THE SCIENCE BEHIND THE CHLORIDE WATER QUALITY STANDARD

Proactive By Design.
Our Company Commitment

Presented to the
DuPage River/Salt Creek Workgroup
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BACKGROUND: URBAN STREAMS

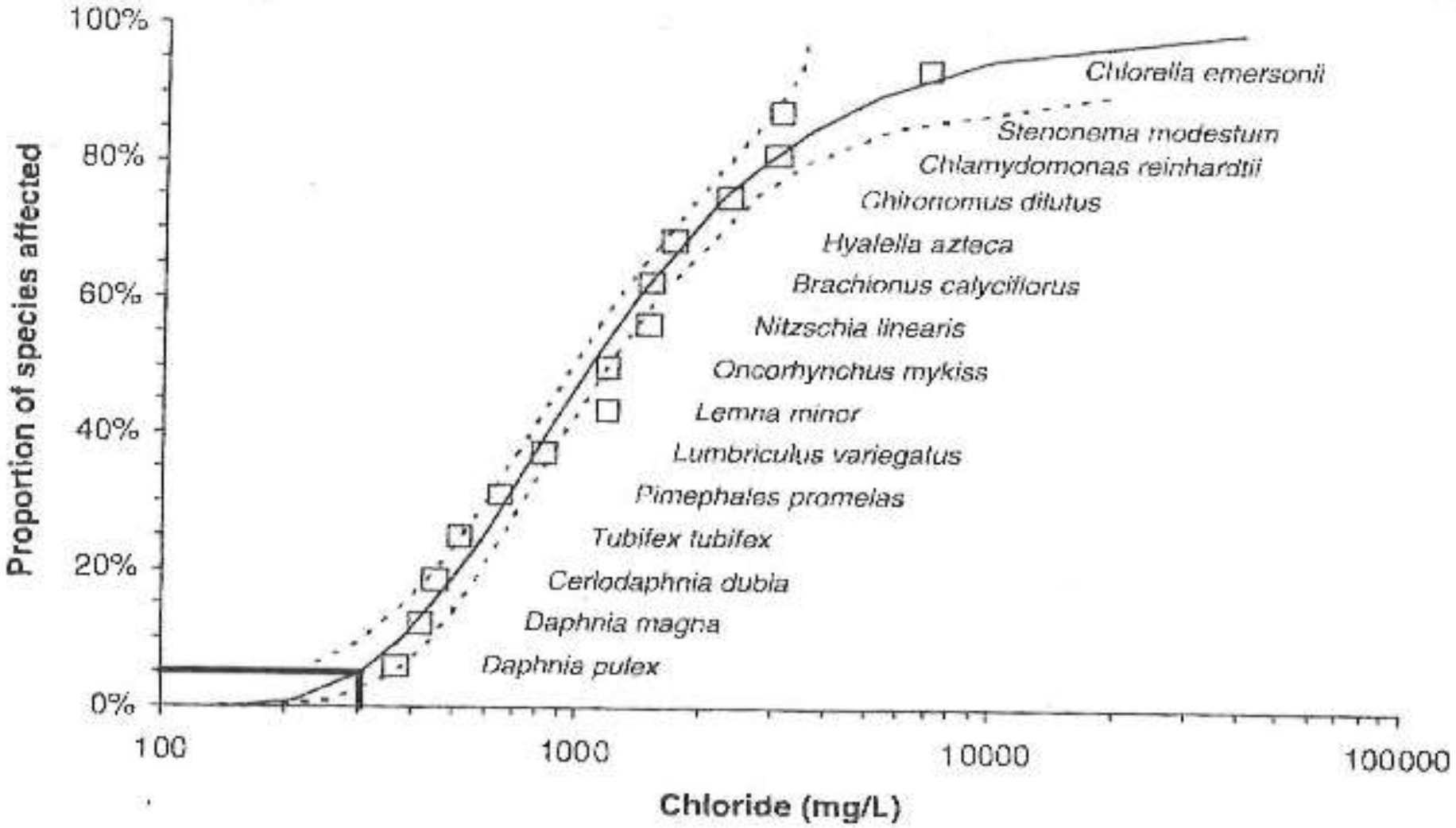
- From 1960 to 2011, chlorides in urban streams have increased by 84%.
- Chloride concentrations have increased more rapidly than the urban growth rate.
- Peak chlorides are a winter time issue; however, extended periods of elevated chlorides (above background) have been observed through much of the summer.

SO HOW ARE TOXICITY STANDARDS DERIVED?

- Derive the **Genus Mean Acute Value** (GMAV) using Geometric Mean of tests for same species.
- Use the Four most sensitive GMAV values (lowest ones) and calculate **Final Acute Value** (FAV).
- Final FAV **1,720 mg/L** Chloride
- Acute Water Quality Standard is set at **50%** of the FAV, or **860 mg/L**.
- Designed to protect 95% of the Species

FROM TOXICITY DATA TO CHRONIC STANDARDS-USEPA PROTOCOL

- Less Chronic Data Exist.
- Calculated **Acute to Chronic Ratio** (**ACR**) for fathead minnow (15.17), rainbow trout(7.308), and *Daphnia pulex* (3.954).
- Final ACR, Geometric Mean, **7.594**.
- Chronic Water Quality Standard = Final Acute Value/Acute to Chronic Ratio (FAV/ACR) or **230 mg/L**.



- "Elphick, J., et al. Chronic Toxicity of chloride To Freshwater Species: Effects of Hardness and Implications For Water Quality Guidelines, Environmental Toxicology and Chemistry, 2011.

RECENT CHLORIDES WATER QUALITY FINDINGS

- 2009, USEPA recommended the following water quality criteria:
  - Acute: **860** mg/L
  - Chronic: **230** mg/L
- Iowa, retained Dr. Soucek, from IDNR.
  - Found chloride toxicity a function of hardness
  - Other states have adopted Iowa standards
  - USEPA approved Iowa's regulations

ILLINOIS DEPARTMENT OF NATURAL RESOURCES

RECENT CHLORIDES WATER QUALITY FINDINGS

- Souceck and Dickinson: Chronic Toxicity of Sodium Salts to the Mayfly *Neocloeon Triangulifer:*
  - 96-hr LC50: 1,062 mg/L Cl/L at **25 degrees C**
  - Acute to Chronic Ratios varied from 2.1 to 6.4 for chronic four metrics evaluated, or 265 to 504 mg/L chronic concentrations.

RECENT CHLORIDES WATER QUALITY FINDINGS

- The DuPage River/Salt Creek Workgroup fish and benthic monitoring **suggest summer chlorides need to be less than 200 mg/L, but <u>not</u> winter chloride concentrations.**
- Could Temperature be a key factor in chloride toxicity?

CHLORIDE TOXICITY

- Macroinvertebrates and mussels are more sensitive to chlorides than fish.
- Some Macroinvertebrates are absent in winter, others are in a dormant state. Mussels activity is significantly retarded in winter. Many mussels are buried in the sediment in the winter months.
- Under federal guidelines, can also develop basin specific standards based on species present. This is what was done for the Chicago Sanitary & Ship Canal (CSSC).

KEY FINDINGS IN R08-9D BY IPCB:

- Board noted the record does not include the science or data to develop water quality standards for chlorides outside of the CSSC.
- Board granted 3-year delay to allow time for best course of action.
- The Board noted that site-specific rule change are available where adequate proof of alternative standard, "as Citgo/PDV provided".

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APPEAL

- The Salt Institute has appealed the 500 mg/L Chloride Standard on the CAWS.
- Appellate Court likely to remand this standard to the Pollution Control Board by end of 2016, due to lack of scientific basis.
- Board will open new docket to establish chloride standards, just on CAWS or Statewide? Likely in 2017. Who will take lead on this?

KEY FINDINGS IN R08-9D BY IPCB:

- Board found the EPA site-specific recalculation procedures for aquatic life criteria was followed for the CSSC. Specific species excluded in the **winter** re-calculation procedure included:
  - Ceriodaphnia (Water flea)
  - Sphaerion (Fingernail clam)
  - Lampsilis (Mussel)
- So precedent set for seasonal standards

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SUMMARY OF CHLORIDE TOXICITY FACTORS-Cont'd

- Temperature is important for several reasons:
  - Limited research has shown that at colder temperatures, chloride toxicity is reduced. (*Silver, 2009* on midges).
  - Mussels become significantly less active in winter, and many are buried in the sediment for the winter.
  - Many macroinvertebrates are absent in the winter months or are in a dormant state.

WHERE DO WE GO FROM HERE?

- Assemble a Consortium to fund the cold temperature research, letters have been sent out.
- Retain David Soucek to conduct the cold temperature studies, along with complete literature search.
- Acute and Chronic, four species at 10 and 25 C:
  - Daphnia
  - Mayfly
  - Fingernail claim
  - amphipod

SUGGESTED FUNDING

- Need **$100,000**
- County Highway Departments: $ 2,500
- Municipal Participants: $ 1,000
- Industrial Participants: $ 1,000
- Salt Institute: ?
- IDOT and City of Chicago: ?
- Tollway: Committed to see study thru

COMMITMENTS TO DATE

- Tollway
- DuPage County DOT
- Geneva
- Hinsdale
- New Lenox
- St. Charles
- Winnetka
- Woodridge
- Citgo Refinery
- IMTT