

Possible Implications of Idaho Rulemaking for Cadmium and Arsenic in North Fork Coeur d'Alene Subbasin

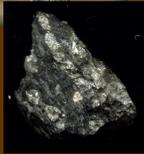
*Presented to North Fork Coeur d'Alene River Watershed Advisory Group
April 30, 2009*

DRAFT for WAG informational purposes and discussion, subject to change.

Rulemaking

- Rulemaking information on DEQ's website:
http://www.deq.idaho.gov/rules/water/58_0102_0801_negotiated.cfm
- Public comment period planned May 6 – June 5, 2009.

Arsenic



- Chemical element (As), considered metalloid
- Well known as a poison
- Uses include wood preservative (now banned), medicine, pigments, bronzing, pyrotechnics, in lead alloy for lead shots and bullets, poisons

Arsenic

- Naturally occurring, common form arsenopyrite often found with gold.
- Elevated levels can come from natural sources or from agriculture or industrial activities.
- Human exposure to arsenic can cause both short and long term health effects. Long term exposure to arsenic has been linked to cancer of the bladder, lungs, skin, kidneys, nasal passages, liver and prostate. Short term exposure to high doses of arsenic can cause other adverse health effects.
- Exposure can be occupational, drinking water, air, food, smoking.



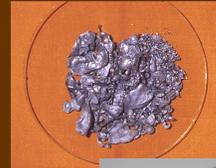
Arsenic

- Depending on the amount, arsenic can be toxic to freshwater fish, invertebrates, and aquatic plants. At low amounts it can slow aquatic plant life, and at higher concentrations it is lethal.
- Algae and invertebrates quite sensitive to arsenic. British Columbia standards 5 micrograms/L for these organisms based on toxicity testing.
- Freshwater fish demonstrated lower sensitivity to arsenic than either invertebrates or algae. A chronic LC50 for fish reported in the literature was 550 micrograms/L for rainbow trout (*Oncorhynchus mykiss*) after 28-d exposure.



Cadmium

- Chemical element (Cd), considered a metal.
- Occurs with zinc ores and is generally recovered as a byproduct from zinc concentrates.
- Cadmium is primarily consumed for the production of rechargeable nickel cadmium batteries; other end uses include pigments, coatings and plating, and as stabilizers for plastics. Solar cell manufacturing may become another significant market for cadmium in the future. (USGS)



Cadmium

- ~ 3/4 of Cd production used in batteries.
- Remainder used in pigments, coatings and plating, and as stabilizers for plastics.



Cadmium

- USGS Mebane Report, 2006:
- The four most sensitive genera to acute exposures were, in order of increasing cadmium resistance, *Oncorhynchus* (Pacific trout and salmon), *Salvelinus* ("char" trout), *Salmo* (Atlantic trout and salmon), and *Cottus* (sculpin).
- The four most sensitive genera to chronic cadmium exposures were *Hyalella* (amphipod), *Cottus*, *Gammarus* (amphipod), and *Salvelinus*.

Other Potential Effects

- Oregon State University researchers report that white-tailed ptarmigan (*Lagopus leucurus*) in Colorado:
 - 1) are exposed to uncharacteristically high levels of cadmium through their diets;
 - 2) accumulate potentially toxic cadmium concentrations in their kidneys after just 700 days of exposure;
 - 3) approximately half of adult ptarmigan in the region experience cadmium-induced nephrosis of kidney tissue and, probably as a result
 - 4) develop calcium-poor leg bones.



Similar to Itai-Itai disease mechanisms of human cadmium poisoning in Japan.

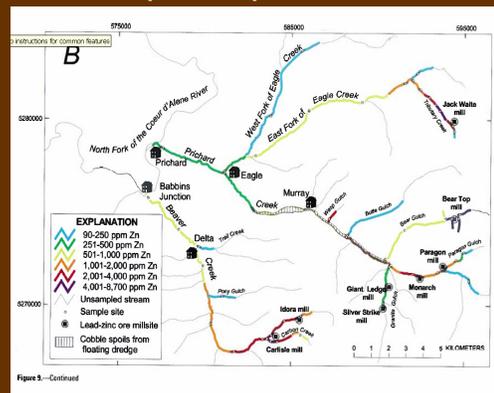
Metals toxicity and impairments

- Streams in the Eagle, Prichard and Beaver creeks area have a long history of important economic production, but also environmental degradation.
- Abandoned mine land surveys and mine reclamation have been accompanied by scientific studies.
- Found enrichments of lead, zinc, mercury, arsenic, cadmium, silver, copper, cobalt and, to a lesser extent, iron and manganese in streambed sediment (USGS 2004).

Metals toxicity and impairments

- Water body assessments determined impairments by Cd, Cu, Pb, Ni and Zn.
- Comprehensive subbasin assessment will compile these data for new assessments and will propose monitoring before developing TMDLs.
- This assessment process will provide further information and conclusions to the WAG about these local contaminants.

Example of pattern: Zinc



State of Idaho Rulemaking

- http://www.deq.idaho.gov/rules/water/58_0102_0801_negotiated.cfm
- To avoid litigation against EPA, to prevent EPA's disapproval of Idaho's criteria and promulgation of a federal rule. This effort represents a negotiation and compromise solution.
- To improve the protection of human health (As) and aquatic life (Cd).

Arsenic Draft Rule

- DEQ proposes to lower the arsenic human health criteria from **50 ug/L** to **10 ug/L**.
- Water analysis method EPA 200.8 ICP-MS, reporting limit 0.2 ug/L in CDA Lake sampling
- The dissolved inorganic arsenic criteria for aquatic life protection would remain the same:
 - Acute (CMC) = 150 ug/L * WER
 - Chronic (CCC) = 340 ug/L * WER

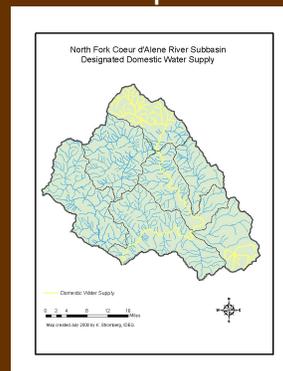


Arsenic Draft Rule

- Human health criteria apply to "Water & Organisms" or "Organisms" only, depending on whether the water body is a source of drinking water.
- Criteria for organisms is essentially a fish tissue criterion.
- Draft rule for dissolved inorganic arsenic:
 - **Water & Organisms = 10 ug/L**
 - **Organisms only = 10 ug/L**

33
As
74.92

Implications in NFCDA



- Reviewed the data used by DEQ Technical Services to produce a draft metals TMDL.
- Compared to maps of beneficial uses: Human health criteria for water and organisms currently apply to streams in yellow. Human health criteria for organisms apply to the rest.

Implications in NFCDA

- Soil samples showed elevated arsenic, especially in Granite Gulch, Wesp Gulch, and near Eagle.
- Only two water samples contained arsenic above the laboratory reporting limit:
0.6 ug/L and 86 ug/L
- Sample with 86 ug/L arsenic concentration was from Mother Lode adit upstream of Murray (1998 report). Consider evaluating zone of influence for Murray's drinking water and risk analysis. Concentration is below aquatic life criteria.

Implications in NFCDA

- So far, draft rule would not change water quality status related to arsenic of NFCDA surface waters.
- No identified arsenic impairments.
- Full watershed assessment for metals is pending. Include Murray DW eval.



Cadmium Draft Rule

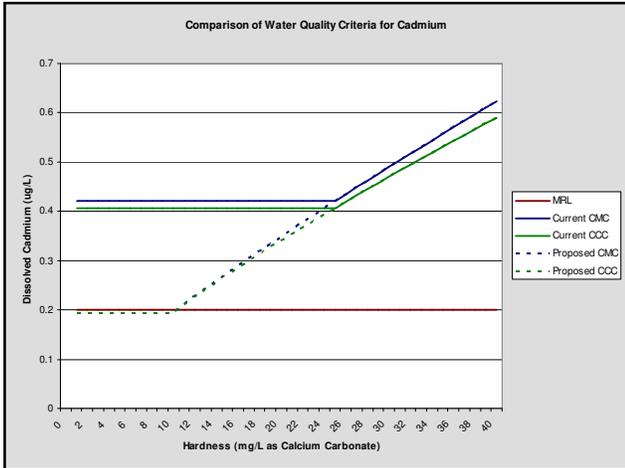
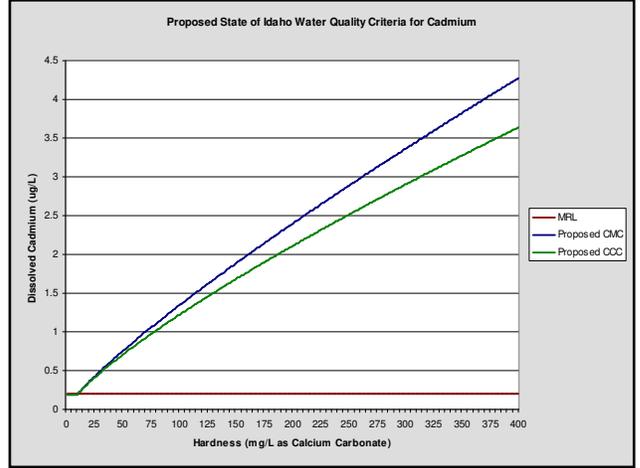
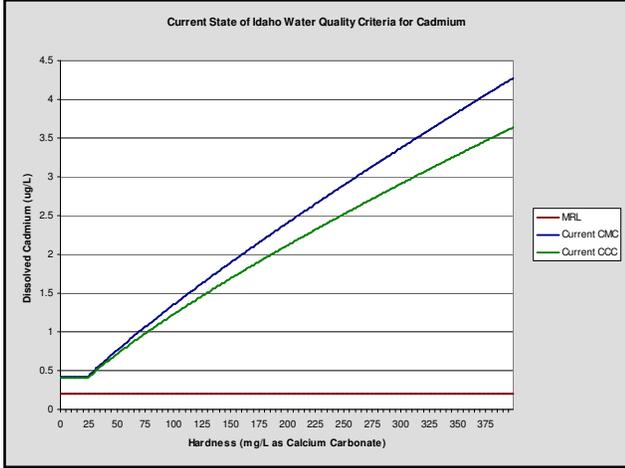
- DEQ proposes to change the criteria for protecting aquatic life.
- There are no specific water quality criteria for cadmium and human health.
- Cadmium toxicity is dependent on water hardness (as amount of Calcium Carbonate), generally increasing with lower hardness. Several other factors are also important.
- DEQ proposes to reduce the "low-end hardness cap" used in calculating the criteria for dissolved cadmium from 25 to 10 mg/L CaCO₃.



Cadmium Draft Rule

48
Cd
112.41

- Water analysis method EPA 200.8 ICP-MS, reporting limit 0.1 ug/L in CDA Lake sampling, another local lab reports as low as 0.2 ug/L.
- Cold water aquatic life criteria apply to all water bodies in subbasin.
- Draft rule would not change criteria when hardness is >25 mg/L or <10 mg/L, but would change when hardness is between 10 and 25 mg/L. Upper limit hardness remains 400 mg/L.



Criteria Comparison for Cadmium Draft Rule, WER =1

| Hardness | Current CMC | Current CCC | Proposed CMC | Proposed CCC |
|----------|-------------|-------------|--------------|--------------|
| 10 | 0.4203 | 0.4064 | 0.1953 | 0.1953 |
| 11 | 0.4203 | 0.4064 | 0.2115 | 0.2115 |
| 12 | 0.4203 | 0.4064 | 0.2274 | 0.2289 |
| 13 | 0.4203 | 0.4064 | 0.2432 | 0.2418 |
| 14 | 0.4203 | 0.4064 | 0.2587 | 0.2565 |
| 15 | 0.4203 | 0.4064 | 0.2741 | 0.2709 |
| 16 | 0.4203 | 0.4064 | 0.2893 | 0.2852 |
| 17 | 0.4203 | 0.4064 | 0.3044 | 0.2993 |
| 18 | 0.4203 | 0.4064 | 0.3193 | 0.3132 |
| 19 | 0.4203 | 0.4064 | 0.3341 | 0.3269 |
| 20 | 0.4203 | 0.4064 | 0.3487 | 0.3405 |
| 21 | 0.4203 | 0.4064 | 0.3633 | 0.3539 |
| 22 | 0.4203 | 0.4064 | 0.3777 | 0.3672 |
| 23 | 0.4203 | 0.4064 | 0.3920 | 0.3804 |
| 24 | 0.4203 | 0.4064 | 0.4062 | 0.3935 |
| 25 | 0.4203 | 0.4064 | 0.4203 | 0.4064 |

Draft for informational purposes only.

Implications in NFCDA

- Hardness in the draft metals TMDL dataset ranged from 6 to 48 mg/L. Typical values in the CDA Basin are often 20-25 mg/L.
- Dissolved cadmium concentrations ranged from <0.2 ug/L (below reporting limit) to 26 ug/L (Carlisle Mine, Carbon Gulch).
- Rough assessments found many results exceeded current water quality standards for dissolved cadmium and that generally, the rule change would be expected to result in few changes in assessment status.
- Full watershed assessment for metals impairments is planned.

Future WAG efforts...?

- Continue full subbasin assessment, including assessment of compliance with water quality criteria for toxics. (Cu, Cd, Pb, Ni, Zn)
- Compile available data.
- Natural background conditions and exemptions apply.
- Continue to support mine remediation and cleanup of tailings (e.g., DEQ Beaver Creek 319 program project in 2010, near Monarch Mill site).
- Consider development of monitoring plan to assess current condition and results of remediation efforts. Coordinate w/ DEQ waste and remediation?
- Focus on meaningful water quality issues and improvements.