

# THE POWER OF MOLY

## Development of Colorado's Water Quality Standard for Molybdenum

April 22, 2024

# Proposal

- Molybdenum (chronic) = 1,600 ug/L (T)
  - Based on best science
  - Protective of health
  - Supports rural communities
- Adopt in Section 31.16, Table III, in Regulation 31
- Adopt on Blue River Segment 14 in Regulation 33

# Common themes in RPHS

- Scope of proposal and outreach
- Relative source contribution
- Protectiveness of proposed standard
- Treatment
- Permitting

# Scope of Proposal

- **WQCD Question 3 (p. 17):** Climax's evidence about molybdenum exposure focuses primarily on local impacts in Summit County. However, Climax is proposing to change the statewide standard. How will communities outside of Summit County be impacted by the proposed standards changes?
  - **Response:** Climax included substantial evidence about the molybdenum exposure to the general population, including information about dietary intake, inhalation, soil ingestion, dermal contact, and drinking water. Appendix B to Dr. Murray's testimony included the relevant information for the EPA "decision tree" structure for determining an RSC using information generally applicable to Colorado.
  - In addition, a change to the Regulation 31 TVS does not result in a change to the statewide standard. Any change to the molybdenum standard on segments other than Blue River Segment 14 would require a site-specific proposal, and the proponent of such change would need to conduct outreach and provide additional support in a rulemaking before the Commission.

# Scope of Proposal

- **NWCCOG Question (p. 3):** Does Climax intend to propose a revised agricultural standard based on the findings of the study the CSU completed in 2021 or any other recent studies?
  - **Response:** Climax does not intend to propose a revision to the agriculture standard at this time. Additional outreach would be conducted prior to making a proposal if any such standard revision is proposed.
- **NWCCOG Question (p. 3):** Are there other updates that Climax would like to provide regarding these [CSU] studies?
  - **Response:** An update was provided in the June 2023 temporary modifications report. Climax will include information in the rebuttal.

# Scope of Proposal

- **NWCCOG Question (p. 3):** Is Climax able to update Figures 3 and 4 to include the entire area that may be influenced by their proposal (i.e., add Park and Denver Counties)?
  - **Response:** Climax can provide the EnviroScreen figures for Park and Denver Counties in its rebuttal for informational purposes, however the proposal will not impact either of these counties.
- **NWCCOG Question (p. 4):** Does Climax anticipate changes to the existing water quality standards applied to Clear Creek or the permit or operations at the Henderson Mine based on its proposal?
  - **Response:** Climax is not proposing a change to the standards applied to Clear Creek. The current proposal will only have a direct relation to the Climax Mine, and the new water treatment plant being constructed at Climax is expected to meet the revised science-based standard.

# Outreach

- **WQCD Question 5 (p. 26):** Does Climax believe its outreach efforts were sufficiently representative of stakeholders throughout the state that may be impacted by this revised, higher molybdenum standard?
  - **Response:** Yes. Climax has been committed to engaging with all interested stakeholders over the past 10+ years, which has included numerous presentations, meetings and webinars. Climax's outreach has focused on the Summit County area as it is the only location where the standard will be applied. Any future application elsewhere in the state would require outreach by the party proposing the change in advance of site-specific consideration by the Commission in a rulemaking.

# Relative Source Contribution

- **WQCD Question 1 (p. 17):** ATSDR specifically notes that, although exposure to molybdenum may be low for the general population, “exposure may be greater for populations near these [mining] activities”. Would a lower RSC be justified by the lack of information about exposure in Colorado (beyond Climax’s Summit County produce study), specifically molybdenum concentrations in water, soil, and air near mines or superfund sites?
  - **Response:** Dr. Murray’s RSC report incorporated very conservative assumptions in concluding that an RSC of 0.8 is justified. This includes:
    - Dr. Murray assumed a conservatively high soil concentration of 1.3 ppm or 40 ppm (the highest concentration reported by EPA).
    - Dr. Murray assumed high rates of soil consumption and assumed that all of the molybdenum in the soil would be consumed.
    - Dr. Murray used information at the high end of the range for inhalation.
  - Even with these very conservative assumptions, soil and inhalation exposures are negligible



# Relative Source Contribution

- **WQCD Question 2 (p. 17):** Does an RSC of 80% adequately protect for lifetime exposures for all Coloradans? For example, would subpopulations, such as formula-fed infants or those consuming produce grown in or watered with molybdenum-rich soil or water, be adequately protected.
  - **Response:** Yes, the proposed standard is adequately protective for lifetime exposures, including sensitive subpopulations.
    - The 10-fold intraspecies UF has been shown to be highly protective of various subpopulations, including infants and children. Consequently, EPA uses only adult values for its human health ambient water quality criteria. The criteria are intended to be adequately protective of a human population over a lifetime.
  - Is the Division aware of a situation where the Commission previously considered these specific scenarios for development of a TVS?

# Protectiveness of Standard

- **WQCD Question 1 (p. 26):** How does a Water Supply standard of 1,600  $\mu\text{g/L}$  protect vulnerable subpopulations, such as individuals with kidney-related health issues like diabetes, end stage renal disease, or kidney cancer?
  - **Response:** The intraspecies uncertainty factor is intended to address differences in susceptibility within the human population, including vulnerable subpopulations.
    - All essential elements are eliminated from the body primarily via the kidneys. An additional UF to protect specific individuals such as those on dialysis with end stage renal disease has never been used for a risk assessment of any essential element.
    - Dr. Murray will provide additional information in rebuttal testimony.

# Protectiveness of Standard

- **WQCD Question 2 (p. 26):** How does a Water Supply standard of 1,600  $\mu\text{g/L}$  account for the cumulative impact of molybdenum exposure in populations already affected by other contaminants that impact the same organs as molybdenum (like kidneys, which may also be impacted by lead from lead service lines)?
  - **Response:** The total safety factor of 300 incorporates protection of sensitive subpopulations, including those exposed to other contaminants.
    - All essential elements are eliminated from the body primarily via the kidneys.
    - There is no known interaction between lead and molybdenum, and kidney damage from lead is currently rare in the US.
    - Excessive lead exposure is an issue, but the best way to address lead toxicity in the US is to reduce the sources of exposure to lead.

# Protectiveness of Standard

- **WQCD Question 3 (p. 26):** How does a Water Supply standard of 1,600  $\mu\text{g/L}$  protect disproportionately-impacted communities? Do Climax or other parties believe an additional uncertainty or safety factor is needed to account for these vulnerabilities?
  - **Response:** The standard incorporates a total safety factor of 300, 10x the current standard's safety factor and 100x used by federal agencies for other essential elements. The intraspecies uncertainty factor of 10 is protective and is intended to address vulnerabilities among humans.

# Protectiveness of Standard

- **NWCCOG Question (p. 6):** Has Climax considered potential interactions with other pollutants? For example, Dr. Heath described potential concerns regarding toxic interactions between lead and molybdenum. Young children may be more susceptible to these potential interactions than adults, due to increased lead exposure. As Dr. Heath notes, increased lead exposure may be more prevalent in older housing stock or areas with past or on-going industrial activity.
  - **Response:** The application of the intraspecies UF of 10 is highly protective of various subpopulations, including infants and children.

# Protectiveness of Standard

- **WQCD Question 4 (p. 26):** Do Climax or other parties believe an additional uncertainty factor for a subchronic to chronic exposure duration is needed?
  - **Response:** An additional UF is not needed as the current safety factor of 300 is appropriately protective.
- **NWCCOG Question (p. 6):** Has Climax considered that young children have an increased water consumption per unit body weight?
  - **Response:** Climax followed EPA and Commission guidance in proposing a standard using the federal and state recommended exposure factors for an average adult (80 kg, 2.4 L/day). Note that the intraspecies UF of 10 is protective of sensitive subpopulations, including infants and children.

# Treatment

- **WQCD Question 1 (p. 28):** How would minimizing the three highest sources of molybdenum (3 Dam Seep, Warren's Pump Station, and #1 Drop Box) reduce the amount of molybdenum that would need to be removed prior to discharge
  - **Response:** Even without an active mining operation, 3 Dam Seep and Warren's Pump Station will continue to produce water and these would not be able to be minimized for some time into the future. Roughly 25% of the total molybdenum loading will come from these smaller waste streams. Reducing #1 Drop Box is not feasible to keep actively mining. This is the primary source of future molybdenum loading due to the mining process.

# Treatment

- **WQCD Question 2 (p. 28):** Has Climax considered an approach that would separate the highest concentration waste stream(s) to allow for treatment of select sources rather than treating the entire wastewater collection on site?
  - **Response:** As stated above the #1 Drop Box (the primary tailings source from active milling/mining) will account for most of the future molybdenum loading. Separating and treating the other smaller waste streams for molybdenum removal would have only a slight effect on total molybdenum reduction. This is why Climax has decided to construct the MRWTP. This will address molybdenum reduction for the main molybdenum source, #1 Drop Box, and can account for the smaller sources.



# Treatment

- **WQCD Question 3 (p. 28):** Climax provided limited data for potential sources (from 2015 to 2017). Has Climax collected any additional data to better understand the sources having the most impact on effluent molybdenum concentrations (i.e. seeps, tailings runoff, etc.)?
  - **Response:** The primary/majority sources of future molybdenum concentrations in influent water to the Climax WTP are expected to be from material mined from now until 2042 (the life of mine period)—this source is known as the #1 Drop Box. As stated above, separating and treating the other smaller waste streams for molybdenum removal would have only a slight effect on total molybdenum reduction.

# Treatment

- **WQCD Question 4 (p. 28):** When Climax begins processing the more oxidized ore mentioned in Exhibit 9, does Climax anticipate a spike in mass loading to the waste stream? Or, will a higher concentration of ore produce a higher recovery rate in the molybdenum extraction process, leading to a similar molybdenum waste stream?
  - **Response:** Processing the more oxidized material will cause increases in mass loading to the tailings waste stream (and subsequent MRWTP influent). In the future this higher molybdenum concentration waste stream will be treated through the MRWTP before effluent can be released to Tenmile Creek. The molybdenum extraction/milling process is ineffective at recovering oxide molybdenum.

# Treatment

- **WQCD Question 1 (p. 30):** Are there new procedures/technologies that go beyond typical mining processes that could better protect future tailings from seepage, that have not been considered in Exhibit 9?
  - **Response:** Dry stack tailing is a procedure that would minimize seepage; however, this would still produce some seepage, particularly with the annual amount of moisture Climax receives. Climax hasn't evaluated this option because the TSFs in use are already in place.
  - Climax is also planning on closing the tailings storage facilities with a dry cover to minimize the amount of flux through the system (and amount of subsequent seepage).
- **WQCD Question 2 (p. 30):** Does the construction and operation of the new MRWTP require a minimum molybdenum loading for the treatment technology to be fully optimized?
  - **Response:** MRWTP was designed for an influent molybdenum concentration up to 10,000  $\mu\text{g/L}$  and will be effective at treating influent concentrations below that number.

# Treatment

- **WQCD Question 3 (p. 30):** Climax provided treatment options like “Removing Molybdenum from Tailing Stream” (Exhibit 9 Appendix F, Option 14) that could potentially be combined with the MRWTP to decrease loads prior to other treatments; however, combining these treatments is not mentioned as a treatment addition to the construction of the full plant. Did Climax consider combining multiple or partial alternative treatments? Would tailings treatment prior to the MRWTP allow the system to lower final concentrations?
  - **Response:** Climax did evaluate a combination of treatments (i.e., Options 10-13) and determined the risk of consistency to meeting a molybdenum standard were unacceptable. Costs were also included as part of this evaluation. Option 14 was eliminated due to long-term impacts on infrastructure, potential risks to TSF stability and concerns about treatment consistency.

# Treatment

- **WQCD Question 4 (p 30):** Can Climax provide a molybdenum-specific process flow diagram, including any proposed treatment alternatives, so that it is easier to understand where treatment is being applied and which portions of the sources of molybdenum are being treated, or combined, and where (e.g., in a pipeline, in a lake, in a tailings storage facility, etc.)?
  - **Response:** Climax evaluated molybdenum sources and water management and treatment alternatives in the 2019 Stantec report. The report includes a process water flow diagram of where molybdenum sources are routed and combined. The MRWTP will provide Climax with a long-term, consistent method for removing molybdenum from the process water stream when it comes online in Q1 2025.

# Treatment

- **WQCD Question 5 (p. 30):** Climax's effluent molybdenum concentrations currently vary seasonally (Exhibit 4, Graph 1 and 2 and above in Figure 5), with higher concentrations during the first half of the year. Once Climax finishes installation of the treatment facility, and once Climax begins mining the oxidized ore, does Climax anticipate any changes to the magnitude of molybdenum discharge concentrations or the seasonality in concentrations? Will molybdenum concentrations remain low during parts of the year?
  - **Response:** Molybdenum concentrations will remain low during parts of the year. The flow in the effluent is a combined flow among the WTP, East Interceptor, and West Interceptor. The Interceptors have low molybdenum concentrations, and higher flow during runoff. Both of those conditions are expected to continue. Therefore, molybdenum concentrations seasonality are not expected to change significantly.

# Permitting

- **WQCD Question 1 (p. 31):** Can Climax provide information about any dilution within its facility, as well as dilution in Segment 13 that may be considered the calculation of WQBELs based on Blue River Segment 14 standards? Is there a possibility that Climax may be permitted to discharge concentrations higher than 1,600  $\mu\text{g/L}$ ?
  - **Response:** Climax has evaluated the potential available dilution and will provide more detail in rebuttal. Based on initial analyses, an effluent limitation is anticipated to be close to the proposed water quality standard as a 30-day average. Effluent flow is very high based on the maximum flow during runoff (the permit has a 220 mgd flow limit). As a result, there is very limited dilution in either Segment 13 or 14 at the critical low flow.
- **WQCD Question 2 (p. 31):** Based on projected concentrations exiting the new MRWTP, does Climax anticipate that it can comply with a limit based on a standard of 1,600  $\mu\text{g/L}$ ?
  - **Response:** Yes

# Permitting

- **WQCD Question 3 (p. 31):** Does Climax anticipate any changes to instream conditions in segments 13 or 14 once the MRWTP or other treatment is online?
  - **Response:** Climax expects the peak molybdenum concentrations in the effluent to decline from a historical maximum of greater than 3000  $\mu\text{g/L}$  to 1600  $\mu\text{g/L}$  or less after treatment is implemented. Climax anticipates similar magnitude reductions in the peak molybdenum concentrations in segments 13 and 14.
- **WQCD Question 4 (p. 31):** Does Climax plan to collect flow data in Segments 13 and/or 14 to facilitate an evaluation of dilution in the future permit renewal?
  - **Response:** Yes. There is a gage currently downstream of the confluence between Segments 13 and 14. Based on the analysis of data from that gage, the critical low flow is substantially less than the facility's permitted flow of 220 mgd.



# Upcoming deadlines and stakeholder meetings



- Upcoming deadlines
  - May 1: Rebuttal statements due
  - June 10-12 (exact date TBD): Rulemaking in Pueblo, Colorado (hybrid option available)
- Upcoming stakeholder meetings:
  - May 6, 2024, 2:00 pm
- Rulemaking hearing website available at <https://drive.google.com/drive/folders/1PklNBMH05dqpVUGwC5GnLmePh8ES6l00>