



Hardness-Based Metals Criteria in NPDES Permits

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Background: How the EPA Determines the Need for Limits (“Reasonable Potential”)

- ▶ A discharge has “Reasonable potential” if the projected receiving water concentration exceeds water quality criteria.
 - ▶ The 99th percentile of the effluent data is estimated using statistics in Chapter 3 of the EPA’s *Technical Support Document for Water Quality-based Toxics Control* (TSD).
 - ▶ Dilution may be considered in a reasonable potential analysis based on an authorized mixing zone.
 - ▶ “Critical” stream flows for mixing are generally specified in Section 210.03.b of the Idaho WQS.

Background: How the EPA Calculates Water Quality-based Effluent Limits

- ▶ If there is “reasonable potential,” then limits are established.
- ▶ Limits are generally calculated based on procedures in Chapter 5 of the TSD.
 - ▶ Mixing zone authorized: Limits meet criteria at the edge of the mixing zone.
 - ▶ No mixing zone authorized: Limits meet criteria at the point of discharge (“end-of-pipe”).
 - ▶ Limits based on aquatic life criteria must meet both acute and chronic water quality criteria.
 - ▶ Both the average monthly limit and maximum daily limit based on the same criterion (either acute or chronic), whichever results in more stringent limits.
 - ▶ Average monthly limit \leq chronic wasteload allocation.
 - ▶ Maximum daily limit \leq acute wasteload allocation.

Metals with hardness-dependent criteria in Idaho

- ▶ Most water quality criteria are fixed values.
 - ▶ E.g., aquatic life criteria for chlorine, cyanide, selenium, and pesticides, and human health criteria.
- ▶ Aquatic life criteria for several metals are based on hardness:
 - ▶ Cadmium, chromium III, copper, lead, nickel, silver, and zinc.
- ▶ Criteria concentrations increase (i.e., become less restrictive) with increasing hardness.
- ▶ The hardness value (and, in turn, the criteria) must be established as part of the reasonable potential analysis and effluent limit calculations.

Idaho WQS Provisions Regarding Hardness (Section 210.03.c)

- ▶ High-end “cap” of 400 mg/L as CaCO_3 even if actual hardness is greater.
- ▶ Low end “floor” of 25 mg/L, except for cadmium, which is 10 mg/L, even if actual hardness is less.
- ▶ “The hardness values used for calculating aquatic life criteria for metals at design discharge conditions shall be representative of the ambient hardnesses for a receiving water that occur at the design discharge conditions given in Subsection 210.03.b.”
 - ▶ Subsection 210.03.b refers to the low flow design discharge conditions (e.g., 1-day, 10-year low flow for acute criteria and 7-day, 10-year low flow for chronic criteria).

Considering the Influence of the Discharge

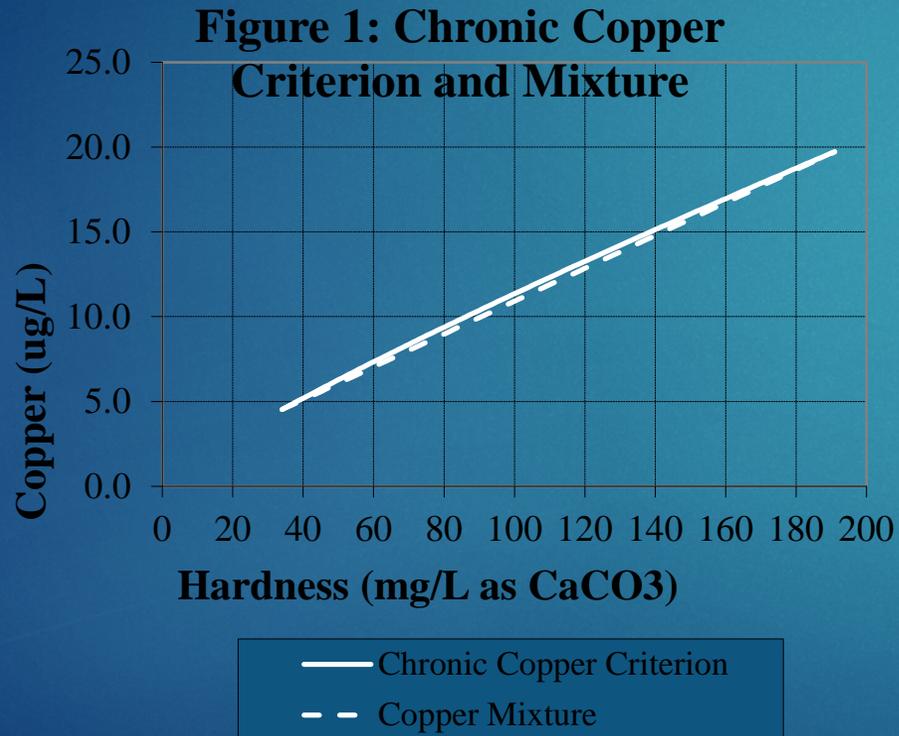
- ▶ Discharges can be harder or softer than the ambient water.
- ▶ This can be factored into the analysis in two ways:
 - ▶ Use hardness measured downstream from the discharge.
 - ▶ Calculate the downstream hardness using a mass balance of the upstream and effluent hardness and flow.
- ▶ Idaho's Draft Mixing Zone Guidance (Section 4.3.3).
 - ▶ "For effluent with greater or lower hardness...than the receiving water body, use an estimate of the fully mixed conditions to calculate the applicable edge of mixing zone concentration."
 - ▶ "If data are available, DEQ strongly suggests dischargers examine the relation between flow and hardness."

Examples

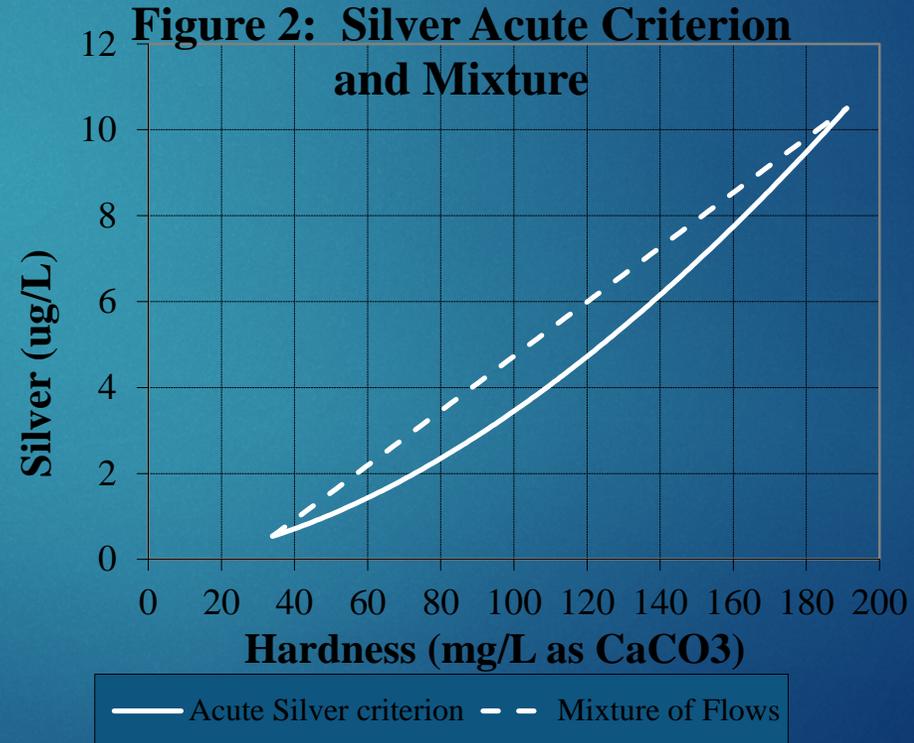
- ▶ Use hardness measured downstream from the discharge.
 - ▶ City of Caldwell (56 mg/L as CaCO_3 , 5th percentile).
 - ▶ City of Meridian (Fivemile Creek, minimum hardness when flow was less than the seasonal median).
 - ▶ 28 mg/L as CaCO_3 from May – September.
 - ▶ 102 mg/L as CaCO_3 from October – April.
 - ▶ Grouse Creek Mine (for silver and Lead).
- ▶ Calculate the downstream hardness using a mass balance of the upstream and effluent hardness and flow.
 - ▶ Grouse Creek Mine (except silver and lead).
 - ▶ City of Meridian (Boise River).
 - ▶ Hardness was calculated at the edge of the mixing zone (not at complete mix).
 - ▶ 5th Percentile was used for both effluent and upstream hardness.

What's special about silver and lead?

Concave down



Concave up



Questions

