Alaska's Efforts to Adopt a Performance-based Approach to EPA (2007) Freshwater Copper Criteria

Alaska Department of Environmental Conservation
ACWA Conference 2024

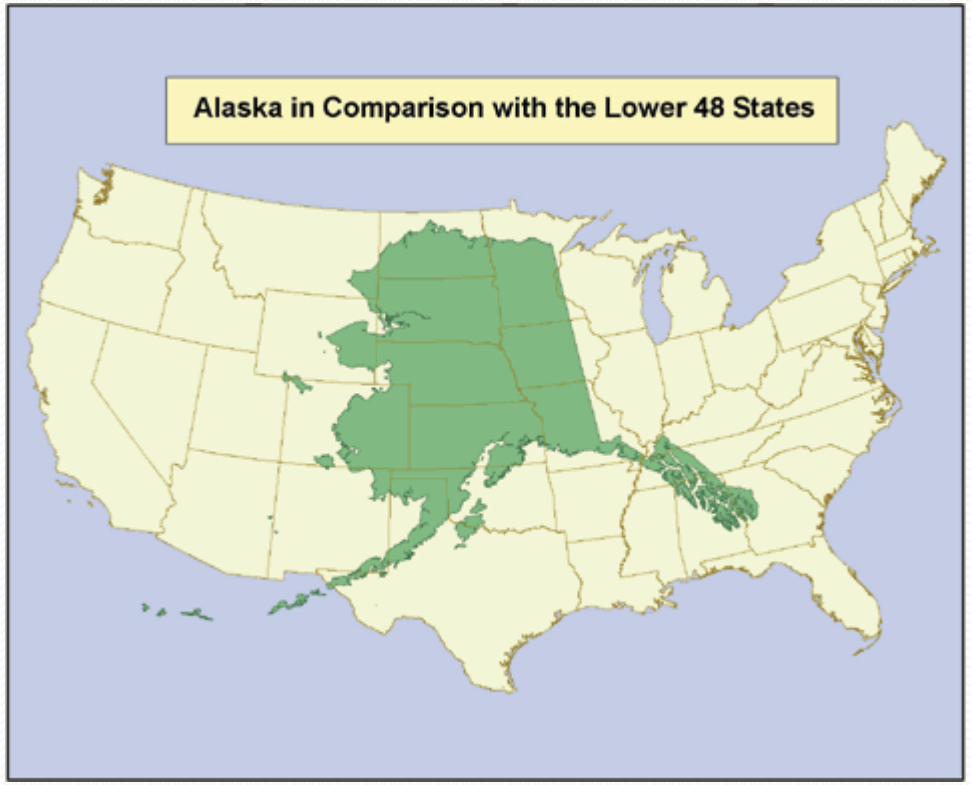
EPA (2007) Recommended WQC for Copper (Cu) Freshwater

https://glacierbayalaska.com/alaska-fishing/fish-species-guide/

- EPA developed revised freshwater aquatic life criteria for copper (Cu) using the Biotic Ligand Model (BLM) in 2007.
- EPA Cu BLM predicts copper toxicity based on site-specific water quality parameters and calculates aquatic life criteria based on the predicted copper toxicity.
  - Considered to be a more robust approach than the (1985) Guidelines for Deriving Numerical National Water Quality Criteria for the Protection of Aquatic Organisms and Their Uses
  - 1985 Hardness-based WQC do not reflect all the effects of water chemistry on copper bioavailability.

Potential for Statewide Adoption in Alaska?

- Not likely to happen…
- 2015-2017 Triennial Review Cycle
  - Alaska has extremely limited monitoring data available.
    - No way to develop statistically defensible ecoregional values
  - Lack of data limits the ability to apply the BLM as a meaningful statewide criteria for the foreseeable future.
  - Alaska plans to assess options for using BLM in determining site specific criteria



Alaska BLM: Foregone conclusion?

While Alaska may not have adopted BLM, EPA has cited its use in numerous instances including *Bristol Bay Assessment* (2014)

"[s]tates such as Alaska may lag in adopting the latest criteria. In particular, the U.S. Environmental Protection Agency (USEPA) (2007) has published copper criteria based on the biotic ligand model (BLM), but Alaska still uses the hardness-based criteria for copper. We use the current USEPA copper criteria in this assessment ***based on the assumption that, before permitting a copper mine in the Bristol Bay watershed, Alaska would adopt those criteria at the state level or would apply them on a site-specific basis to any discharge permits.***" (USEPA, 2014. 8-3)

BLM on a site-specific basis in Alaska? (1)

- 2014: Approached by a POTW seeking relief for Cu based on receiving water conditions
  - EPA pressed use of BLM rather than a WER or other approaches
  - Multiple challenges determining the regulated area SSC would be in effect and demonstrating downstream protection
  - Proposal did not consider the relationship between effluent and the receiving water and potential mitigating effects

- 2017: A second POTW approaches DEC with a proposal to develop end-of-pipe limits using the BLM
  - 2022: DEC is provided with a great dataset to consider
  - Permit is currently administratively extended to accommodate this work

BLM on a site-specific basis in Alaska? (2)

- 2022: DEC determines rather than pursuing SSC on a case-by-case basis – why not develop a performance-based approach (PBA) and receive EPA-approval to develop Cu criteria ourselves!

- When states and authorized tribes choose to adopt both the water chemistry-dependent criteria and an associated derivation methodology; this concept – combining criteria with associated derivation methodology – is referred to as a **"performance-based approach."**
  - (EPA Review and Approval of State and Tribal Water Quality Standards 65 Fed. Reg. 24641 (Apr. 27, 2000)

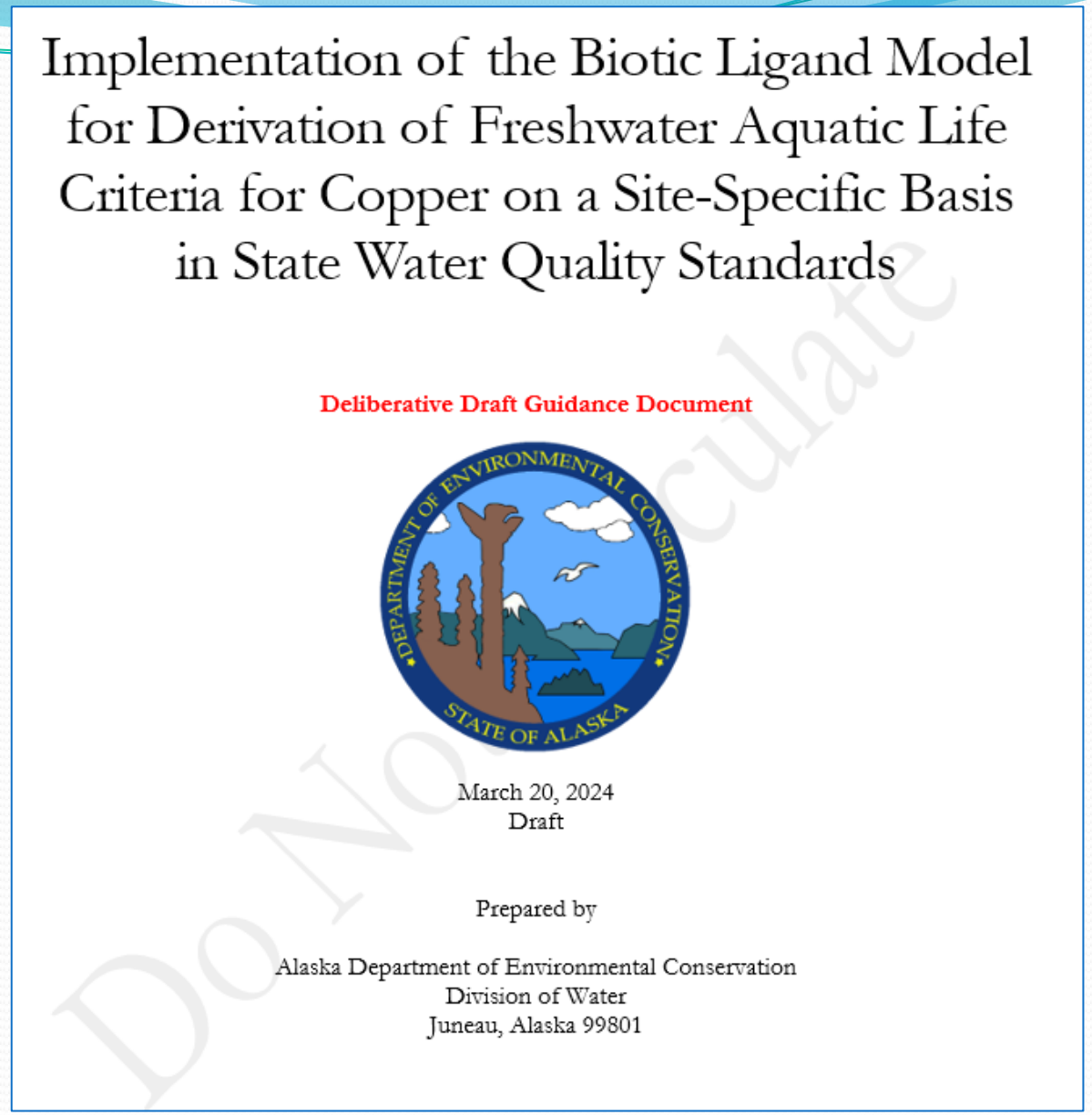
Alaska's PBA proposal

Key Points:

- Focuses on development of SSC for the purpose of informing Water Quality Based Effluent Limits (WQBELs) rather than more traditional waterbody-based criteria

- Predicable, transparent, repeatable process that applies the most recent EPA-recommended approach to calculating Cu toxicity

- Informed by the efforts of several other states (e.g, Colorado, Idaho, Iowa


Implementation of the Biotic Ligand Model for Derivation of Freshwater Aquatic Life Criteria for Copper on a Site-Specific Basis in State Water Quality Standards

Deliberative Draft Guidance Document

March 20, 2024
Draft

Prepared by

Alaska Department of Environmental Conservation
Division of Water
Juneau, Alaska 99801

Key PBA Attributes

Much more prescriptive than our WQS and permitting groups are generally used to

Reads more like a Quality Assurance Project Plan (QAPP)

Includes specific data reporting requirements

Includes a case study for illustrative purposes

Workplan Proposals Require:

a) Description of the proposed work and need for a BLM-derived WQC;
b) Description of the discharge facility and its effluent characteristics including effluent Cu levels, potential sources, and previous efforts to address source control;
c) Brief description of historic water quality and flow data that may inform the project;
d) The route of discharge flow and design low flows for the receiving water;
e) The description of the site where the BLM-WQC would be applied;
f) The proposed sampling location(s);
g) Temporal sampling collection protocols and seasonality;
h) Description of other details for the proposed work, such as flow measurement, number of proposed sampling events, list of proposed sampling parameters, and QA/QC protocols; and
i) Summary of consultation with Alaska Department of Environmental Conservation in order to assure the proposed work will address site-specific facility and receiving water concerns.

Final Reporting Requirements (1)

1. All info identified in the Workplan
2. Demonstrate adherence to DEC-approved QAPPs.
3. Results of all chemical and physical sample measurements
4. Description of BLM IWQC results, identification of outliers and similar statistical anomalies, and uncertainties associated with the data collection and analysis process.

Final Reporting Requirements (2)

1. Sample information will include the following:
   a. Date and time of each sampling of the Site water;
   b. Sampling location characteristics
   c. Effluent flow during each sampling event;
   d. Upstream flow during each sampling event, either measured directly or estimated from relevant neighboring gauges;
   e. Prior meteorological conditions affecting flow and sampled water quality;
   f. Sample collection methodology, measurements of all chemical concentrations, and testing methods;

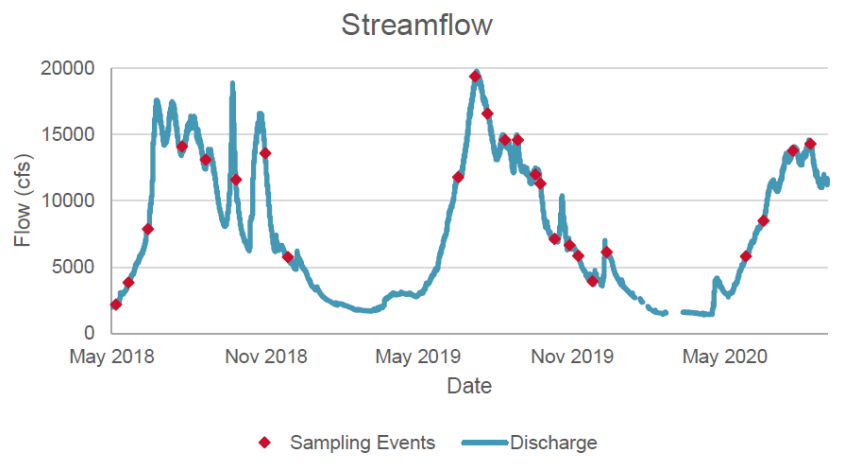


Table 2. Summary of Conditions

Sample Condition	
Ice Free	24 Sampling Events
Salmon Present	12 Sampling Events
Spring Break-up	1 Sampling Event
Peak Flow	19,800 CFS
Highest Flow Sampled	19,400 CFS
Low Flow	1,390 CFS
Lowest Flow Sampled	2,190 CFS
Lowest Annual 7-day Minimum during study*	1,443 CFS

**USGS: Water-Year Summary for USA, 2019, 2020*

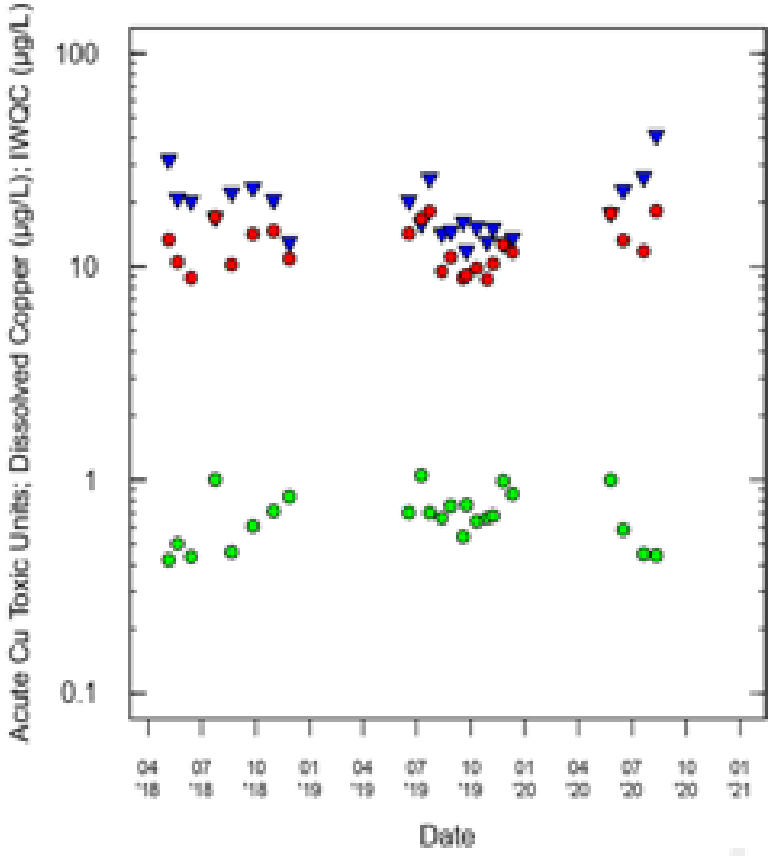
Interpreting the IWQC results

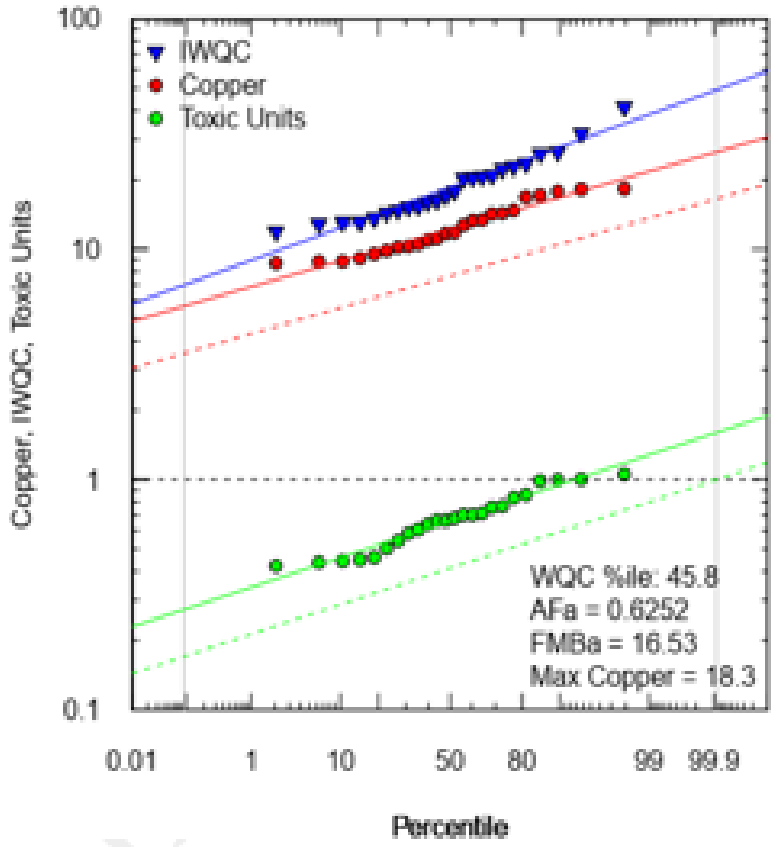
1. For those proposals that **do not collect Cu** concentration data, **DEC will apply the lowest 10th percentile** of the IWQC distribution to calculate acute and chronic Cu criteria protective of aquatic life, unless a lower percentile is needed to protect the Site when copper is most bioavailable (e.g., consideration of threatened or endangered species; unexplained variability in IWQCs).

2. For those proposals that collect Cu concentration data, DEC will apply the **fixed monitoring benchmark (FMB)** value derived from the range of calculated IWQCs to calculate acute and chronic Cu criteria protective of aquatic life.

Demonstrative Case Study

Figure 3. An example dataset for FMB calculations showing acute IWQC, Cu concentrations, and toxic units as either a time-series (left) or probability plot (right).





FMB represents a concentration that is predicted to not result in a WQC exceedance (e.g., 1 in 3 y) 99.9% of time (Ryan et. Al 2018)

Implementation

- FMB/10th Percentile values will be used to calculate WQBELs for APDES/state permits
  - Documentation will be included in the Fact Sheet of the permit

- APDES permittees will continue to sample effluent and receiving water and update the model's dataset
  - Federal triennial language requires review of WQS – including SSC
  - DEC is required to ensure the SSC are still protective upon permit renewal

Next steps

SHARE “FINAL” DRAFT OF THE PBA AND SPECIFIC REGULATIONS ADOPTING THE PBA *BY REFERENCE* TO EPA FOR PRE-PUBLIC NOTICE.

PUBLIC NOTICE (EARLY FALL 2024)

ADOPT AND SEND TO EPA FOR APPROVAL (WINTER 2025)