Overview of OWQ's Aquatic Life Methodology and the Need to do Updates

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Indiana's Surface Water Quality Standards

- Currently, two sets of rules:
  - Waters outside of the Great Lakes System ("Downstate").
  - Waters within the Great Lakes System.

- Differences between rules:
  - Some criteria (narrative and numeric);
  - **Methodologies to derive criteria for substances that are not in rule;**
  - Specific federal requirements for Great Lakes states and provinces.

One of IDEM's overarching goals is to have consistent WQS rules for the whole state, when it makes sense to do so.

Aquatic Life Methodology – Rulemaking Proposal

- OWQ plans to propose a rulemaking to update Downstate (outside of the Great Lakes basin) procedures for calculating aquatic life criteria for substances for which U.S. EPA has not published Nationally Recommended Water Quality Criteria (NRWQC). The rulemaking would:
  - Apply the Great Lakes aquatic life methodology statewide.
  - Update the aquatic life methodology to reflect current U.S. EPA guidance and the latest science available on calculating criteria with a limited toxicity dataset.
  - Allow IDEM to proceed with permitting and use more appropriate methods to derive ambient WQC when there are not criteria in rule for substances that could adversely impact aquatic life.

Indiana's Narrative Water Quality Standards

- 327 IAC 2-1-6 (Downstate) and 327 IAC 2-1.5-8 (Great Lakes) both contain narrative standards that protect Indiana's waterbodies from substances in amounts that could be acutely or chronically toxic to aquatic life.
- To protect our designated uses and implement our narrative standards, IDEM must at times "interpret or translate the narrative standards" into a numerical expression.
- To translate narrative to numeric, the rules contain an aquatic life criterion derivation methodology for the Downstate and Great Lakes region, for situations where IDEM must calculate a water quality value for a pollutant of concern, mainly when a permit applicant proposes to discharge a pollutant that does not have a numeric criterion.

Downstate Aquatic Life Methodology

Acute Criteria Derivation

- Method 1 (Complete Toxicity Dataset)
- Method 2 (Limited Dataset)

Chronic Criteria Derivation

- Method 1 (Complete Toxicity Dataset)
- Method 2 & 3 (Limited Dataset)

Great Lakes System Aquatic Life Methodology

Complete Toxicity Dataset

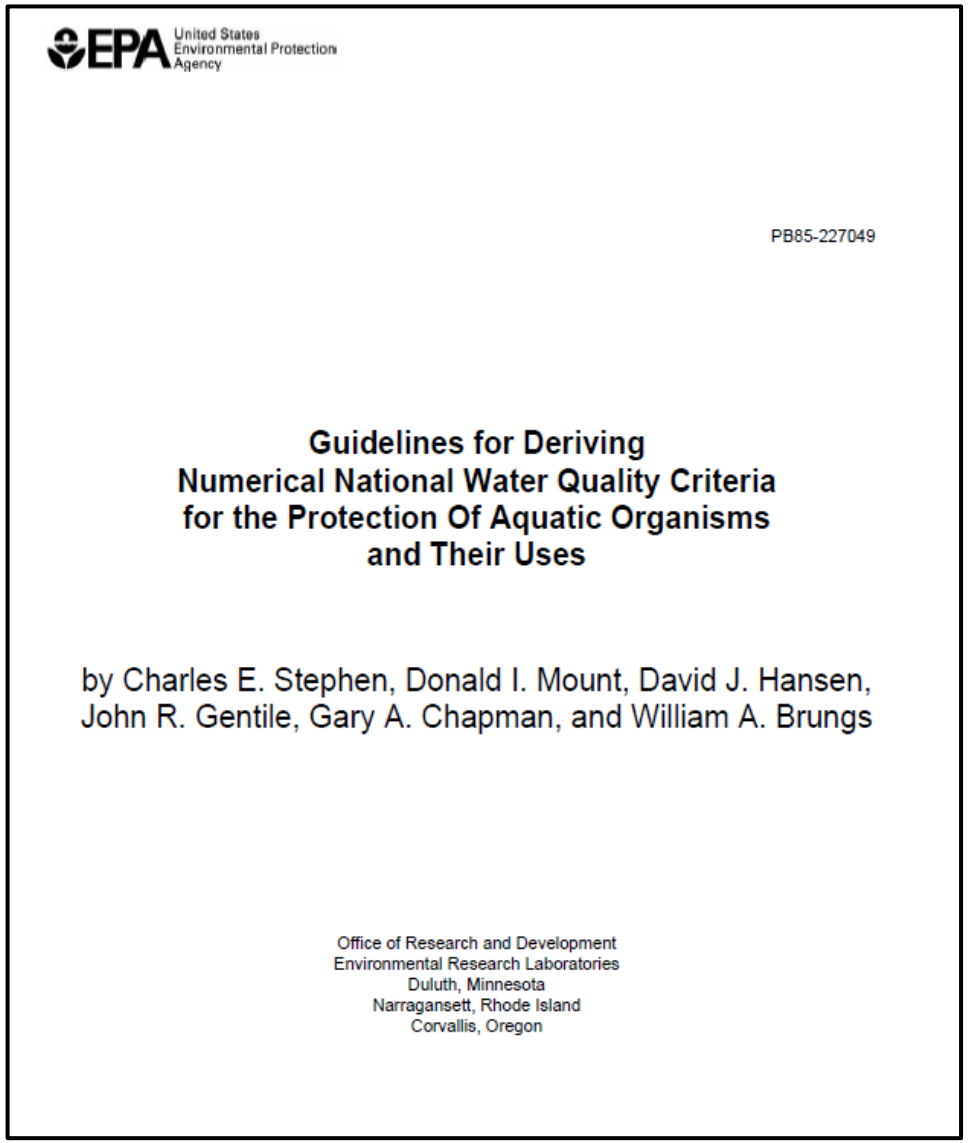
- Tier I Methodology for acute and chronic criterion derivation

Limited Toxicity Dataset

- Tier II Methodology for acute and chronic values derivation

U.S. EPA's 1985 Guidelines for Deriving Aquatic Life Criteria

- U.S. EPA's main guidance document for deriving aquatic life criteria is the 1985 guidelines document.
- Guidance procedures are designed to protect 95% of aquatic genera.
- Guidelines are used by U.S. EPA when they work on developing their nationally recommended criteria.
- Aquatic life criteria are based on short-term and long-term aquatic life tests.
- **Note:** 1985 guidelines did not address what to do when there is limited toxicity information available.



EPA United States Environmental Protection Agency

PB85-227049

Guidelines for Deriving Numerical National Water Quality Criteria for the Protection Of Aquatic Organisms and Their Uses

by Charles E. Stephen, Donald I. Mount, David J. Hansen, John R. Gentile, Gary A. Chapman, and William A. Brungs

Office of Research and Development
Environmental Research Laboratories
Duluth, Minnesota
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Minimum Data Requirements (MDRs) Freshwater

SALMONID

SECOND FISH FAMILY

CHORDATA

PLANKTONIC CRUSTACEAN

BENTHIC CRUSTACEAN

INSECT

ROTIFERA, ANNELIDA, MOLLUSCA

OTHER INSECT OR MOLLUSC

Photo Credit: U.S. EPA Aquatic Life Criteria WQS Academy 2022 Presentation

Acute Toxicity Tests

96-hour LC_{50} values from the literature

Concentration:

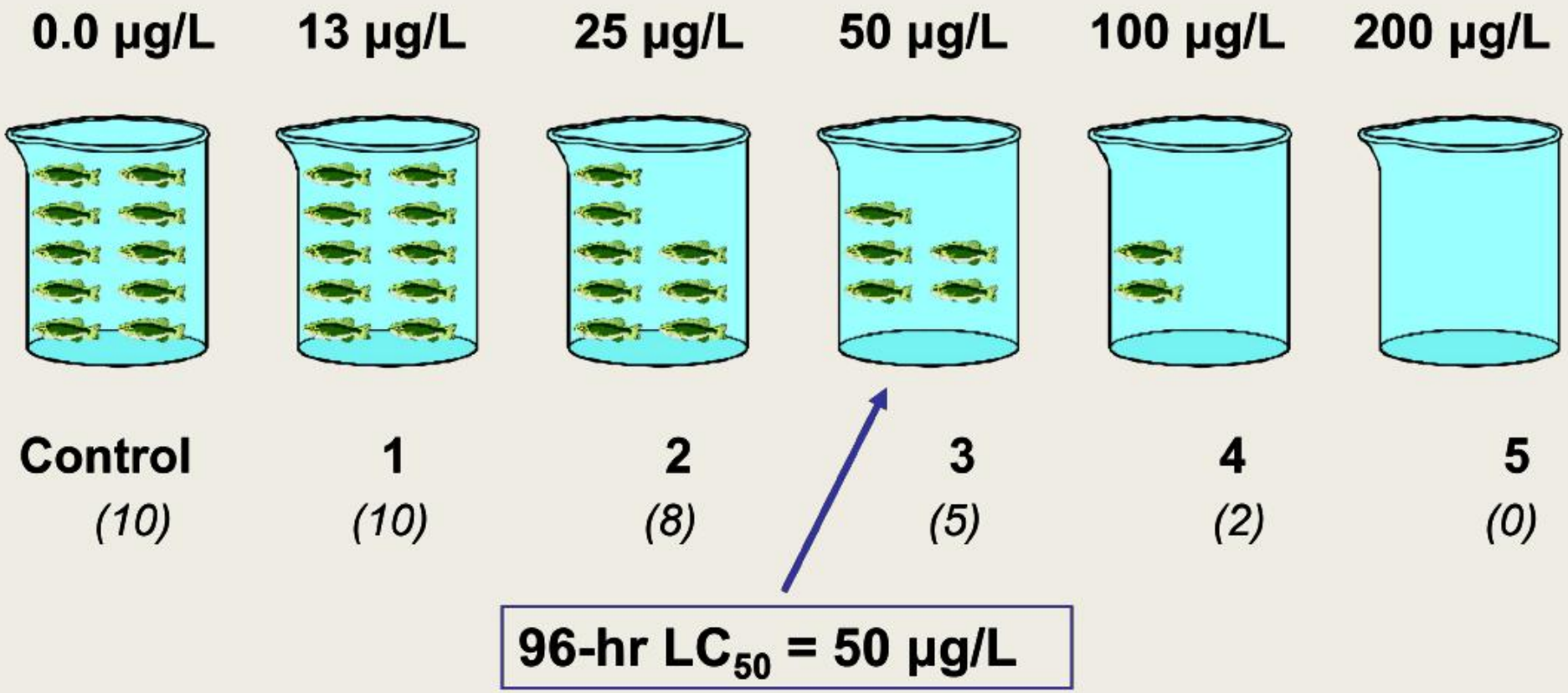

Photo Credit: U.S. EPA Aquatic Life Criteria WQS Academy 2022 Presentation

Chronic Toxicity Tests

- Chronic tests are typically much longer than acute tests
- Chronic toxicity tests examine a chemical's effects on long-term survival, growth, and reproduction effects
- Chronic tests are typically more expensive than acute tests
- Acute-to-Chronic Ratio (ACR) is a ratio of acute to chronic toxicity
  - Based on acute and chronic tests using the same species in same dilution water
  - ACRs can be used to calculate a chronic criterion when there is limited toxicity data available

$$ACR = \frac{Acute\ Value}{Chronic\ Value}$$

About the Great Lakes Initiative

In March 1995, U.S. EPA published Water Quality Guidance for the Great Lakes watershed, commonly known as the **Great Lakes Initiative (GLI)**.

The guidance consists of:

- water quality criteria for 29 pollutants to protect aquatic life, wildlife, and human health, and
- detailed methodologies to develop criteria for additional pollutants;
- implementation procedures to develop
  - consistent, enforceable water quality-based effluent limits in discharge permits,
  - as well as total maximum daily loads of pollutants that can be allowed to reach the Lakes and their tributaries from all sources;
- and antidegradation policies and procedures.

The Great Lakes watershed includes eight U.S. States: Minnesota, Wisconsin, Illinois, Indiana, Michigan, Ohio, Pennsylvania, and New York.

Photo credit: About the Great Lakes Initiative | US EPA

Great Lakes Aquatic Life Methodology

- Retained core procedure of 1985 Guidelines when calculating an aquatic life criterion. The "Tier I" procedure of Great Lakes methodology is almost identical to that in U.S. EPA's 1985 Guidelines.

- Added a "Tier II procedure" to handle situations where limited toxicity data exists for a pollutant.
  - Is based on academic research papers and U.S. EPA's statistical analysis applied to empirical toxicity data.
  - Went through Scientific Advisory Board (SAB) committee and the federal register rulemaking process.
  - Includes a Tier II procedure for calculating **derived acute and chronic Tier II values**. The Tier II procedure is based on applying protective factors to account for the uncertainty surrounding how acutely and/or chronically toxic the pollutant is.

Downstate versus Great Lakes Methodology for Tier I Criteria

- U.S. EPA's 1985 national methodology (and the Great Lakes methodology) requires toxicity data for **eight families** and **three acute-to-chronic ratios** for the chronic derivation**.**
- Downstate methodology only requires toxicity data from **five families** and only requires **one acute-to chronic ratio** when deriving a chronic criterion (not inline with EPA's 1985 Guidelines).
  - The Downstate methodology does not require toxicity data from the families of aquatic organisms that U.S. EPA considers sensitive to toxic pollutants

Methodology Requirements	Downstate Aquatic Life Methodology	Great Lakes Aquatic Life Methodology
Number of families for Tier I	5*	8
Number of acute-chronic ratios for Tier I criterion	1*	3

*** not consistent with EPA's 1985 guidance**

Downstate versus Great Lakes Methodology for Tier II/Secondary Values

- When calculating a Tier II value, the Great Lakes methodology uses an adjustment factor in the calculation based on how many aquatic life families are represented in the toxicity dataset.
- The Downstate methodology uses adjustment factors as well, but it is based on the presence or absence of rainbow trout toxicity data.

- If there are no chronic data available for a chemical:
  - The Downstate methodology calculates the final chronic value by dividing the Final Acute Value (FAV) by 45, while the Great Lakes System methodology divides the FAV by 18. **This difference may allow for a less stringent/conservative derived criterion.**

Comparing Tier II/Secondary Acute Adjustment Factors

Great Lakes Aquatic Life Methodology	
# of Aquatic Families Represented	Adjustment Factor Used
1	21.9
2	13.0
3	8.0
4	7.0
5	6.1
6	5.2
7	4.3

Downstate Aquatic Life Methodology		
	Rainbow trout Present	Rainbow trout Absent
Adjustment Factor Used	5	10

Other Benefits of Adopting the Great Lakes Methodology Statewide

- The Great Lakes methodology provides a detailed road map with written directions on how to calculate the acute and chronic criteria. The methodology makes very clear which kind of toxicity data are acceptable and not acceptable, such as test conditions, test duration, and appropriate toxicity endpoints.

It's Been 35 Years Since the Downstate Aquatic Life Methodology was Adopted

- **1985 EPA Guidelines for Deriving Water Quality Criteria**
- 1990 IDEM Rulemaking for Waters Outside of Great Lakes system
  - IDEM adopted a downsized version of U.S. EPA's 1985 Guidelines for Deriving Water Quality Criteria
  - IDEM adopted a methodology to derive criteria for pollutants with limited toxicity data based on other states' methodology (Wisconsin and Ohio)
- **1995 Great Lakes Water Quality Guidance**
  - Tier I methodology- almost identical to 1985 Guidelines
  - Tier II methodology- methodology for pollutants with limited toxicity data
- 1997 IDEM Great Lakes Rulemaking
  - IDEM adopted Great Lakes Tier I and Tier II methodology for the Great Lakes system for deriving aquatic life criteria

What Happens to Downstate Derived Criteria when you Recalculate them Under the Proposed (Great Lakes) Methodology?

- Some of the derived criteria will become less stringent under the updated methodology and some of the derived criteria will become more stringent under the updated methodology.
- The number of impacted permits is relatively small. There are a select few permit limits that are based on a derived aquatic life criterion.
- The calculation depends on several factors:
  - How toxic is the pollutant?
  - How many aquatic life families are represented?
  - Are there any chronic data available for the pollutant?

Note: Derived criteria can be re-calculated if additional toxicity data becomes available.

Rationale for Updating Aquatic Life Methodology

- This rule update will help IDEM fulfill Indiana's goal of preventing toxics in toxic amounts in Indiana's waterbodies and protect Indiana's aquatic life use designation.
- IDEM is not proposing a new framework, rather IDEM is proposing to update the current Downstate methodology to more appropriately address situations where limited toxicity data exists for a pollutant.
- The proposed rulemaking is in line with Executive Order 25-38
  - Regulations and rules should be grounded in best available science and should benefit the environment
- IDEM believes that applying the Great Lakes aquatic life methodology statewide provides consistency in protecting Indiana's designated uses and supports sound water quality management decisions.

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IDEM Water Quality Standards Webpage
idem.IN.gov/cleanwater/resources/water-quality-standards

Questions?