THE SCIENCE BEHIND THE CHLORIDE WATER QUALITY STANDARD

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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**.
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
RECENT CHLORIDES WATER QUALITY FINDINGS

• Soucek 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 not 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 Ro8-9D 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”.
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 Ro8-9D 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
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