Reasonable Potential Process for Copper Using the Biotic Ligand Model

Water Quality Permitting and Program Development
700 NE Multnomah St.
Suite 600
Portland, OR 97232
Phone: 503-229-5696
800-452-4011
Fax: 503-229-5850
Contact: Jeffrey Navarro
www.oregon.gov/DEQ

DEQ is a leader in restoring, maintaining and enhancing the quality of Oregon's air, land and water.

DEQ
State of Oregon
Department of Environmental Quality

Disclaimer

This document represents Oregon DEQ's current directions to staff on how to implement the water quality standard for copper in individual NPDES Permits. This directive is intended solely as guidance for DEQ employees. It does not constitute rulemaking by the Environmental Quality Commission and may not be relied upon to create an enforceable right or benefit, substantive or procedural, enforceable at law or in equity, by any person. With written managerial approval, DEQ employees may deviate from this directive. DEQ anticipates revising this directive from time to time as conditions warrant.

Document development

Prepared By: Aliana Britson, Senior Permit Policy Consultant

Reviewed By: Jeffrey Navarro, Senior Permitting Program Analyst
Robert Burkhart, Senior Water Quality Specialist

Approved By: Rebecca J Bodnar Date: 08/07/2024

Translation or other formats

Español | 한국어 | 繁體中文 | Русский | Tiếng Việt | العربية
800-452-4011 | TTY: 711 | deqinfo@deq.oregon.gov

Non-discrimination statement

DEQ does not discriminate on the basis of race, color, national origin, disability, age or sex in administration of its programs or activities. Visit DEQ's Civil Rights and Environmental Justice page.

Table of Contents

1 Background

A new Oregon aquatic life water quality standard for copper was approved by EPA in January 2017. The new standard states that the copper criteria are to be based on the Biotic Ligand Model (BLM), which is a metal bioavailability model that uses water characteristics to develop site-specific instantaneous water quality criteria. The following discussion provides an overview of the procedures to determine if the discharge from a permitted facility has a reasonable potential to cause or contribute to exceedances of the model-based criteria.

The OAR 340-041-8033 endnote N states "BLM results from Instantaneous Water Quality Criteria (IWQC) based on sufficient measured input parameter data are more accurate and supersede results based on estimates or default values." IWQC are the protective criteria for Clean Water Act Purposes calculated by the copper BLM from a set of input parameters from a water sample. Ideally, complete, paired sets of input parameter data measured from the effluent and ambient environment upstream of the discharge are available to calculate the applicable IWQC.

Required BLM input parameters:
Temperature (°C)
pH (Standard Units)
Dissolved Organic Carbon (DOC) (mg/L)
Calcium (mg/L)
Magnesium (mg/L)
Sodium (mg/L)
Potassium (mg/L)
Sulfate (mg/L)
Chloride (mg/L)
Alkalinity (mg/L $CaCO_3$ equivalent)

For the purposes of a reasonable potential analysis (RPA) using the BLM, these data sets would be collected over a long enough period to characterize the range of both the upstream ambient receiving waterbody and the effluent copper water chemistry conditions and include the most bioavailable conditions. If the input parameter data is incomplete or unavailable, DEQ will substitute conservative estimates or default values for input parameters to determine protective instantaneous copper criteria and to complete the copper RPA. Substitution of input parameters will be completed based on this procedure using available guidance materials.

2 Purpose

The purpose of this document is to provide DEQ staff a procedure and methodology for evaluating the potential of a point source discharge permittee to exceed the water quality standards for copper. The current water quality criteria for copper are listed in OAR 340-041-8033 table 30 and endnote N.

3 Applicability

a. Reasonable potential to exceed the water quality criteria for copper must be determined for a facility if any one of the following applies:

    i. The facility is required to monitor for copper under existing permit conditions (e.g. is required to perform toxics monitoring).

    ii. When DEQ determines that copper is a pollutant of concern. See RPA IMD for how to determine pollutants of concern.

b. Permittees for which copper is a pollutant of concern must submit a minimum of monthly concurrent samples collected over a two-year period to evaluate the Copper BLM for initial evaluation of site-specific conditions.

    i. Due to variability in local water chemistry conditions, there needs to be enough data to capture the most sensitive of bioavailable conditions. The data should capture both seasonal and inter-annual variability which must be balanced with the length of a permit cycle.

    ii. All data intended to be used to evaluate copper using the BLM will be submitted to DEQ using the specified electronic data delivery method.

c. DEQ has identified copper subject matter experts (SME) who coordinate with water quality permitting and standards staff to refine and implement this methodology. The Copper SMEs are responsible for completing the RPA in accordance with this IMD and providing a memo to the permit writer that includes analytical results, fact sheet language, and permit requirements.

    i. It is the responsibility of the permit writer to determine whether copper is a pollutant of concern and to submit a request to the copper SME for determination of reasonable potential to exceed the water quality criteria.

    ii. Individual point source discharge permittees must provide at minimum concurrent samples of temperature, pH, DOC, specific conductance, and copper from the upstream ambient receiving waterbody and effluent streams. Missing input parameters or parameters rejected due to data quality concerns will be substituted with defaults according to OAR 340-041-8033 Table 30 Endnote N.

    iii. Smaller data sets may be used by the SME when limited data is available or a smaller data set is determined to be sufficient through best professional judgement.

    iv. See monitoring section for monitoring frequency requirements in subsequent permit renewals.

4 Methodology

a. In accordance with DEQ's Regulatory Mixing Zone Internal Management Directive Part 1and Part 2, acute criteria must be met at the edge of the zone of initial dilution (ZID) and chronic criteria at the regulatory mixing zone (RMZ). Additionally, DEQ will determine whether chronic criteria are met at 100% mix to ensure that copper toxicity does not occur outside of the RMZ. The standard methodology for determining whether a discharge has a reasonable potential to cause or contribute to exceedances of toxic water quality criteria is to first determine the applicable acute and chronic criteria, and then to determine whether the expected concentrations of the toxic pollutant in the effluent have a reasonable potential to exceed these criteria during site specific scenarios. BLM generated instantaneous water quality criteria are developed using input parameter data covering a range of environmental (for receiving waterbody ambient) and operational (for effluent) conditions. From these data sets, DEQ derives acute and chronic instantaneous water quality criteria that are protective of water quality beneficial uses.

b. To derive sets of instantaneous water quality criteria, measured or conservative estimates of mixed concentrations of BLM input parameters must be determined. The RPA will use a simple mass-balance equation to determine the mixed concentration of the BLM input parameters for the ZID, RMZ, and at 100% mix.

    i. For detailed instructions on inputs and outputs used for the BLM, refer to specific instructions embedded into the RPA worksheet

c. All analysis must be conducting using approved EPA methods according to 40 CFR part 136

d. General procedure:

    i. Permittees provide two years of concurrent monthly samples for copper and BLM input parameters for both the effluent and the receiving water.

        1. Minimum BLM input parameters required will be temperature, pH, specific conductance and DOC. The permittee may collect the additional geochemical ion and alkalinity input parameters if desired.

        2. In the event 24 months of concurrent monthly samples are not available, follow the directions for "incomplete data sets" and "no data sets" below. Permit writers will not delay permit development to wait for data collection.

    ii. Dilutions used in the mixed value calculations are identified by the mixing zone SME and represent a conservative value developed using low flow conditions for the Z ZID, RMZ, and at 100% mix.

    iii. Calculate concentration of copper and each required input parameters by mass balance for each set of monthly samples at the edge of ZID, RMZ, and at 100% mix:

    iv. Calculate the IWQC using the BLM model for each set of samples at the edge of the ZID, RMZ, and at 100% mix

    v. Compare the mixed copper concentration to the corresponding IWQC at the edge of the ZID (acute), RMZ (chronic), and 100% mix (chronic) for that sampling date.

vi. A dissolved copper concentration exceeding the corresponding IWQC indicates reasonable potential to exceed the IWQC. Because the criteria is in the dissolved fraction, the use of total recoverable copper will not be used to determine reasonable potential. If dissolved copper is not available, total recoverable copper may be used to determine if additional monitoring is needed (see Monitoring section).

5 Data analysis

a. Determine reasonable potential for pollutant to exceed water quality criteria using a paired data set. This analysis assumes permittees submit all 24 samples of copper and required BLM input parameters measured in the field for effluent and upstream ambient receiving waterbody.

   a. Data requirements:

Paired Data Set[1]	
Ambient Data	**Effluent Data**
• Concurrent BLM input parameters for the ambient upstream[2] of the discharge location • Data must be collected at the same time and location for all BLM input parameters a. pH b. DOC c. Temperature d. Dissolved[3] major ions or specific conductance e. Dissolved and total copper • 24 months[4] of data are available and concurrent with effluent data	• Concurrent BLM input parameters for the effluent stream • Data must be collected at the same time and location for all critical BLM input parameters: a. pH b. DOC c. Temperature d. Dissolved[3] major ions or specific conductance e. Dissolved and total copper • 24 months[4] of data are available and concurrent with ambient upstream data

   b. Calculate[5] the BLM input parameter concentrations at edge of ZID, RMZ, and at 100% mix for each paired data set.

   c. Enter the respective input parameter concentrations into the BLM software to calculate a set of instantaneous water quality criteria.

[1] Paired data refers to concurrent samples that have been taken from two locations (upstream ambient and effluent) within 24 hours of each other.
[2] Preferred upstream location is one that does not include permitted discharges, major confluences and is appropriate for safe sampling procedures. Alternate locations may be considered for safety, accessibility or existing monitoring stations that collect appropriate data. Best professional judgement may be used for upstream locations that are not preferred or alternate locations and must be representative of the conditions at or near the outfall.
[3] Dissolved results are preferred, total recoverable results may be used.
[4] Smaller data sets may be used if the data is adequate to represent the variability of the stream and seasonal conditions; rationale must be included in the permit fact sheet.
[5] Calculations are described and listed in detail in the copper BLM RPA worksheet.

1. See *Implementation of the Freshwater Aquatic Life Water Quality Standards for Copper and Software instructions* for guidance on entering data into the copper BLM software.

2. Compare each day's IWQC to the corresponding effluent copper concentration by dividing the mixed concentration (ZID, RMZ, and 100% mix) by the IWQC. The result is a toxic unit.

3. Toxic units greater than 1.0 that can be attributed to the effluent copper concentration indicate reasonable potential to exceed the water quality criteria.

b. Determine reasonable potential for pollutant to exceed water quality criteria using an incomplete data set. This analysis incorporates the use of established defaults and statistical estimates in place of missing BLM input parameters

    a. Note that this scenario is for situations where some data are available but not complete (e.g. have effluent data but no ambient data or have paired ambient and effluent data set but are missing input parameters). If the data set is paired, but is less than 24 samples, an analysis will be done only with the data available (e.g. if 18 data sets are available, then the analysis is run with the 18 and with no use of defaults to make up the remaining six samples). The presence of paired copper data is the deciding factor in whether a data set will be included in an analysis.

b. Data requirements:

Incomplete Data Sets[6]	
Ambient Data	**Effluent Data**
• When ambient data is either not concurrent, or is concurrent but missing input parameters follow the input parameter substitution and estimation procedures outlined in Endnote N (1) and (2) of Table 30: a. If there is no pH data use 10th percentile from closest representative data source[7]. b. If there is no temperature data use the monthly mean temperature from closest representative data source[7] c. If data is non-detect: use defaults if MRL is above default, or use ½ DL if MRL is below default.	• When effluent data is either not concurrent, or is concurrent but missing input parameters follow the input parameter substitution and estimation procedures outlined in Endnote N(1) and (2) of Table 30: a. DOC, use default specified below. b. If no pH data, use 10th percentile from DMR data c. If no temperature data, use monthly mean temperature from DMR data d. If data is non-detect: use defaults if MRL is above default, use ½ DL if MRL is below default. • Where concurrent effluent data is not available: a. Follow the input parameter substitution and estimation procedures outlined in Endnote N(1 and 2) of Table 30

a. Calculate the BLM input parameter concentrations at edge of ZID, RMZ, and at 100% mix for each data set.

b. Enter the respective input parameter concentrations into the BLM software to calculate a set of IWQCs.

1. When effluent DOC values are not available for domestic facilities, use 6.46 mg/L as a default.

(a.) Rationale: The DOC default is based on the 20th percentile of DOC data from domestic wastewater sources in Oregon (see the ORDEQ Memo "DOC Default for Domestic POTW Majors").

c. Compare each day's IWQC to the corresponding effluent copper concentration by dividing the mixed concentration (ZID, RMZ, and 100% mix) by the IWQC. The result is a toxic unit. Toxic units greater than 1.0 that can be attributed to the effluent copper concentration indicate reasonable potential to exceed the water quality criteria.

[6] Unpaired data set includes a mixture of concurrent, missing and estimated samples taken from upstream ambient and effluent locations. Missing ambient and effluent samples are replaced using substitutions or geo region defaults designated in the *Implementation of the Freshwater Aquatic Life Water Quality Standards for Copper*.
[7] Closest representative data sources are ideally within the same Assessment Unit or the next Assessment Unit upstream

1. If 10% or more of the toxic units are greater than 1.0 and the results are not inconclusive (see item 3 below), there is reasonable potential, and the permittee will be given an effluent limit.

2. The copper SME should carefully evaluate the data when less than 10% of the toxic units are greater than 1.0. If the data is sound (does not fall into the inconclusive category (see 3.b. below)) and there is reasonable potential, then the permittee will be given an effluent limit.

3. When the results are inconclusive, the copper team will indicate that copper is a pollutant of concern and include monitoring for 24 concurrent data sets as described in section 8 (Monitoring). The use of substitutions according to Table 30 Endnote N does not render data to be inconclusive. Inconclusive results include:

   (a.) TUs greater than 1 based on total recoverable copper results (either for effluent or ambient copper).

   (b.) If substitute ambient pH or temperature data used in the RPA is not from the same Assessment Unit the permittee discharges into or the next Assessment Unit upstream.

b. Determine reasonable potential for pollutant to exceed water quality criteria using a 'no data' set

   a. Note that this scenario is for situations where there is no paired copper data, but some effluent copper data or estimate of effluent copper concentrations exist that can be compared to the IWQC.

   b. Data Requirements:

No Data Set	
Ambient Data	**Effluent Data**
• Follow the input parameter substitution and estimation procedures outlined in Endnote N (1) and (2) of Table 30. a. If there is no pH data use 10th percentile from closest representative data source[7]. b. If there is no temperature data use the mean temperature from closest representative data source[7] i. This needs to be done once: subsequent entries will be equal.	• Follow the input parameter substitution and estimation procedures outlined in Endnote N (1) and (2) of Table 30 a. If there is no pH data, use 10th percentile from DMR data b. If there is no temperature data, use the monthly mean temperature from DMR data

c. Use the default action values or substitution criteria to calculate the BLM input parameter concentrations at the edge of the ZID, RMZ, and at 100% mix

    1. When effluent DOC values are not available for domestic facilities, use 6.46 mg/L.

        (a.) Rationale: The DOC default is based on the 20th percentile of DOC data from domestic wastewater sources in Oregon (see the ORDEQ Memo "DOC Default for Domestic POTW Majors").

d. Enter the respective input parameter concentrations into the BLM software to calculate an IWQC.

e. Calculate the maximum estimated effluent concentration using the TSD methodology found in section 3.3.2[8]. For ambient copper, use either the 90th percentile of copper data (if more than 4 samples) or the maximum ambient copper concentration (if fewer than 4 samples) in the Assessment Unit the permittee discharges into or the next Assessment Unit upstream. If there is no ambient copper data within this area, use the average copper value for the HUC 8 watershed.

f. Compare the IWQC to the maximum estimated effluent copper concentration by dividing the mixed concentration (ZID, RMZ, and 100% mix) by the IWQC. The result is a toxic unit.

g. Toxic units greater than 1.0 that can be attributed to the effluent copper concentration where the results are not inconclusive (see item 1 below) indicate reasonable potential to exceed the water quality criteria.

    1. When the results are inconclusive, the copper team will indicate that copper is a pollutant of concern and include monitoring for 24 concurrent data sets as described in section 8 (Monitoring). The use of substitutions according to Table 30 Endnote N does not render data to be inconclusive. Inconclusive results include:

        (a.) TUs greater than 1 based on total recoverable copper results (either for effluent or ambient copper).

        (b.) If substitute ambient pH or temperature data used in the RPA is not from the same Assessment Unit the permittee discharges into or the next Assessment Unit upstream.

6 Develop effluent limits

a. When data analysis results in reasonable potential to exceed the water quality criteria, the copper SME will calculate limits according to the methodology found in the EPA TSD Section 5.4 and 5.5 using the 10th percentile of the IWQC calculated for the acute (ZID) and chronic (RMZ and 100% mix) criteria.

[8] Technical Support Document for Water Quality-based Toxics Control. USEPA Office of Water, EPA/505/2-90-001 PB91-127415, March 1991

b. Limits are required to be in the total recoverable fraction (40 CFR 122.45(c)). Site specific translations from dissolved to total recoverable can be developed according to the EPA guidance "The Metals Translator: Guidance for Calculating a Total Recoverable Permit Limit from a Dissolved Criterion"[9].

    i. In the absence of a site-specific translator, a conservative translator of 1 will be applied to convert limits into the total recoverable fraction[10].

c. Copper monitoring frequency for the effluent limit will be the same as for any other toxic pollutant with limits. See monitoring matrix.

7 Communication with permit writer

Once the RPA is completed, the SME will prepare a memo to the permit writer communicating the rational for the RPA, required schedule B monitoring, draft fact sheet language, schedule A limits (if necessary), and notes regarding any deviations from the process outlined in this document. This memo will be saved in the permit development folder.

8 Monitoring

a. All permittees that have copper as a pollutant of concern will be required to monitor at a minimum for ambient and effluent copper, temperature, pH, DOC, and specific conductance in schedule B of the permit.

b. Once a facility has submitted 24 concurrent sample sets and the evaluation determines there is no reasonable potential to exceed the water quality criteria for dissolved copper, monitoring will be:

    i. Correlated with the priority pollutant toxics sampling (12 samples quarterly over 3 years – see monitoring matrix).

    ii. If dissolved copper was unavailable and a total recoverable copper concentration exceeds the corresponding IWQC, then an additional 24 monitoring events will be required in the new permit beginning in January of the second year of the permit cycle.

c. Deviations from item 8.b must be justified in the fact sheet.

    i. Evaluation of toxic units should be a primary factor in increasing or decreasing monitoring requirements.

    ii. When a seasonal pattern is recognized, the copper SME can require more, or less monitoring during those seasons.

[9] U.S. EPA Office of Water (4305) EPA 823-B-96-007 June 1996
[10] OAR 340-041-8033 Endnote F specifies conversion factors for dissolved to total recoverable metals criteria. However, there is no conversion factor for freshwater copper.

9 Special considerations

a. Currently, there are no established statewide or regional translations between total recoverable and dissolved copper concentrations. Partitioning between total and dissolved copper can change due to changing water quality conditions (e.g. temperature, pH, DOC). Site specific translations can be developed according to the EPA guidance "The Metals Translator: Guidance for Calculating a Total Recoverable Permit Limit from a Dissolved Criterion"[9].

    i. It is not expected that the partitioning between total and dissolved copper will change for domestic discharges.

    ii. For industrial facilities, the partitioning between total and dissolved may be more likely to change depending on how different the industrial discharge is compared to the ambient water.

b. Regional default values should not be used in place of measured data. Because the defaults use the 20th percentile, they may be less conservative in certain scenarios.

c. Additional discharge scenarios

    i. Ocean or saline receiving water – do not run BLM.

        i. DEQ policy is to apply the freshwater criterion in estuarine environments when the 90th percentile salinity is below 1 ppt and to apply the salt water criterion when the 90th percentile salinity is greater than 10 ppt. If the salinity lies between these values, DEQ policy is to run both a freshwater and a saltwater analysis and apply the more conservative limits (if any) resulting from the two analyses.

    ii. No mixing zone

        i. End of pipe analysis.

        ii. Consider potential impacts to the receiving stream

    iii. Seasonal or intermittent dischargers

        i. The permittee is still required to collect 24 concurrent samples for initial evaluation. The permittee will only be required to sample during the months in which a discharge occurs. Note that this will likely take longer than two years and should be accounted for when establishing copper BLM monitoring.

10 Record of revisions to directive

Revision	Date	Changes	Editor
v1.0	9/3/2024	Development of guidance into IMD	Aliana Britson

State of Oregon
DEQ Department of Environmental Quality

Memorandum

To: Jennifer Wigal, WQ Administrator
cc: Rebecca Bodnar, Permitting and Program Development Manager

Connie Dou, Standards, Source Water Protection, and Assessments Manager
Michael Kucinski, Deputy WQ Administrator

From: Aliana Britson, Ph.D., Senior Permit Policy Consultant

Date: 3/31/2026

Subject: Simplifying Copper BLM and Aluminum Implementation in NPDES Individual Permits

Executive summary

The following memo describes an analysis conducted by Water Quality Permitting and Program Development to simplify the reasonable potential analysis process for Copper BLM and Aluminum for domestic wastewater facilities in qualifying situations. The simplified approach requires less monitoring, data entry, and analysis, while still being protective of the criteria. The adoption of this approach is intended to simplify individual NPDES permit issuance.

Overview

Oregon's freshwater copper criterion became effective on Jan. 9, 2017. As described in OAR 340-041-8033 (under Table 30, Endnote N), the freshwater copper criteria are based upon the Biotic Ligand Model (BLM), a metal bioavailability model, which calculates the acute and chronic copper criteria based on the concentrations of dissolved organic carbon, pH, temperature, calcium, magnesium, sodium, potassium, sulfate, chloride, and alkalinity. Oregon's freshwater aluminum criteria were published April 19, 2021 to protect aquatic life. The freshwater aluminum criterion is similar to copper in that it is an instantaneous criterion that changes based on pH, dissolved organic carbon, and total hardness.

Currently, implementation of the Copper BLM and Aluminum criteria in NPDES permits requires 12-24 paired sets of measured input parameters from effluent and ambient monitoring each permit cycle that are then evaluated to determine the applicable criteria used in NPDES permit renewals. Paired sampling is defined as effluent and ambient samples collected within the same 24-hour period. While this strategy results in site-specific criteria tailored to the particular effluent/ambient mixture within the regulatory mixing zone as well as a more exact determination of whether there is Reasonable Potential (RP) to exceed the copper or aluminum criteria, the paired sampling approach is resource intensive for both permittees and DEQ. Furthermore, DEQ has often found data quality issues with the paired data (especially ambient pH), which then results in the rejection of datasets and extra effort on the part of the permittee to resample. Therefore, a simplified approach is desired in situations where it is unlikely for the permitted discharge to have RP, and a heightened level of site-specific data collection is not necessary.

Water Quality Permitting Program and Development
700 NE Multnomah Street, Suite 600, Portland, OR 97232
503-229-5263, Toll-free in Oregon: 800-452-4011

This memo outlines that simplified approach for monitoring and determining RP for copper and aluminum, the analysis done to determine which scenarios warrant a simplified approach, the results of that analysis, and directions on when to use or not use the simplified approach in NPDES permits. This memo applies primarily to domestic permittees. This memo may also apply to industrial permittees as described in the sections below.

Final determination of whether the paired or simplified approach to copper and aluminum is implemented in an NPDES permit is the purview of the Copper/Aluminum SME. This determination is to be recorded in the permit fact sheet language.

Simplified approach

As an alternative to the paired sampling, only effluent copper and aluminum monitoring would be required in the permit. The effluent copper and aluminum sampling would be included in the Effluent Toxics Metals, Cyanide, and Hardness table in Schedule B and monitored at the same frequency as the other metals (currently 12 samples per permit cycle). Ambient monitoring for dissolved copper and bioavailable aluminum would only be required if there was no other recent local data[1]. It should be noted in this case that only bioavailable aluminum should be used when determining whether ambient aluminum data is present. Neither total recoverable aluminum nor dissolved aluminum data should be substituted for bioavailable aluminum.

When determining RP, the copper and aluminum data would be run in accordance with the RPA IMD with the applicable default criteria in Tables 1 and 2 (see Results section below) applied.

If it is found that there is RP for the permittee to exceed the copper or aluminum criteria when using the simplified approach, it is first recommended to evaluate the copper and aluminum data (effluent and ambient) to ensure there are no data quality issues. If the values reported by the permittee are found to have no data quality issues, then a limit and associated compliance monitoring should be included in the permit.

For those situations where a permittee has reasonable potential to exceed the copper or aluminum criteria using the default values proposed in this memo, and the permittee is not expected to be able to achieve those limits, then a compliance schedule could be included in the permit. If a compliance schedule is included in the permit, the compliance schedule may not include time for the permittee to collect additional data. However, DEQ may reconsider the limit before it becomes final, as antibacksliding requirements do not apply to limits that are not yet effective. If in a timely request for a modification, the permittee provides paired data (minimum of 12 samples each collected 1 month apart) showing that the site-specific criteria are less stringent than the default criteria from Table 1 and 2, and that there is no RP to exceed the site-specific criteria as determined when using the Copper BLM IMD, then DEQ may choose to modify the permit and remove the final limit before it becomes effective. The modification request should be submitted more than six months prior to the final limit becoming effective so that DEQ has adequate time to process the modification and complete the public notice process.

Methodology and analysis

The goal of this analysis was to determine what scenarios would not result in RP for copper and aluminum when using conservative inputs (low criteria and high effluent and ambient copper/aluminum concentrations) and use that as a guide to determine when alternatives to paired sampling may be warranted.

To determine conservative copper criteria, the monte carlo analysis used to develop the Stormwater General 1200-Z NPDES Permit benchmarks was used[2]. The 1200-Z analysis utilized ambient data compiled between 2010-2019 to develop the best fit distribution for each region[3] for each relevant CuBLM parameter. These distributions were then used to develop 10,000 randomly generated data points for the full suite of CuBLM parameters.

---

[1] See “Reasonable Potential Analysis Process for Toxic Pollutants” Section 3.2: Ambient Characterization
[2] See Permit Evaluation Report 1200-Z – March 2021 Appendix A for a more detailed description of the analysis
[3] Regions are defined in “Implementation of the Freshwater Aquatic Life Water Quality Standards for Copper”

For this analysis, the 10,000 randomly generated datapoints from the 1200-Z monte carlo were used to calculate the acute and chronic criteria for each region. The 10th percentile of the 10,000 calculated criteria was then determined to be used as default regional copper criteria (See Table 1 below).

For aluminum, the default aluminum criteria adopted by the DEQ Water Quality Standards group were used.[4]

To determine a conservative effluent copper value, effluent dissolved copper data collected between 2020-2025 was pulled from AWQMS for all domestic municipalities and screened for quality control issues. No data from industrial facilities was used in the analysis; because no data from industrial facilities was used in this analysis, the conclusions should not be applied to industrial facilities without additional justification. From this data a 95th percentile effluent copper value of 7.9 ug/L (n = 524) was determined. Effluent total aluminum data from the same time period was also screen for quality control issues, resulting in an effluent aluminum 95th percentile of 304 ug/L (n=563).

A conservative ambient copper value was determined using statewide river/stream dissolved copper data from 2020-2025 (AWQMS data pull). After screening for QA/QC issues, a 90th percentile[5] value of 1.9 ug/L was determined (n=3,737). A conservative ambient aluminum value was determined using statewide bioavailable aluminum data from 2022-2025.[6] After screening for quality control issues, a 90th percentile value of 36.1 ug/L (n= 967).

Using these values, an analysis was performed to determine what level of dilution a facility would need to not have RP to exceed the default criteria calculated. This was done by calculating the concentration of copper and aluminum at the edge of the ZID or RMZ using Equation 1 and comparing the results to the default copper or aluminum criteria, respectively.

Equation 1:

$$S = \frac{Ce - Ca}{Cm - Ca}$$

Where S is the dilution factor, Ce is the concentration of the pollutant in the effluent,[7] Ca is the concentration of the pollutant in the ambient water, and Cm is the concentration of the effluent at the edge of the regulatory mixing zone. The 95th percentile concentration of the effluent was used for Ce, the 90th percentile of the ambient concentration was used for Ca, and the aquatic life criteria was used for Cm. To ensure a conservative analysis, results for S were rounded up to the next whole number.

Results

The Acute Aquatic Life (ZID) and Chronic Aquatic Life (RMZ) dilutions required for a permittee to have no RP for copper given conservative analytical inputs are listed in Table 1. The highest dilutions required for no RP in any region are an Acute Aquatic Life (ZID) dilution of 4 and a Chronic Aquatic Life (RMZ) dilution of 25.

Table 1: Copper BLM

Region	Acute Criteria (ug/L)	Chronic Criteria (ug/L)	ZID Dilution Factor Needed for no RP	RMZ Dilution Factor Needed for no RP
Cascades	3.72	2.31	4	15
Coastal	4.11	2.55	3	10
Columbia River	7.78	4.83	2	3
Eastern	7.43	4.62	2	3
Willamette Valley	3.46	2.15	4	25

[4] "Aluminum Standard Interpretation and Application Procedures" June 2021

[5] The 90th percentile was used in accordance with the current version of the RPA IMD

[6] The approved method for bioavailable aluminum has only been available since November 2024. DEQ lab has been collecting data prior to this as part of method development.

[7] The dilution factor represents how much the effluent mixes with the receiving water. Larger numbers represent greater mixing of the effluent with the receiving water.

The ZID and RMZ dilutions required for a permittee to have no RP for aluminum given conservative analytical inputs are listed in Table 2. In all cases, domestic permittees with ZID dilutions greater than 1 and RMZ dilutions greater than 2 are unlikely to have RP to exceed the aluminum criteria.

Table 2: Aluminum

Ecoregion	Acute Criteria (ug/L)	Chronic Criteria (ug/L)	ZID Dilution Factor Needed for no RP	RMZ Dilution Factor Needed for no RP
Coast Range	580	300	1	2
Klamath Mountains	1500	770	1	1
Willamette Valley	830	440	1	1
Cascades	360	210	1	2
Eastern Cascades Slopes and Foothills	1100	620	1	1
Columbia Plateau	1400	800	1	1
Blue Mountains	1200	740	1	1
Snake River Plain	2900	1200	1	1
Northern Basin and Range	1300	680	1	1
Columbia River	1600	750	1	1

When is the simplified approach appropriate?

The simplified approach is appropriate for domestic permittees with dilutions equal to or greater than the eco-region dilutions specified in Table 1 and 2 where previous data indicates the copper values are below 7.9 ug/L (95th percentile effluent copper from statewide data, 2020-2025) and aluminum values (95th percentile effluent aluminum) from statewide data, 2020-2025) below 304 ug/L.

This approach may also be applied to industrial facilities if previous sampling has shown the copper values to be below 7.9 ug/L and aluminum to be below 304 ug/L and the dilutions are equal to or greater than those in Tables 1 and 2.

In situations where a permittee's dilutions warrant simplified monitoring for aluminum but not for copper, the permittee may include aluminum monitoring in the Metals, Cyanide, and Hardness table but should require paired Copper BLM sampling.

When is the simplified approach not appropriate?

It is not recommended to use the simplified approach for facilities where previous sampling efforts, ideally from the last five years, have shown effluent dissolved copper or total recoverable aluminum values in excess of the concentrations used in this analysis (7.9 ug/L for copper and 304 ug/L for aluminum). If the analysis from the renewal in progress shows that a change in dilution - 10%, or a change in effluent copper or aluminum of +10% would result in RP, then the proposed permit should include paired monitoring for that parameter near to RP. The applicant may waive paired monitoring if they submit a written comment indicating they understand that that waiver could result in an effluent limit at the following permit renewal. An exception to this monitoring requirement may be made if the facility has large enough dilutions that the Table 1 or 2 default criteria would not be exceeded even with the higher copper or aluminum values.

Do not use the simplified approach for facilities with dilutions lower than those in Tables 1 and 2. The simplified approach should also not be used when the receiving stream is impaired for copper or aluminum as there is no assimilative capacity in these scenarios and a dilution of 1 is used in analyses for impaired parameters.

Paired data should be included in the renewal for situations where the dilutions may significantly lower from one permit cycle to the next and may go below the dilutions in Table 1 and 2. This analysis is to be recorded in the permit fact sheet. Dilutions may lower as a result of increased effluent flows from new development, for example. Dilutions may also lower as a result of decreased ambient flows, especially in managed flow scenarios. Lower dilutions could also occur if estimated values were used for the current permit analysis, but additional data or mixing zone studies are being included in the proposed permit to provide updated dilutions.

The simplified approach is not recommended for industrial facilities where there is no representative effluent copper or aluminum data available. In these situations, paired monitoring should be included in the proposed permit. The permittee may request, in writing, to have the simplified approach included in the proposed permit at Applicant Review or Public Notice.

It is not recommended to apply the simplified approach to facilities that already have copper limits, as those limits would have been based on paired sampling and criteria that were determined using site specific data. As a result, it is not appropriate to apply the default criteria proposed here to re-evaluate permit limits. In these situations, paired monitoring should be included in the permit so that the site-specific criteria may be re-evaluated at permit renewal.

Examples

Example 1:

Metropolis WWTP is a major domestic permittee located in the Willamette Valley with an NPDES permit up for renewal. Data collected over the last permit cycle shows that their highest dissolved copper concentration is 5.0 ug/L and their highest total aluminum concentration was 100 ug/L. The mixing zone study from 4 years ago shows that the permittee has a ZID dilution of 5 and an RMZ dilution of 40. Nearby ambient data shows that the 90th percentile concentrations are 1 ug/L for dissolved copper and 30 ug/L for bioavailable aluminum.

Because the ZID and RMZ dilutions are higher than the dilutions needed in Tables 1 and 2 for the Willamette Valley and the permittee did not have effluent or ambient concentrations higher than those used to derive the Table 1 and 2 dilutions, the permittee qualifies for the simplified approach. The permit writer will include copper and aluminum monitoring with the toxics metals monitoring tables in the permit and not include paired monitoring in the proposed permit (unless specifically requested by the permittee).

Example 2:

Brick Co. is a manufacturing company located in Klamath Falls with an individual NPDES permit that has been administratively extended for over 10 years. Recent submitted data shows that during normal operations dissolved copper concentrations are normally around 4 ug/L. However, a few times each year the company switches to alternative operations that cause dissolved copper concentrations to spike to 20 ug/L. Aluminum concentrations remain steady, with a high of 200 ug/L, regardless of operating condition. The ZID and RMZ dilutions are 4 and 5. The permittee has not done any paired sampling. No local ambient data was found for copper or aluminum, but data located much further downstream was used to develop a 90th percentile of 1.2 ug/L for dissolved copper and 400 ug/L for bioavailable aluminum.

Because the effluent dissolved copper concentrations exceed the 7.9 ug/L a few times a year, the simplified approach is not recommended for copper. Paired copper monitoring should be included in the proposed permit. For aluminum, the simplified approach should be used because the permittee meets the dilutions in Table 2 for the Klamath Mountains and the effluent data is lower than the values used in the memo analysis. Though the estimated bioavailable aluminum ambient concentration is higher than that used in the analysis, it is lower than the default criteria for the Klamath Mountains and therefore would not result in a call of RP. As a result, the permittee is still eligible for simplified monitoring for aluminum. Ambient monitoring for dissolved copper and bioavailable aluminum should be included in the proposed permit given the lack of local data.

If the permittee wishes to have simplified monitoring for copper, they would need to be made aware of the likelihood of an exceedance of the default criteria and a copper limit being included at the next permit renewal. A formal letter or comment during PN would need to be submitted by the permittee indicating that the permittee

is aware of the risks and wishes to forgo the paired sampling before the simplified approach for copper could be included in the permit.

Flowcharts

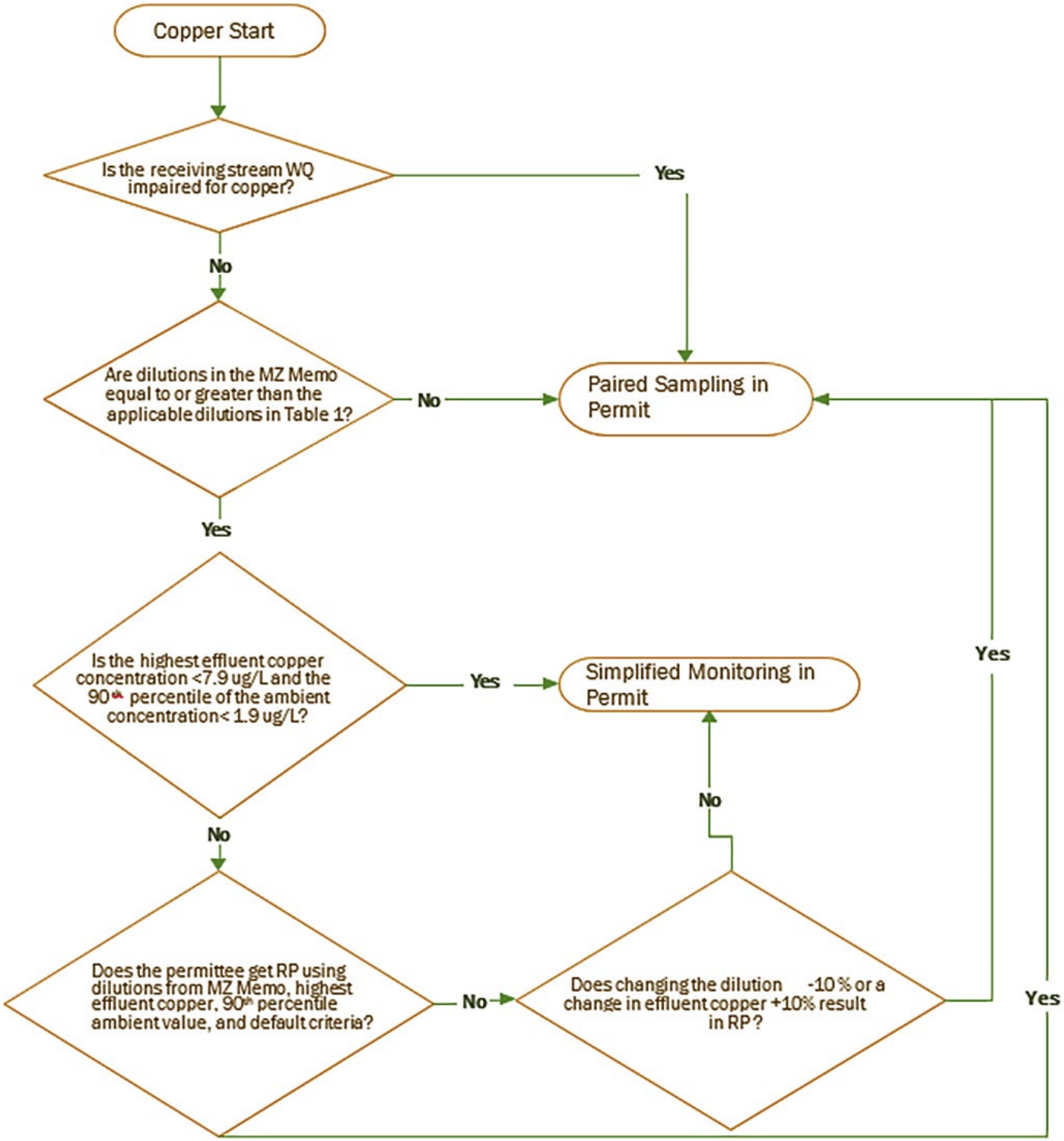

Figure 1: Copper Monitoring Decision Flowchart

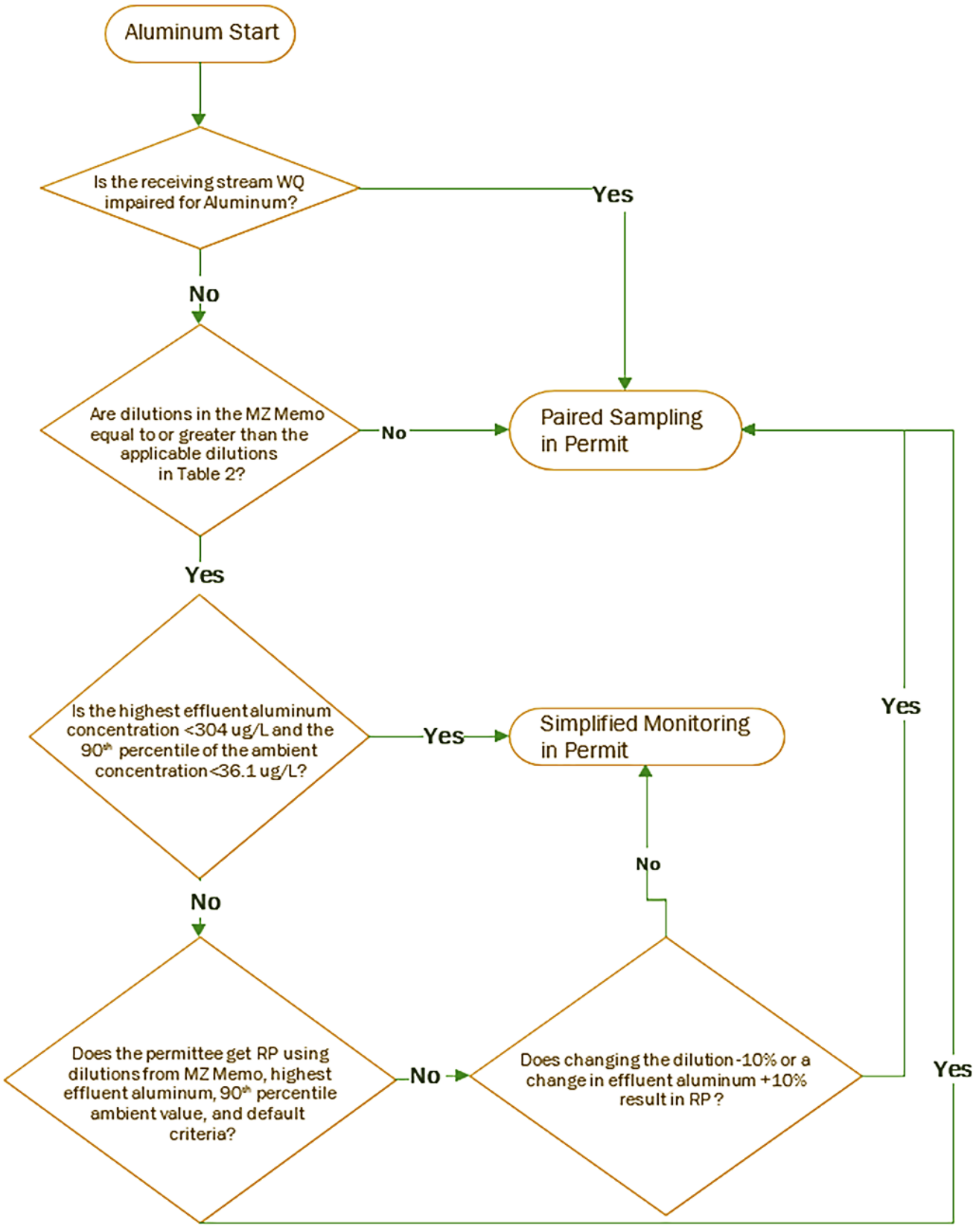

Figure 2: Aluminum Monitoring Decision Flowchart