars over the past 30 years or so to clean-up our rivers, to allow the return of many native species to their former habitat, just to allow more pollutants to be discharged into them?