Site-Specific Water Quality Criteria Development
Pajarito Plateau

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Individual Permit Public Meeting
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Site-Specific Water Quality Criteria (SSWQC)

- SSWQC Overview
- Background
- Implications
- Process
- Scientific rationale for SSWQC
- EPA and NMED guidance
- Site-specific evaluation
- Next steps and regulatory process
History of U.S. EPA National Recommended Aquatic Life Criteria for Copper

1976 “Red Book”

1980

1984

1995

2007 “Cu BLM”

Updates based on best available science
• The bioavailability and toxicity of metals depends on water chemistry (EPA 1985, 2007a, 2007b, 2016)

• EPA has addressed water chemistry and metals bioavailability by adjusting criteria to hardness (EPA 1996, 2016)

• Current New Mexico criteria for copper and other metals are calculated as a function of hardness based on EPA (1996) recommended criteria

\[
\text{Acute Copper Criteria} = \exp(0.9422 \times \ln(\text{hardness}) - 1.700) \\
\text{Chronic Copper Criteria} = \exp(0.8545 \times \ln(\text{hardness}) - 1.702)
\]
Hardness-based criteria do not consider other water chemistry parameters (e.g., pH and dissolved organic carbon).

Therefore, hardness-based criteria do not reflect all the effects of water chemistry on metals bioavailability (USEPA 2007, 2016).

U.S. EPA developed the copper biotic ligand model (BLM) to reflect the latest scientific knowledge on metals speciation and bioavailability (EPA 2007, 2016).
The biotic ligand model (BLM) is a software tool that accounts for the effect of water chemistry on the bioavailability and toxicity of copper based on local water chemistry.

The BLM reflects the latest science on metals toxicity to aquatic organisms (US EPA 2007, 2016).

The BLM for copper uses ten input parameters: pH, DOC, Ca, Mg, Na, SO₄, K, Cl, alkalinity & temperature (but only sensitive to a few parameters).
Biotic Ligand Model Conceptual Framework

Chemistry

Physics

DOM

H^+

Ca^{2+}

Na^+

M^{n+}

M

Organic Complexes

Inorganic Complexes

chlorides: MCl^{(n-1)+}

hydroxides: MOH^{(n-1)+}

carbonates

sulfides

GILL/BIOTIC LIGAND

Arterial

Venous

Active Influx

Passive Efflux

J_l

J_e

J_r

Renal Excretion

Chemistry

Physiology
Oregon (2016) & Idaho (2017) have adopted EPA 2007 BLM-based copper AWQC as replacements for hardness equation.

BLM-based copper criteria are being adopted across North America.
• Hardness-based criteria are potentially under-protective (i.e., not stringent enough) or over-protective (i.e., too stringent) depending on site-specific water chemistry (EPA 2020).

• “Stringency” varies depending on water chemistry of the site (EPA 2020).

• BLM-based criteria will provide a level of protection that is intended to protect aquatic life based on EPA guidelines (EPA 2007).

• By using the latest available science, BLM-based criteria should be neither under-protective nor over-protective (EPA 2020).

EPA 2020: https://www.epa.gov/wqc/supplementary-training-materials-background
Not all BLM parameters are significant.
Therefore, BLM can be simplified into an equation consistent with other aquatic life criteria for more transparency:

\[ \text{Copper BLM-based criteria} = \exp \left( \text{Intercept} \times (x \times \text{pH}) + (x \times \text{DOC}) + (x \times \text{hardness}) \right) \]
New Mexico Water Quality Standards – Site-Specific Water Quality Criteria

Title 20
Chapter 6
Part 4
Environmental Protection
Water Quality Standards for Interstate and Intrastate Surface Waters

20.6.4.1 Issuing Agency: Water Quality Control Commission.

20.6.4.2 Scope: Except as otherwise provided by statute or regulation of the water quality control commission, this part governs all surface waters of the state of New Mexico, which are subject to the New Mexico Water Quality Act, Sections 74-6-1 through 74-6-17 NMSA 1978.

20.6.4.3 Statutory Authority: This part is adopted by the water quality control commission pursuant to Subsection C of Section 74-6-4 NMSA 1978.

20.6.4.4 Duration: Permanent.

20.6.4.5 Effective Date: October 12, 2000, unless a later date is indicated in the history note at the end of a section.

20.6.4.6 Objective:
A. The purpose of this part is to establish water quality standards that consist of the designated use or uses of surface waters of the state, the water quality criteria necessary to protect the use or uses and an attenuation policy.
B. The state of New Mexico is required under the New Mexico Water Quality Act (Subsection C of Section 74-6-4 NMSA 1978) and the federal Clean Water Act, as amended (33 U.S.C. Section 1251 et seq.) to adopt water quality standards that protect the public health or welfare, enhance the quality of water and are consistent with and serve the purposes of the New Mexico Water Quality Act and the federal Clean Water Act. It is the objective of the federal Clean Water Act to restore and maintain the chemical, physical and biological integrity of the nation’s waters, including those in New Mexico. This part is consistent with Section 101(a)(2) of the federal Clean Water Act, which declares that it is the national goal that wherever attainable, an interim goal of water quality that provides for the protection and propagation of fish, shellfish and wildlife and provides for recreational use in and on the water be achieved by July 1, 1983. Agricultural, municipal, domestic and industrial water supply are other essential uses of New Mexico’s surface water; however, water contaminants resulting from these activities will not be permitted to lower the quality of surface waters of the state below that required for protection and propagation of fish, shellfish and wildlife and recreation in and on the water, where practicable.
C. Pursuant to Subsection A of Section 74-6-12 NMSA 1978, this part does not grant to the water quality control commission or to any other entity the power to take away or modify property rights in water.

20.6.4.7 Definitions: Terms defined in the New Mexico Water Quality Act, but not defined in this part will have the meaning given in the Water Quality Act.
A. Terms beginning with numerals or the letter “A,” and abbreviations for units.
(1) “4T3 temperature” means the temperature not to be exceeded for four or more consecutive hours in a 24-hour period or more than three consecutive days.
(2) “6T3 temperature” means the temperature not to be exceeded for six or more consecutive hours in a 24-hour period or more than three consecutive days.
(3) Abbreviations used to indicate units are defined as follows:
(a) “cfu/100 ml.” means colony-forming units per 100 milliliters; the results for E. coli may be reported as either colony forming units (CFU) or the most probable number (MPN), depending on the analytical method used;
(b) “cfs” means cubic feet per second.
NMAC §20.6.4.10 D(1):
SSWQC may be developed based on relevant site-specific conditions, such as:

a. Actual species present at a site

b. Physical or chemical characteristics alter the bioavailability and/or toxicity of a chemical

c. Physical, biological, or chemical factors alter the bioaccumulation potential of a chemical

d. Natural background exceed numeric criteria

e. Other factors or combination of factors approved by the commission
NMAC §20.6.4.10 D(4):
A derivation of site-specific criteria shall rely on a scientifically-defensible method, such as:

a. The recalculation procedure, the water-effect ratio procedure, or the resident species procedure

b. The streamlined water-effect ratio procedure for copper

c. The biotic ligand model for copper

d. EPA methods for deriving AWQC for human health

e. A determination of natural background
Draft SSWQC Analysis for the Pajarito Plateau
• DQO/DQA Evaluation (Windward 2018)
• Prepared in collaboration with SWQB
  • SWQB guidance (locations, methods, reporting)
• Used EPA’s DQO/DQA process
• Data for 48 surface water locations
• >500 events with BLM inputs
  • Includes storm-flow and base-flow events
• April 2005 to October 2019
Notes:
1. DQO/DQA BLM dataset augmented with 2018-2019 data (n= 521)
2. Sub-watershed data includes all samples (developed and undeveloped landscapes)
3. Excludes samples with MDLs > criterion

Exceedance Ratio = \( \frac{\text{Metal concentration}}{\text{Criterion}} \)
## 303(d) listings - NMED 2018-2020 Integrated Report

<table>
<thead>
<tr>
<th>AU Name</th>
<th>WQS Reference</th>
<th>IMPAIRMENT</th>
<th>IR Category (by AU)</th>
<th>CYCLE FIRST LISTED</th>
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</thead>
<tbody>
<tr>
<td>Pajarito Canyon (Two Mile Canyon to Arroyo de La Delfe)</td>
<td>20.6.4.128</td>
<td>Cu, Acute</td>
<td>5/5B</td>
<td>2016</td>
</tr>
<tr>
<td>Mortandad Canyon (within LANL)</td>
<td>20.6.4.128</td>
<td>Cu, Acute</td>
<td>5/5C</td>
<td>2018</td>
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<tr>
<td>Sandia Canyon (Sigma Canyon to NPDES outfall 001)</td>
<td>20.6.4.126</td>
<td>Cu, Acute</td>
<td>5/5B</td>
<td>2010</td>
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<tr>
<td></td>
<td></td>
<td>Al, TR</td>
<td>5/5B</td>
<td></td>
</tr>
<tr>
<td>Acid Canyon (Pueblo to headwaters)</td>
<td>20.6.4.98</td>
<td>Cu, Acute</td>
<td>5/5B</td>
<td>2010</td>
</tr>
<tr>
<td></td>
<td>20.6.4.98</td>
<td>Al, Acute</td>
<td>5/5B</td>
<td>2018</td>
</tr>
<tr>
<td>Walnut Canyon (Pueblo Canyon to headwaters)</td>
<td>20.6.4.98</td>
<td>Cu, Acute</td>
<td>5/5B</td>
<td>2014</td>
</tr>
<tr>
<td>Graduation Canyon (Pueblo Canyon to headwaters)</td>
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<td>Cu, Acute</td>
<td>5/5B</td>
<td>2010</td>
</tr>
<tr>
<td>South Fork Acid Canyon (Acid Canyon to headwaters)</td>
<td>20.6.4.98</td>
<td>Cu, Acute</td>
<td>5/5B</td>
<td>2014</td>
</tr>
<tr>
<td>DP Canyon (Grade control to upper LANL bnd)</td>
<td>20.6.4.128</td>
<td>Cu, Diss.</td>
<td>5/5B</td>
<td>2018</td>
</tr>
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<td></td>
<td></td>
<td>Al, TR</td>
<td>5/5B</td>
<td>2018</td>
</tr>
<tr>
<td>Pueblo Canyon (Acid Canyon to headwaters)</td>
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<td></td>
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<td>2018</td>
</tr>
<tr>
<td>Arroyo de la Delfe (Pajarito Canyon to headwaters)</td>
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<td>Cu, Diss.</td>
<td>5/5B</td>
<td>2018</td>
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<td>Al, TR</td>
<td>5/5B</td>
<td>2018</td>
</tr>
<tr>
<td>Pajarito Canyon (Lower LANL bnd to Two Mile Canyon)</td>
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<td>Cu, Acute</td>
<td>5/5B</td>
<td>2018</td>
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<td>Al, TR</td>
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<tr>
<td>Two Mile Canyon (Pajarito to headwaters)</td>
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</table>

- **5B**: Impaired, review of the WQS in needed prior to TMDL development
- **5C**: Impaired, additional data collection is needed prior to TMDL development

- Copper on NMED 303(d) list for several stream reaches throughout the Pajarito Plateau
- Listing category is “5B” = Review of water quality standard is needed prior to TMDL development
Regarding 303(d) listings for metals on the Pajarito Plateau:

“Specific impairments are noted as IR Cat 5 B to acknowledge LANL’s ongoing discussions and research regarding applicable water quality standards on the Pajarito Plateau for these parameters.”

5B: Impaired, review of the WQS in needed prior to TMDL development
Work Plan: Not a specific requirement under per 20.6.4.10 NMAC but developed for transparency and planning purposes (draft available).

Technical Report: Present & justify the derivation of copper SSWQC, including specific surface waters to which SSWQC would apply & the rationale for proposing SSWQC (targeting Q1 2021).

Stakeholder & Public Review: Solicit input from stakeholders (NMED, EPA) and from the general public; respond to all input received (targeting Q1 2021 for report comments & next public meeting).

Petition & Rulemaking: A petition for copper SSWQC will be developed based on (1) conclusions presented in the final Technical Report, (2) NMED and EPA comments, and (3) input from other potential stakeholders and the general public (rulemaking schedule TBD).
• Content: Describes regulatory and scientific basis of BLM and an approach to develop SSWQC for the Pajarito Plateau.

• Status: Submitted July 7th, 2020, comments requested from NMED & DOE

• Process: Next step is a Technical SSWQC Report with recommended SSWQC:
  (a) for stakeholder (NMED, EPA, public) review/comments
  (b) Report will provide the technical & regulatory basis of the SSWQC petition (technical exhibit to petition)
Questions