Oregon Department of Environmental Quality
Nov. 2-3, 2016
Oregon Environmental Quality Commission meeting
Rulemaking, Action item G

Water Quality Standards for Copper

This file contains the following documents:

- EQC staff report
- Attachment A: Draft rules – edits highlighted
- Attachment B: Draft rules – no markup
- Attachment C: Public comments and DEQ responses
- Attachment D: Final Issue Paper

DEQ recommendation to the EQC

DEQ recommends that the Environmental Quality Commission amend OAR 340-041-0033 and the associated Table 30 as shown in Attachment A in order to revise Oregon's water quality standard for copper.

Overview

Summary

The proposed rule amendment will:

- Revise Oregon's water quality criteria for copper to protect freshwater aquatic life. The revised criteria are based on the U.S. Environmental Protection Agency's 2007 recommendation to use the Biotic Ligand Model to derive site-specific criteria based on the water chemistry of a site, which affects the bioavailability and toxicity of copper to aquatic life.

- Respond to EPA's Jan. 31, 2013, disapproval of hardness-based copper criteria that Oregon adopted in 2004. EPA disapproved Oregon's 2004 adopted criteria in response to a 2012 National Marine Fisheries Service Biological Opinion, which concluded that the criteria would jeopardize threatened and endangered species, and because EPA updated their national copper criteria recommendations in 2007.

DEQ's goal is to submit the copper standard, if adopted by the commission, to EPA immediately so that EPA can approve the state standard before Jan. 16, 2017. A consent decree requires EPA to adopt a federal copper standard for Oregon unless EPA is able to approve a revised state standard.

Brief history

In 2004, the Oregon Environmental Quality Commission adopted the current copper criteria. These criteria were based on EPA's recommended criteria for freshwater (1995) and saltwater (1999) at the time. However, EPA did not act on the criteria until 2013, when it disapproved the 2004 freshwater criteria. As a result, the freshwater criteria have never been in effect in Oregon. Rather, Oregon continues to use the previous freshwater criteria based on EPA's 1986 recommendations. EPA approved Oregon's adoption of the saltwater copper criteria in 2013; those criteria are now in effect for Clean Water Act purposes.

In August 2012, the National Marine Fisheries Service completed an Endangered Species Act consultation on Oregon's 2004 copper criteria, which are equations that use water hardness to determine the copper criteria and concluded that the freshwater copper criteria would jeopardize threatened and endangered species.

Based on this jeopardy determination, EPA disapproved Oregon's freshwater copper criteria on Jan. 31, 2013. The Biological Opinion recommended that the copper criteria be revised based on EPA's 2007 recommendations to use the Biotic Ligand Model. The National Marine Fisheries Service is also interested in ensuring that aquatic life will be protected where the data to derive site-specific criteria using the Biotic Ligand Model is not available.

DEQ's proposed freshwater copper criteria are consistent with EPA's 2007 recommendation to use the Biotic Ligand Model. DEQ's proposed rule also includes procedures to use protective estimates and default values when the measured data needed to derive Biotic Ligand Model criteria are not available for a specific time and location. Oregon's proposed criteria follow the Reasonable and Prudent Alternatives and other recommendations from the NMFS' 2013 opinion. DEQ expects the proposed criteria are sufficient to satisfy the Endangered Species Act consultation requirements. Therefore, EPA should be able approve Oregon's proposed revised copper criteria as protective of aquatic life and threatened and endangered species.

In April 2015, Northwest Environmental Advocates filed a lawsuit against the EPA for failing to "promptly" adopt aquatic life criteria for copper, cadmium, aluminum and ammonia for Oregon. The resultant consent decree requires EPA to adopt final cadmium and copper criteria by Jan. 16, 2017. Pursuant to that schedule, EPA published a proposed rule in the Federal Register on April 18, 2016 for comment: Aquatic Life Criteria for Copper and Cadmium in Oregon (81 FR 22555, April 18, 2016). However, the Clean Water Act section 303(c) gives states the primary responsibility for adopting water quality standards for their waters. To that end, the consent decree stipulates that if EPA approves a revised state copper criteria before the January 2017 deadline, EPA does not have to finalize the federal rule.

DEQ is recommending that the Environmental Quality Commission adopt revised copper criteria on Nov. 2, 2016. DEQ's objective is to submit the state criteria to EPA immediately for their approval prior to Jan. 16, 2017, in anticipation of an EPA approval action, precluding the need for a federal rule. DEQ is not proposing to revise the state's acute cadmium criterion. Therefore, EPA will adopt a federal freshwater acute cadmium criterion for Oregon.

Key policy and technical issues

1. The protectiveness and accuracy of the copper criteria

DEQ is proposing to revise Oregon's freshwater aquatic life criteria for copper by adopting the Biotic Ligand Model as described in the 2007 Revision of the U.S. Environmental Protection Agency's Aquatic Life Ambient Freshwater Criteria – Copper. This is the most current copper criteria recommended by EPA. Its use to protect threatened and endangered salmon populations in Oregon is also recommended by the National Marine Fisheries Service and U.S. Fish and Wildlife Service. The Biotic Ligand Model is the result of over 15 years of development and research into the mechanisms affecting metal toxicity to aquatic organisms. The BLM accounts for changes to copper bioavailability produced by interaction with different water chemistry conditions. Using the BLM will provide a high degree of protection to aquatic life during vulnerable water chemistry conditions and will also identify those conditions that are less sensitive, where toxicity occurs at greater copper concentrations. It is a superior method for determining the site-specific toxicity of copper to aquatic organisms, and is considered more scientifically robust and accurate than the hardness-based copper criteria currently in effect in Oregon.

2. Procedures when Biotic Ligand Model input parameter data is not available

The Biotic Ligand Model uses data for thirteen different water quality parameters (shown in Table 1). The model requires the user to collect data for ten of these parameters (bolded in Table 1) at specific water body locations and times and enter those values into the model to derive an acute and chronic Instantaneous Water Quality Criteria. These parameters influence the bioavailability and toxicity of copper to aquatic organisms. While DEQ has experience applying multi-parameter criteria, such as for ammonia, which is dependent on pH and temperature, the number of parameters in the BLM introduces additional complexity.

Table 1: BLM Parameters for Copper	
• **Temperature**	• **Potassium (K^+)**
• **pH**	• **Sulfate (SO_4^{-2})**
• **Dissolved Organic Carbon (DOC)**	• **Chloride (Cl^+)**
• **Sodium (Na^+)**	• **Alkalinity**
• **Calcium (Ca^{+2})**	• Humic Acid %
• **Magnesium (Mg^{+2})**	• Sulfide (S^-)
	• Dissolved Inorganic Carbon

One issue that arises in using the BLM is how to calculate protective acute and chronic criteria for a specific time and location when not all the required input data is available. Oregon's proposed rule includes procedures explaining how to substitute values for each input parameter when the measured data for a sample is not available. The model is particularly sensitive to pH, and dissolved organize carbon. The model is less sensitive to the value of alkalinity, calcium, magnesium, sodium, potassium, sulfate and chloride, and temperature. According to the model documentation, measurement of DIC, humic acid percentage, and sulfide are optional.

Alkalinity and Ions: One significant procedure that Oregon developed is the ability to estimate alkalinity, calcium, magnesium, sodium, potassium, sulfate and chloride values using specific conductance data. While these parameters are widely collected, one or more values is often missing from a sample. Specific conductance is a commonly collected water quality parameter, however, and there is a high degree of correlation between the concentration of the ions and alkalinity and specific conductance. DEQ's Technical Support Document demonstrates that using these estimates generates accurate instantaneous criteria values for Oregon waters. The specific equation for each parameter is included in the rule. Where specific conductance is not available, DEQ will use conservative default values for alkalinity and the ions based on the same method described for dissolved organic carbon below.

Temperature and pH: Temperature and pH data are widely collected and missing from very few samples. However, the rule provides methods to estimate pH and temperature values when site specific data is not available. Because pH and temperature data are widely collected around the state, data from nearby locations with similar site characteristics can be used to generate representative estimates. DEQ will use data from similar locations or the same site at different times to generate the best practical estimate for pH. For temperature, DEQ will use the monthly mean of data from similar nearby locations as the estimate. This provides a clear procedures and is sufficiently accurate because the BLM is not very sensitive to temperature.

Dissolved organic carbon: Dissolved organic carbon data has not been widely collected in Oregon in the past and is missing from about 50% of the samples evaluated. Because the BLM is quite sensitive to DOC concentration, the criteria derived by the model vary significantly based on the DOC input value. Starting in 2013, in preparation for using the BLM, DEQ made collecting additional DOC data a priority for its monitoring program. As more DOC data is collected, DEQ will be able to generate accurate criteria and there will be less need to rely on conservative default values.

DEQ did not identify an accurate method to estimate dissolved organic carbon. Therefore, the rule provides procedures to generate conservative default values to use where measured data is not available. DEQ identifies the BLM output that results from using conservative DOC default values as Default Action Values. They will be used in Clean Water Act programs as substitutes for the actual instantaneous water quality criteria until the data needed to derive the accurate criteria are available. Therefore, DEQ thinks it is important to identify that they are conservative default values as opposed to the accurate model result or instantaneous water quality criteria, which are the correct protective criteria.

In order to ensure that aquatic life are protected, DEQ will use conservative default input parameter values that provide a high probability that the default action value will be at least as stringent as the accurate instantaneous water quality criteria. DEQ proposes using default inputs values equal to the 20^{th} percentile of the distribution of DOC data from most regions, and the 15^{th} percentile for the eastern region. These default DOC values provide an 89 to 100 percent probability that the copper default action value will be at least as stringent as the accurate instantaneous water quality criteria, depending on the region, and a 95 percent probability statewide, for each individual sample. DEQ evaluated a range of default values and compared BLM derived criteria based on the various default values to IWQC based on measured data statewide and by region. DEQ found that instantaneous water quality criteria based on defaults lower than the 20^{th} percentile are significantly more stringent than necessary to protect aquatic life in the majority of cases when compared to the accurate instantaneous water quality criteria based on measured input data. Lower default values would result in regulatory actions disproportionate with the risk presented by copper.

Using DEQ's proposed procedures, in the few instances when the default action values are less stringent than the accurate instantaneous water quality criteria, both the default action values and the accurate IWQC are at very low copper concentrations, below the measurable level for copper. Also, importantly, a majority of these values are lower than the 1.45 μg/L level identified by the National Marine Fisheries Service in its 2012 Biological Opinion as a level that would protect threatened and endangered species. Additional information on the rationale and justification for DEQ's proposed default values is provided in the attached Issue Paper and in the Technical Support Document available online (see link below).

DEQ will calculate the default dissolved organic carbon, alkalinity and ion values for each region based on the procedures in the rule and publish those default values on DEQ's website. These will be updated periodically as the data base grows if the additional data results in a change in the default value.

Dissolved inorganic carbon (DIC), sulfide and humic acid: The model calculates the value of dissolved inorganic carbon from pH and alkalinity data, which are required inputs. The model documentation includes general default values for humic acid (10%) and sulfide ($1x10^{-6}$mg/L) that are sufficient for all uses in Oregon. If measured data for these parameters is available, it may be input by the user and will result in valid criteria.

Use of default action values: DEQ's intent is that permitted dischargers collect the data needed to calculate accurate instantaneous water quality criteria and apply the BLM criterion as intended so that the permits do not need to rely on the conservative default values, particularly major sources. Preliminary data suggests that, because of the increased accuracy of the BLM, the accurate instantaneous water quality criteria may be less stringent than those derived from the hardness-based equation in about half of cases, so it is advantageous to dischargers to collect the data. Sources may also wish to screen copper concentrations in their effluent against the conservative default action values. For sources discharging low levels of copper, which may include many smaller communities, use of the defaults may present a streamlined and achievable way to meet their requirements.

It is also DEQ's intent that once measured data is collected and accurate instantaneous water quality criterias can be derived, that those criteria will be used in place of default action values. DEQ understands that in implementing pollution control programs, such as NPDES permits, 401 certifications and TMDLs, DEQ must evaluate data that represent the range of conditions that occur at the site in order to ensure that aquatic life are protected during the conditions where copper toxicity is the most bioavailable, and therefore, toxic.

3. Applying a performance-based standard

EPA allows, and in this case recommends, performance-based standards. This means that EPA approves the method that will be used to determine a criteria result but the individual results will vary. In order to approve a performance-based standard, EPA requires that the method generate results that are predictable and repeatable. This is straight-forward when it comes to adopting the model and deriving instantaneous water quality criteria based on measured data inputs. However, the procedures for deriving BLM results using estimated and default input parameter values must also be clear. DEQ has worked with a technical advisory committee, a policy advisory committee and EPA to develop a proposed rule to meet these objectives. In addition, in response to public comment, DEQ has made further revisions to ensure the proposed standard rule accomplishes this objective and can be approved as a performance based standard.

4. Implementation issues

The BLM standard for copper, as a performance-based standard, presents the need to establish or clarify implementation procedures that differ from the procedures used to implement static numeric aquatic life criteria. Oregon already has other equation-derived criteria that vary depending on the input parameter value. These include the current hardness-based criteria for copper and other metals as well as the ammonia criteria that are dependent on pH and temperature input data. The ammonia criteria were revised by EQC and approved by EPA in 2015. The copper BLM criterion is not different in concept from these, but it is more complex. The BLM requires measured data for 10 input parameters instead of one or two. In addition, one of the input parameters, dissolved organic carbon, has not been commonly collected by DEQ or other entities that regularly collect data in Oregon waters. The value of dissolved organic carbon has a significant effect on the resulting criteria.

Implementation issues include the following:

- How much data to require permittees to collect in order to ensure that the permitting analysis will evaluate bioavailable conditions.

  DEQ expects to require 24 monthly samples over at least two years to represent the range of conditions reasonably expected to occur at the site to use in conducting a reasonable potential analysis and establishing permit limits, if needed. If sufficient data is not available, DEQ will need to conduct the permitting analysis and develop limits based on default action values.

- How to transition from using conservative default action values to using the correct criteria based on measured data when it becomes available.

  DEQ wants its programs to be able to transition efficiently and in a manner that incentivizes the collection of data. The continued implementation of overly stringent default values could lead to misallocation of public and private resources toward identifying and correcting problems that do not actually occur, and may cause locations and times where toxic conditions do actually occur to not receive the priority they deserve.

- Addressing anti-backsliding requirements related to the modification of permits limits that were based on conservative default values if measured data indicates permit limits are not needed or would be protective with less stringent limits.

  DEQ's understanding from discussions with EPA is that the backsliding prohibition does not apply to effluent limits that have not yet become effective because of a compliance schedule. In cases where additional data collection demonstrates an effluent limit is not needed or a less stringent limit will ensure compliance with the criterion, a permit may be modified to remove or modify the limits if this modification occurs prior to the effluent limits becoming final per the compliance schedule.

- Addressing how DEQ will assess waterbodies where there is a mixture of accurate criteria and default values associated with those copper samples and determining whether one data set can take precedence over another and under what circumstances.

  DEQ will follow the assessment protocol for the definition of sufficient data to assess a waterbody. If measured data and, therefore, accurate instantaneous water quality criterias are available for the number of samples needed to assess a waterbody, DEQ will use that data. DEQ expects it will not list a waterbody as impaired based on conservative default action values if there is sufficient data to assess the waterbody based on measured data and based on that data, the waterbody is attaining the criteria.

As mentioned above, many of these questions are not unique to the copper BLM, but the decisions may have an impact on communities and other facilities, so it is important that DEQ identify and document its procedures for consistent implementation. DEQ will work with EPA as it further develops these procedures to ensure they are consistent with federal regulation.

5. EPA should approve the state criteria rather than promulgating federal copper criteria.

Oregon has proposed criteria consistent with EPA's published freshwater copper criteria recommendations and the National Marine Fisheries Service's biological opinion. DEQ conducted a robust set of analyses, assembled and received detailed input from a Technical Review Panel of national experts, including EPA, and developed a proposed rule that is clear, robust and protective of aquatic life, including ESA listed species. Oregon's proposed rule is more consistent with the approach of using the BLM as the water quality standard to derive instantaneous criteria based on the water chemistry conditions than is EPA's proposed rule for Oregon that was published for public comment in May 2016.

The Clean Water Act gives states the primary authority to establish water quality standards for state waters. If DEQ adopts and submits to EPA a standard that protects beneficial uses based on the best available science and is consistent with EPA's recommended 304(a) criteria, EPA should approve the state standard and not adopt a federal rule for the state. In some cases, due to ESA-listed species, the water quality standard may need to be more stringent than federal recommendations. In this case, EPA's proposed criteria are based on species more sensitive than Oregon's threatened and endangered species. DEQ's proposed standard will protect threatened and endangered species and meets the recommendations of the National Marine Fisheries Service and the U.S. Fish and Wildlife Service in their 2012 Biological Opinions.

Affected Parties

Regulated parties could be affected by the revised water quality standard for copper, including facilities that discharge to Oregon waterbodies and either have copper monitoring requirements or have permit limits for copper in their discharge permit requirements. These facilities include municipal wastewater treatment plants, municipal stormwater systems that are required to have a permit, and industrial facilities. In addition, the rule could impact forest or agriculture activities that the Oregon Departments of Forestry and Agriculture regulate if any of those activities may lead to discharges that contain copper. See the Fiscal and Economic Impact statement below for additional information.

Statement of Need

What need would the proposed rule address?

The proposed rule amendments address the federal Clean Water Act requirement that states establish water quality criteria to protect designated beneficial uses of the state's waters and update those criteria periodically based on the best available science. The revised copper criteria are being proposed to protect fish and other organisms that live in Oregon waters. The criteria will also be used for all state and federal actions and programs that implement water quality standards, such as wastewater permitting, water quality certifications, total maximum daily loads and nonpoint source water quality plans and regulations. Copper is a common pollutant of concern in National Pollutant Discharge Elimination System discharge permits. Therefore, the criteria will be used to control copper discharges to waters of the state in order to protect aquatic life.

The proposed rule amendments also address EPA's Jan. 31, 2013, disapproval of Oregon's adopted 2004 copper criteria. If Oregon fails to revise its copper criteria prior to that date with sufficient time for EPA to review and act upon Oregon's submission, EPA will adopt federal criteria that will apply in Oregon. EPA's latest criteria recommendations for copper take into account how site-specific water chemistry affects the bioavailability and toxicity of copper to aquatic organisms in freshwater. In addition, the proposed rule addresses a Biological Opinion by NMFS under the Endangered Species Act. The opinion found that the hardness-based copper criteria do not fully protect threatened and endangered salmon and steelhead.

How would the proposed rule address the need?

DEQ has been implementing copper criteria based on EPA's 1986 recommendations. Subsequent EPA recommendations published in 2007, based on using a Biotic Ligand Model, more accurately reflect copper toxicity than the previous criteria, which are based on water hardness. The proposed rule amendments establish revised copper criteria that protect aquatic life in Oregon freshwaters. Once EQC adopts the revised criteria and EPA subsequently approves the adopted criteria, the new copper criteria become effective for all Clean Water Act programs, including the National Pollutant Discharge Elimination System permitting program. Adopting the rule will eliminate the need for the EPA to adopt copper standards and will protect water quality and aquatic life in Oregon.

How will DEQ know the rule addressed the need?

DEQ will know the proposed rule amendments addressed the needs described above if the rules clearly identify and define Oregon's revised criteria for copper and EPA approves the copper criteria revisions.

Rules affected, authorities, supporting documents

Lead division

Environmental Solutions Division

Program or activity

Water Quality Standards

Chapter 340 action

Amend: OAR 340-041-0033; 340-041-8033

Statutory authority

ORS 468.020, 468B.030, 468B.035, 468B.048

Statutes implemented

ORS 468B.030, 468B.035 & 468B.048

Legislation

No legislation

Other authority

Federal Clean Water Act

Documents relied on for rulemaking

Document title	Document location
Oregon Copper Standard Review Issue Paper. ODEQ, 2016	Attached to this staff report below
Technical Support Document: An Evaluation to Derive Statewide Copper Criteria Using the Biotic Ligand Model. ODEQ, 2016.	An Evaluation to Derive Statewide Copper Criteria Using the Biotic Ligand Model
Clean Water Act 303(c) Determinations On Oregon's New and Revised Aquatic Life Toxic Criteria Submitted on July 8, 2004, and as Amended by Oregon's April 23, 2007 and July 21, 2011 Submissions. Environmental Protection Agency Region 10, 2013.	CWA Determinations on Oregon's New and Revised Aquatic Life Toxic Criteria
Aquatic Life Ambient Freshwater Quality Criteria – Copper; EPA-822-R-07-001. EPA, February 2007.	Aquatic Life Ambient Freshwater Life Criteria
Federal Register: Proposed Aquatic Life Criteria for Copper and Cadmium in Oregon. April 2016.	Proposed Aquatic Life Criteria for Copper and Cadmium
Endangered Species Act Biological Opinion for Environmental Protection Agency's Proposed Approval of Certain Oregon Administrative Rules	DEQ Headquarters 811 SW Sixth Avenue Portland, OR 97204

Document title	Document location
Related to Revised Water Quality Criteria for Toxic Pollutants. National Marine Fisheries Service Consultation Number: 2008/00148. National Marine Fisheries Service, August 14, 2012.	Or USEPA Region 10 Seattle, WA
Other documents as identified in DEQ's Copper Standard Review Issue Paper. DEQ, 2016.	DEQ Headquarters 811 SW Sixth Avenue Portland, OR 97204

Statement of fiscal and economic impact

Fiscal and Economic Impact

The following section describes the fiscal and economic impact of amending the copper criteria from the current hardness-based criteria to the Biotic Ligand Model -based criteria. DEQ expects the following impacts:

- Additional time for DEQ staff to implement the criteria, particularly in water quality permitting and assessment. TMDL implementation may also be impacted to a lesser extent.
- Costs for certain local governments and businesses holding individual NPDES permits to conduct additional monitoring of BLM parameters. DEQ estimates these impacts to be $5028 to $8580 per affected permit holder per outfall.
- Costs for local governments and businesses that will have permit requirements for the first time due to rule revisions in order to conduct copper compliance monitoring. DEQ expects these costs to be approximately $500 per year per outfall for each affected permit holder.
- Costs for treating copper in wastewater effluent for any local governments or businesses that may have more stringent criteria as a result of the revised standards. The cost to update existing treatment systems or enhance pre-treatment programs may be on the order of approximately $10,000 per year. However, if new treatment systems need to be installed, costs could rise into the millions of dollars.
- Costs for holders of certain classes of general and industrial stormwater permits to conduct copper monitoring and, in some cases, update treatment to meet benchmarks, limits or narrative requirements.
- Regulatory relief for certain permit holders if the revised rules result in less stringent copper criteria in their receiving waters due to a TMDL developed using the revised criteria.
- Potential benefits to businesses relying on healthy fish populations for revenue.

DEQ is statutorily required to analyze the impact of changes to Oregon rules. Thus, the analysis here describes impacts of changing Oregon's rules and associated implementation procedures from the current hardness-based copper criteria to BLM criteria. However, if DEQ does not move forward with these changes, EPA will promulgate BLM-based criteria on behalf of Oregon. EPA's proposed rules, which were available during development of this analysis, utilize more conservative assumptions for calculating copper criteria under the BLM. As a result, the cost of potentially implementing criteria promulgated by EPA for the state are likely to be more than implementing the rule amendments proposed by DEQ.

Statement of Cost of Compliance

DEQ is unable to quantify the total impact of the proposed rules because the impacts of the proposed rules will vary. However, this document provides information on the cost of activities that could be required of agencies and regulated parties as a result of the copper water quality standard. In general, DEQ expects that the proposed rule may affect the following types of facilities:

- Municipal and industrial facilities with National Pollution Discharge Elimination System permits that are classified as major.
- Industrial facilities with NPDES permits classified as minor (those discharging less than one million gallons per day) and that have the potential to discharge significant amounts of copper, such as wood treatment facilities.
- Municipal facilities with minor NPDES permits classified as minor that discharge to waters that will be listed as impaired under this proposed rule.
- Facilities that are covered under general NPDES permits for activities associated with copper, including 1700A Washwater general permit and the proposed 2300-A Pesticide general permit.
- Facilities that are covered under the 1200-A stormwater permit for gravel mining and that discharge into waters that will be listed as impaired under the proposed rule.
- Facilities that are covered under the 1200-COLS, 1200-Z, or 1200-ZN stormwater permits for industrial facilities.
- Any facilities that receive wasteload allocations in a total maximum daily load developed to meet BLM-based copper criteria under this rule.

The proposed rule amendment specifies the method to calculate protective copper criteria based on 10 water chemistry parameters that may vary from waterbody to waterbody and over time. The BLM-based criteria at a given location may be more or less stringent than the current hardness based-criteria for copper. In about half of the locations for which DEQ has sufficient data to compare the two methods, the copper criteria under the BLM will be less stringent than the current criteria. In those cases, there would be not be a fiscal impacts or there may be some level of regulatory relief. In addition, effluent copper levels, cost of compliance, will vary based on the specific attributes of each facility’s discharge and its receiving waters.

One factor that will affect the cost of compliance is the effect of the new rules on whether or not a waterbody will be listed as impaired for not meeting copper criteria on DEQ’s 303(d) list of impaired waters. Impaired listings could potentially affect any of the above entities. Subsequent TMDLs could affect permit holders that receive wasteload allocations, whether they are individual, stormwater or general permit holders. The proposed rules could result in the following impacts:

- *The rules result in less stringent criteria than the hardness-based criteria in a water currently listed as impaired and copper criteria indicate that water is meeting revised criteria.* This impact would potentially provide regulatory relief for affected parties.

- *The rules result in less stringent criteria than the hardness-based criteria in a water currently listed as impaired, but copper data indicate that the water is meeting the revised criteria.* There could be some incremental regulatory relief for affected parties.

- *The rules result in more stringent criteria than the hardness-based criteria in a water currently listed as impaired and copper data indicate that the water is not meeting the revised criteria.* There may be some incremental impacts for affected parties due to the proposed criteria, such as more stringent effluent limits or benchmarks and need for additional treatment costs.

- *The rules result in more stringent criteria in a water that would not be listed as impaired under the current criteria and copper data indicate that the water is no meeting the revised criteria.* There could be substantial impacts for affected parties including the need for additional monitoring and treatment.

Initial analysis developed as part of the Technical Support Document indicates that copper levels exceed BLM criteria in much of the Willamette River Basin, as well as a few scattered areas around the state. However, much of the Willamette Basin already is listed as impaired or is proposed for listing in the 2012 Integrated Report. Other areas have not been assessed due to a lack of data. Until DEQ is able to perform a full water quality assessment, DEQ cannot predict how many new impairment listings will occur that would not otherwise not have, nor, how many currently listed streams will be delisted as a result of the new standard.

The proposed criteria will require many municipal and industrial NPDES permit holders to spend at least several thousand dollars per permit cycle on monitoring for BLM parameters to determine if there is reasonable potential for the entity to cause or contribute to an exceedance of the copper criteria and to determine appropriate effluent limits, if required. For each outfall that an affected permit holder uses to discharge wastewater, they will have to analyze both outfall and ambient (upstream) water in the receiving stream for BLM parameters monthly for 12-24 months. This additional monitoring will cost each entity a few thousand dollars per permit cycle. New or more stringent effluent limits for copper could result in costs that range from minimal to millions of dollars per facility if advanced treatment upgrades are required. On the other hand, in areas where there may be less stringent criteria, there may be some level of regulatory relief.

State and federal agencies

Revising the copper criteria will require some costs to DEQ for training and to incorporate implementing the new criteria into Clean Water Act programs, such as permitting, assessing state waters and developing Total Maximum Daily Loads. In addition, DEQ expects that the BLM-based standard will require increased staff time to apply and implement relative to the current hardness-based criteria. There will also be increased monitoring costs, both for sample collection and sample analyses (for example, in DEQ’s ambient monitoring program).

DEQ NPDES Permitting Program

Individual Permits

The proposed copper criteria would require additional DEQ permitting staff time to administer the National Pollutant Discharge Elimination System permitting program for individual permits in the near term for transition from current to proposed criteria and in the long term for the additional data and analysis that will be required to implement the BLM criteria. These criteria are much more complex than previous criteria that have been implemented and will require additional knowledge, expertise and data analysis.

Direct Impacts

The proposed rules would require DEQ permitting staff to:

- Update existing guidance to reflect changes to the criteria;
- Develop tools for permit writers to implement the criteria in permits;
- Train permit writers on how to implement the new criteria;
- Provide technical assistance to many industrial and domestic facilities in the transition to the new copper criteria;

- Spend additional time during each permit renewal in accessing compliance with a more complex criterion for the following dischargers:
- Major industrial or municipal sources; or
    - Minor industrial or municipal sources that discharge into streams that may be listed as impaired under the new criteria or are associated with industries that are associated with copper; and
- Account for potential differences in copper compliance monitoring reviews for dischargers with copper effluent limits.

It is difficult to estimate how many permits must receive additional assistance to account for changes to the copper criteria before assessing the waters under the new criteria.

General Permits

Implementing the proposed water quality criteria for copper could impact developing and implementing general permits, because a general permit includes a single set of requirements to regulate similar activities statewide or in limited geographical areas. General permits which could be affected include the proposed 2300A Pesticide general permit, as well as other general permits associated with operations where copper could be part of the discharge, such as the 1700A Washwater general permit. General permit writers will need additional time to incorporate the new criteria into permits. This effort could be relatively minimal if regional or a single conservative copper limit was put in place, or much more extensive if site-specific copper limits would need to be developed. In addition, state staff who oversee implementation of general permits will need additional time to ensure copper monitoring done as part of permit requirements complies with appropriate copper limits or benchmarks. Moreover, to the extent that copper limits may be more stringent than they would be under current criteria, additional time may be needed to work with permittees to implement Best Management Practices (BMPs) needed to meet criteria in receiving waters.

If a more site-specific copper limit is needed, some entities may opt to obtain an individual permit. This is more costly than obtaining coverage under a general permit.

Stormwater Permits

Implementing the proposed water quality criteria could impact state staff who draft and oversee industrial stormwater general permits. This includes the 1200Z industrial stormwater permit, 1200COLS stormwater permit for the Columbia Slough and 1200A stormwater permit for gravel mining. The 1200Z and 1200COLS permits have benchmarks for copper. The 1200A stormwater permit does not have benchmarks for copper, but does have monitoring requirements and action levels for facilities that discharge to waters listed as impaired for copper. In some cases, benchmarks and action levels may not change. However, it is possible that they may. DEQ staff drafting and finalizing general stormwater permits will need time to determine how to incorporate the new criteria into permits. In particular, DEQ will need to determine the extent to which it may need to incorporate watershed-based or regional permit limits. These limits can then be incorporated into assignment letters for each individual permittees.

Changes to benchmarks and action levels would require DEQ permitting staff to:

- Update existing guidance to reflect changes to the criteria;
- Train permit writers on how to implement the new criteria;
- Provide technical assistance to many facilities in the transition to the new copper criteria;

- Spend additional time assessing compliance and conducting enforcement with a more complex criterion;
- Account for potential differences in copper compliance monitoring reviews for dischargers with copper effluent limits.

If a more site-specific copper limit is needed, some entities may opt to obtain an individual permit. This is more costly than obtaining coverage under a general permit.

It is unlikely that implementing the proposed water quality criteria would impact DEQ staff working on municipal stormwater (MS4) permits as such permits are practice-based. DEQ already requires monitoring for copper and other metals in some MS4 permits and does not anticipate changing these requirements. To the extent that any municipalities detect any copper in their stormwater runoff, DEQ requires adaptive management. This requirement will not substantially change.

401 Certification Program

It is possible that a revised copper criteria could be for more stringent conditions or denial of a Clean Water Act section 401 certifications if the potential discharge subject to the federal permit or license contains copper. Adopting the proposed criteria would require additional time for DEQ staff to determine the appropriate site-specific or regional criteria that would be used for evaluating the application for certification. The additional effort for implementing the BLM-based criteria in place of the hardness based criteria in the regard should be small.

Assessment Program

The proposed revised copper criteria may affect the Integrated Report process through which DEQ designates waterbodies as meeting or not meeting water quality standards. The changes will require time from DEQ staff members to develop a methodology through which DEQ would assess whether waterbodies are meeting the copper criteria. DEQ will need to use the input parameter data from each location and time to determine the applicable copper criterion and then compare the copper data from the same time and location against the criterion. Because the BLM requires data for 10 different parameters to determine site specific criteria (IWQC), such a process is more complex than the current hardness-based copper criterion. Moreover, in the case that DEQ does not have data for some of the input parameters, DEQ would have to use additional time to determine the inputs for the missing parameters, according to stated procedures, which will differ by location or ecoregion. This process will likely require some initial cost to build it into the computer-based analysis tools for assessment that will incorporate deriving the criteria result for the sample.

Total Maximum Daily Load Program

If the proposed revisions result in additional impairment listings during the assessment process, these listings will result in the need to develop additional TMDLs. If the proposed revisions result in less stringent copper criteria in certain areas, it is possible that some waters will be removed from the 303(d) list and a TMDL will not be needed. Prior to undergoing the 303(d) assessment process, DEQ cannot predict whether the proposed changes will result in the need for more or fewer TMDLs than would be required using the hardness-based criteria. If the new criteria do result in additional listings, the likely impact would be to add to DEQ’s backlog of TMDL work.

The cost of developing copper TMDLs under the revised standard will be greater. TMDL development will require collecting data for BLM parameters to which the criterion is sensitive, rather than just hardness, in addition to dissolved copper. The additional cost for each TMDL will vary based on how many sampling events (timing and number of locations) DEQ must take for each TMDL. Analysis of each BLM sample could cost as much as $130-140 more as compared to the current hardness-based criteria. Moreover, modeling of appropriate TMDL wasteload and load allocations is expected to be more complex and therefore take additional time for computer modeling and description in the TMDL document. Therefore, DEQ expects each TMDL under the proposed criteria would utilize more DEQ staff time and resources than would be required under the current criteria. The proportion of added time relative to the time it takes to develop the TMDL overall may not be large, however.

Other State Permitting Agencies

DEQ does not anticipate the proposed rules would have a direct or indirect effect on other state agencies or change their involvement or the general permits they administer. The Oregon Department of Agriculture does have authority for implementing the Federal Insecticide, Fungicide and Rodenticide Act in Oregon. But this authority does not extend to discharges to state waters.

Local governments

The proposed revisions would impact local governments. Potential impacts include:

- Additional permit application monitoring for BLM parameters for all domestic wastewater treatment facilities classified as major NDPES dischargers, as well as minor dischargers discharging to waters that will be listed as impaired for copper on DEQ's 303(d) list of impaired waters;
- Additional compliance monitoring for copper if the proposed revisions result in copper effluent limits for municipal facilities that would not have limits under the current rules;
- Increased cost of compliance or need for additional resources to justify alternative compliance mechanisms if the proposed revisions result in new or more stringent effluent limits for copper; and,
- Cost of complying with any new or more restrictive limits that may be incorporated into the pesticide general permit.

DEQ is unable to quantify the impacts to local governments. Impacts to each facility are site-specific. In some cases, based on site-specific criteria developed through the BLM, applicable copper criteria may be less stringent for some municipalities and the revisions will provide some level of regulatory relief. In other cases, criteria may be more stringent and result in higher costs to the local government, as described in this section. To the extent possible, DEQ has included some estimates in the description of impacts to local governments below. However, DEQ has not quantified total impacts.

Direct Impacts

Monitoring for BLM parameters
Due to the proposed revisions, all major municipal NPDES permit holders (approximately 50), as well as any minor NPDES permit holders that discharge into streams that DEQ has listed as impaired for copper, will be required to monitor for dissolved copper and other BLM parameters at least bi-monthly for two years. This monitoring will allow DEQ to determine if effluent limits for copper are necessary for the facility. DEQ would require permit holders to monitor effluent water and the receiving water upstream of the discharge. Under the current hardness-based copper criteria, these dischargers only would have to monitor for copper and hardness.

DEQ requested costs from two different laboratories to estimate the approximate costs for analyzing BLM parameters. For each month, laboratory analysis costs ranged from $259 to $267.50, assuming one sample from effluent and one sample upstream of the discharge. Assuming that each facility would be required to monitor for 12-24 months, costs to the facility for each discharge location would range from $3108 to $6,420. In addition, many facilities would have to utilize additional staff time for conducting the monitoring or to contract monitoring to an outside entity. U.S. EPA estimated a rate of $43 of staff time to collect each sample, based on the average labor rate for a wastewater treatment operator in the United States.[1] DEQ has included a range of costs from $40-$45, as the cost will vary from facility to facility. As a result, in addition to analysis costs, staff time associated with collecting samples would cost from $1920-2160 ($40-45/sample x 48 samples). As a result, the cost for two years of monthly sampling for a single outfall and ambient site would total $5028 to $8580. Additional costs would occur if monitoring for more than one outfall was required.

As noted above, such costs would only be borne by major municipal Waste Water Treatment Plants (approximately 11 facilities) as well as certain minor municipal WWTPs.

Permit compliance monitoring
In areas where the proposed revisions result in more stringent criteria than under the current standards, municipal wastewater treatment facilities may need to monitor for copper if they are given effluent limits they do not currently have. DEQ cannot estimate how many wastewater treatment facilities would have to monitor for copper that would not have to under the current criteria. In general, the annual costs incurred or saved by large businesses would be approximately $480-540 (12 samples x $40-45/sample for analysis). DEQ assumes that these facilities will not have increased costs for sample collection as these facilities would already be collecting samples for other parameters.

Treatment costs
If the monitoring described above indicates that a municipal WWTP discharges copper that would cause or contribute to an exceedance of the criteria in Oregon waters, DEQ would establish an effluent limit for that WWTP. In some cases, the effluent limit under the revised standard may be more stringent than under the current standard, or an effluent limit may be required where it was not before. In some cases, the applicable copper criterion may be less stringent. However, if the facility had a copper effluent limit in place, that limit likely would remain under anti-backsliding rules.

DEQ cannot quantify the increased treatment costs for any facility receiving more stringent or new effluent limits, as each facility will be subject to a different set of circumstances. Potential options may include:

- Optimizing existing treatment processes
- Implementing source control or pollution prevention programs
- Installing a new wastewater treatment process
- Applying for alternative compliance mechanisms (variances, intake credits)

Each of these options would result in additional costs. Alternative compliance mechanisms may be a lower cost alternative, but if new wastewater treatment technologies are required, that could be very expensive. EPA estimated that installing the most expensive treatment technology (ion exchange) could cost as much as $22.6 million cumulatively for the 9 major municipal facilities it considered in its

[1] U.S. EPA. 2016. Economic Analysis for the Proposed Rule: Aquatic Life Criteria for Copper and Cadmium in Oregon. Prepared by Horsley Witten Group, Inc... U.S. EPA Office of Water, Washington, DC.

analysis. In comments to DEQ, the Oregon Association of Clean Water Agencies suggests that capital and operation costs for ion exchange would be much higher than EPA's estimates (letter to DEQ, Janet Gillaspie, Oregon Association of Clean Water Agencies, 6/27/16). Using OR-ACWA's estimates for capital and operation costs, which were provided as a unit cost (i.e. million-gallons-per-day of effluent being treated), DEQ calculated that the total costs for the same 9 major facilities could be 53% to 250% higher than EPA's estimates. Furthermore, OR-ACWA suggests that ion exchange may not be effective due to the need to frequently remove particles and growth from the system.

EPA's analysis did not account for all large dischargers or for any smaller wastewater treatment plants that may receive effluent limits under the proposed standard. As a result, Oregon's rules may impact more entities than DEQ's. However, additional costs may be offset by differences in implementing Oregon's rule as compared to EPA's rule.

Treatment costs – stormwater and general permits
Local governments that hold general permits may be required to pay for additional treatment under the proposed rules if: 1) the proposed rules result in more stringent criteria than under the current rules; and 2) the permit holder has the potential to discharge copper in their effluent. In addition, it may be more difficult in certain situations for a permit holder to meet narrative limits. The most likely general permits that the proposed rule would be affect are the 100-J cooling water permit because of the potential for leaching of copper from pipes, and the 2300-A pesticide general permit, because copper is a component in certain pesticides.

Indirect Impacts

DEQ has not identified any indirect impacts of the copper rule to local government.

Public

The proposed amendments could result in indirect impacts to the public, particularly due to increased rates for sewer service. In addition, higher treatment costs for businesses could result in increased costs for goods and services provided by the businesses. Or, it is possible that higher sewer rates would make it more difficult for a community to attract new business.

Direct Impacts

DEQ does not expect the public to incur direct fiscal or economic impacts from the proposed rules, as DEQ does not directly regulate individuals.

Indirect Impacts

The proposed amendments to the copper criteria could result in indirect impacts to the public. In particular, additional monitoring and treatment that WWTPs may do as a result of the revised rules could result in higher sewer rates. The impacts would be relatively negligible for people in municipalities that will not receive a copper effluent limit or that have one that will not substantially change due to the proposed revisions. The impacts could be more substantial for people living in municipalities that would need to upgrade treatment to remove copper from their effluent. In some cases, communities may apply for alternative compliance mechanisms, such as variances, if increased treatment would result in widespread and substantial economic harm to the community.

Businesses that produce goods and services for Oregonians and that may need to conduct additional monitoring and treatment as a result of the proposed rule could potentially pass on additional costs to consumers.

Large businesses - businesses with more than 50 employees

The proposed revisions may affect large businesses that discharge wastewater or stormwater to Oregon waters. In some cases, copper criteria developed using the BLM may be less stringent than the current hardness-based criteria and will provide some level of regulatory relief. In other cases, they may be more stringent and result in higher costs to large businesses.

In summary, the rule may affect the following groups of large businesses:

- Businesses that have major individual NPDES permits (those which discharge greater than 1 million gallons) (approximately 15 permits);
- Businesses that have minor individual NPDES permits and which discharge into waters that are limited for copper or which manufacture products that are associated with copper, such as wood treatment manufacturers;
- Businesses that hold industrial stormwater (1200-Z, 1200-A, 1200-COLS) permits and that discharge to waters that are limited for copper or which manufacture products that are associated with copper;
- Businesses that hold general permits for products or processes that may be associated with copper, such as the 2300-A general permit for pesticides or the 100-J permit for cooling water.

Direct Impacts

Permit renewal and application monitoring
Some large businesses that are NPDES permit holders would have to monitor the BLM parameters as well as dissolved copper. DEQ may require such facilities to monitor monthly or bi-monthly for two years in order to determine the applicable criterion of the receiving water. The results of this monitoring will allow DEQ to determine if effluent limits for copper are necessary for the facility. Monitoring would be required in the effluent and in upstream ambient waters.

In order to estimate the additional costs for the required data collection, DEQ requested costs from two different laboratories. For each month, laboratory analysis costs ranged from $259 to $267.50, assuming one sample from effluent and one sample upstream of the discharge. If each facility monitors for 12-24 months, costs to the facility for each discharge location would range from $3108 to $6,420. In addition, many facilities would have to utilize additional staff time for conducting the monitoring or to contract monitoring to an outside entity. DEQ estimates that this cost is similar to that for local governments, as described in the section above. As a result, in addition to analysis costs, staff time associated with collecting samples would cost approximately $960-2160 ($40-45/sample x 24 to 48 samples). As a result, the cost for two years of monthly sampling for a single outfall and ambient location would be approximately $4068 to $8580. Costs would be more expensive for facilities having to monitor more than one outfall.

DEQ does not have sufficient information to determine how many facilities would need to expend these costs to monitor for the BLM parameters. All 15 major industrial permittees (all large businesses) would need to expend these costs. In addition, some of the 114 currently active minor industrial permittees would have to expend these costs if they discharge to streams that would be listed as impaired under the proposed revisions, or are likely to have copper in their effluent as a result of their production and treatment process (e.g., wood treatment facilities and facilities that discharge cooling waters that have come into contact with copper pipes). As DEQ does not know which streams will be listed as impaired or delisted under the revised standard as compared to the current standard, the number of facilities that will be impacted is unknown.

Discharge monitoring costs
In areas where the proposed revisions result in more stringent standards than the current standards, the proposed revisions to the copper standard may require some additional large businesses to conduct monthly monitoring for copper . Because the standard varies by location, DEQ cannot estimate how many businesses would have effluent limits for copper that do not or would not under the current standard. In general, the annual costs large businesses would incur would be approximately $540 (12 samples x approximately $45/sample for analysis). If these large businesses already are monitoring for other metals, costs would be less. DEQ assumes that these facilities will not have increased costs for sample collection as these facilities would already be collecting samples for other parameters.

Some large businesses with industrial stormwater permits for sand and gravel operations, such as the 1200A permit, may have to monitor for copper if they discharge to waters that would be listed as impaired for copper under the proposed revisions, where those waters would not be under the current rule. Holders of 1200Z and 1200 COLS industrial stormwater permits already are monitoring for total recoverable copper, but may incur moderately higher expense if they must monitor for dissolved copper. In general, the annual costs incurred by large businesses due to stormwater sampling would be approximately $80-180 (4 samples x $20-45/sample). Costs would be lower where the facility already is monitoring for total recoverable copper. DEQ assumes that costs for sample collection are non-existent or minimal as these facilities would already be collecting samples for other parameters. As DEQ does not currently know which streams will be listed as impaired, as compared to those listed as impaired under the current criteria, the number of facilities that will have to undertake these costs is unknown.

Treatment costs – individual permits
If monitoring indicates that a large business holding an individual NPDES permit has reasonable potential to cause or contribute to an exceedance of the copper criteria, DEQ would establish an effluent limit for that discharger. In some cases, the effluent limit may be more stringent than a facility currently has in place, or the revision to the copper criteria would result in an effluent limit where none had existed before. In some cases, if the facility already had a copper effluent in place and the applicable copper criterion is less stringent or there is no reasonable potential under the new criteria, anti-backsliding provisions will dictate whether there will still be the same effluent limit, a less stringent effluent limit or no limit.

DEQ cannot quantify increased treatment costs for facilities receiving more stringent or new effluent limits. DEQ does not know how many facilities would have effluent limits under the new standard that do not currently have them. Moreover, each facility will be subject to a different set of circumstances and effluent limits. As a result, treatment options can vary greatly.

Potential compliance options for each facility may include:

- Optimizing existing treatment processes;
- Implementing source control or pollution prevention programs;
- Installing a new wastewater treatment process; or
- Applying for alternative compliance mechanisms (variances, intake credits).

Each of these options would result in additional costs from minor (alternative compliance mechanisms) to expensive (new wastewater treatment technology). DEQ has relied on information presented in EPA's Economic Analysis for the Proposed Rule: Aquatic Life Criteria for Copper and Cadmium in Oregon (2016) for information on treatment costs. EPA presented costs for pollution prevention and end-of-pipe treatment for a subset of facilities that the rule may affect. Only one of these facilities is private. The estimated annual cost for pollution prevention for this facility is approximately $10,000. One-time costs for alternative compliance mechanisms are not presented for each facility. EPA estimates those costs to be from $42,350 to $120,000 for facilities discharging 1-5 million gallons per day (mgd), $42,350-$230,000 for facilities discharging 5-20 mgd, and $42,350-345,000 for facilities discharging greater than 20 mgd. Annualized costs for installing and operating end-of-pipe treatment (ion exchange) for the one private facility assessed ranged from $920,000 to $1,140,000. In comments, a member of the copper advisory committee suggested that treatment costs for ion exchange could be significantly higher (pers. comm., Janet Gillaspie, Oregon Association of Clean Water Agencies (OR-ACWA), 6/27/16). Using cost information provided by OR-ACWA, DEQ calculated that annualized costs could range from $1.4 to $4 million.

DEQ presents these costs as examples, but does not extrapolate the costs to other private facilities, as each one will have different baseline copper effluent levels, be subject to different criteria under the BLM, have different processes, and different flow rates. Moreover, DEQ does not know how many facilities will be subject to more stringent or new effluent limits due to the proposed revisions until the rule is adopted and implemented.

Treatment costs – stormwater and general permits

Small businesses that hold general permits may be required to pay for additional treatment under the proposed rules if: 1) the proposed rules result in more stringent criteria than under the current rules; and 2) the permit holder has the potential to discharge copper in their effluent. In addition, it may be more difficult in certain situations for a permit holder to meet narrative limits. The most likely general permits that the proposed rule would be affect are the 100-J cooling water permit because of the potential for leaching of copper from pipes, and the 2300-A pesticide general permit, because copper is a component in certain pesticides.

In addition, holders of the 1200-A sand and gravel mining general NPDES permit may be impacted if: 1) the proposed rules result in more stringent criteria than the current rules set; 2) the more stringent criteria result in an impairment listing that would not have occurred under the current rules; and 3) the permit holder has copper in excess of benchmarks in the stormwater permit. If a permittee exceeds the benchmark, DEQ would require them to update their BMPs to reduce copper in their discharge. As sand and gravel operators do not typically discharge copper, DEQ concludes that it is likely that few, if any, facilities covered under the sand and gravel permit will be impacted.

Holders of other permits, such as the 1200-Z and 1200-COLS Industrial Stormwater permits also may be impacted if the revised rule results in an impairment listing and the subsequent TMDL includes wasteload allocations for holders of these permits that are more stringent than current benchmarks. If wasteload allocations are more stringent and a facility exceeds these allocations when they otherwise would have met benchmarks, the facility would have to install filtration to treat stormwater. Filtration costs can vary widely, but can range from $10,000 to $500,000 depending on the size of the facility (*pers. Comm.*, Erich Brandstetter, DEQ, 5/4/16).

Indirect Impacts

The revised rules may have a positive impact on large businesses if they result in positive impacts to aquatic life, such as salmonid species. In particular, improvements to fish populations and the allowed catch size or season could positively impact fish processors, although it would be speculative to estimate the positive impact.

Small businesses – businesses with 50 or fewer employees

The proposed rule may affect small businesses that discharge wastewater or stormwater to Oregon waters. In some cases, copper criteria developed using the BLM may be less stringent than the current hardness-based criteria and the revisions will provide some level of regulatory relief. In other cases, they may be more stringent and result in higher costs to small businesses.

In summary, the rule may affect the following groups of small businesses:

- Businesses that have minor individual NPDES permits and that discharge into waters that are limited for copper or which manufacture products that are associated with copper, such as wood treatment manufacturers;
- Businesses that hold industrial stormwater permits (1200-Z, 1200-COLS) or sand and gravel stormwater permits (1200-A) and that discharge to waters that are limited for copper or which manufacture products that are associated with copper;
- Businesses that hold general permits for products or processes that may be associated with copper, such as the 2300-A general permit for pesticides or the 100-J permit for cooling water.

Direct Impacts

Permit renewal and application monitoring
Under the proposed revisions, DEQ would require certain small businesses holding NPDES permits to monitor bi-monthly or monthly for two years in order to determine the applicable criterion of the receiving water and if the discharge could result in exceeding the copper standard. This data will also allow DEQ to establish appropriate effluent limits, if needed. Monitoring would be required in the effluent and in ambient (upstream) waters.

In order to estimate additional costs to each facility, DEQ requested costs from two different laboratories to estimate the approximate costs for analyzing BLM parameters. For each month laboratory analysis costs ranged from $259 to $267.50, assuming one sample from effluent and one sample upstream of the discharge. Assuming that each facility would be required to monitor for 12-24 months, costs to the facility for each discharge location would range from $3,108 to $6,420. In addition, many facilities would have to utilize additional staff time for conducting the monitoring or to contract monitoring to an outside entity. DEQ estimates that this cost is similar to that for local governments, as described in that section above. As a result, in addition to analysis costs, staff time associated with collecting samples would cost approximately $960-2160 ($40-45/sample x 24-48 samples). As a result, the cost for two years of monthly sampling for a single outfall and ambient location would be approximately $4068 to $8580. Costs would be higher for facilities required to monitor for additional outfalls.

DEQ does not have sufficient information to determine how many facilities would need to expend these costs to monitor for the BLM parameters. Some of the 114 currently active minor industrial permittees (some of which may be small businesses) would have to expend these costs if they discharge to streams that would be listed as impaired under the proposed revisions, or are likely to have copper in their effluent as a result of their production and treatment process (e.g., wood treatment facilities that use preservatives with copper and facilities that discharge cooling waters that have come into contact with copper pipes). As DEQ does not currently know which streams will be listed as impaired, the number of these facilities is unknown.

Discharge monitoring costs

In areas where the proposed revisions result in more stringent standards than the current standards, the proposed revisions to the copper standard may require some small businesses to monitor for copper if they have effluent limits that they would not have under the current standard. However, in cases where the revised standard is less stringent than the current standard, the revised standards may result in fewer businesses having effluent limits. Because the standard varies by location, DEQ does not have information to estimate how many businesses would have effluent limits for copper that do not or would not under the current standard, and how many would not have effluent limits that would under the current standard. In general, the annual costs incurred or saved by small businesses would be approximately $540 (12 samples x $45/sample for analysis). DEQ assumes that these facilities will not have increased costs for sample collection as these facilities would already be collecting samples for other parameters.

Some small businesses with industrial stormwater permits may have to monitor for copper if they discharge to waters that would be listed as impaired for copper under the proposed revisions, where those waters would not be under the current rule. For those covered by the 1200-Z and 1200-COLS permits, if the proposed revisions result in revising the permit such that they must monitor for dissolved rather than total recoverable copper, there may be minor cost increases for analysis. In general, the annual costs incurred or saved by small businesses due to stormwater sampling would be approximately $80-180 (4 samples x $20-45/sample) with the smaller amount being associated with incremental costs of monitoring for dissolved instead of total recoverable copper. DEQ assumes that additional costs for sample collection are non-existent or minimal as these facilities would already be collecting samples for other parameters. As DEQ does not currently know which streams will be listed as impaired under the revised criteria as compared to the current criteria, the number of facilities that will have added costs or reduced costs is unknown.

Treatment costs – individual permits

If monitoring indicates that a small business holding an individual NPDES permit has reasonable potential to cause or contribute to a water body not meeting the copper criteria, DEQ would establish an effluent limit for that discharge permit. In some cases, the effluent limit may be more stringent than the facility currently has in place, or the revised copper criteria may require an effluent limit where one was not required before. In some cases, the applicable copper criterion will be less stringent. However, if the facility had a copper effluent limit in place, that limit likely would remain under anti-backsliding rules.

DEQ cannot quantify increased treatment costs for any facility receiving more stringent or new effluent limits. DEQ does not know how many facilities that do not have effluent limits under the current standard (or would not if DEQ continued to use the current standard) would have effluent limits under the new standard. Moreover, each facility will be subject to a different set of circumstances and effluent limits. As a result, treatment options can vary greatly.

Potential compliance options for each facility may include:

- Optimizing existing treatment processes;
- Implementing source control or pollution prevention programs;
- Installing a new wastewater treatment process; or
- Applying for alternative compliance mechanisms (variances, intake credits).

Each of these options would result in additional costs from minor (applying for alternative compliance mechanisms) to expensive (installing new end-of-pipe treatment). DEQ has relied on information presented in EPA's Economic Analysis for the Proposed Rule: Aquatic Life Criteria for Copper and Cadmium in Oregon (2016). EPA presented costs for pollution prevention and end-of-pipe treatment for a subset of facilities that the rule may affect. Only one of these facilities is private. The estimated annual cost for pollution prevention for this facility is approximately $10,000. EPA did not present one-time costs for alternative compliance mechanisms for each facility, but estimated them to be from $42,350 to $120,000 for facilities discharging 1-5 million gallons per day (mgd), $42,350-$230,000 for facilities discharging 5-20 mgd, and $42,350-345,000 for facilities discharging greater than 20 mgd. EPA's estimated annualized costs for installing and operating end-of-pipe treatment for the one private facility that treated approximately 5 million gallons per day (mgd) assessed ranged from $920,000 to $1,140,000. However, a member of the copper advisory committee provided information suggesting that installation and operation costs for ion exchange would be significantly higher (pers. comm., Janet Gillaspie, Oregon Association of Clean Water Agencies, 6/27/16). Using cost information provided by OR-ACWA, DEQ calculated that annualized costs could range from $1.4 to $4 million per year, much higher than EPA's estimates.

DEQ is presenting these costs as examples, but is not extrapolating these costs to other private facilities, as each one will have different baseline copper effluent levels, be subject to different criteria under the BLM, have different processes, and different flow rates. Moreover, DEQ cannot be certain how many facilities will have more stringent or new effluent limits due to the proposed revisions until the rule is adopted and implemented.

Treatment costs – stormwater and general permits

Small businesses that hold general permits may be required to pay for additional treatment under the proposed rules if: 1) the proposed rules result in more stringent criteria than under the current rules; and 2) the permit holder has the potential to discharge copper in their effluent. In addition, it may be more difficult in certain situations for a permit holder to meet narrative limits. The most likely general permits that the proposed rule would be affect are the 100-J cooling water permit because of the potential for leaching of copper from pipes, and the 2300-A pesticide general permit, because copper is a component in certain pesticides.

In addition, holders of the 1200-A sand and gravel mining general NPDES permit may be impacted if: 1) the proposed rules result in more stringent criteria than they do under the current rules; 2) the more stringent criteria result in an impairment listing that would not have occurred under the current rules; and 3) the permit holder has copper in excess of benchmarks in the stormwater permit. If a permittee exceeds the benchmark, DEQ would require them to update their BMPs to reduce copper in their discharge. As sand and gravel operators do not typically discharge copper, DEQ concludes that it is likely that few, if any, facilities covered under the sand and gravel permit will be impacted.

Holders of other permits, such as the 1200-Z and 1200-COLS Industrial Stormwater permits also may be impacted if the revised rule results in an impairment listing and the subsequent TMDL includes wasteload allocations for holders of these permits that are more stringent than current benchmarks or if narrative limits become more restrictive. If wasteload allocations are more stringent and a facility exceeds these allocations when they otherwise would have met benchmarks, the facility would have to install filtration to treat stormwater. Filtration costs can vary widely, but can range from $10,000 to $500,000 depending on the size of the facility (*pers. Comm.*, Erich Brandstetter, DEQ, 5/4/16).

Indirect Impacts

The revised standard may have a positive impact on small businesses if it results in positive impacts to aquatic life, such as salmonid species. In particular, improvements to fish populations could positively impact commercial and recreational fishing businesses, as well as other businesses that rely on income from recreational users of water and tribal fisheries.

a. Estimated number of small businesses and types of businesses and industries with small businesses subject to proposed rule.	The following types of small businesses are subject to the proposed rule: - Small businesses that are covered by individual NPDES permits and discharge to waters impaired for copper (approximately 14) - Wood treatment facilities that are small businesses that discharge to Oregon waters (approximately 7) - Small businesses covered by the 100J Cooling Water general permit (6) and 2300A pesticide general permit (none currently). - Small businesses covered by the 1200A Sand and Gravel Stormwater permit (approximately 82), and 1200COLS and 1200Z Industrial Stormwater permits (approximately 170).
b. Projected reporting, recordkeeping and other administrative activities, including costs of professional services, required for small businesses to comply with the proposed rule.	
c. Projected equipment, supplies, labor and increased administration required for small businesses to comply with the proposed rule.	
d. Describe how DEQ involved small businesses in developing this proposed rule.	Two advisory committee members representing small businesses were included on the advisory committee, one representing small and large industry and one representing commercial fishermen. These members were able to provide input on the proposed rule and its implementation and were provided an opportunity to review and provide comments on the fiscal impact statement.

How DEQ involved small businesses in developing this rule

DEQ included two advisory committee members representing small businesses on the advisory committee, one representing small and large industry and one representing commercial fishermen. These members were able to provide input on the proposed rule and its implementation and were provided an opportunity to review and provide comments on the fiscal impact statement.

Documents relied on for fiscal and economic impact

Document title	Document location
Economic Analysis for the Proposed Rule: Aquatic Life Criteria for Copper and Cadmium in Oregon	Economic Analysis
Personal communication, Jarred Willis, ESC Lab Services to Sarah Rockwell, DEQ, 2/16/16	On file at DEQ HQ
Personal communication, Kathy Kreps, Test America to Sarah Rockwell, DEQ, 2/15/16	On file at DEQ HQ

Advisory committee

DEQ appointed an advisory committee for the copper rule. Meeting summaries are available on DEQ's website and a summary of the committee's discussions are included in the Copper Standard Review Issue Paper, also available on the website.

As ORS 183.33 requires, DEQ asked for the committee's input on:

- Whether the proposed rules would have a fiscal impact,
- The extent of the impact, and
- Whether the proposed rules would have a significant impact on small businesses and complies with ORS 183.540.

The committee reviewed the draft fiscal and economic impact statement and provided comment to DEQ via conference call. DEQ also asked the committee to provide written comments to DEQ regarding the fiscal impact statement and whether the rules would have a significant adverse impact on small businesses. During the conference call, the committee members offered the following comments:

- If DEQ does not adopt a revised copper standard, EPA is under court order to promulgate its proposed copper criteria, which would likely have a more significant effect on small businesses and other affected entities than DEQ's proposed criteria.
- The sampling and analysis costs for BLM parameters may be higher than that presented in the draft fiscal statement.
- Members of the committee concurred with cost estimates associated with updating stormwater treatment requirements if the proposed copper rule would result in facilities needing to do so.
- Members of the committee concurred that estimating costs associated with updating wastewater treatment would be difficult given the complexity of the new standard.

In written comments, the Oregon Association of Clean Water Agencies suggested that the cost estimates provided by EPA's economic analysis for installing ion exchange may be low. DEQ included the alternative information provided by OR-ACWA in to provide another estimate of treatment costs in this fiscal impact statement.

The committee determined the proposed rules could have a significant adverse impact on small businesses in Oregon, but would likely have less impact than EPA's proposed rules.

As ORS 183.333 and 183.540 require, DEQ asked the committee to consider how DEQ could reduce the rules' fiscal impact on small business. DEQ received comments suggesting that the use of default values could result in costs to small businesses, as well as large businesses and municipalities. DEQ has recommended using location-specific values for the BLM where feasible. No alternatives were suggested that could reduce costs to small businesses while achieving the goal of the rule.

Housing cost

As ORS 183.534 requires, DEQ evaluated whether the proposed rules would have an effect on the development cost of a 6,000-square-foot parcel and construction of a 1,200-square-foot detached, single-family dwelling on that parcel. DEQ determined the proposed rules would have no effect on the development costs because there would be no effect on construction operators including those that are covered by the 1200C construction stormwater permit.

Federal relationship

Relationship to federal requirements

ORS 183.332, ORS 468A.327 and OAR 340-011-0029 require DEQ to attempt to adopt rules that correspond with existing equivalent federal laws and rules unless there are reasons not to do so. This section complies with OAR 340-011-0029 and ORS 468A.327 requirements to clearly identify the relationship between the proposed rules and applicable federal requirements.

The proposed rules implement a federal regulation. The federal Clean Water Act and its associated regulations require states to adopt water quality standards to protect beneficial uses of the nation's waters. States must base standards on substantial evidence. DEQ must submit the proposed standards to EPA for approval after EQC adoption and Attorney General certification that they were duly adopted under state law. DEQ determined that the proposed copper standards revisions meet federal requirements. DEQ worked with EPA while developing the proposed rules and DEQ expects EPA will approve these proposed rules. Other rule amendments and rule notes correct errors, provide additional clarifications and align with plain English requirements.

What alternatives did DEQ consider if any?

DEQ analyzed what would happen if it took no action. This alternative would result in EPA promulgation of a federal regulation to address its Jan. 31, 2013, action disapproving Oregon's copper criteria. Therefore, DEQ concluded it would be preferable for the state to adopt a state rule. DEQ stakeholders supported state adoption of the copper BLM criteria and encouraged DEQ to pursue adoption of these criteria in a timely manner in order to avoid a federal promulgation.

DEQ considered addressing EPA's January 2013 disapproval of the state's aquatic life toxics criteria for aluminum and cadmium as part of this rulemaking. However, DEQ did not know the potential remedies to address EPA's disapproval for these pollutants at the time it initiated this rulemaking. EPA published updated recommended cadmium criteria in April 2016. However, this action came too late to include the cadmium revision in the current rulemaking and still meet the rulemaking schedule necessary to avoid federal promulgation of the copper standard. EPA is still developing aluminum criteria recommendations.

Land Use

Land-use considerations

In adopting new or amended rules, ORS 197.180 and OAR 340-018-0070 require DEQ to determine whether the proposed rules significantly affect land use.

Under OAR 660-030-0005 and OAR 340 Division 18, DEQ considers that rules affect land use if:

- The statewide land use planning goals specifically refer to the rule or program, or
- The rule or program is reasonably expected to have significant effects on:
  - Resources, objectives or areas identified in the statewide planning goals, or
  - Present or future land uses identified in acknowledged comprehensive plans

To determine whether the proposed rules involve programs or actions that affect land use, DEQ reviewed its Statewide Agency Coordination plan, which describes the DEQ programs that have been determined to significantly affect land use.

Determination

The proposed rules would revise Oregon's freshwater aquatic life criteria for copper. The rules do not change the designation of aquatic life as a beneficial use of state waters and the revised copper water quality standard will continue to protect this use.

DEQ determined that the proposed rules do not affect land use under OAR 340-018-0030 or DEQ's State Agency Coordination Program.

DEQ adopted a State Agency Coordination plan that describes which of DEQ's rules and programs affect land use or constitute a land-use program, and how DEQ will comply with state land-use goals and ensure compatibility with local comprehensive plans. Rules that affect land use are termed a "land use program" under the controlling statutes. Water quality standards revisions were not determined to be a "land use program."

Stakeholder and public involvement

Advisory committees

DEQ convened a technical review panel to review and advise staff on the technical analysis and evaluation conducted to provide the scientific basis for the proposed criteria. The Technical Support Document (DEQ, 2016 - Technical Support Document) includes a list of the panel members, DEQ's compilation and analysis of information that occurred during the technical review, and the comments of the panel on the information and analysis. The technical review panel provided input through written comments, contacting DEQ staff directly, and during two conference calls (Aug. and Dec. 2015). The Technical Support Document is listed in the section above in the "documents relied upon" table and is posted on the web site for this rulemaking. DEQ greatly appreciates the time and assistance provided by this group of experts on copper, aquatic toxicity and the Biotic Ligand Model.

The Technical Review Panel members were:

Name	Affiliation	Area of Expertise
Kathleen Collins	U.S. EPA, Region 10	water quality standards
Luis Cruz, Joe Beaman	U.S. EPA, Headquarters	water quality standards, aquatic toxicology, ecological risk
Jeff Lockwood	National Marine Fisheries Service, NOAA	ecological risk/Endangered Species Act
Chris Mebane	USGS	aquatic toxicology, ecological risk, BLM user
Dianne Barton	Columbia River Intertribal Fish Commission	aquatic toxicology, ecological risk
Dr. William Stubblefield	Oregon State University	metals, aquatic toxicology, ecological risk, BLM user
Dr. Jeff Louch, Dr. Barry Malmberg	National Council for Air and Stream Improvement, Inc.	water quality standards
Robert Baumgartner	Clean Water Services	water quality standards, BLM user
Dr. Robert Gensemer, Carrie Claytor, John Gondek, Amanda Kovach	GEI Consultants	metals, water quality standards, ecological risk, BLM user, site-specific and statewide standards updates
Scott Tobiason, Robert Santore, Dave DeForest	Windward Environmental, LLC	metals, water quality standards, ecological risk, BLM user, site-specific and statewide standards updates

DEQ also convened a stakeholder group, the Copper Rulemaking Advisory Committee. The committee included representatives from local government, non-profit, industry and recreational user associations. The committee included representatives from local government, non-profit, agriculture, industry and recreational user associations as shown in the table below. The committee met four times. The committee's web page is located at: Copper Standards Rulemaking Advisory Committee.

The committee members were:

Name	Representing
Robert Baumgartner	Clean Water Services
Alice Brawley-Chesworth	City of Portland, Bureau of Environmental Services, ACWA
Michael Campbell	Oregon Water Quality Standards Group
Scott Dahlman	Oregonians for Food & Shelter
Glen Spain	Pacific Coast Federation of Fishermen's Associations
Kathryn VanNatta	Northwest Pulp & Paper Association
Brian Wegener	Tualatin Riverkeepers

Meeting notifications

To notify people about the advisory committee's meetings:

- On Dec. 2, 2015, prior to the first advisory committee meeting, DEQ sent a GovDelivery email notice to DEQ Public Notices, Rulemaking, and Water Quality Standards subscribers that provided information about the meeting schedule and described how to sign up for advisory committee meeting notices.
- Prior to the third meeting, DEQ sent another GovDelivery bulletin to the water quality standards rulemaking list, which included people who signed up for notices about the copper standard rulemaking.
- Staff added advisory committee announcements to DEQ's calendar of public meetings at DEQ Calendar and on the State of Oregon Newsroom website.

Stakeholder committee discussions

DEQ held four stakeholder advisory committee meetings to discuss and provide input to DEQ on the options for adopting criteria based on the BLM into Oregon's water quality standards rules. The committee focused on how the rules would be implemented in Clean Water Act programs and helped DEQ understand and evaluate the implications of implementing the copper BLM standard. In addition, advisory committee members were invited to provide input on DEQ's draft Statement of Fiscal and Economic Impact analysis during a conference call on June 16, 2016, and in writing by June 22, 2016.

Over the course of the meetings, the advisory committee received information from DEQ on:

- The background and scope of the rulemaking;
- The history of Oregon's previous and current copper standard, EPA's disapproval of DEQ's 2004 criteria and the NMFS biological opinion;
- The scientific basis for the Biotic Ligand Model and the data the model uses;
- Findings from the Technical Support Document;
- Permitting procedures;
- Implementing the standard for 303(d) assessment;
- Draft rule language; and
- The rulemaking process.

During the first meeting, Dec. 17, 2015, the committee expressed concern regarding the timeline for the rulemaking and the opportunity to provide feedback. Specifically, committee members pointed out that the complexity of the standards will require adaptability and resources to be properly implemented. Some committee members questioned whether DEQ had identified all relevant sources of copper. Members provided input that copper is sometimes primarily a stormwater runoff issue rather than a permitted NPDES discharge issue and that knowing the sources would be important for future mitigation and reduction strategies. Additionally, members stated that BLM implementation considerations for permitting and 303(d) listings would need to be a focus of advisory committee discussions.

On Jan. 27, 2016, the committee convened to discuss three topics: the Technical Support Document, use of a performance-based standards approach, and the procedures to derive BLM criteria, particularly when some of the input parameter data is not available. The committee discussed these procedures and draft documents, providing suggestions and questions on how to address missing data.

On Feb. 25, 2016, the committee met to discuss draft BLM criteria procedures, provide input on how to implement the BLM standard in NPDES permitting and review draft rule language. Committee members expressed concerns about creating anti-backsliding problems if default values or conservative assumptions are used for NPDES permit analysis prior to the collection of site-specific data. In addition, the committee raised considerations about anti-degradation, using conservative criteria, and questions about the Municipal Separate Storm Sewer System (also known as the MS4) program. Members asked DEQ to provide a plan on how to clearly communicate to major sources about what BLM data they will need to collect.

During the last meeting, held on April 26, 2016, the committee learned about and discussed EPA's draft proposed rule for freshwater copper criteria for Oregon. DEQ presented information that compared different methods to estimate missing BLM parameters. The committee provided input on DEQ's draft approach to implement BLM criteria in NPDES permitting and the Assessment Methodology for the Integrated Report development, as well as DEQ's initial draft rule language. Three members of the committee provided a joint draft proposal to DEQ with suggested rule language and there was discussion about what should be included in the water quality criteria rule language.

DEQ was asked to consider and provide information regarding back-sliding issues, how to ensure permittees collect the required data, implications for pre-treatment, and future outreach and guidance.

EQC prior involvement

DEQ shared information about this rulemaking with the EQC as part of the Director's Report at their meeting on Aug. 12-13, 2015.

In addition, on Dec. 22, 2015, DEQ staff informed the Commissioners via email that the stakeholder Advisory Committee meetings had begun.

Public Notice

DEQ provided notice of the proposed rulemaking and rulemaking hearing on Aug. 1, 2016 by:

- Filing notice on July 15, 2016, with the Oregon Secretary of State for publication in the Aug. 1, 2016 Oregon Bulletin
- Notifying the EPA by email
- Posting the Notice, Invitation to Comment and Draft Rules on the web page for this rulemaking; located at: Water Quality Standards for Copper 2016, http://www.oregon.gov/deq/RulesandRegulations/Pages/2015/Rwqcopper.aspx
- Emailing interested parties on the following DEQ lists through GovDelivery:
    - Water quality standards (3,795 subscribers)
    - Water quality permitting, (2,311 subscribers)
    - DEQ Rulemaking, (6,725 subscribers)
- Emailing the following key legislators required under ORS 183.335:
    - Senator Chris Edwards, Chair, Senate Environment and Natural Resources committee
    - Representative Vega Pederson, Chair, House Energy and Environment committee
- Emailing advisory committee members
- Postings on Twitter and Facebook
- Posting on the DEQ event calendar: DEQ Calendar

Public hearings

DEQ held two public hearings in Portland. The meetings began with an informational webinar, which could be accessed from any location through the internet. The formal hearing followed. People were provided the opportunity to testify in person at the Portland location or by phone from any location. The tables below provide the details.

DEQ considered all written comments received at the hearings listed below before completing the draft rules. The summary of all comments and responses is in this Environmental Quality Commission staff report.

Request for other options
During the public comment period, DEQ requested public comment on whether to consider other options for achieving the rules' substantive goals while reducing the rules' negative economic impact on business. This document includes a summary of comments and DEQ responses.

Public hearings and comment

DEQ held two public hearing(s). DEQ received 13 public comment submittals. Later sections of this document include a summary of comments received, DEQ's responses, and a list of the commenters. Original comments are on file with DEQ.

Presiding Officers' Record

Hearing 1

Meeting location: DEQ, 811 SW 6th Ave, 10th floor, Room EQC-A, Portland, Oregon
Meeting date and time: August 30, 2016, 6:00 pm, informational meeting; 6:30 pm public hearing
Presiding Officer: Roxann Nayar

The presiding officer convened the hearing, summarized procedures for the hearing, and explained that DEQ was recording the hearing. The presiding officer asked people who wanted to present verbal comments to sign the registration list, or if attending by phone, to indicate their intent to present comments. The presiding officer advised all attending parties interested in receiving future information about the rulemaking to sign up for GovDelivery email notices.

As Oregon Administrative Rule 137-001-0030 requires, the presiding officer summarized the content of the rulemaking notice.

DEQ added all names and affiliations of hearing participants who presented testimony to the commenter section of this staff report. The commenter list includes a cross reference to the hearing number. DEQ added all written and oral comments presented at each hearing to the summary of comments and agency responses section of this staff report.

Hearing 2

Meeting location: DEQ, 811 SW 6th Ave, 10th floor, Room EQC-A, Portland, Oregon

Meeting date and time: August 31, 2016, 2:00 pm, informational meeting, 2:30pm public hearing
Presiding Officer: Roxann Nayar

The presiding officer convened the hearing, summarized procedures for the hearing, and explained that DEQ was recording the hearing. The presiding officer asked people who wanted to present verbal comments to sign the registration list, or if attending by phone, to indicate their intent to present comments. The presiding officer advised all attending parties interested in receiving future information about the rulemaking to sign up for GovDelivery email notices.

As Oregon Administrative Rule 137-001-0030 requires, the presiding officer summarized the content of the rulemaking notice.

DEQ added all names and affiliations of hearing participants who presented testimony to the commenter section of this staff report. The commenter list includes a cross reference to the hearing number. DEQ added all written and oral comments presented at each hearing to the summary of comments and agency responses section of this staff report.

Summary of comments and DEQ responses

For public comments received by the close of the public comment period, the comment summaries and responses are included as Attachment C. The comments are summarized with cross references to the commenter number. DEQ's response follows the summary. Original comments are on file with DEQ.

Commenters

Comments received by close of public comment period: 13

The table below lists people and organizations that submitted public comments about the proposed rules by the deadline. Original comments are on file with DEQ.

List of Commenters		
#	Name	Organization
1	Janet Gillaspie	Oregon Association of Clean Water Agencies
2	Nina Bell	Northwest Environmental Advocates
3	Carrie Claytor[A], Robert W. Gensemer, Ph.D.[B], John Gondek[B], Robert Santore[C], Scott Tobiason[3], David DeForest[C]	Copper Development Association[A], Inc., GEI Consultants, Inc.[B], Windward Environmental, LLC[C]
4	Amy Nelson, Ben Hung, and Joe Volosin	Anchor QEA, LLC
5	Kathleen Roberts	North American Metals Council
6	Kathryn VanNatta	Northwest Pulp and Paper Association
7	Kim Cox	City of Portland, Bureau of Environmental Services
8	Brandy Humphreys	The Confederated Tribes of the Grand Ronde Community of Oregon
9	Michael Campbell	Oregon Water Quality Standards Group[2]
10	Barry Malmberg	National Council for Air and Stream Improvement, Inc.
11	Robert Baumgartner	Clean Water Services
12	Scott Dahlman[A]	Oregonians for Food and Shelter[A], Oregon Farm Bureau, Oregon Dairy Farmer's Association, Oregon Forest & Industries Council, Oregon Water Resources Congress, Oregon Cattlemen's Association

[2] A coalition of industrial and port clients, who hold, or have members who hold, NPDES permits for facilities in Oregon.

List of Commenters		
#	Name	Organization
13	Rochelle Labiosa	US Environmental Protection Agency, Region 10

Implementation

Notification
The proposed rules would become effective for state law purposes upon filing on approximately Nov. 4, 2016. DEQ will notify affected parties by:

Compliance and enforcement

- Affected parties -Text
- DEQ staff - Text

Measuring, sampling, monitoring and reporting

- Affected parties - Text
- DEQ staff - Text

Systems

- Website - Text
- Database - Text
- Invoicing - Text

Training

- Affected parties - Text
- DEQ staff - Text

Five-year review

ORS 183.405

Requirement

Oregon law requires DEQ to review new rules within five years after EQC adopts them. The law also exempts some rules from review. DEQ determined whether the rules described in this report are subject to the five-year review. DEQ based its analysis on the law in effect when EQC adopted these rules.

Exemption from five-year rule review

The Administrative Procedures Act exempts all of the proposed rules from the five-year review because the proposed rules would:

- Amend or repeal an existing rule. ORS 183.405(4).
- Implement a court order or a civil proceeding settlement. ORS 183.405(5)(a).
- Adopt a federal law or rule by reference. ORS 183.405((5)(b).

DEPARTMENT OF ENVIRONMENTAL QUALITY

DIVISION 41

WATER QUALITY STANDARDS: BENEFICIAL USES, POLICIES, AND CRITERIA FOR OREGON

340-041-0033

Toxic Substances

~~Effectiveness. Amendments to this rule and associated revisions to Table 30 under OAR 340-041-8033 do not become applicable for purposes of ORS chapter 468B or the federal Clean Water Act until EPA approves the revisions it identifies as water quality standards according to 40 CFR 131.21 (4/27/2000).~~

(1) Toxic Substances Narrative. Toxic substances may not be introduced above natural background levels in waters of the state in amounts, concentrations, or combinations that may be harmful, may chemically change to harmful forms in the environment, or may accumulate in sediments or bioaccumulate in aquatic life or wildlife to levels that adversely affect public health, safety, or welfare or aquatic life, wildlife or other designated beneficial uses.

(2) Aquatic Life Numeric Criteria. Levels of toxic substances in waters of the state may not exceed the applicable aquatic life criteria ~~listed~~ as defined in Table 30 under OAR 340-041-8033.

(3) Human Health Numeric Criteria. The criteria for waters of the state listed in Table 40 under OAR 340-041-8033 are established to protect Oregonians from potential adverse health effects associated with long-term exposure to toxic substances associated with consumption of fish, shellfish and water.

(4) To establish permit or other regulatory limits for toxic substances without criteria in Table 30 under OAR 340-041-8033 or Table 40 under 340-041-8033, DEQ may use the guidance values in Table 31 under 340-041-8033, public health advisories, and published scientific literature. DEQ may also require or conduct bio-assessment studies to monitor the toxicity to aquatic life of complex effluents, other suspected discharges or chemical substances without numeric criteria.

(5) Establishing Site-Specific Background Pollutant Criteria: This provision is a performance-based water quality standard that results in site-specific human health water quality criteria under the conditions and procedures specified in this rule section. It addresses existing permitted discharges of a pollutant removed from the same body of water. For waterbodies where a discharge does not increase the pollutant's mass and does not increase the pollutant concentration by more than 3 percent, and where the water body meets a pollutant concentration

associated with a risk level of 1 x 10-4, DEQ concludes that the pollutant concentration continues to protect human health.

(a) Definitions: As used in this section:

(A) "Background pollutant concentration" means the ambient water body concentration immediately upstream of the discharge, regardless of whether those pollutants are natural or result from upstream human activity.

(B) An "intake pollutant" is the amount of a pollutant present in waters of the state (including groundwater) as provided in subsection (C), below, at the time it is withdrawn from such waters by the discharger or other facility supplying the discharger with intake water.

(C) "Same body of water": An intake pollutant is considered to be from the "same body of water" as the discharge if DEQ finds that the intake pollutant would have reached the vicinity of the outfall point in the receiving water within a reasonable period had the permittee not removed it ~~not been removed by the permittee~~. To make this finding, DEQ requires information showing that:

(i) The background concentration of the pollutant in the receiving water (excluding any amount of the pollutant in the facility's discharge) is similar to that in the intake water; and,

(ii) There is a direct hydrological connection between the intake and discharge points.

(I) DEQ may also consider other site-specific factors relevant to the transport and fate of the pollutant to make the finding in a particular case that a pollutant would or would not have reached the vicinity of the outfall point in the receiving water within a reasonable period had the permittee not removed it ~~it not been removed by the permittee~~.

(II) An intake pollutant from groundwater may be considered to be from the "same body of water" if DEQ determines that the pollutant would have reached the vicinity of the outfall point in the receiving water within a reasonable period had the permittee not removed it ~~it not been removed by the permittee~~. A pollutant is not from the same body of water if the groundwater contains the pollutant partially or entirely due to past or present human activity, such as industrial, commercial, or municipal operations, disposal actions, or treatment processes.

(iii) Water quality characteristics (e.g., temperature, pH, hardness) are similar in the intake and receiving waters.

(b) Applicability

(A) DEQ may establish site-specific criteria under this rule section only for carcinogenic pollutants.

(B) Site-specific criteria established under this rule section apply in the vicinity of the discharge for purposes of establishing permit limits for the specified permittee.

(C) The underlying waterbody criteria continue to apply for all other Clean Water Act programs.

(D) The site-specific background pollutant criterion will be effective when DEQ issues upon DEQ issuance of the permit for the specified permittee.

(E) DEQ will reevaluate any site-specific criteria developed under this procedure upon permit renewal.

(c) DEQ may establish a site-specific background pollutant criterion when all of the following conditions are met:

(A) The discharger has a currently effective NPDES permit;

(B) The mass of the pollutant discharged to the receiving waterbody does not exceed the mass of the intake pollutant from the same body of water, as defined in section (5)(a)(C) above, and therefore does not increase the total mass load of the pollutant in the receiving water body;

(C) DEQ has not assigned the discharger a TMDL wasteload allocation for the pollutant in question;

(D) The permittee uses any feasible pollutant reduction measures available and known to minimize the pollutant concentration in their discharge;

(E) The pollutant discharge has not been chemically or physically altered in a manner that causes adverse water quality impacts that would not occur if the intake pollutants were left in-stream; and,

(F) The timing and location of the pollutant discharge would not cause adverse water quality impacts that would not occur if the intake pollutant were left in-stream.

(d) The site-specific background pollutant criterion must be the most conservative of the following four values. Section (5)(e) of this rule describes Tthe procedures for deriving these values are described in the sections (5)(e) of this rule.

(A) The projected in-stream pollutant concentration resulting from the current discharge concentration and any feasible pollutant reduction measures under (c)(D) above, after mixing with the receiving stream.

(B) The projected in-stream pollutant concentration resulting from the portion of the current discharge concentration associated with the intake pollutant mass after mixing with the receiving stream. This analysis ensures that there will be no increase in the mass of the intake pollutant in the receiving water body as required by condition (c)(B) above.

(C) The projected in-stream pollutant concentration associated with a 3 percent increase above the background pollutant concentration as calculated:

(i) For the main stem Willamette and Columbia Rivers, using 25 percent of the harmonic mean flow of the waterbody.

(ii) For all other waters, using 100 percent of the harmonic mean flow or similar critical flow value of the waterbody.

(D) A criterion concentration value representing a human health risk level of 1×10^{-4}. DEQ calculates this value using EPA's human health criteria derivation equation for carcinogens (EPA 2000), a risk level of 1×10^{-4}, and the same values for the remaining calculation variables that were used to derive the underlying human health criterion.

(e) Procedure to derive a site-specific human health water quality criterion to address a background pollutant:

(A) DEQ will develop a flow-weighted characterization of the relevant flows and pollutant concentrations of the receiving waterbody, effluent and all facility intake pollutant sources to determine the fate and transport of the pollutant mass.

(i) The pollutant mass in the effluent discharged to a receiving waterbody may not exceed the mass of the intake pollutant from the same body of water.

(ii) Where a facility discharges intake pollutants from multiple sources that originate from the receiving waterbody and from other waterbodies, DEQ will calculate the flow-weighted amount of each source of the pollutant in the characterization.

(iii) Where a municipal water supply system provides intake water for a facility and the supplier provides treatment of the raw water that removes an intake water pollutant, the concentration and mass of the intake water pollutant must be determined at the point where the water enters the water supplier's distribution system.

(B) Using the flow weighted characterization developed in section (5)(e)(A), DEQ will calculate the in-stream pollutant concentration following mixing of the discharge into the receiving water. DEQ will use the resultant concentration to determine the conditions in section (5)(d)(A) and (B).

(C) Using the flow-weighted characterization, DEQ will calculate the in-stream pollutant concentration based on an increase of 3 percent above background pollutant concentration. DEQ will use the resultant concentration to determine the condition in Section (5)(d)(C).

(i) For the main stem Willamette and Columbia Rivers, DEQ will use 25 percent of the harmonic mean flow of the waterbody.

(ii) For all other waters, DEQ will use 100 percent of the harmonic mean flow or similar critical flow value of the waterbody.

(D) DEQ will select the most conservative of the following values as the site-specific water quality criterion.

(i) The projected in-stream pollutant concentration described in section (5)(e)(B);

(ii) The in-stream pollutant concentration based on an increase of 3 percent above background described in section (5)(e)(C); or

(iii) A water quality criterion based on a risk level of 1×10^{-4}.

(f) Calculation of water quality based effluent limits based on a site-specific background pollutant criterion:

(A) For discharges to receiving waters with a site-specific background pollutant criterion, DEQ will use the site-specific criterion in the calculation of a numeric water quality based effluent limit.

(B) DEQ will compare the calculated water quality based effluent limits to any applicable aquatic toxicity or technology based effluent limits and select the most conservative for inclusion in the permit conditions.

(g) In addition to the water quality based effluent limits described in section (5)(f), DEQ will calculate a mass-based limit where necessary to ensure that the condition described in section (5)(c)(B) is met. Where mass-based limits are included, the permit will specify how DEQ will assess compliance with mass-based effluent limitations.

(h) The permit shall include a provision requiring DEQ to consider the re-opening of the permit and re-evaluation of the site-specific background pollutant criterion if new information shows the discharger no longer meets the conditions described in subsections (5)(c) and (e).

(i) Public Notification Requirements.

(A) If DEQ proposes to grant a site-specific background pollutant criterion, it must provide public notice of the proposal and hold a public hearing. The public notice may be included in the public notification of a draft NPDES permit or other draft regulatory decision that would rely on the criterion and will also be published on DEQ's water quality standards website;

(B) DEQ will publish a list of all site-specific background pollutant criteria approved according to this rule. DEQ will add the criterion to this list within 30 days of its effective date. The list will identify the:

(i) Permittee;

(ii) Site-specific background pollutant criterion and the associated risk level;

(iii) Waterbody to which the criterion applies;

(iv) Allowable pollutant effluent limit; and,

(v) How to obtain additional information about the criterion.

(6) Arsenic Reduction Policy: The inorganic arsenic criterion for the protection of human health from the combined consumption of organisms and drinking water is 2.1 micrograms per liter. While this criterion is protective of human health and more stringent than the federal maximum contaminant level (MCL) for arsenic in drinking water, which is 10 micrograms per liter, it is based on a higher risk level than EQC used to establish other human health criteria. This higher risk level recognizes that much of the risk is due to naturally high levels of inorganic arsenic in Oregon's waterbodies. In order to maintain the lowest human health risk from inorganic arsenic in drinking water, EQC determined that it is appropriate to adopt the following policy to limit the human contribution to that risk.

(a) It is EQC policy to reduce the addition of inorganic arsenic from new or existing anthropogenic sources to waters of the state within a surface water drinking water protection area to the maximum amount feasible. The requirements of this rule section (OAR 340-041-0033(6)) apply to sources that discharge to surface waters of the state with an ambient inorganic arsenic concentration equal to or lower than the applicable numeric inorganic arsenic criteria for the protection of human health.

(b) Definitions. As used in this section:

(A) "Add inorganic arsenic" means to discharge a net mass of inorganic arsenic from a point source (the mass of inorganic arsenic discharged minus the mass of inorganic arsenic taken into the facility from a surface water source).

(B) A "surface water drinking water protection area," means an area delineated as such by DEQ under the source water assessment program of the federal Safe Drinking Water Act, 42 U.S.C. § 300j 13. DEQ delineates these areas to protect public or community drinking water supplies that use surface water sources. These delineations are on DEQ's drinking water program Web page.

(C) "Potential to significantly increase inorganic arsenic concentrations in the public drinking water supply source water" means:

(i) A~~a~~ discharge will increase the concentration of inorganic arsenic in the receiving water by 10 percent or more after mixing with the harmonic mean flow of the receiving water; or

(ii) A~~a~~s an alternative, if sufficient data are available, the discharge will increase the concentration of inorganic arsenic in the surface water intake water of a public water system by 0.021 micrograms per liter or more based on a mass balance calculation.

(c) Following the effective date of this rule, applications for an individual NPDES permit or permit renewal received from industrial dischargers located in a surface water drinking water protection area and identified by DEQ as likely to add inorganic arsenic to the receiving water must include sufficient data to enable DEQ to determine whether:

(A) The discharge adds inorganic arsenic; and,

(B) The discharge has the potential to significantly increase inorganic arsenic concentrations in the public drinking water supply source water.

(d) Where DEQ determines that both conditions in subsection (c) of this section (6) are true, the industrial discharger must develop an inorganic arsenic reduction plan and propose all feasible measures to reduce its inorganic arsenic loading to the receiving water. The proposed plan, including proposed measures, monitoring and reporting requirements, and a schedule for those actions, will be described in the fact sheet and incorporated into the source's NPDES permit after public comment and DEQ review and approval. In developing the plan, the source must:

(A) Identify how much it can minimize its inorganic arsenic discharge through pollution prevention measures, process changes, wastewater treatment, alternative water supply for groundwater users, or other possible pollution prevention and control measures;

(B) Evaluate the costs, feasibility and environmental impacts of the potential inorganic arsenic reduction and control measures;

(C) Estimate the predicted reduction in inorganic arsenic and the reduced human health risk expected to result from the control measures;

(D) Propose specific inorganic arsenic reduction or control measures, if feasible, and an implementation schedule; and,

(E) Propose monitoring and reporting requirements to document progress in plan implementation and the inorganic arsenic load reductions.

(e) In order to implement this section, DEQ will develop the following information and guidance within 120 days of the effective date of this rule and periodically update it as warranted by new information:

(A) A list of industrial sources or source categories, including industrial stormwater and sources covered by general permits likely to add inorganic arsenic to surface waters of the state. For industrial sources or source categories permitted under a general permit that have been identified by DEQ as likely sources of inorganic arsenic, DEQ will evaluate options for reducing inorganic arsenic during permit renewal or evaluation of Stormwater Pollution Control Plans.

(B) Quantitation limits for monitoring inorganic arsenic concentrations.

(C) Information and guidance to assist sources in estimating, according to subsection (d)(C) of this section, the reduced human health risk expected to result from inorganic arsenic control measures based on the most current EPA risk assessment.

(f) It is the policy of EQC that landowners engaged in agricultural or development practices on land where pesticides, fertilizers, or soil amendments containing arsenic are currently being or have previously been applied, implement conservation practices to minimize the erosion and runoff of inorganic arsenic to waters of the state or to a location where such material could readily migrate into waters of the state.

NOTE: Tables 30, 31 and 40 are found under OAR 340-041-8033.

Stat. Auth.: ORS 468.020, 468B.030, 468B.035 & 468B.048
Stats. Implemented: ORS 468B.030, 468B.035 & 468B.048
Hist.: DEQ 17-2003, f. & cert. ef. 12-9-03; DEQ 3-2004, f. & cert. ef. 5-28-04; DEQ 17-2010, f. & cert. ef. 12-21-10; DEQ 8-2011, f. & cert. ef. 6-30-11; DEQ 10-2011, f. & cert. ef. 7-13-11; DEQ 17-2013, f. 12-23-13, cert. ef. 4-18-14; DEQ 1-2015, f. & cert. ef. 1-7-15

340-041-8033

Toxics Water Quality Criteria Tables

Table 30: Aquatic Life Water Quality Criteria for Toxic Pollutants. This table, referenced in OAR 340-041-0033, contains information about the applicability and content of the criteria contained in the table.

Table 31: Aquatic Life Water Quality Guidance Values for Toxic Pollutants. This table, referenced in OAR 340-041-0033, contains information about the applicability and content of the criteria contained in the table.

Table 40: Human Health Water Quality Criteria for Toxic Pollutants. This table, referenced in OAR 340-041-0033, contains information about the applicability and content of the criteria contained in the table.

~~The tables listed above in this rule are referenced in the water quality standards Toxics Substances Rule under OAR 340-041-0033. See that rule for important information about the applicability and content of these tables.~~

~~**NOTE:** In January 2015, the Environmental Quality Commission adopted revisions to Table 30 that revised the aquatic life freshwater criteria for ammonia. The Table 30 version accessed below reflects the revision to the ammonia criteria including several other clarifications. **Revised Table 30 is not applicable for Clean Water Act purposes until EPA approves the revisions.**~~

Stat. Auth.: ORS 468.020, 468B.030, 468B.035 & 468B.048
Stats. Implemented: ORS 468B.030, 468B.035 & 468B.048

TABLE 30: Aquatic Life Water Quality Criteria for Toxic Pollutants

Effective April 18, 2014

Aquatic Life Criteria Summary

The concentration for each compound listed in Table 30 is a criterion not to be exceeded in waters of the state in order to protect aquatic life. The aquatic life criteria apply to waterbodies where the protection of fish and aquatic life are the designated uses. All values are expressed as micrograms per liter (µg/L). Compounds are listed in alphabetical order with the corresponding information: the Chemical Abstract Service (CAS) number, whether there is a human health criterion for the pollutant (i.e. "y"= yes, "n" = no), and the associated aquatic life freshwater and saltwater acute and chronic criteria. Italicized pollutants are not identified as priority pollutants by EPA. Dashes in the table column indicate that there is no aquatic life criterion.

Unless otherwise noted in the table below, the acute criterion is the Criterion Maximum Concentration (CMC) applied as a one-hour average concentration, and the chronic criterion is the Criterion Continuous Concentration (CCC) applied as a 96-hour (4 days) average concentration. The CMC and CCC criteria should not be exceeded more than once every three years. Footnote A, associated with eleven pesticide pollutants in Table 30, describes the exception to the frequency and duration of the toxics criteria stated in this paragraph.

OAR 340-041-8033
Table 30
Aquatic Life Water Quality Criteria for Toxic Pollutants

				Freshwater (µg/L)		Saltwater (µg/L)	
	Pollutant	**CAS Number**	**Human Health Criterion**	**Acute Criterion (CMC)**	**Chronic Criterion (CCC)**	**Acute Criterion (CMC)**	**Chronic Criterion (CCC)**
1	Aldrin	309002	y	3 [A]	--	1.3 [A]	--
[A] *See expanded endnote A at bottom of Table 30 for alternate frequency and duration of this criterion.*							
2	*Alkalinity*		n	--	20,000 [B]	--	--
[B] *Criterion shown is the minimum (i.e. CCC in water may not be below this value in order to protect aquatic life).*							

OAR 340-041-8033
Table 30
Aquatic Life Water Quality Criteria for Toxic Pollutants

	Pollutant	CAS Number	Human Health Criterion	Freshwater (µg/L) Acute Criterion (CMC)	Freshwater (µg/L) Chronic Criterion (CCC)	Saltwater (µg/L) Acute Criterion (CMC)	Saltwater (µg/L) Chronic Criterion (CCC)
3	*Ammonia*	7664417	n	*Criteria are pH, temperature, and salmonid or sensitive coldwater species dependent--See document USEPA January 1985 (Fresh Water).* [M]		*Ammonia criteria for saltwater may depend on pH and temperature. Values for saltwater criteria (total ammonia) can be calculated from the tables specified in Ambient Water Quality Criteria for Ammonia (Saltwater)--1989 (EPA 440/5-88-004; http://water.epa.gov/scitech/swguidance/standards/criteria/current/index.cfm)*	
[M] *See expanded endnote M equations at bottom of Table 30 to calculate freshwater ammonia criteria*							
4	Arsenic	7440382	y	340 [C, D]	150 [C, D]	69 [C, D]	36 [C, D]
[C] *Criterion is expressed in terms of "dissolved" concentrations in the water column.* [D] *Criterion is applied as total inorganic arsenic (i.e. arsenic (III) + arsenic (V)).*							
5	BHC Gamma (Lindane)	58899	y	0.95	0.08 [A]	0.16 [A]	--
[A] *See expanded endnote A at bottom of Table 30 for alternate frequency and duration of this criterion.*							
6	Cadmium	7440439	n	*See* E	*See* C, F	40 [C]	8.8 [C]
[C] *Criterion is expressed in terms of "dissolved" concentrations in the water column.* [E] *The freshwater criterion for this metal is expressed as "total recoverable" and is a function of hardness (mg/L) in the water column. To calculate the criterion, use formula under expanded endnote E at bottom of Table 30.* [F] *The freshwater criterion for this metal is expressed as a function of hardness (mg/L) in the water column. To calculate the criterion, use formula under expanded endnote F at bottom of Table 30.*							
7	Chlordane	57749	y	2.4 [A]	0.0043 [A]	0.09 [A]	0.004 [A]
[A] *See expanded endnote A at bottom of Table 30 for alternate frequency and duration of this criterion.*							
8	*Chloride*	16887006	n	860,000	230,000	--	--
9	*Chlorine*	7782505	n	19	11	13	7.5
10	*Chlorpyrifos*	2921882	n	0.083	0.041	0.011	0.0056

OAR 340-041-8033
Table 30
Aquatic Life Water Quality Criteria for Toxic Pollutants

	Pollutant	CAS Number	Human Health Criterion	Freshwater (µg/L) Acute Criterion (CMC)	Freshwater (µg/L) Chronic Criterion (CCC)	Saltwater (µg/L) Acute Criterion (CMC)	Saltwater (µg/L) Chronic Criterion (CCC)
11	Chromium III	16065831	n	*See* C, F	*See* C, F	--	--
[C] *Criterion is expressed in terms of "dissolved" concentrations in the water column.* [F] *The freshwater criterion for this metal is expressed as a function of hardness (mg/L) in the water column. To calculate the criterion, use formula under expanded endnote F at bottom of Table 30.*							
12	Chromium VI	18540299	n	16 [C]	11 [C]	1100 [C]	50 [C]
[C] *Criterion is expressed in terms of "dissolved" concentrations in the water column.*							
13	Copper	7440508	y	*See* E	*See* E	4.8 [C]	3.1 [C]
[C] *Criterion is expressed in terms of "dissolved" concentrations in the water column.* [E] *The freshwater criterion for this metal is expressed as "total recoverable" and is a function of hardness (mg/L) in the water column. To calculate the criterion, use formula under expanded endnote E at bottom of Table 30.*							
14	Cyanide	57125	y	22 [J]	5.2 [J]	1 [J]	1 [J]
[J] *This criterion is expressed as µg free cyanide (CN)/L.*							
15	DDT 4,4'	50293	y	1.1 [A, G]	0.001 [A, G]	0.13 [A, G]	0.001 [A, G]
[A] *See expanded endnote A at bottom of Table 30 for alternate frequency and duration of this criterion.* [G] *This criterion applies to DDT and its metabolites (i.e. the total concentration of DDT and its metabolites should not exceed this value).*							
16	*Demeton*	8065483	n	--	0.1	--	0.1
17	Dieldrin	60571	y	0.24	0.056	0.71 [A]	0.0019 [A]
[A] *See expanded endnote A at bottom of Table 30 for alternate frequency and duration of this criterion.*							
18	Endosulfan	115297	n	0.22 [A, H]	0.056 [A, H]	0.034 [A, H]	0.0087 [A, H]
[A] *See expanded endnote A at bottom of Table 30 for alternate frequency and duration of this criterion.* [H] *This value is based on the criterion published in Ambient Water Quality Criteria for Endosulfan (EPA 440/5-80-046) and should be applied as the sum of alpha- and beta-endosulfan.*							
19	Endosulfan Alpha	959988	y	0.22 [A]	0.056 [A]	0.034 [A]	0.0087 [A]
[A] *See expanded endnote A at bottom of Table 30 for alternate frequency and duration of this criterion.*							
20	Endosulfan Beta	33213659	y	0.22 [A]	0.056 [A]	0.034 [A]	0.0087 [A]

OAR 340-041-8033
Table 30
Aquatic Life Water Quality Criteria for Toxic Pollutants

	Pollutant	CAS Number	Human Health Criterion	Freshwater (µg/L)		Saltwater (µg/L)	
				Acute Criterion (CMC)	Chronic Criterion (CCC)	Acute Criterion (CMC)	Chronic Criterion (CCC)
A See expanded endnote A at bottom of Table 30 for alternate frequency and duration of this criterion.							
21	Endrin	72208	y	0.086	0.036	0.037 A	0.0023 A
A See expanded endnote A at bottom of Table 30 for alternate frequency and duration of this criterion.							
22	*Guthion*	86500	n	--	0.01	--	0.01
23	Heptachlor	76448	y	0.52 A	0.0038 A	0.053 A	0.0036 A
A See expanded endnote A at bottom of Table 30 for alternate frequency and duration of this criterion.							
24	Heptachlor Epoxide	1024573	y	0.52 A	0.0038 A	0.053 A	0.0036 A
A See expanded endnote A at bottom of Table 30 for alternate frequency and duration of this criterion.							
25	*Iron (total)*	7439896	n	--	1000	--	--
26	Lead	7439921	n	*See* C , F	*See* C , F	210 C	8.1 C
C Criterion is expressed in terms of "dissolved" concentrations in the water column. F The freshwater criterion for this metal is expressed as a function of hardness (mg/L) in the water column. To calculate the criterion, use formula under expanded endnote F at bottom of Table 30.							
27	*Malathion*	121755	n	--	0.1	--	0.1
28	Mercury (total)	7439976	n	2.4	0.012	2.1	0.025
29	*Methoxychlor*	72435	y	--	0.03	--	0.03
30	*Mirex*	2385855	n	--	0.001	--	0.001
31	Nickel	7440020	y	*See* C , F	*See* C , F	74 C	8.2 C
C Criterion is expressed in terms of "dissolved" concentrations in the water column. F The freshwater criterion for this metal is expressed as a function of hardness (mg/L) in the water column. To calculate the criterion, use formula under expanded endnote F at bottom of Table 30.							
32	*Parathion*	56382	n	0.065	0.013	--	--
33	Pentachlorophenol	87865	y	*See* H	*See* H	13	7.9
H Freshwater aquatic life values for pentachlorophenol are expressed as a function of pH, and are calculated as follows: CMC=(exp(1.005(pH)-4.869); CCC=exp(1.005(pH)-5.134).							
34	*Phosphorus*	7723140	n	--	--	--	0.1

OAR 340-041-8033
Table 30
Aquatic Life Water Quality Criteria for Toxic Pollutants

	Pollutant	CAS Number	Human Health Criterion	Freshwater (µg/L) Acute Criterion (CMC)	Freshwater (µg/L) Chronic Criterion (CCC)	Saltwater (µg/L) Acute Criterion (CMC)	Saltwater (µg/L) Chronic Criterion (CCC)
	Elemental						
35	Polychlorinated Biphenyls (PCBs)	NA	y	2 [K]	0.014 [K]	10 [K]	0.03 [K]
[K] *This criterion applies to total PCBs (e.g. determined as Aroclors or congeners)*							
36	Selenium	7782492	y	*See* **C**, **L**	4.6 [C]	290 [C]	71 [C]
[C] *Criterion is expressed in terms of "dissolved" concentrations in the water column.* [L] *The CMC=(1/[(f1/CMC1)+(f2/CMC2)]µg/L) * CF where f1 and f2 are the fractions of total selenium that are treated as selenite and selenate, respectively,and CMC1 and CMC2 are 185.9 µg/L and 12.82 µg/L, respectively. See expanded endnote F for the Conversion Factor (CF) for selenium.*							
37	Silver	7440224	n	*See* **C**, **F**	0.10 [C]	1.9 [C]	--
[C] *Criterion is expressed in terms of "dissolved" concentrations in the water column.* [F] *The freshwater acute criterion for this metal is expressed as a function of hardness (mg/L) in the water column. To calculate the criterion, use formula under expanded endnote F at bottom of Table 30.*							
38	*Sulfide Hydrogen Sulfide*	7783064	n	--	2	--	2
39	Toxaphene	8001352	y	0.73	0.0002	0.21	0.0002
40	*Tributyltin (TBT)*	688733	n	0.46	0.063	0.37	0.01
41	Zinc	7440666	y	*See* **C**, **F**	*See* **C**, **F**	90 [C]	81 [C]
[C] *Criterion is expressed in terms of "dissolved" concentrations in the water column.* [F] *The freshwater criterion for this metal is expressed as a function of hardness (mg/L) in the water column. To calculate the criterion, use formula under expanded endnote F at bottom of Table 30.*							

Expanded Endnotes A, E, F, M

Endnote A: Alternate Frequency and Duration for Certain Pesticides

This criterion is based on EPA recommendations issued in 1980 that were derived using guidelines that differed from EPA's 1985 Guidelines which update minimum data requirements and derivation procedures. The CMC may not be exceeded at any time and the CCC may not be exceeded based on a 24-hour average. The CMC may be applied using a one hour averaging period not to be exceeded more than once every three years, if the CMC values given in Table 30 are divided by 2 to obtain a value that is more comparable to a CMC derived using the 1985 Guidelines.

Endnote E: Equations for Hardness-Dependent Freshwater Metals Criteria for Cadmium Acute and Copper Acute and Chronic Criteria

The freshwater criterion for this metal is expressed as total recoverable with two significant figures, and is a function of hardness (mg/L) in the water column. Criteria values for hardness are calculated using the following formulas (CMC refers to the acute criterion; CCC refers to the chronic criterion):

$$\textbf{CMC} = (\exp(m_A*[\ln(\text{hardness})] + b_A))$$

$$\textbf{CCC} = (\exp(m_C*[\ln(\text{hardness})] + b_C))$$

Chemical	m_A	b_A	m_C	b_C
Cadmium	1.128	-3.828	N/A	N/A
Copper	0.9422	-1.464	0.8545	-1.465

Endnote F: Equations for Hardness-Dependent Freshwater Metals Criteria and Conversion Factor Table

The freshwater criterion for this metal is expressed as dissolved with two significant figures, and is a function of hardness (mg/L) in the water column. Criteria values for hardness are calculated using the following formulas (CMC refers to the acute criterion; CCC refers to the chronic criterion):

$$\textbf{CMC} = (\exp(m_A*[\ln(\text{hardness})] + b_A))*CF$$

$$\textbf{CCC} = (\exp(m_C*[\ln(\text{hardness})] + b_C))*CF$$

"CF" is the conversion factor used for converting a metal criterion expressed as the total recoverable fraction in the water column to a criterion expressed as the dissolved fraction in the water column.

Chemical	m_A	b_A	m_C	b_C
Cadmium	N/A	N/A	0.7409	-4.719
Chromium III	0.8190	3.7256	0.8190	0.6848
Lead	1.273	-1.460	1.273	-4.705
Nickel	0.8460	2.255	0.8460	0.0584
Silver	1.72	-6.59	--	--
Zinc	0.8473	0.884	0.8473	0.884

The conversion factors (CF) below must be used in the equations above for the hardness-dependent metals in order to convert total recoverable metals criteria to dissolved metals criteria. For metals that are not hardness-dependent (i.e. arsenic, chromium VI, selenium, and silver (chronic)), or are saltwater criteria, the criterion value associated with the metal in Table 30 already reflects a dissolved criterion based on its conversion factor below.

Conversion Factor (CF) Table for Dissolved Metals

Chemical	Freshwater		Saltwater	
	Acute	Chronic	Acute	Chronic
Arsenic	1.000	1.000	1.000	1.000
Cadmium	N/A	1.101672-[(ln hardness)(0.041838)]	0.994	0.994

Chromium III	0.316	0.860	--	--
Chromium VI	0.982	0.962	0.993	0.993
Copper	N/A	N/A	0.83	0.83
Lead	1.46203-[(ln hardness)(0.145712)]	1.46203-[(ln hardness)(0.145712)]	0.951	0.951
Nickel	0.998	0.997	0.990	0.990
Selenium	0.996	0.922	0.998	0.998
Silver	0.85	0.85	0.85	--
Zinc	0.978	0.986	0.946	0.946

Endnote M: Equations for Freshwater Ammonia Calculations

Acute Criterion

The 1-hour average concentration of un-ionized ammonia (mg/L NH_3) may not exceed more often than once every three years on average, the numerical value given by:

CMC_{NH3} = 0.52/FT/FPH/2 where:

FT = temperature adjustment factor
FPH = pH adjustment factor
TCAP = temperature cap

$FT = 10^{0.03(20-TCAP)}$; TCAP ≤ T ≤ 30˚ C
$FT = 10^{0.03(20-T)}$; 0 ≤ T ≤ TCAP

FPH = 1 8≤ pH ≤ 9
$FPH = \frac{1 + 10^{7.4-pH}}{1.25}$ 6.5 ≤ pH ≤ 8

TCAP = 20 ˚C; Salmonids and other sensitive coldwater species present
TCAP = 25 ˚C; Salmonids and other sensitive coldwater species absent

Chronic Criterion

The 4-day average concentration of un-ionized ammonia (mg/L NH_3) may not exceed more often than once every three years on average, the average numerical value given by:

CCC_{NH3} = 0.80/FT/FPH/RATIO

where FT and FPH are as above for acute criterion and:

RATIO = 16 *where* 7.7 ≤ pH ≤ 9

$$\text{RATIO} = 24 \times \left[\frac{10^{7.7 - pH}}{1 + 10^{7.4 - pH}} \right]$$ *where* 6.5≤ pH ≤ 7.7

TCAP = 15 ˚C; Salmonids and other sensitive coldwater species present
TCAP = 20 ˚C; Salmonids and other sensitive coldwater species absent

REVISED TABLE 30: Aquatic Life Water Quality Criteria

for Toxic Pollutants

Revised Version of This Table Not in Effect Until Approved By EPA

Aquatic Life Criteria Summary

The concentration for each compound listed in Table 30 is a criterion not to be exceeded inestablished for waters of the state in order to protect aquatic life. The aquatic life criteria apply to waterbodies where the protection of fish and aquatic life is a designated use. All values are expressed as micrograms per liter (µg/L). Compounds are listed in alphabetical order with the corresponding information: the Chemical Abstract Service (CAS) number, whether there is a human health criterion for the pollutant (i.e. "y"= yes, "n" = no), and the associated aquatic life freshwater and saltwater acute and chronic criteria. Italicized pollutants are not identified as priority pollutants by EPA. Dashes in the table column indicate that there is no aquatic life criterion.

Unless otherwise noted in the table below, the acute criterion is the Criterion Maximum Concentration (CMC) applied as a one-hour average concentration, and the chronic criterion is the Criterion Continuous Concentration (CCC) applied as a 96-hour (4 days) average concentration. The CMC and CCC criteria may not be exceeded more than once every three years. Footnote A, associated with eleven pesticide pollutants in Table 30, describes the exception to the frequency and duration of the toxics criteria stated in this paragraph.

Oregon Department of Environmental Quality
Revised Table 30 – Not In Effect Until Approved by EPA
Aquatic Life Water Quality Criteria for Toxic Pollutants
340-041-8033

	Pollutant	CAS Number	Human Health Criterion	Freshwater (µg/L)	Saltwater (µg/L)

				Acute Criterion (CMC)	Chronic Criterion (CCC)	Acute Criterion (CMC)	Chronic Criterion (CCC)
1	Aldrin	309002	y	3 [A]	--	1.3 [A]	--
[A] See expanded endnote A at bottom of Table 30 for alternate frequency and duration of this criterion.							
2	*Alkalinity*		n	--	20,000 [B]	--	--
[B] Criterion shown is the minimum (i.e. CCC in water may not be below this value in order to protect aquatic life).							
3	*Ammonia*	7664417	n	*The ammonia criteria are pH and temperature dependent — See ammonia criteria Tables 30(a)-(c) at end of Table 30.*[M]		*The ammonia criteria are pH, temperature and salinity dependent. Values for saltwater criteria (total ammonia) can be calculated from the tables specified in Ambient Water Quality Criteria for Ammonia (Saltwater)—1989 (EPA 440/5-88-004) See DEQ's calculator for calculating saltwater ammonia criteria at: http://www.deq.state.or.us/wq/standards/toxics.htm.*	
[M] The acute criteria in Table 30(a) apply in waterbodies where salmonids are a designated use in OAR 340-041-0101 through OAR 340-041-0340. The acute criteria in Table 30(b) apply in waterbodies where salmonids are not a designated use. The chronic criteria in Table 30(c) apply where fish and aquatic life is a designated use. It is not necessary to account for the presence or absence of salmonids or the presence of any early life stage of fish for the chronic criteria. Refer to DEQ's beneficial use website at: http://www.deq.state.or.us/wq/standards/uses.htm for additional information on salmonid beneficial use designations, including tables and maps.							
4	Arsenic	7440382	y	340 [C, D]	150 [C, D]	69 [C, D]	36 [C, D]
[C] Criterion is expressed in terms of "dissolved" concentrations in the water column. [D] Criterion is applied as total inorganic arsenic (i.e. arsenic (III) + arsenic (V)).							
5	BHC Gamma (Lindane)	58899	y	0.95	0.08 [A]	0.16 [A]	--
[A] See expanded endnote A at bottom of Table 30 for alternate frequency and duration of this criterion.							
6	Cadmium	7440439	n	*See* **E**	*See* **C, F**	40 [C]	8.8 [C]
[C] Criterion is expressed in terms of "dissolved" concentrations in the water column. [E] The freshwater criterion for this metal is expressed as "total recoverable" and is a function of hardness (mg/L) in the water column. To calculate the criterion, use formula under expanded endnote E at bottom of Table 30. [F] The freshwater criterion for this metal is expressed as a function of hardness (mg/L) in the water column. To calculate the criterion, use formula under expanded endnote F at bottom of Table 30.							
7	Chlordane	57749	y	2.4 [A]	0.0043 [A]	0.09 [A]	0.004 [A]
[A] See expanded endnote A at bottom of Table 30 for alternate frequency and duration of this criterion.							
8	*Chloride*	16887006	n	860,000	230,000	--	--
9	*Chlorine*	7782505	n	19	11	13	7.5

Oregon Department of Environmental Quality

~~Revised~~ Table 30 ~~– Not In Effect Until Approved by EPA~~

Aquatic Life Water Quality Criteria for Toxic Pollutants

340-041-8033

	Pollutant	CAS Number	Human Health Criterion	Freshwater (µg/L) Acute Criterion (CMC)	Freshwater (µg/L) Chronic Criterion (CCC)	Saltwater (µg/L) Acute Criterion (CMC)	Saltwater (µg/L) Chronic Criterion (CCC)
10	*Chlorpyrifos*	2921882	n	0.083	0.041	0.011	0.0056
11	Chromium III	16065831	n	*See* **C, F**	*See* **C, F**	--	--

[C] *Criterion is expressed in terms of "dissolved" concentrations in the water column.*

[F] *The freshwater criterion for this metal is expressed as a function of hardness (mg/L) in the water column. To calculate the criterion, use formula under expanded endnote F at bottom of Table 30.*

12	Chromium VI	18540299	n	16 [C]	11 [C]	1100 [C]	50 [C]

[C] *Criterion is expressed in terms of "dissolved" concentrations in the water column.*

13	Copper	7440508	y	*See* ~~E~~ **C, N**	*See* ~~E~~ **C, N**	4.8 [C]	3.1 [C]

[C] *Criterion is expressed in terms of "dissolved" concentrations in the water column.*

~~[E] *The freshwater criterion for this metal is expressed as "total recoverable" and is a function of hardness (mg/L) in the water column. To calculate the criterion, use formula under expanded endnote E at bottom of Table 30.*~~

[N] *The freshwater criterion for copper is a function of the concentration of ions, alkalinity, organic carbon, pH and temperature in the water column. To calculate the criterion, use the Biotic Ligand Model referenced in endnote N at the bottom of Table 30. The acute copper criterion (CMC) is applied as a one-hour average concentration. The chronic criterion (CCC) is applied as a 96-hour (4 days) average concentration. See endnote N also for procedures and information.*

*[**Note**: The Environmental Quality Commission adopted these revised copper criteria on 11/02/2016. However, the revised criteria become effective for federal Clean Water Act purposes upon approval by the U.S. Environmental Protection Agency.*

14	Cyanide	57125	y	22 [J]	5.2 [J]	1 [J]	1 [J]

[J] *This criterion is expressed as µg free cyanide (CN)/L.*

15	DDT 4,4'	50293	y	1.1 [A, G]	0.001 [A, G]	0.13 [A, G]	0.001 [A, G]

[A] *See expanded endnote A at bottom of Table 30 for alternate frequency and duration of this criterion.*

[G] *This criterion applies to DDT and its metabolites (i.e. the total concentration of DDT and its metabolites should not exceed this value).*

16	*Demeton*	8065483	n	--	0.1	--	0.1
17	Dieldrin	60571	y	0.24	0.056	0.71 [A]	0.0019 [A]

Oregon Department of Environmental Quality

~~Revised~~ Table 30 ~~– Not In Effect Until Approved by EPA~~

Aquatic Life Water Quality Criteria for Toxic Pollutants

340-041-8033

	Pollutant	CAS Number	Human Health Criterion	Freshwater (µg/L)		Saltwater (µg/L)	
				Acute Criterion (CMC)	Chronic Criterion (CCC)	Acute Criterion (CMC)	Chronic Criterion (CCC)
[A] *See expanded endnote A at bottom of Table 30 for alternate frequency and duration of this criterion.*							
18	Endosulfan	115297	n	0.22 [A, H]	0.056 [A, H]	0.034 [A, H]	0.0087 [A, H]
[A] *See expanded endnote A at bottom of Table 30 for alternate frequency and duration of this criterion.* [H] *This value is based on the criterion published in Ambient Water Quality Criteria for Endosulfan (EPA 440/5-80-046) and should be applied as the sum of alpha- and beta-endosulfan.*							
19	Endosulfan Alpha	959988	y	0.22 [A]	0.056 [A]	0.034 [A]	0.0087 [A]
[A] *See expanded endnote A at bottom of Table 30 for alternate frequency and duration of this criterion.*							
20	Endosulfan Beta	33213659	y	0.22 [A]	0.056 [A]	0.034 [A]	0.0087 [A]
[A] *See expanded endnote A at bottom of Table 30 for alternate frequency and duration of this criterion.*							
21	Endrin	72208	y	0.086	0.036	0.037 [A]	0.0023 [A]
[A] *See expanded endnote A at bottom of Table 30 for alternate frequency and duration of this criterion.*							
22	*Guthion*	86500	n	--	0.01	--	0.01
23	Heptachlor	76448	y	0.52 [A]	0.0038 [A]	0.053 [A]	0.0036 [A]
[A] *See expanded endnote A at bottom of Table 30 for alternate frequency and duration of this criterion.*							
24	Heptachlor Epoxide	1024573	y	0.52 [A]	0.0038 [A]	0.053 [A]	0.0036 [A]
[A] *See expanded endnote A at bottom of Table 30 for alternate frequency and duration of this criterion.*							
25	*Iron (total)*	7439896	n	--	1000	--	--
26	Lead	7439921	n	*See* **C , F**	*See* **C , F**	210 [C]	8.1 [C]
[C] *Criterion is expressed in terms of "dissolved" concentrations in the water column.* [F] *The freshwater criterion for this metal is expressed as a function of hardness (mg/L) in the water column. To calculate the criterion, use formula under expanded endnote F at bottom of Table 30.*							
27	*Malathion*	121755	n	--	0.1	--	0.1
28	Mercury (total)	7439976	n	2.4	0.012	2.1	0.025
29	*Methoxychlor*	72435	y	--	0.03	--	0.03

Oregon Department of Environmental Quality

~~Revised~~ Table 30 ~~– Not In Effect Until Approved by EPA~~

Aquatic Life Water Quality Criteria for Toxic Pollutants 340-041-8033

	Pollutant	CAS Number	Human Health Criterion	Freshwater (µg/L)		Saltwater (µg/L)	
				Acute Criterion (CMC)	Chronic Criterion (CCC)	Acute Criterion (CMC)	Chronic Criterion (CCC)
30	*Mirex*	2385855	n	--	0.001	--	0.001
31	Nickel	7440020	y	*See* **C , F**	*See* **C , F**	74 [C]	8.2 [C]
[C] *Criterion is expressed in terms of "dissolved" concentrations in the water column.* [F] *The freshwater criterion for this metal is expressed as a function of hardness (mg/L) in the water column. To calculate the criterion, use formula under expanded endnote F at bottom of Table 30.*							
32	*Parathion*	56382	n	0.065	0.013	--	--
33	Pentachlorophenol	87865	y	*See* **H**	*See* **H**	13	7.9
[H] *Freshwater aquatic life values for pentachlorophenol are expressed as a function of pH, and are calculated as follows: CMC=(exp(1.005(pH)-4.869); CCC=exp(1.005(pH)-5.134).*							
34	*Phosphorus Elemental*	7723140	n	--	--	--	0.1
35	Polychlorinated Biphenyls (PCBs)	NA	y	2 [K]	0.014 [K]	10 [K]	0.03 [K]
[K] *This criterion applies to total PCBs (e.g.* determined as Aroclors or congeners)							
36	Selenium	7782492	y	*See* **C** , **L**	4.6 [C]	290 [C]	71 [C]
[C] *Criterion is expressed in terms of "dissolved" concentrations in the water column.* [L] *The CMC=(1/[(f1/CMC1)+(f2/CMC2)]µg/L) * CF where f1 and f2 are the fractions of total selenium that are treated as selenite and selenate, respectively, and CMC1 and CMC2 are 185.9 µg/L and 12.82 µg/L, respectively. See expanded endnote F for the Conversion Factor (CF) for selenium.*							
37	Silver	7440224	n	*See* **C** , **F**	0.10 [C]	1.9 [C]	--
[C] *Criterion is expressed in terms of "dissolved" concentrations in the water column.* [F] *The freshwater acute criterion for this metal is expressed as a function of hardness (mg/L) in the water column. To calculate the criterion, use formula under expanded endnote F at bottom of Table 30.*							
38	*Sulfide Hydrogen Sulfide*	7783064	n	--	2	--	2
39	Toxaphene	8001352	y	0.73	0.0002	0.21	0.0002
40	*Tributyltin (TBT)*	688733	n	0.46	0.063	0.37	0.01
41	Zinc	7440666	y	*See* **C , F**	*See* **C , F**	90 [C]	81 [C]

Oregon Department of Environmental Quality

~~Revised~~ Table 30 ~~– Not In Effect Until Approved by EPA~~

Aquatic Life Water Quality Criteria for Toxic Pollutants

340-041-8033

				Freshwater (µg/L)		Saltwater (µg/L)	
	Pollutant	**CAS Number**	**Human Health Criterion**	**Acute Criterion (CMC)**	**Chronic Criterion (CCC)**	**Acute Criterion (CMC)**	**Chronic Criterion (CCC)**

C *Criterion is expressed in terms of "dissolved" concentrations in the water column.*

F *The freshwater criterion for this metal is expressed as a function of hardness (mg/L) in the water column. To calculate the criterion, use formula under expanded endnote F at bottom of Table 30.*

Endnote A: Alternate Frequency and Duration for Certain Pesticides

This criterion is based on EPA recommendations issued in 1980 that were derived using guidelines that differed from EPA's 1985 Guidelines which update minimum data requirements and derivation procedures. The CMC may not be exceeded at any time and the CCC may not be exceeded based on a 24-hour average. The CMC may be applied using a one hour averaging period not to be exceeded more than once every three years, if the CMC values given in Table 30 are divided by 2 to obtain a value that is more comparable to a CMC derived using the 1985 Guidelines.

Endnote E: Equation~~s~~ for Hardness-Dependent Freshwater ~~Metals Criteria for~~ Cadmium Acute ~~and Copper Acute and Chronic~~ Criteria

The freshwater criterion for this metal is expressed as total recoverable with two significant figures, and is a function of hardness (mg/L) in the water column. Criteria values ~~for~~ based on hardness are calculated using the following formula~~s~~ (CMC refers to the acute criterion~~; CCC refers to the chronic criterion~~):

$$\textbf{CMC} = (\exp(m_A*[\ln(\text{hardness})] + b_A))$$

~~$\textbf{CCC} = (\exp(m_C*[\ln(\text{hardness})] + b_C))$~~

Chemical	m_A	b_A	m_C	b_C
Cadmium	1.128	-3.828	N/A	N/A
~~Copper~~	~~0.9422~~	~~-1.464~~	~~0.8545~~	~~-1.465~~

Endnote F: Equations for Hardness-Dependent Freshwater Metals Criteria and Conversion Factor Table

The freshwater criterion for this metal is expressed as dissolved with two significant figures, and is a function of hardness (mg/L) in the water column. Criteria values ~~for~~ based on hardness are calculated using the following formulas (CMC refers to the acute criterion; CCC refers to the chronic criterion):

$$\textbf{CMC} = (\exp(m_A*[\ln(\text{hardness})] + b_A))*CF$$

$$\textbf{CCC} = (\exp(m_C*[\ln(\text{hardness})] + b_C))*CF$$

“CF” is the conversion factor used for converting a metal criterion expressed as the total recoverable fraction in the water column to a criterion expressed as the dissolved fraction in the water column.

Chemical	m_A	b_A	m_C	b_C
Cadmium	N/A	N/A	0.7409	-4.719
Chromium III	0.8190	3.7256	0.8190	0.6848
Lead	1.273	-1.460	1.273	-4.705
Nickel	0.8460	2.255	0.8460	0.0584
Silver	1.72	-6.59	--	--
Zinc	0.8473	0.884	0.8473	0.884

The conversion factors (CF) below must be used in the equations above for the hardness-dependent metals in order to convert total recoverable metals criteria to dissolved metals criteria. For metals that are not hardness-dependent (i.e. arsenic, chromium VI, selenium, and silver (chronic)), or are saltwater criteria, the criterion value associated with the metal in Table 30 already reflects a dissolved criterion based on its conversion factor below.

Conversion Factor (CF) Table for Dissolved Metals

Chemical	Freshwater		Saltwater	
	Acute	Chronic	Acute	Chronic
Arsenic	1.000	1.000	1.000	1.000
Cadmium	N/A	1.101672-[(ln hardness)(0.041838)]	0.994	0.994
Chromium III	0.316	0.860	--	--
Chromium VI	0.982	0.962	0.993	0.993
Copper	N/A	N/A	0.83	0.83
Lead	1.46203-[(ln hardness)(0.145712)]	1.46203-[(ln hardness)(0.145712)]	0.951	0.951
Nickel	0.998	0.997	0.990	0.990
Selenium	0.996	0.922	0.998	0.998
Silver	0.85	0.85	0.85	--
Zinc	0.978	0.986	0.946	0.946

Endnote N: Deriving freshwater copper criteria

The freshwater copper criteria at any time are the Biotic Ligand Model (BLM) derived Instantaneous Water Quality Criteria (IWQC) output based on a concurrently measured set of model input parameter values. The Biotic Ligand Model uses multiple ambient water quality parameters to derive 1-hour acute exposure (CMC) and 96-hour chronic exposure (CCC) water quality criteria (IWQC) for copper based on the site specific water chemistry that determines the toxicity of copper to aquatic life. If measured data for one or more of the model input parameters used to derive the acute and chronic IWQC is not available, the procedures in section (1) or (2) of this endnote will be used as specified to substitute an estimate or a default value for the missing input parameter. BLM results (IWQC) based on sufficient measured input parameter data are more accurate and supersede results based on estimates or default values. The acceptable BLM software to calculate the IWQC include version 2.2.3, referenced in "Aquatic Life Ambient Freshwater Quality Criteria – Copper": EPA-822-R-07-001, February 2007, and version 2.2.4. The criteria are expressed as dissolved copper in micrograms per liter (to the nearest one-tenth).

(1) Input Parameter Substitution and Estimation Procedures to Derive BLM Criteria (IWQC)

If the measured value for any input parameter needed to derive an IWQC using the BLM is not available, DEQ will substitute an estimated input parameter value according to the procedures described in this section [Endnote N (1)]. If the data required to determine the estimated parameter value is not available, DEQ will use default values derived according to the procedures in Endnote N (2).

(a) Total recoverable concentration measurements will be substituted for dissolved concentration measurements that are not available. For alkalinity, calcium, chloride, magnesium, potassium, sodium and sulfate, total recoverable concentration measurements will be used as a direct substitute for dissolved concentration measurements. Total organic carbon (TOC) measurements will be multiplied by 0.83 to convert the TOC value to an equivalent dissolved organic carbon (DOC) value; except where sufficient TOC and DOC data are available for a site, DEQ will calculate and apply a site-specific translator in place of 0.83 to convert TOC values to DOC for use in the BLM.

(b) Alkalinity, calcium, chloride, magnesium, potassium, sodium and sulfate:
If data for any of these BLM input parameters are missing from a particular dataset, DEQ will estimate its value based on the relationship of the ion or alkalinity to specific conductance measurements for that data set using the regression analysis equations in Table 1. Specific conductance measurements must be concurrent with the other BLM input parameters dataset.

Table N-1.

Parameter	**Regression Equation**
Alkalinity	Alk. = $\exp^{(0.88\cdot[\ln(SpC)] - 0.41)}$
Calcium	Ca = $\exp^{(0.96\cdot[\ln(SpC)] - 2.29)}$
Chloride	Cl = $\exp^{(1.15\cdot[\ln(SpC)] - 3.82)}$
Magnesium	Mg = $\exp^{(0.91\cdot[\ln(SpC)] - 3.09)}$
Potassium	K = $\exp^{(0.84\cdot[\ln(SpC)] - 3.74)}$
Sodium	Na = $\exp^{(0.86\cdot[\ln(SpC)] - 2.22)}$
Sulfate	SO_4 = $\exp^{(1.45\cdot[\ln(SpC)] - 5.59}$

Where, "SpC" is a measurement of specific conductance in µmhos/cm, "ln" is the natural logarithm, and "exp" is a mathematical constant that is the base of the natural logarithm.

(c) pH
If concurrent pH data is missing from the sample dataset, DEQ will use a representative pH value determined by interpolating from data available for the site or proximate monitoring locations where conditions (such as type of water body, stream flow and geology) are similar to the site. DEQ will use the available data and methods to produce the best practicable estimate of pH for the site and time for which the IWQC is being derived.

(d) Temperature
If concurrent temperature data is missing from the sample dataset, DEQ will use a monthly mean temperature based on data available for the site or proximate monitoring locations where conditions (such as type of water body and stream flow) are similar to the site.

(e) Humic Acid
If sufficient high quality data on the percentage of humic acid as a proportion of DOC is available for a site, DEQ will use that value in the BLM in place of the default value of 10% used in the model.

(2) Default Action Values

If the measured value for DOC, alkalinity, calcium, chloride, magnesium, potassium, sodium or sulfate is not available to derive an IWQC using the BLM, and the parameter value cannot be estimated as specified in section (1) above, DEQ will use a conservative input value for the missing parameter as described in this section [Endnote N (2)] to derive a default action value using the Biotic Ligand Model. The default action value will be used for Clean Water Act purposes until measured or estimated input parameter data are available to derive accurate copper criteria (IWQC) based on site specific water chemistry.

(a) The default input parameter values for DOC, alkalinity calcium, chloride, magnesium, potassium, sodium and sulfate will be the percentile value from the distribution of the high quality data available for surface waters in the region as shown in Table N-2.

Table N-2. Percentile of data distribution to be used as default value by region

Region	**DOC** percentile	**Alkalinity and Ions** percentile
Willamette	20th	20th
Coastal	20th	20th
Cascades	20th	20th
Eastern	15th	15th
Columbia River	20th	20th

(b) The regional default values for each parameter and region will be updated periodically as additional high quality data becomes available and is added to DEQ's database.
(c) The regional default values for each parameter are available on DEQ's website.
(d) The regions listed in Table N-2 are comprised of the following EPA Level III ecoregions or waterbody:
(i) Willamette: the Willamette Valley
(ii) Coastal: Coast Range and Klamath Mountains

(iii) Cascades: Cascades
(iv) Eastern: Eastern Cascades Slopes and Foothills, Columbia Plateau, Blue Mountains, Northern Basin and Range and Snake River Plain
(v) Columbia River: Columbia River mainstem in Oregon

(3) General Policies

(a) The copper BLM derives instantaneous criteria results (IWQC) that vary at a site over time reflecting the effect of local water chemistry on copper toxicity to aquatic organisms. DEQ will apply the BLM criteria for Clean Water Act purposes to protect the water body during the most bioavailable or toxic conditions.

(b) For assessing waters of the state, DEQ will use approaches that give preference to the use of BLM criteria derived with site-specific measured input parameter data.

Table 30(a): Ammonia Acute Criteria Values (One-hour Average)—Salmonid Species Present
Temperature and pH-Dependent and expressed as Total Ammonia Nitrogen (mg/L TAN)

Criteria cannot be exceeded more than once every three years

$$Acute\ Criterion = MIN\left(\left(\frac{0.275}{1+10^{7.204-pH}}+\frac{39.0}{1+10^{pH-7.204}}\right),\left(0.7249\times\left(\frac{0.0114}{1+10^{7.204-pH}}+\frac{1.6181}{1+10^{pH-7.204}}\right)\times\left(23.12\times 10^{0.036\times(20-T)}\right)\right)\right)$$

	Temperature (°C)															
pH	**0-14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**
6.5	33	33	32	29	27	25	23	21	19	18	16	15	14	13	12	11	9.9
6.6	31	31	30	28	26	24	22	20	18	17	16	14	13	12	11	10	9.5
6.7	30	30	29	27	24	22	21	19	18	16	15	14	13	12	11	9.8	9.0
6.8	28	28	27	25	23	21	20	18	17	15	14	13	12	11	10	9.2	8.5
6.9	26	26	25	23	21	20	18	17	15	14	13	12	11	10	9.4	8.6	7.9
7.0	24	24	23	21	20	18	17	15	14	13	12	11	10	9.4	8.6	8.0	7.3
7.1	22	22	21	20	18	17	15	14	13	12	11	10	9.3	8.5	7.9	7.2	6.7
7.2	20	20	19	18	16	15	14	13	12	11	9.8	9.1	8.3	7.7	7.1	6.5	6.0
7.3	18	18	17	16	14	13	12	11	10	9.5	8.7	8.0	7.4	6.8	6.3	5.8	5.3
7.4	15	15	15	14	13	12	11	9.8	9.0	8.3	7.7	7.0	6.5	6.0	5.5	5.1	4.7
7.5	13	13	13	12	11	10	9.2	8.5	7.8	7.2	6.6	6.1	5.6	5.2	4.8	4.4	4.0
7.6	11	11	11	10	9.3	8.6	7.9	7.3	6.7	6.2	5.7	5.2	4.8	4.4	4.1	3.8	3.5
7.7	9.6	9.6	9.3	8.6	7.9	7.3	6.7	6.2	5.7	5.2	4.8	4.4	4.1	3.8	3.5	3.2	3.0
7.8	8.1	8.1	7.9	7.2	6.7	6.1	5.6	5.2	4.8	4.4	4.0	3.7	3.4	3.2	2.9	2.7	2.5
7.9	6.8	6.8	6.6	6.0	5.6	5.1	4.7	4.3	4.0	3.7	3.4	3.1	2.9	2.6	2.4	2.2	2.1
8.0	5.6	5.6	5.4	5.0	4.6	4.2	3.9	3.6	3.3	3.0	2.8	2.6	2.4	2.2	2.0	1.9	1.7
8.1	4.6	4.6	4.5	4.1	3.8	3.5	3.2	3.0	2.7	2.5	2.3	2.1	2.0	1.8	1.7	1.5	1.4
8.2	3.8	3.8	3.7	3.5	3.1	2.9	2.7	2.4	2.3	2.1	1.9	1.8	1.6	1.5	1.4	1.3	1.2
8.3	3.1	3.1	3.1	2.8	2.6	2.4	2.2	2.0	1.9	1.7	1.6	1.4	1.3	1.2	1.1	1.0	0.96
8.4	2.6	2.6	2.5	2.3	2.1	2.0	1.8	1.7	1.5	1.4	1.3	1.2	1.1	1.0	0.93	0.86	0.79
8.5	2.1	2.1	2.1	1.9	1.8	1.6	1.5	1.4	1.3	1.2	1.1	0.98	0.90	0.83	0.77	0.71	0.65
8.6	1.8	1.8	1.7	1.6	1.5	1.3	1.2	1.1	1.0	0.96	0.88	0.81	0.75	0.69	0.63	0.59	0.54
8.7	1.5	1.5	1.4	1.3	1.2	1.1	1.0	0.94	0.87	0.80	0.74	0.68	0.62	0.57	0.53	0.49	0.45
8.8	1.2	1.2	1.2	1.1	1.0	0.93	0.86	0.79	0.73	0.67	0.62	0.57	0.52	0.48	0.44	0.41	0.37
8.9	1.0	1.0	1.0	0.93	0.85	0.79	0.72	0.67	0.61	0.56	0.52	0.48	0.44	0.40	0.37	0.34	0.32
9.0	0.88	0.88	0.86	0.79	0.73	0.67	0.62	0.57	0.52	0.48	0.44	0.41	0.37	0.34	0.32	0.29	0.27

Table 30(b): Ammonia Acute Criteria Values (One-hour Average*)—Salmonid Species Absent
Temperature and pH-Dependent and expressed as Total Ammonia Nitrogen (mg/L TAN)

Criteria cannot be exceeded more than once every three years

$$Acute\ Criterion = 0.7249 \times \frac{0.0114}{1 + 10^{7.204-pH}} + \frac{1.6181}{1 + 10^{pH-7.204}} \times MIN\left(51.93, 23.12 \times 10^{0.036\times(20-T)}\right)$$

Temperature (°C)

pH	0-10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
6.5	51	48	44	41	37	34	32	29	27	25	23	21	19	18	16	15	14	13	12	11	9.9
6.6	49	46	42	39	36	33	30	28	26	24	22	20	18	17	16	14	13	12	11	10	9.5
6.7	46	44	40	37	34	31	29	27	24	22	21	19	18	16	15	14	13	12	11	9.8	9.0
6.8	44	41	38	35	32	30	27	25	23	21	20	18	17	15	14	13	12	11	10	9.2	8.5
6.9	41	38	35	32	30	28	25	23	21	20	18	17	15	14	13	12	11	10	9.4	8.6	7.9
7.0	38	35	33	30	28	25	23	21	20	18	17	15	14	13	12	11	10	9.4	8.6	7.9	7.3
7.1	34	32	30	27	25	23	21	20	18	17	15	14	13	12	11	10	9.3	8.5	7.9	7.2	6.7
7.2	31	29	27	25	23	21	19	18	16	15	14	13	12	11	9.8	9.1	8.3	7.7	7.1	6.5	6.0
7.3	27	26	24	22	20	18	17	16	14	13	12	11	10	9.5	8.7	8.0	7.4	6.8	6.3	5.8	5.3
7.4	24	22	21	19	18	16	15	14	13	12	11	9.8	9.0	8.3	7.7	7.0	6.5	6.0	5.5	5.1	4.7
7.5	21	19	18	17	15	14	13	12	11	10	9.2	8.5	7.8	7.2	6.6	6.1	5.6	5.2	4.8	4.4	4.0
7.6	18	17	15	14	13	12	11	10	9.3	8.6	7.9	7.3	6.7	6.2	5.7	5.2	4.8	4.4	4.1	3.8	3.5
7.7	15	14	13	12	11	10	9.3	8.6	7.9	7.3	6.7	6.2	5.7	5.2	4.8	4.4	4.1	3.8	3.5	3.2	2.9
7.8	13	12	11	10	9.3	8.5	7.9	7.2	6.7	6.1	5.6	5.2	4.8	4.4	4.0	3.7	3.4	3.2	2.9	2.7	2.5
7.9	11	9.9	9.1	8.4	7.7	7.1	6.6	3.0	5.6	5.1	4.7	4.3	4.0	3.7	3.4	3.1	2.9	2.6	2.4	2.2	2.1
8.0	8.8	8.2	7.6	7.0	6.4	5.9	5.4	5.0	4.6	4.2	3.9	3.6	3.3	3.0	2.8	2.6	2.4	2.2	2.0	1.9	1.7
8.1	7.2	6.8	6.3	5.8	5.3	4.9	4.5	4.1	3.8	3.5	3.2	3.0	2.7	2.5	2.3	2.1	2.0	1.8	1.7	1.5	1.4
8.2	6.0	5.6	5.2	4.8	4.4	4.0	3.7	3.4	3.1	2.9	2.7	2.4	2.3	2.1	1.9	1.8	1.6	1.5	1.4	1.3	1.2
8.3	4.9	4.6	4.3	3.9	3.6	3.3	3.1	2.8	2.6	2.4	2.2	2.0	1.9	1.7	1.6	1.4	1.3	1.2	1.1	1.0	0.96
8.4	4.1	3.8	3.5	3.2	3.0	2.7	2.5	2.3	2.1	2.0	1.8	1.7	1.5	1.4	1.3	1.2	1.1	1.0	0.93	0.86	0.79
8.5	3.3	3.1	2.9	2.7	2.4	2.3	2.1	1.9	1.8	1.6	1.5	1.4	1.3	1.2	1.1	0.98	0.90	0.83	0.77	0.71	0.65
8.6	2.8	2.6	2.4	2.2	2.0	1.9	1.7	1.6	1.5	1.3	1.2	1.1	1.0	0.96	0.88	0.81	0.75	0.69	0.63	0.58	0.54
8.7	2.3	2.2	2.0	1.8	1.7	1.6	1.4	1.3	1.2	1.1	1.0	0.94	0.87	0.80	0.74	0.68	0.62	0.57	0.53	0.49	0.45
8.8	1.9	1.8	1.7	1.5	1.4	1.3	1.2	1.1	1.0	0.93	0.86	0.79	0.73	0.67	0.62	0.57	0.52	0.48	0.44	0.41	0.37
8.9	1.6	1.5	1.4	1.3	1.2	1.1	1.0	0.93	0.85	0.79	0.72	0.67	0.61	0.56	0.52	0.48	0.44	0.40	0.37	0.34	0.32
9.0	1.4	1.3	1.2	1.1	1.0	0.93	0.86	0.79	0.73	0.67	0.62	0.57	0.52	0.48	0.44	0.41	0.37	0.34	0.32	0.29	0.27

Table 30(c): Ammonia Chronic Criteria Values (30-day Rolling Average*)

Temperature and pH-Dependent and expressed as Total Ammonia Nitrogen (mg/L TAN)

* The highest four-day average within the 30-day averaging period must not be more than 2.5 times the chronic value

Criteria cannot be exceeded more than once every three years

$$Chronic\ Criterion = 0.8876 \times \left(\frac{0.0278}{1+10^{7.688-pH}} + \frac{1.1994}{1+10^{pH-7.688}}\right) \times \left(2.126 \times 10^{0.028\times(20-MAX(T,7))}\right)$$

	Temperature (°C)																							
pH	**0-7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**
6.5	4.9	4.6	4.3	4.1	3.8	3.6	3.3	3.1	2.9	2.8	2.6	2.4	2.3	2.1	2.0	1.9	1.8	1.6	1.5	1.5	1.4	1.3	1.2	1.1
6.6	4.8	4.5	4.3	4.0	3.8	3.5	3.3	3.1	2.9	2.7	2.5	2.4	2.2	2.1	2.0	1.8	1.7	1.6	1.5	1.4	1.3	1.3	1.2	1.1
6.7	4.8	4.5	4.2	3.9	3.7	3.5	3.2	3.0	2.8	2.7	2.5	2.3	2.2	2.1	1.9	1.8	1.7	1.6	1.5	1.4	1.3	1.2	1.2	1.1
6.8	4.6	4.4	4.1	3.8	3.6	3.4	3.2	3.0	2.8	2.6	2.4	2.3	2.1	2.0	1.9	1.8	1.7	1.6	1.5	1.4	1.3	1.2	1.1	1.1
6.9	4.5	4.2	4.0	3.7	3.5	3.3	3.1	2.9	2.7	2.5	2.4	2.2	2.1	2.0	1.8	1.7	1.6	1.5	1.4	1.3	1.2	1.2	1.1	1.0
7.0	4.4	4.1	3.8	3.6	3.4	3.2	3.0	2.8	2.6	2.4	2.3	2.2	2.0	1.9	1.8	1.7	1.6	1.5	1.4	1.3	1.2	1.1	1.1	0.99
7.1	4.2	3.9	3.7	3.5	3.2	3.0	2.8	2.7	2.5	2.3	2.2	2.1	1.9	1.8	1.7	1.6	1.5	1.4	1.3	1.2	1.2	1.1	1.0	0.95
7.2	4.0	3.7	3.5	3.3	3.1	2.9	2.7	2.5	2.4	2.2	2.1	2.0	1.8	1.7	1.6	1.5	1.4	1.3	1.3	1.2	1.1	1.0	0.96	0.90
7.3	3.8	3.5	3.3	3.1	2.9	2.7	2.6	2.4	2.2	2.1	2.0	1.8	1.7	1.6	1.5	1.4	1.3	1.3	1.2	1.1	1.0	0.97	0.91	0.85
7.4	3.5	3.3	3.1	2.9	2.7	2.5	2.4	2.2	2.1	2.0	1.8	1.7	1.6	1.5	1.4	1.3	1.3	1.2	1.1	1.0	0.96	0.90	0.85	0.79
7.5	3.2	3.0	2.8	2.7	2.5	2.3	2.2	2.1	1.9	1.8	1.7	1.6	1.5	1.4	1.3	1.2	1.2	1.1	1.0	0.95	0.89	0.83	0.78	0.73
7.6	2.9	2.8	2.6	2.4	2.3	2.1	2.0	1.9	1.8	1.6	1.5	1.4	1.4	1.3	1.2	1.1	1.1	0.98	0.92	0.86	0.81	0.76	0.71	0.67
7.7	2.6	2.4	2.3	2.2	2.0	1.9	1.8	1.7	1.6	1.5	1.4	1.3	1.2	1.1	1.1	1.0	0.94	0.88	0.83	0.78	0.73	0.68	0.64	0.60
7.8	2.3	2.2	2.1	1.9	1.8	1.7	1.6	1.5	1.4	1.3	1.2	1.2	1.1	1.0	0.95	0.89	0.84	0.79	0.74	0.69	0.65	0.61	0.57	0.53
7.9	2.1	1.9	1.8	1.7	1.6	1.5	1.4	1.3	1.2	1.2	1.1	1.0	0.95	0.89	0.84	0.79	0.74	0.69	0.65	0.61	0.57	0.53	0.50	0.47
8.0	1.8	1.7	1.6	1.5	1.4	1.3	1.2	1.1	1.1	1.0	0.94	0.88	0.83	0.78	0.73	0.68	0.64	0.60	0.56	0.53	0.50	0.44	0.44	0.41
8.1	1.5	1.5	1.4	1.3	1.2	1.1	1.1	0.99	0.92	0.87	0.81	0.76	0.71	0.67	0.63	0.59	0.55	0.52	0.49	0.46	0.43	0.40	0.38	0.35
8.2	1.3	1.2	1.2	1.1	1.0	0.96	0.90	0.84	0.79	0.74	0.70	0.65	0.61	0.57	0.54	0.50	0.47	0.44	0.42	0.39	0.37	0.34	0.32	0.30
8.3	1.1	1.1	0.99	0.93	0.87	0.82	0.76	0.72	0.67	0.63	0.59	0.55	0.52	0.49	0.46	0.43	0.40	0.38	0.35	0.33	0.31	0.29	0.27	0.26
8.4	0.95	0.89	0.84	0.79	0.74	0.69	0.65	0.61	0.57	0.53	0.50	0.47	0.44	0.41	0.39	0.36	0.34	0.32	0.30	0.28	0.26	0.25	0.23	0.22
8.5	0.80	0.75	0.71	0.67	0.62	0.58	0.55	0.51	0.48	0.45	0.42	0.40	0.37	0.35	0.33	0.31	0.29	0.27	0.25	0.24	0.22	0.21	0.20	0.18
8.6	0.68	0.64	0.60	0.56	0.53	0.49	0.46	0.43	0.41	0.38	0.36	0.33	0.31	0.29	0.28	0.26	0.24	0.23	0.21	0.20	0.19	0.18	0.16	0.15
8.7	0.57	0.54	0.51	0.47	0.44	0.42	0.39	0.37	0.34	0.32	0.30	0.28	0.27	0.25	0.23	0.22	0.21	0.19	0.18	0.17	0.16	0.15	0.14	0.13
8.8	0.49	0.46	0.43	0.40	0.38	0.35	0.33	0.31	0.29	0.27	0.26	0.24	0.23	0.21	0.20	0.19	0.17	0.16	0.15	0.14	0.13	0.13	0.12	0.11
8.9	0.42	0.39	0.37	0.34	0.32	0.30	0.28	0.27	0.25	0.23	0.22	0.21	0.19	0.18	0.17	0.16	0.15	0.14	0.13	0.12	0.12	0.11	0.10	0.09
9.0	0.36	0.34	0.32	0.30	0.28	0.26	0.24	0.23	0.21	0.20	0.19	0.18	0.17	0.16	0.15	0.14	0.13	0.12	0.11	0.11	0.10	0.09	0.09	0.08

State of Oregon Department of Environmental Quality

TABLE 31: Aquatic Life Water Quality Guidance Values for Toxic Pollutants

Effective April 18, 2014

Water Quality Guidance Values Summary [A]

The concentration for each compound listed in Table 31 is a guidance value that DEQ may use in application of Oregon's Toxic Substances Narrative (340-041-0033(2)) to waters of the state in order to protect aquatic life. All values are expressed as micrograms per liter (µg/L) except where noted. Compounds are listed in alphabetical order with the corresponding EPA number (from National Recommended Water Quality Criteria: 2002, EPA-822-R-02-047), corresponding Chemical Abstract Service (CAS) number, aquatic life freshwater acute and chronic guidance values, and aquatic life saltwater acute and chronic guidance values.

Oregon Department of Environmental Quality
Table 31
Aquatic Life Water Quality Guidance Values for Toxic Pollutants
340-041-8033

EPA No.	Pollutant	CAS Number	Freshwater		Saltwater	
			Acute	Chronic	Acute	Chronic
56	Acenaphthene	83329	1,700	520	970	710
17	Acrolein	107028	68	21	55	
18	Acrylonitrile	107131	7,550	2,600		
1	Antimony	7440360	9,000	1,600		
19	Benzene	71432	5,300		5,100	700
59	Benzidine	92875	2,500			
3	Beryllium	7440417	130	5.3		
19 B	BHC (Hexachlorocyclohexane-Technical)	319868	100		0.34	
21	Carbon Tetrachloride	56235	35,200		50,000	
	Chlorinated Benzenes		250	50	160	129

Oregon Department of Environmental Quality
Table 31
Aquatic Life Water Quality Guidance Values for Toxic Pollutants
340-041-8033

EPA No.	Pollutant	CAS Number	Freshwater		Saltwater	
			Acute	Chronic	Acute	Chronic
	Chlorinated naphthalenes		1,600		7.5	
	Chloroalkyl Ethers		238,000			
26	Chloroform	67663	28,900	1,240		
45	Chlorophenol 2-	95578	4,380	2,000		
	Chlorophenol 4-	106489			29,700	
52	Methyl-4-chlorophenol 3-	59507	30			
5a	Chromium (III)	16065831			10,300	
109	DDE 4,4'-	72559	1,050		14	
110	DDD 4,4'-	72548	0.06		3.6	
	Diazinon	333415	0.08	0.05		
	Dichlorobenzenes		1,120	763	1,970	
29	Dichloroethane 1,2-	107062	118,000	20,000	113,000	
	Dichloroethylenes		11,600		224,000	
46	Dichlorophenol 2,4-	120832	2,020	365		
31	Dichloropropane 1,2-	78875	23,000	5,700	10,300	3,040
32	Dichloropropene 1,3-	542756	6,060	244	790	
47	Dimethylphenol 2,4-	105679	2,120			
	Dinitrotoluene		330	230	590	370
16	Dioxin (2,3,7,8-TCDD)	1746016	0.01	38 pg/L		
85	Diphenylhydrazine 1,2-	122667	270			
33	Ethylbenzene	100414	32,000		430	
86	Fluoranthene	206440	3,980		40	16

Oregon Department of Environmental Quality
Table 31
Aquatic Life Water Quality Guidance Values for Toxic Pollutants
340-041-8033

EPA No.	Pollutant	CAS Number	Freshwater		Saltwater	
			Acute	Chronic	Acute	Chronic
	Haloethers		360	122		
	Halomethanes		11,000		12,000	6,400
89	Hexachlorobutadiene	87683	90	9.3	32	
90	Hexachlorocyclopentadiene	77474	7	5.2	7	
91	Hexachloroethane	67721	980	540	940	
93	Isophorone	78591	117,000		12,900	
94	Naphthalene	91203	2,300	620	2,350	
95	Nitrobenzene	98953	27,000		6,680	
	Nitrophenols		230	150	4,850	
26 B	Nitrosamines	35576911	5,850		3,300,000	
	Pentachlorinated ethanes		7,240	1,100	390	281
54	Phenol	108952	10,200	2,560	5,800	
	Phthalate esters		940	3	2,944	3.4
	Polynuclear Aromatic Hydrocarbons				300	
	Tetrachlorinated Ethanes		9,320			
37	Tetrachloroethane 1,1,2,2-	79345		2,400	9,020	
	Tetrachloroethanes		9,320			
38	Tetrachloroethylene	127184	5,280	840	10,200	450
	Tetrachlorophenol 2,3,5,6					440
12	Thallium	7440280	1,400	40	2,130	
39	Toluene	108883	17,500		6,300	5,000
	Trichlorinated ethanes		18,000			
41	Trichloroethane 1,1,1-	71556			31,200	
42	Trichloroethane 1,1,2-	79005		9,400		

Oregon Department of Environmental Quality Table 31 **Aquatic Life Water Quality Guidance Values for Toxic Pollutants** **340-041-8033**						
EPA No.	**Pollutant**	**CAS Number**	**Freshwater**		**Saltwater**	
			Acute	**Chronic**	**Acute**	**Chronic**
43	Trichloroethylene	79016	45,000	21,900	2,000	
55	Trichlorophenol 2,4,6-	88062		970		

The following chemicals/compounds/classes are of concern due to the potential for toxic effects to aquatic organisms; however, no guidance values are designated. If these compounds are identified in the waste stream, then a review of the scientific literature may be appropriate for deriving guidance values.

- ❑ Polybrominated diphenyl ethers (PBDE)
- ❑ Polybrominated biphenyls (PBB)
- ❑ Pharmaceuticals
- ❑ Personal care products
- ❑ Alkyl Phenols
- ❑ Other chemicals with Toxic effects

Footnotes:

A Values in Table 31 are applicable to all basins.

B This number was assigned to the list of non-priority pollutants in National Recommended Water Quality Criteria: 2002 (EPA-822-R-02-047).

TABLE 40: Human Health Water Quality Criteria for Toxic Pollutants

Effective April 18, 2014

Human Health Criteria Summary

The concentration for each pollutant listed in Table 40 was derived to protect Oregonians from potential adverse health impacts associated with long-term exposure to toxic substances associated with consumption of fish, shellfish, and water. The "organism only" criteria are established to protect fish and shellfish consumption and apply to waters of the state designated for fishing. The "water + organism" criteria are established to protect the consumption of drinking water, fish, and shellfish, and apply where both fishing and domestic water supply (public and private) are designated uses. All criteria are expressed as micrograms per liter (µg/L), unless otherwise noted. Pollutants are listed in alphabetical order. Additional information includes the Chemical Abstract Service (CAS) number, whether the criterion is based on carcinogenic effects (can cause cancer in humans), and whether there is an aquatic life criterion for the pollutant (i.e. "y"= yes, "n" = no). All the human health criteria were calculated using a fish consumption rate of 175 grams per day unless otherwise noted. A fish consumption rate of 175 grams per day is approximately equal to 23 8-ounce fish meals per month. For pollutants categorized as carcinogens, values represent a cancer risk of one additional case of cancer in one million people (i.e. 10^{-6}), unless otherwise noted. All metals criteria are for total metal concentration, unless otherwise noted. Italicized pollutants represent non-priority pollutants. The human health criteria revisions established by OAR 340-041-0033 and shown in Table 40 do not become applicable for purposes of ORS chapter 468B or the federal Clean Water Act until approved by EPA pursuant to 40 CFR 131.21 (4/27/2000).

Oregon Department of Environmental Quality

Table 40

Human Health Water Quality Criteria for Toxic Pollutants

340-041-8033

No.	Pollutant	CAS Number	Carcinogen	Aquatic Life Criterion	*Human Health Criteria for the Consumption of:* Water + Organism (µg/L)	Organism Only (µg/L)
1	Acenaphthene	83329	n	n	95	99
2	Acrolein	107028	n	n	0.88	0.93
3	Acrylonitrile	107131	y	n	0.018	0.025
4	Aldrin	309002	y	y	0.0000050	0.0000050
5	Anthracene	120127	n	n	2900	4000
6	Antimony	7440360	n	n	5.1	64
7	Arsenic (inorganic) [A]	7440382	y	y	2.1	2.1(freshwater) 1.0 (saltwater)
	[A] The arsenic criteria are expressed as total inorganic arsenic. The "organism only" freshwater criterion is based on a risk level of approximately 1 x 10^{-5}, and the "water + organism" criterion is based on a risk level of 1 x 10^{-4}.					
8	Asbestos [B]	1332214	y	n	7,000,000 fibers/L	--
	[B] The human health risks from asbestos are primarily from drinking water, therefore no "organism only" criterion was developed. The "water + organism" criterion is based on the Maximum Contaminant Level (MCL) established under the Safe Drinking Water Act.					
9	*Barium* [C]	7440393	n	n	1000	--
	[C] The human health criterion for barium is the same as originally published in the 1976 EPA Red Book which predates the 1980 methodology and did not utilize the fish ingestion BCF approach. This same criterion value was also published in the 1986 EPA Gold Book. Human health risks are primarily from drinking water, therefore no "organism only" criterion was developed. The "water + organism" criterion is based on the Maximum Contaminant Level (MCL) established under the Safe Drinking Water Act.					
10	Benzene	71432	y	n	0.44	1.4
11	Benzidine	92875	y	n	0.000018	0.000020
12	Benz(a)anthracene	56553	y	n	0.0013	0.0018
13	Benzo(a)pyrene	50328	y	n	0.0013	0.0018
14	Benzo(b)fluoranthene 3,4	205992	y	n	0.0013	0.0018
15	Benzo(k)fluoranthene	207089	y	n	0.0013	0.0018

Oregon Department of Environmental Quality

Table 40

Human Health Water Quality Criteria for Toxic Pollutants

340-041-8033

No.	Pollutant	CAS Number	Carcinogen	Aquatic Life Criterion	*Human Health Criteria for the Consumption of:* Water + Organism (µg/L)	Organism Only (µg/L)
16	BHC Alpha	319846	y	n	0.00045	0.00049
17	BHC Beta	319857	y	n	0.0016	0.0017
18	BHC Gamma (Lindane)	58899	n	y	0.17	0.18
19	Bromoform	75252	y	n	3.3	14
20	Butylbenzyl Phthalate	85687	n	n	190	190
21	Carbon Tetrachloride	56235	y	n	0.10	0.16
22	Chlordane	57749	y	y	0.000081	0.000081
23	Chlorobenzene	108907	n	n	74	160
24	Chlorodibromomethane	124481	y	n	0.31	1.3
25	Chloroethyl Ether bis 2	111444	y	n	0.020	0.053
26	Chloroform	67663	n	n	260	1100
27	Chloroisopropyl Ether bis 2	108601	n	n	1200	6500
28	*Chloromethyl ether, bis*	542881	y	n	0.000024	0.000029
29	Chloronaphthalene 2	91587	n	n	150	160
30	Chlorophenol 2	95578	n	n	14	15
31	*Chlorophenoxy Herbicide (2,4,5,-TP)* [D]	93721	n	n	10	--
	[D] *The Chlorophenoxy Herbicide (2,4,5,-TP) criterion is the same as originally published in the 1976 EPA Red Book which predates the 1980 methodology and did not utilize the fish ingestion BCF approach. This same criterion value was also published in the 1986 EPA Gold Book. Human health risks are primarily from drinking water, therefore no "organism only" criterion was developed. The "water + organism" criterion is based on the Maximum Contaminant Level (MCL) established under the Safe Drinking Water Act.*					
32	*Chlorophenoxy Herbicide (2,4-D)* [E]	94757	n	n	100	--

Oregon Department of Environmental Quality

Table 40

Human Health Water Quality Criteria for Toxic Pollutants

340-041-8033

No.	Pollutant	CAS Number	Carcinogen	Aquatic Life Criterion	*Human Health Criteria for the Consumption of:* Water + Organism (µg/L)	Organism Only (µg/L)
	[E] The Chlorophenoxy Herbicide (2,4-D) criterion is the same as originally published in the 1976 EPA Red Book which predates the 1980 methodology and did not utilize the fish ingestion BCF approach. This same criterion value was also published in the 1986 EPA Gold Book. Human health risks are primarily from drinking water, therefore no "organism only" criterion was developed. The "water + organism" criterion is based on the Maximum Contaminant Level (MCL) established under the Safe Drinking Water Act.					
33	Chrysene	218019	y	n	0.0013	0.0018
34	Copper [F]	7440508	n	y	1300	--
	[F] Human health risks from copper are primarily from drinking water, therefore no "organism only" criterion was developed. The "water + organism" criterion is based on the Maximum Contaminant Level (MCL) established under the Safe Drinking Water Act.					
35	Cyanide [G]	57125	n	y	130	130
	[G] The cyanide criterion is expressed as total cyanide (CN)/L.					
36	DDD 4,4'	72548	y	n	0.000031	0.000031
37	DDE 4,4'	72559	y	n	0.000022	0.000022
38	DDT 4,4'	50293	y	y	0.000022	0.000022
39	Dibenz(a,h)anthracene	53703	y	n	0.0013	0.0018
40	Dichlorobenzene(m) 1,3	541731	n	n	80	96
41	Dichlorobenzene(o) 1,2	95501	n	n	110	130
42	Dichlorobenzene(p) 1,4	106467	n	n	16	19
43	Dichlorobenzidine 3,3'	91941	y	n	0.0027	0.0028
44	Dichlorobromomethane	75274	y	n	0.42	1.7
45	Dichloroethane 1,2	107062	y	n	0.35	3.7
46	Dichloroethylene 1,1	75354	n	n	230	710
47	Dichloroethylene trans 1,2	156605	n	n	120	1000

Oregon Department of Environmental Quality

Table 40

Human Health Water Quality Criteria for Toxic Pollutants

340-041-8033

No.	Pollutant	CAS Number	Carcinogen	Aquatic Life Criterion	*Human Health Criteria for the Consumption of:* Water + Organism (µg/L)	Organism Only (µg/L)
48	Dichlorophenol 2,4	120832	n	n	23	29
49	Dichloropropane 1,2	78875	y	n	0.38	1.5
50	Dichloropropene 1,3	542756	y	n	0.30	2.1
51	Dieldrin	60571	y	y	0.0000053	0.0000054
52	Diethyl Phthalate	84662	n	n	3800	4400
53	Dimethyl Phthalate	131113	n	n	84000	110000
54	Dimethylphenol 2,4	105679	n	n	76	85
55	Di-n-butyl Phthalate	84742	n	n	400	450
56	Dinitrophenol 2,4	51285	n	n	62	530
57	*Dinitrophenols*	25550587	n	n	62	530
58	Dinitrotoluene 2,4	121142	y	n	0.084	0.34
59	Dioxin (2,3,7,8-TCDD)	1746016	y	n	0.00000000051	0.00000000051
60	Diphenylhydrazine 1,2	122667	y	n	0.014	0.020
61	Endosulfan Alpha	959988	n	y	8.5	8.9
62	Endosulfan Beta	33213659	n	y	8.5	8.9
63	Endosulfan Sulfate	1031078	n	n	8.5	8.9
64	Endrin	72208	n	y	0.024	0.024
65	Endrin Aldehyde	7421934	n	n	0.030	0.030
66	Ethylbenzene	100414	n	n	160	210
67	Ethylhexyl Phthalate bis 2	117817	y	n	0.20	0.22
68	Fluoranthene	206440	n	n	14	14

Oregon Department of Environmental Quality

Table 40

Human Health Water Quality Criteria for Toxic Pollutants

340-041-8033

No.	Pollutant	CAS Number	Carcinogen	Aquatic Life Criterion	*Human Health Criteria for the Consumption of:* Water + Organism (µg/L)	Organism Only (µg/L)
69	Fluorene	86737	n	n	390	530
70	Heptachlor	76448	y	y	0.0000079	0.0000079
71	Heptachlor Epoxide	1024573	y	y	0.0000039	0.0000039
72	Hexachlorobenzene	118741	y	n	0.000029	0.000029
73	Hexachlorobutadiene	87683	y	n	0.36	1.8
74	*Hexachlorocyclo-hexane-Technical*	608731	y	n	0.0014	0.0015
75	Hexachlorocyclopentadiene	77474	n	n	30	110
76	Hexachloroethane	67721	y	n	0.29	0.33
77	Indeno(1,2,3-cd)pyrene	193395	y	n	0.0013	0.0018
78	Isophorone	78591	y	n	27	96
79	*Manganese* [H]	7439965	n	n	--	100
	[H] *The "fish consumption only" criterion for manganese applies only to salt water and is for total manganese. This EPA recommended criterion predates the 1980 human health methodology and does not utilize the fish ingestion BCF calculation method or a fish consumption rate.*					
80	*Methoxychlor* [I]	72435	n	y	100	--
	[I] *The human health criterion for methoxychlor is the same as originally published in the 1976 EPA Red Book which predates the 1980 methodology and did not utilize the fish ingestion BCF approach. This same criterion value was also published in the1986 EPA Gold Book. Human health risks are primarily from drinking water, therefore no "organism only" criterion was developed. The "water + organism" criterion is based on the Maximum Contaminant Level (MCL) established under the Safe Drinking Water Act.*					
81	Methyl Bromide	74839	n	n	37	150
82	Methyl-4,6-dinitrophenol 2	534521	n	n	9.2	28
83	Methylene Chloride	75092	y	n	4.3	59
84	Methylmercury (mg/kg) [J]	22967926	n	n	--	0.040 mg/kg

Oregon Department of Environmental Quality

Table 40

Human Health Water Quality Criteria for Toxic Pollutants

340-041-8033

No.	Pollutant	CAS Number	Carcinogen	Aquatic Life Criterion	Human Health Criteria for the Consumption of: Water + Organism (µg/L)	Human Health Criteria for the Consumption of: Organism Only (µg/L)
	[J] This value is expressed as the fish tissue concentration of methylmercury. Contaminated fish and shellfish is the primary human route of exposure to methylmercury.					
85	Nickel	7440020	n	y	140	170
86	*Nitrates* [K]	14797558	n	n	10000	--
	[K] The human health criterion for nitrates is the same as originally published in the 1976 EPA Red Book which predates the 1980 methodology and did not utilize the fish ingestion BCF approach. This same criterion value was also published in the 1986 EPA Gold Book. Human health risks are primarily from drinking water, therefore no "organism only" criterion was developed. The "water + organism" criterion is based on the Maximum Contaminant Level (MCL) established under the Safe Drinking Water Act.					
87	Nitrobenzene	98953	n	n	14	69
88	*Nitrosamines*	35576911	y	n	0.00079	0.046
89	*Nitrosodibutylamine, N*	924163	y	n	0.0050	0.022
90	*Nitrosodiethylamine, N*	55185	y	n	0.00079	0.046
91	Nitrosodimethylamine, N	62759	y	n	0.00068	0.30
92	Nitrosodi-n-propylamine, N	621647	y	n	0.0046	0.051
93	Nitrosodiphenylamine, N	86306	y	n	0.55	0.60
94	*Nitrosopyrrolidine, N*	930552	y	n	0.016	3.4
95	*Pentachlorobenzene*	608935	n	n	0.15	0.15
96	Pentachlorophenol	87865	y	y	0.15	0.30
97	Phenol	108952	n	n	9400	86000
98	Polychlorinated Biphenyls (PCBs) [L]	NA	y	y	0.0000064	0.0000064
	[L] This criterion applies to total PCBs (e.g. determined as Aroclors or congeners).					
99	Pyrene	129000	n	n	290	400

Oregon Department of Environmental Quality

Table 40

Human Health Water Quality Criteria for Toxic Pollutants

340-041-8033

No.	Pollutant	CAS Number	Carcinogen	Aquatic Life Criterion	*Human Health Criteria for the Consumption of:*	
					Water + Organism (µg/L)	Organism Only (µg/L)
100	Selenium	7782492	n	y	120	420
101	*Tetrachlorobenzene, 1,2,4,5-*	95943	n	n	0.11	0.11
102	Tetrachloroethane 1,1,2,2	79345	y	n	0.12	0.40
103	Tetrachloroethylene	127184	y	n	0.24	0.33
104	Thallium	7440280	n	n	0.043	0.047
105	Toluene	108883	n	n	720	1500
106	Toxaphene	8001352	y	y	0.000028	0.000028
107	Trichlorobenzene 1,2,4	120821	n	n	6.4	7.0
108	Trichloroethane 1,1,2	79005	y	n	0.44	1.6
109	Trichloroethylene	79016	y	n	1.4	3.0
110	Trichlorophenol 2,4,6	88062	y	n	0.23	0.24
111	*Trichlorophenol, 2, 4, 5-*	95954	n	n	330	360
112	Vinyl Chloride	75014	y	n	0.023	0.24
113	Zinc	7440666	n	y	2100	2600

DEPARTMENT OF ENVIRONMENTAL QUALITY

DIVISION 41

WATER QUALITY STANDARDS: BENEFICIAL USES, POLICIES, AND CRITERIA FOR OREGON

340-041-0033

Toxic Substances

(1) Toxic Substances Narrative. Toxic substances may not be introduced above natural background levels in waters of the state in amounts, concentrations, or combinations that may be harmful, may chemically change to harmful forms in the environment, or may accumulate in sediments or bioaccumulate in aquatic life or wildlife to levels that adversely affect public health, safety, or welfare or aquatic life, wildlife or other designated beneficial uses.

(2) Aquatic Life Numeric Criteria. Levels of toxic substances in waters of the state may not exceed the applicable aquatic life criteria as defined in Table 30 under OAR 340-041-8033.

(3) Human Health Numeric Criteria. The criteria for waters of the state listed in Table 40 under OAR 340-041-8033 are established to protect Oregonians from potential adverse health effects associated with long-term exposure to toxic substances associated with consumption of fish, shellfish and water.

(4) To establish permit or other regulatory limits for toxic substances without criteria in Table 30 under OAR 340-041-8033 or Table 40 under 340-041-8033, DEQ may use the guidance values in Table 31 under 340-041-8033, public health advisories, and published scientific literature. DEQ may also require or conduct bio-assessment studies to monitor the toxicity to aquatic life of complex effluents, other suspected discharges or chemical substances without numeric criteria.

(5) Establishing Site-Specific Background Pollutant Criteria: This provision is a performance-based water quality standard that results in site-specific human health water quality criteria under the conditions and procedures specified in this rule section. It addresses existing permitted discharges of a pollutant removed from the same body of water. For waterbodies where a discharge does not increase the pollutant’s mass and does not increase the pollutant concentration by more than 3 percent, and where the water body meets a pollutant concentration associated with a risk level of 1 x 10-4, DEQ concludes that the pollutant concentration continues to protect human health.

(a) Definitions: As used in this section:

(A) “Background pollutant concentration” means the ambient water body concentration immediately upstream of the discharge, regardless of whether those pollutants are natural or result from upstream human activity.

(B) An "intake pollutant" is the amount of a pollutant present in waters of the state (including groundwater) as provided in subsection (C), below, at the time it is withdrawn from such waters by the discharger or other facility supplying the discharger with intake water.

(C) "Same body of water": An intake pollutant is considered to be from the "same body of water" as the discharge if DEQ finds that the intake pollutant would have reached the vicinity of the outfall point in the receiving water within a reasonable period had the permittee not removed it. To make this finding, DEQ requires information showing that:

(i) The background concentration of the pollutant in the receiving water (excluding any amount of the pollutant in the facility's discharge) is similar to that in the intake water; and,

(ii) There is a direct hydrological connection between the intake and discharge points.

(I) DEQ may also consider other site-specific factors relevant to the transport and fate of the pollutant to make the finding in a particular case that a pollutant would or would not have reached the vicinity of the outfall point in the receiving water within a reasonable period had the permittee not removed it.

(II) An intake pollutant from groundwater may be considered to be from the "same body of water" if DEQ determines that the pollutant would have reached the vicinity of the outfall point in the receiving water within a reasonable period had the permittee not removed it. A pollutant is not from the same body of water if the groundwater contains the pollutant partially or entirely due to past or present human activity, such as industrial, commercial, or municipal operations, disposal actions, or treatment processes.

(iii) Water quality characteristics (e.g., temperature, pH, hardness) are similar in the intake and receiving waters.

(b) Applicability

(A) DEQ may establish site-specific criteria under this rule section only for carcinogenic pollutants.

(B) Site-specific criteria established under this rule section apply in the vicinity of the discharge for purposes of establishing permit limits for the specified permittee.

(C) The underlying waterbody criteria continue to apply for all other Clean Water Act programs.

(D) The site-specific background pollutant criterion will be effective when DEQ issues the permit for the specified permittee.

(E) DEQ will reevaluate any site-specific criteria developed under this procedure upon permit renewal.

(c) DEQ may establish a site-specific background pollutant criterion when all of the following conditions are met:

(A) The discharger has a currently effective NPDES permit;

(B) The mass of the pollutant discharged to the receiving waterbody does not exceed the mass of the intake pollutant from the same body of water, as defined in section (5)(a)(C) above, and therefore does not increase the total mass load of the pollutant in the receiving water body;

(C) DEQ has not assigned the discharger a TMDL wasteload allocation for the pollutant in question;

(D) The permittee uses any feasible pollutant reduction measures available and known to minimize the pollutant concentration in their discharge;

(E) The pollutant discharge has not been chemically or physically altered in a manner that causes adverse water quality impacts that would not occur if the intake pollutants were left in-stream; and,

(F) The timing and location of the pollutant discharge would not cause adverse water quality impacts that would not occur if the intake pollutant were left in-stream.

(d) The site-specific background pollutant criterion must be the most conservative of the following four values. Section (5)(e) of this rule describes the procedures for deriving these values.

(A) The projected in-stream pollutant concentration resulting from the current discharge concentration and any feasible pollutant reduction measures under (c)(D) above, after mixing with the receiving stream.

(B) The projected in-stream pollutant concentration resulting from the portion of the current discharge concentration associated with the intake pollutant mass after mixing with the receiving stream. This analysis ensures that there will be no increase in the mass of the intake pollutant in the receiving water body as required by condition (c)(B) above.

(C) The projected in-stream pollutant concentration associated with a 3 percent increase above the background pollutant concentration as calculated:

(i) For the main stem Willamette and Columbia Rivers, using 25 percent of the harmonic mean flow of the waterbody.

(ii) For all other waters, using 100 percent of the harmonic mean flow or similar critical flow value of the waterbody.

(D) A criterion concentration value representing a human health risk level of 1×10^{-4}. DEQ calculates this value using EPA's human health criteria derivation equation for carcinogens (EPA

2000), a risk level of 1 x 10^{-4}, and the same values for the remaining calculation variables that were used to derive the underlying human health criterion.

(e) Procedure to derive a site-specific human health water quality criterion to address a background pollutant:

(A) DEQ will develop a flow-weighted characterization of the relevant flows and pollutant concentrations of the receiving waterbody, effluent and all facility intake pollutant sources to determine the fate and transport of the pollutant mass.

(i) The pollutant mass in the effluent discharged to a receiving waterbody may not exceed the mass of the intake pollutant from the same body of water.

(ii) Where a facility discharges intake pollutants from multiple sources that originate from the receiving waterbody and from other waterbodies, DEQ will calculate the flow-weighted amount of each source of the pollutant in the characterization.

(iii) Where a municipal water supply system provides intake water for a facility and the supplier provides treatment of the raw water that removes an intake water pollutant, the concentration and mass of the intake water pollutant must be determined at the point where the water enters the water supplier's distribution system.

(B) Using the flow weighted characterization developed in section (5)(e)(A), DEQ will calculate the in-stream pollutant concentration following mixing of the discharge into the receiving water. DEQ will use the resultant concentration to determine the conditions in section (5)(d)(A) and (B).

(C) Using the flow-weighted characterization, DEQ will calculate the in-stream pollutant concentration based on an increase of 3 percent above background pollutant concentration. DEQ will use the resultant concentration to determine the condition in Section (5)(d)(C).

(i) For the main stem Willamette and Columbia Rivers, DEQ will use 25 percent of the harmonic mean flow of the waterbody.

(ii) For all other waters, DEQ will use 100 percent of the harmonic mean flow or similar critical flow value of the waterbody.

(D) DEQ will select the most conservative of the following values as the site-specific water quality criterion.

(i) The projected in-stream pollutant concentration described in section (5)(e)(B);

(ii) The in-stream pollutant concentration based on an increase of 3 percent above background described in section (5)(e)(C); or

(iii) A water quality criterion based on a risk level of 1 x 10^{-4}.

(f) Calculation of water quality based effluent limits based on a site-specific background pollutant criterion:

(A) For discharges to receiving waters with a site-specific background pollutant criterion, DEQ will use the site-specific criterion in the calculation of a numeric water quality based effluent limit.

(B) DEQ will compare the calculated water quality based effluent limits to any applicable aquatic toxicity or technology based effluent limits and select the most conservative for inclusion in the permit conditions.

(g) In addition to the water quality based effluent limits described in section (5)(f), DEQ will calculate a mass-based limit where necessary to ensure that the condition described in section (5)(c)(B) is met. Where mass-based limits are included, the permit will specify how DEQ will assess compliance with mass-based effluent limitations.

(h) The permit shall include a provision requiring DEQ to consider the re-opening of the permit and re-evaluation of the site-specific background pollutant criterion if new information shows the discharger no longer meets the conditions described in subsections (5)(c) and (e).

(i) Public Notification Requirements.

(A) If DEQ proposes to grant a site-specific background pollutant criterion, it must provide public notice of the proposal and hold a public hearing. The public notice may be included in the public notification of a draft NPDES permit or other draft regulatory decision that would rely on the criterion and will also be published on DEQ's water quality standards website;

(B) DEQ will publish a list of all site-specific background pollutant criteria approved according to this rule. DEQ will add the criterion to this list within 30 days of its effective date. The list will identify the:

(i) Permittee;

(ii) Site-specific background pollutant criterion and the associated risk level;

(iii) Waterbody to which the criterion applies;

(iv) Allowable pollutant effluent limit; and,

(v) How to obtain additional information about the criterion.

(6) Arsenic Reduction Policy: The inorganic arsenic criterion for the protection of human health from the combined consumption of organisms and drinking water is 2.1 micrograms per liter. While this criterion is protective of human health and more stringent than the federal maximum contaminant level (MCL) for arsenic in drinking water, which is 10 micrograms per liter, it is based on a higher risk level than EQC used to establish other human health criteria. This higher

risk level recognizes that much of the risk is due to naturally high levels of inorganic arsenic in Oregon's waterbodies. In order to maintain the lowest human health risk from inorganic arsenic in drinking water, EQC determined that it is appropriate to adopt the following policy to limit the human contribution to that risk.

(a) It is EQC policy to reduce the addition of inorganic arsenic from new or existing anthropogenic sources to waters of the state within a surface water drinking water protection area to the maximum amount feasible. The requirements of this rule section (OAR 340-041-0033(6)) apply to sources that discharge to surface waters of the state with an ambient inorganic arsenic concentration equal to or lower than the applicable numeric inorganic arsenic criteria for the protection of human health.

(b) Definitions. As used in this section:

(A) "Add inorganic arsenic" means to discharge a net mass of inorganic arsenic from a point source (the mass of inorganic arsenic discharged minus the mass of inorganic arsenic taken into the facility from a surface water source).

(B) A "surface water drinking water protection area," means an area delineated as such by DEQ under the source water assessment program of the federal Safe Drinking Water Act, 42 U.S.C. § 300j 13. DEQ delineates these areas to protect public or community drinking water supplies that use surface water sources. These delineations are on DEQ's drinking water program Web page.

(C) "Potential to significantly increase inorganic arsenic concentrations in the public drinking water supply source water" means:

(i) A discharge will increase the concentration of inorganic arsenic in the receiving water by 10 percent or more after mixing with the harmonic mean flow of the receiving water; or

(ii) As an alternative, if sufficient data are available, the discharge will increase the concentration of inorganic arsenic in the surface water intake water of a public water system by 0.021 micrograms per liter or more based on a mass balance calculation.

(c) Following the effective date of this rule, applications for an individual NPDES permit or permit renewal received from industrial dischargers located in a surface water drinking water protection area and identified by DEQ as likely to add inorganic arsenic to the receiving water must include sufficient data to enable DEQ to determine whether:

(A) The discharge adds inorganic arsenic; and,

(B) The discharge has the potential to significantly increase inorganic arsenic concentrations in the public drinking water supply source water.

(d) Where DEQ determines that both conditions in subsection (c) of this section (6) are true, the industrial discharger must develop an inorganic arsenic reduction plan and propose all feasible measures to reduce its inorganic arsenic loading to the receiving water. The proposed plan, including proposed measures, monitoring and reporting requirements, and a schedule for those actions, will be described in the fact sheet and incorporated into the source's NPDES permit after public comment and DEQ review and approval. In developing the plan, the source must:

(A) Identify how much it can minimize its inorganic arsenic discharge through pollution prevention measures, process changes, wastewater treatment, alternative water supply for groundwater users, or other possible pollution prevention and control measures;

(B) Evaluate the costs, feasibility and environmental impacts of the potential inorganic arsenic reduction and control measures;

(C) Estimate the predicted reduction in inorganic arsenic and the reduced human health risk expected to result from the control measures;

(D) Propose specific inorganic arsenic reduction or control measures, if feasible, and an implementation schedule; and,

(E) Propose monitoring and reporting requirements to document progress in plan implementation and the inorganic arsenic load reductions.

(e) In order to implement this section, DEQ will develop the following information and guidance within 120 days of the effective date of this rule and periodically update it as warranted by new information:

(A) A list of industrial sources or source categories, including industrial stormwater and sources covered by general permits likely to add inorganic arsenic to surface waters of the state. For industrial sources or source categories permitted under a general permit that have been identified by DEQ as likely sources of inorganic arsenic, DEQ will evaluate options for reducing inorganic arsenic during permit renewal or evaluation of Stormwater Pollution Control Plans.

(B) Quantitation limits for monitoring inorganic arsenic concentrations.

(C) Information and guidance to assist sources in estimating, according to subsection (d)(C) of this section, the reduced human health risk expected to result from inorganic arsenic control measures based on the most current EPA risk assessment.

(f) It is the policy of EQC that landowners engaged in agricultural or development practices on land where pesticides, fertilizers, or soil amendments containing arsenic are currently being or have previously been applied, implement conservation practices to minimize the erosion and runoff of inorganic arsenic to waters of the state or to a location where such material could readily migrate into waters of the state.

NOTE: Tables 30, 31 and 40 are found under OAR 340-041-8033.

Stat. Auth.: ORS 468.020, 468B.030, 468B.035 & 468B.048
Stats. Implemented: ORS 468B.030, 468B.035 & 468B.048

Hist.: DEQ 17-2003, f. & cert. ef. 12-9-03; DEQ 3-2004, f. & cert. ef. 5-28-04; DEQ 17-2010, f. & cert. ef. 12-21-10; DEQ 8-2011, f. & cert. ef. 6-30-11; DEQ 10-2011, f. & cert. ef. 7-13-11; DEQ 17-2013, f. 12-23-13, cert. ef. 4-18-14; DEQ 1-2015, f. & cert. ef. 1-7-15

340-041-8033

Toxics Water Quality Criteria Tables

Table 30: Aquatic Life Water Quality Criteria for Toxic Pollutants. This table, referenced in OAR 340-041-0033, contains information about the applicability and content of the criteria contained in the table.

Table 31: Aquatic Life Water Quality Guidance Values for Toxic Pollutants. This table, referenced in OAR 340-041-0033, contains information about the applicability and content of the criteria contained in the table.

Table 40: Human Health Water Quality Criteria for Toxic Pollutants. This table, referenced in OAR 340-041-0033, contains information about the applicability and content of the criteria contained in the table.

Stat. Auth.: ORS 468.020, 468B.030, 468B.035 & 468B.048
Stats. Implemented: ORS 468B.030, 468B.035 & 468B.048

TABLE 30: Aquatic Life Water Quality Criteria for Toxic Pollutants

Aquatic Life Criteria Summary

The concentration for each compound listed in Table 30 is a criterion established for waters of the state in order to protect aquatic life. The aquatic life criteria apply to waterbodies where the protection of fish and aquatic life is a designated use. All values are expressed as micrograms per liter (µg/L). Compounds are listed in alphabetical order with the corresponding information: the Chemical Abstract Service (CAS) number, whether there is a human health criterion for the pollutant (i.e. "y"= yes, "n" = no), and the associated aquatic life freshwater and saltwater acute and chronic criteria. Italicized pollutants are not identified as priority pollutants by EPA. Dashes in the table column indicate that there is no aquatic life criterion.

Unless otherwise noted in the table below, the acute criterion is the Criterion Maximum Concentration (CMC) applied as a one-hour average concentration, and the chronic criterion is the Criterion Continuous Concentration (CCC) applied as a 96-hour (4 days) average concentration. The CMC and CCC criteria may not be exceeded more than once every three years. Footnote A, associated with eleven pesticide pollutants in Table 30, describes the exception to the frequency and duration of the toxics criteria stated in this paragraph.

Oregon Department of Environmental Quality
Table 30
Aquatic Life Water Quality Criteria for Toxic Pollutants
340-041-8033

	Pollutant	CAS Number	Human Health Criterion	Freshwater (µg/L)		Saltwater (µg/L)	
				Acute Criterion (CMC)	Chronic Criterion (CCC)	Acute Criterion (CMC)	Chronic Criterion (CCC)
1	Aldrin	309002	y	3 [A]	--	1.3 [A]	--
[A] *See expanded endnote A at bottom of Table 30 for alternate frequency and duration of this criterion.*							
2	*Alkalinity*		n	--	20,000 [B]	--	--

DEQ State of Oregon Department of Environmental Quality

Oregon Department of Environmental Quality
Table 30
Aquatic Life Water Quality Criteria for Toxic Pollutants
340-041-8033

	Pollutant	**CAS Number**	**Human Health Criterion**	**Freshwater (µg/L)** Acute Criterion (CMC)	**Freshwater (µg/L)** Chronic Criterion (CCC)	**Saltwater (µg/L)** Acute Criterion (CMC)	**Saltwater (µg/L)** Chronic Criterion (CCC)
[B] *Criterion shown is the minimum (i.e. CCC in water may not be below this value in order to protect aquatic life).*							
3	*Ammonia*	7664417	n	*The ammonia criteria are pH and temperature dependent — See ammonia criteria Tables 30(a)-(c) at end of Table 30.*[M]		*The ammonia criteria are pH, temperature and salinity dependent. Values for saltwater criteria (total ammonia) can be calculated from the tables specified in Ambient Water Quality Criteria for Ammonia (Saltwater)—1989 (EPA 440/5-88-004) See DEQ's calculator for calculating saltwater ammonia criteria at: http://www.deq.state.or.us/wq/standards/toxics.htm*	
[M] *The acute criteria in Table 30(a) apply in waterbodies where salmonids are a designated use in OAR 340-041-0101 through OAR 340-041-0340. The acute criteria in Table 30(b) apply in waterbodies where salmonids are not a designated use. The chronic criteria in Table 30(c) apply where fish and aquatic life is a designated use. It is not necessary to account for the presence or absence of salmonids or the presence of any early life stage of fish for the chronic criteria. Refer to DEQ's beneficial use website at: http://www.deq.state.or.us/wq/standards/uses.htm for additional information on salmonid beneficial use designations, including tables and maps.*							
4	Arsenic	7440382	y	340 [C, D]	150 [C, D]	69 [C, D]	36 [C, D]
[C] *Criterion is expressed in terms of "dissolved" concentrations in the water column.* [D] *Criterion is applied as total inorganic arsenic (i.e. arsenic (III) + arsenic (V)).*							
5	BHC Gamma (Lindane)	58899	y	0.95	0.08 [A]	0.16 [A]	--
[A] *See expanded endnote A at bottom of Table 30 for alternate frequency and duration of this criterion.*							
6	Cadmium	7440439	n	*See* **E**	*See* **C, F**	40 [C]	8.8 [C]
[C] *Criterion is expressed in terms of "dissolved" concentrations in the water column.* [E] *The freshwater criterion for this metal is expressed as "total recoverable" and is a function of hardness (mg/L) in the water column. To calculate the criterion, use formula under expanded endnote E at bottom of Table 30.* [F] *The freshwater criterion for this metal is expressed as a function of hardness (mg/L) in the water column. To calculate the criterion, use formula under expanded endnote F at bottom of Table 30.*							

DEQ State of Oregon Department of Environmental Quality

Oregon Department of Environmental Quality
Table 30
Aquatic Life Water Quality Criteria for Toxic Pollutants
340-041-8033

	Pollutant	**CAS Number**	**Human Health Criterion**	**Freshwater (*µg/L*)**		**Saltwater (*µg/L*)**	
				Acute Criterion (CMC)	**Chronic Criterion (CCC)**	**Acute Criterion (CMC)**	**Chronic Criterion (CCC)**
7	Chlordane	57749	y	2.4 [A]	0.0043 [A]	0.09 [A]	0.004 [A]
[A] See expanded endnote A at bottom of Table 30 for alternate frequency and duration of this criterion.							
8	*Chloride*	16887006	n	860,000	230,000	--	--
9	*Chlorine*	7782505	n	19	11	13	7.5
10	*Chlorpyrifos*	2921882	n	0.083	0.041	0.011	0.0056
11	Chromium III	16065831	n	*See* **C, F**	*See* **C, F**	--	--
[C] Criterion is expressed in terms of "dissolved" concentrations in the water column. *[F] The freshwater criterion for this metal is expressed as a function of hardness (mg/L) in the water column. To calculate the criterion, use formula under expanded endnote F at bottom of Table 30.*							
12	Chromium VI	18540299	n	16 [C]	11 [C]	1100[C]	50[C]
[C] Criterion is expressed in terms of "dissolved" concentrations in the water column.							
13	Copper	7440508	y	*See* **C, N**	*See* **C, N**	4.8 [C]	3.1 [C]
[C] Criterion is expressed in terms of "dissolved" concentrations in the water column. *[N] The freshwater criterion for copper is a function of the concentration of ions, alkalinity, organic carbon, pH and temperature in the water column. To calculate the criterion, use the Biotic Ligand Model referenced in endnote N at the bottom of Table 30. The acute copper criterion (CMC) is applied as a one-hour average concentration. The chronic criterion (CCC) is applied as a 96-hour (4 days) average concentration. See endnote N also for procedures and information.* *[**Note**: The Environmental Quality Commission adopted these revised copper criteria on 11/02/2016. However, the revised criteria become effective for federal Clean Water Act purposes upon approval by the U.S. Environmental Protection Agency.]*							
14	Cyanide	57125	y	22 [J]	5.2 [J]	1 [J]	1 [J]
[J] This criterion is expressed as µg free cyanide (CN)/L.							
15	DDT 4,4'	50293	y	1.1 [A, G]	0.001 [A, G]	0.13 [A, G]	0.001 [A, G]
[A] See expanded endnote A at bottom of Table 30 for alternate frequency and duration of this criterion. *[G] This criterion applies to DDT and its metabolites (i.e. the total concentration of DDT and its metabolites should not exceed this value).*							
16	*Demeton*	8065483	n	--	0.1	--	0.1

Oregon Department of Environmental Quality
Table 30
Aquatic Life Water Quality Criteria for Toxic Pollutants
340-041-8033

				Freshwater (µg/L)		**Saltwater (µg/L)**	
	Pollutant	**CAS Number**	**Human Health Criterion**	**Acute Criterion (CMC)**	**Chronic Criterion (CCC)**	**Acute Criterion (CMC)**	**Chronic Criterion (CCC)**
17	Dieldrin	60571	y	0.24	0.056	0.71[A]	0.0019[A]
[A] *See expanded endnote A at bottom of Table 30 for alternate frequency and duration of this criterion.*							
18	Endosulfan	115297	n	0.22 [A, H]	0.056 [A, H]	0.034 [A, H]	0.0087 [A, H]
[A] *See expanded endnote A at bottom of Table 30 for alternate frequency and duration of this criterion.* [H] *This value is based on the criterion published in Ambient Water Quality Criteria for Endosulfan (EPA 440/5-80-046) and should be applied as the sum of alpha- and beta-endosulfan.*							
19	Endosulfan Alpha	959988	y	0.22 [A]	0.056 [A]	0.034 [A]	0.0087 [A]
[A] *See expanded endnote A at bottom of Table 30 for alternate frequency and duration of this criterion.*							
20	Endosulfan Beta	33213659	y	0.22 [A]	0.056 [A]	0.034 [A]	0.0087 [A]
[A] *See expanded endnote A at bottom of Table 30 for alternate frequency and duration of this criterion.*							
21	Endrin	72208	y	0.086	0.036	0.037 [A]	0.0023 [A]
[A] *See expanded endnote A at bottom of Table 30 for alternate frequency and duration of this criterion.*							
22	*Guthion*	86500	n	--	0.01	--	0.01
23	Heptachlor	76448	y	0.52 [A]	0.0038 [A]	0.053 [A]	0.0036 [A]
[A] *See expanded endnote A at bottom of Table 30 for alternate frequency and duration of this criterion.*							
24	Heptachlor Epoxide	1024573	y	0.52 [A]	0.0038 [A]	0.053 [A]	0.0036 [A]
[A] *See expanded endnote A at bottom of Table 30 for alternate frequency and duration of this criterion.*							
25	*Iron (total)*	7439896	n	--	1000	--	--
26	Lead	7439921	n	*See* **C , F**	*See* **C , F**	210 [C]	8.1 [C]
[C] *Criterion is expressed in terms of "dissolved" concentrations in the water column.* [F] *The freshwater criterion for this metal is expressed as a function of hardness (mg/L) in the water column. To calculate the criterion, use formula under expanded endnote F at bottom of Table 30.*							
27	*Malathion*	121755	n	--	0.1	--	0.1
28	Mercury (total)	7439976	n	2.4	0.012	2.1	0.025

Oregon Department of Environmental Quality

Table 30

Aquatic Life Water Quality Criteria for Toxic Pollutants

340-041-8033

	Pollutant	**CAS Number**	**Human Health Criterion**	**Freshwater (µg/L)**		**Saltwater (µg/L)**	
				Acute Criterion (CMC)	**Chronic Criterion (CCC)**	**Acute Criterion (CMC)**	**Chronic Criterion (CCC)**
29	*Methoxychlor*	72435	y	--	0.03	--	0.03
30	*Mirex*	2385855	n	--	0.001	--	0.001
31	Nickel	7440020	y	*See* **C , F**	*See* **C , F**	74 [C]	8.2 [C]
[C] *Criterion is expressed in terms of "dissolved" concentrations in the water column.* [F] *The freshwater criterion for this metal is expressed as a function of hardness (mg/L) in the water column. To calculate the criterion, use formula under expanded endnote F at bottom of Table 30.*							
32	*Parathion*	56382	n	0.065	0.013	--	--
33	Pentachlorophenol	87865	y	*See* **H**	*See* **H**	13	7.9
[H] *Freshwater aquatic life values for pentachlorophenol are expressed as a function of pH, and are calculated as follows: CMC=(exp(1.005(pH)-4.869); CCC=exp(1.005(pH)-5.134).*							
34	*Phosphorus Elemental*	7723140	n	--	--	--	0.1
35	Polychlorinated Biphenyls (PCBs)	NA	y	2 [K]	0.014 [K]	10 [K]	0.03 [K]
[K] *This criterion applies to total PCBs (e.g.* determined as Aroclors or congeners)							
36	Selenium	7782492	y	*See* **C , L**	4.6 [C]	290 [C]	71 [C]
[C] *Criterion is expressed in terms of "dissolved" concentrations in the water column.* [L] *The CMC=(1/[(f1/CMC1)+(f2/CMC2)]µg/L) * CF where f1 and f2 are the fractions of total selenium that are treated as selenite and selenate, respectively, and CMC1 and CMC2 are 185.9 µg/L and 12.82 µg/L, respectively. See expanded endnote F for the Conversion Factor (CF) for selenium.*							
37	Silver	7440224	n	*See* **C , F**	0.10 [C]	1.9 [C]	--
[C] *Criterion is expressed in terms of "dissolved" concentrations in the water column.* [F] *The freshwater acute criterion for this metal is expressed as a function of hardness (mg/L) in the water column. To calculate the criterion, use formula under expanded endnote F at bottom of Table 30.*							
38	*Sulfide Hydrogen Sulfide*	7783064	n	--	2	--	2
39	Toxaphene	8001352	y	0.73	0.0002	0.21	0.0002
40	*Tributyltin (TBT)*	688733	n	0.46	0.063	0.37	0.01

Oregon Department of Environmental Quality
Table 30
Aquatic Life Water Quality Criteria for Toxic Pollutants
340-041-8033

	Pollutant	CAS Number	Human Health Criterion	Freshwater (µg/L)		Saltwater (µg/L)	
				Acute Criterion (CMC)	Chronic Criterion (CCC)	Acute Criterion (CMC)	Chronic Criterion (CCC)
41	Zinc	7440666	y	*See* **C , F**	*See* **C , F**	90 [C]	81 [C]

[C] *Criterion is expressed in terms of "dissolved" concentrations in the water column.*

[F] *The freshwater criterion for this metal is expressed as a function of hardness (mg/L) in the water column. To calculate the criterion, use formula under expanded endnote F at bottom of Table 30.*

Expanded Endnotes A, E, F, N

Endnote A: Alternate Frequency and Duration for Certain Pesticides

This criterion is based on EPA recommendations issued in 1980 that were derived using guidelines that differed from EPA's 1985 Guidelines which update minimum data requirements and derivation procedures. The CMC may not be exceeded at any time and the CCC may not be exceeded based on a 24-hour average. The CMC may be applied using a one hour averaging period not to be exceeded more than once every three years, if the CMC values given in Table 30 are divided by 2 to obtain a value that is more comparable to a CMC derived using the 1985 Guidelines.

Endnote E: Equation for Hardness-Dependent Freshwater Cadmium Acute Criteria

The freshwater criterion for this metal is expressed as total recoverable with two significant figures, and is a function of hardness (mg/L) in the water column. Criteria values based on hardness are calculated using the following formula (CMC refers to the acute criterion):

$$\mathbf{CMC} = (\exp(m_A*[\ln(\text{hardness})] + b_A))$$

Chemical	m_A	b_A	m_C	b_C
Cadmium	1.128	-3.828	N/A	N/A

Endnote F: Equations for Hardness-Dependent Freshwater Metals Criteria and Conversion Factor Table

The freshwater criterion for this metal is expressed as dissolved with two significant figures, and is a function of hardness (mg/L) in the water column. Criteria values based on hardness are calculated using the following formulas (CMC refers to the acute criterion; CCC refers to the chronic criterion):

$$\mathbf{CMC} = (\exp(m_A*[\ln(\text{hardness})] + b_A))*CF$$

$$\mathbf{CCC} = (\exp(m_C*[\ln(\text{hardness})] + b_C))*CF$$

"CF" is the conversion factor used for converting a metal criterion expressed as the total recoverable fraction in the water column to a criterion expressed as the dissolved fraction in the water column.

Chemical	m_A	b_A	m_C	b_C
Cadmium	N/A	N/A	0.7409	-4.719
Chromium III	0.8190	3.7256	0.8190	0.6848
Lead	1.273	-1.460	1.273	-4.705
Nickel	0.8460	2.255	0.8460	0.0584
Silver	1.72	-6.59	--	--
Zinc	0.8473	0.884	0.8473	0.884

The conversion factors (CF) below must be used in the equations above for the hardness-dependent metals in order to convert total recoverable metals criteria to dissolved metals criteria. For metals that are not hardness-dependent (i.e. arsenic, chromium VI, selenium, and silver (chronic)), or are saltwater criteria, the criterion value associated with the metal in Table 30 already reflects a dissolved criterion based on its conversion factor below.

Conversion Factor (CF) Table for Dissolved Metals

Chemical	Freshwater		Saltwater	
	Acute	Chronic	Acute	Chronic
Arsenic	1.000	1.000	1.000	1.000
Cadmium	N/A	1.101672-[(ln hardness)(0.041838)]	0.994	0.994
Chromium III	0.316	0.860	--	--
Chromium VI	0.982	0.962	0.993	0.993
Copper	N/A	N/A	0.83	0.83
Lead	1.46203-[(ln hardness)(0.145712)]	1.46203-[(ln hardness)(0.145712)]	0.951	0.951
Nickel	0.998	0.997	0.990	0.990
Selenium	0.996	0.922	0.998	0.998
Silver	0.85	0.85	0.85	--
Zinc	0.978	0.986	0.946	0.946

Endnote N: Deriving freshwater copper criteria

The freshwater copper criteria at any time are the Biotic Ligand Model (BLM) derived Instantaneous Water Quality Criteria (IWQC) output based on a concurrently measured set of model input parameter values. The Biotic Ligand Model uses multiple ambient water quality parameters to derive 1-hour acute exposure (CMC) and 96-hour chronic exposure (CCC) water quality criteria (IWQC) for copper based on the site specific water chemistry that determines the toxicity of copper to aquatic life. If measured data for one or more of the model input parameters used to derive the acute and chronic IWQC is not available, the procedures in section (1) or (2) of this endnote will be used as specified to substitute an estimate or a default value for the missing input parameter. BLM results (IWQC) based on sufficient measured input parameter data are more accurate and supersede results based on estimates or default values. The acceptable BLM software to calculate the IWQC include version 2.2.3, referenced in “Aquatic Life Ambient Freshwater Quality Criteria – Copper”: EPA-822-R-07-001, February 2007, and version 2.2.4. The criteria are expressed as dissolved copper in micrograms per liter (to the nearest one-tenth).

(1) Input Parameter Substitution and Estimation Procedures to Derive BLM Criteria (IWQC)

If the measured value for any input parameter needed to derive an IWQC using the BLM is not available, DEQ will substitute an estimated input parameter value according to the procedures described in this section [Endnote N (1)]. If the data required to determine the estimated parameter value is not available, DEQ will use default values derived according to the procedures in Endnote N (2).

(a) Total recoverable concentration measurements will be substituted for dissolved concentration measurements that are not available. For alkalinity, calcium, chloride, magnesium, potassium, sodium and sulfate, total recoverable concentration measurements will be used as a direct substitute for dissolved concentration measurements. Total organic carbon (TOC) measurements will be multiplied by 0.83 to convert the TOC value to an equivalent dissolved organic carbon (DOC) value; except where sufficient TOC and DOC data are available for a site, DEQ will calculate and apply a site-specific translator in place of 0.83 to convert TOC values to DOC for use in the BLM.

(b) Alkalinity, calcium, chloride, magnesium, potassium, sodium and sulfate:
If data for any of these BLM input parameters are missing from a particular dataset, DEQ will estimate its value based on the relationship of the ion or alkalinity to specific conductance measurements for that data set using the regression analysis equations in Table 1. Specific conductance measurements must be concurrent with the other BLM input parameters dataset.

Table N-1.

Parameter	**Regression Equation**
Alkalinity	Alk. = $\exp^{(0.88 \cdot [\ln(SpC)] - 0.41)}$
Calcium	Ca = $\exp^{(0.96 \cdot [\ln(SpC)] - 2.29)}$
Chloride	Cl = $\exp^{(1.15 \cdot [\ln(SpC)] - 3.82)}$
Magnesium	Mg = $\exp^{(0.91 \cdot [\ln(SpC)] - 3.09)}$
Potassium	K = $\exp^{(0.84 \cdot [\ln(SpC)] - 3.74)}$
Sodium	Na = $\exp^{(0.86 \cdot [\ln(SpC)] - 2.22)}$
Sulfate	SO_4 = $\exp^{(1.45 \cdot [\ln(SpC)] - 5.59}$

Where, “SpC” is a measurement of specific conductance in μmhos/cm, “ln” is the natural logarithm, and “exp” is a mathematical constant that is the base of the natural logarithm.

(c) pH
If concurrent pH data is missing from the sample dataset, DEQ will use a representative pH value determined by interpolating from data available for the site or proximate monitoring locations where conditions (such as type of water body, stream flow and geology) are similar to the site. DEQ will use the available data and methods to produce the best practicable estimate of pH for the site and time for which the IWQC is being derived.

(d) Temperature
If concurrent temperature data is missing from the sample dataset, DEQ will use a monthly mean temperature based on data available for the site or proximate monitoring locations where conditions (such as type of water body and stream flow) are similar to the site.

(e) Humic Acid
If sufficient high quality data on the percentage of humic acid as a proportion of DOC is available for a site, DEQ will use that value in the BLM in place of the default value of 10% used in the model.

(2) Default Action Values

If the measured value for DOC, alkalinity, calcium, chloride, magnesium, potassium, sodium or sulfate is not available to derive an IWQC using the BLM, and the parameter value cannot be estimated as specified in section (1) above, DEQ will use a conservative input value for the missing parameter as described in this section [Endnote N (2)] to derive a default action value using the Biotic Ligand Model. The default action value will be used for Clean Water Act purposes until measured or estimated input parameter data are available to derive accurate copper criteria (IWQC) based on site specific water chemistry.

(a) The default input parameter values for DOC, alkalinity calcium, chloride, magnesium, potassium, sodium and sulfate will be the percentile value from the distribution of the high quality data available for surface waters in the region as shown in Table N-2.

Table N-2. Percentile of data distribution to be used as default value by region

Region	**DOC** percentile	**Alkalinity and Ions** percentile
Willamette	20th	20th
Coastal	20th	20th
Cascades	20th	20th
Eastern	15th	15th
Columbia River	20th	20th

(b) The regional default values for each parameter and region will be updated periodically as additional high quality data becomes available and is added to DEQ's database.
(c) The regional default values for each parameter are available on DEQ's website.
(d) The regions listed in Table N-2 are comprised of the following EPA Level III ecoregions or waterbody:

(i) Willamette: the Willamette Valley
(ii) Coastal: Coast Range and Klamath Mountains
(iii) Cascades: Cascades
(iv) Eastern: Eastern Cascades Slopes and Foothills, Columbia Plateau, Blue Mountains, Northern Basin and Range and Snake River Plain
(v) Columbia River: Columbia River mainstem in Oregon

(3) General Policies

(a) The copper BLM derives instantaneous criteria results (IWQC) that vary at a site over time reflecting the effect of local water chemistry on copper toxicity to aquatic organisms. DEQ will apply the BLM criteria for Clean Water Act purposes to protect the water body during the most bioavailable or toxic conditions.
(b) For assessing waters of the state, DEQ will use approaches that give preference to the use of BLM criteria derived with site-specific measured input parameter data.

Table 30(a): Ammonia Acute Criteria Values (One-hour Average)—Salmonid Species Present
Temperature and pH-Dependent and expressed as Total Ammonia Nitrogen (mg/L TAN)

Criteria cannot be exceeded more than once every three years

$$Acute\ Criterion = MIN\left(\left(\frac{0.275}{1+10^{7.204-pH}}+\frac{39.0}{1+10^{pH-7.204}}\right),\left(0.7249\times\left(\frac{0.0114}{1+10^{7.204-pH}}+\frac{1.6181}{1+10^{pH-7.204}}\right)\times\left(23.12\times\ 10^{0.036\times(20-T)}\right)\right)\right)$$

	Temperature (ºC)															
pH	**0-14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**
6.5	33	33	32	29	27	25	23	21	19	18	16	15	14	13	12	11	9.9
6.6	31	31	30	28	26	24	22	20	18	17	16	14	13	12	11	10	9.5
6.7	30	30	29	27	24	22	21	19	18	16	15	14	13	12	11	9.8	9.0
6.8	28	28	27	25	23	21	20	18	17	15	14	13	12	11	10	9.2	8.5
6.9	26	26	25	23	21	20	18	17	15	14	13	12	11	10	9.4	8.6	7.9
7.0	24	24	23	21	20	18	17	15	14	13	12	11	10	9.4	8.6	8.0	7.3
7.1	22	22	21	20	18	17	15	14	13	12	11	10	9.3	8.5	7.9	7.2	6.7
7.2	20	20	19	18	16	15	14	13	12	11	9.8	9.1	8.3	7.7	7.1	6.5	6.0
7.3	18	18	17	16	14	13	12	11	10	9.5	8.7	8.0	7.4	6.8	6.3	5.8	5.3
7.4	15	15	15	14	13	12	11	9.8	9.0	8.3	7.7	7.0	6.5	6.0	5.5	5.1	4.7
7.5	13	13	13	12	11	10	9.2	8.5	7.8	7.2	6.6	6.1	5.6	5.2	4.8	4.4	4.0
7.6	11	11	11	10	9.3	8.6	7.9	7.3	6.7	6.2	5.7	5.2	4.8	4.4	4.1	3.8	3.5
7.7	9.6	9.6	9.3	8.6	7.9	7.3	6.7	6.2	5.7	5.2	4.8	4.4	4.1	3.8	3.5	3.2	3.0
7.8	8.1	8.1	7.9	7.2	6.7	6.1	5.6	5.2	4.8	4.4	4.0	3.7	3.4	3.2	2.9	2.7	2.5
7.9	6.8	6.8	6.6	6.0	5.6	5.1	4.7	4.3	4.0	3.7	3.4	3.1	2.9	2.6	2.4	2.2	2.1
8.0	5.6	5.6	5.4	5.0	4.6	4.2	3.9	3.6	3.3	3.0	2.8	2.6	2.4	2.2	2.0	1.9	1.7
8.1	4.6	4.6	4.5	4.1	3.8	3.5	3.2	3.0	2.7	2.5	2.3	2.1	2.0	1.8	1.7	1.5	1.4
8.2	3.8	3.8	3.7	3.5	3.1	2.9	2.7	2.4	2.3	2.1	1.9	1.8	1.6	1.5	1.4	1.3	1.2
8.3	3.1	3.1	3.1	2.8	2.6	2.4	2.2	2.0	1.9	1.7	1.6	1.4	1.3	1.2	1.1	1.0	0.96
8.4	2.6	2.6	2.5	2.3	2.1	2.0	1.8	1.7	1.5	1.4	1.3	1.2	1.1	1.0	0.93	0.86	0.79
8.5	2.1	2.1	2.1	1.9	1.8	1.6	1.5	1.4	1.3	1.2	1.1	0.98	0.90	0.83	0.77	0.71	0.65
8.6	1.8	1.8	1.7	1.6	1.5	1.3	1.2	1.1	1.0	0.96	0.88	0.81	0.75	0.69	0.63	0.59	0.54
8.7	1.5	1.5	1.4	1.3	1.2	1.1	1.0	0.94	0.87	0.80	0.74	0.68	0.62	0.57	0.53	0.49	0.45
8.8	1.2	1.2	1.2	1.1	1.0	0.93	0.86	0.79	0.73	0.67	0.62	0.57	0.52	0.48	0.44	0.41	0.37
8.9	1.0	1.0	1.0	0.93	0.85	0.79	0.72	0.67	0.61	0.56	0.52	0.48	0.44	0.40	0.37	0.34	0.32
9.0	0.88	0.88	0.86	0.79	0.73	0.67	0.62	0.57	0.52	0.48	0.44	0.41	0.37	0.34	0.32	0.29	0.27

Table 30(b): Ammonia Acute Criteria Values (One-hour Average*)—Salmonid Species Absent
Temperature and pH-Dependent and expressed as Total Ammonia Nitrogen (mg/L TAN)

Criteria cannot be exceeded more than once every three years

$$Acute\ Criterion = 0.7249 \times \frac{0.0114}{1+10^{7.204-pH}} + \frac{1.6181}{1+10^{pH-7.204}} \times MIN\left(51.93, 23.12 \times 10^{0.036\times(20-T)}\right)$$

	Temperature (ºC)																				
pH	**0-10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**
6.5	51	48	44	41	37	34	32	29	27	25	23	21	19	18	16	15	14	13	12	11	9.9
6.6	49	46	42	39	36	33	30	28	26	24	22	20	18	17	16	14	13	12	11	10	9.5
6.7	46	44	40	37	34	31	29	27	24	22	21	19	18	16	15	14	13	12	11	9.8	9.0
6.8	44	41	38	35	32	30	27	25	23	21	20	18	17	15	14	13	12	11	10	9.2	8.5
6.9	41	38	35	32	30	28	25	23	21	20	18	17	15	14	13	12	11	10	9.4	8.6	7.9
7.0	38	35	33	30	28	25	23	21	20	18	17	15	14	13	12	11	10	9.4	8.6	7.9	7.3
7.1	34	32	30	27	25	23	21	20	18	17	15	14	13	12	11	10	9.3	8.5	7.9	7.2	6.7
7.2	31	29	27	25	23	21	19	18	16	15	14	13	12	11	9.8	9.1	8.3	7.7	7.1	6.5	6.0
7.3	27	26	24	22	20	18	17	16	14	13	12	11	10	9.5	8.7	8.0	7.4	6.8	6.3	5.8	5.3
7.4	24	22	21	19	18	16	15	14	13	12	11	9.8	9.0	8.3	7.7	7.0	6.5	6.0	5.5	5.1	4.7
7.5	21	19	18	17	15	14	13	12	11	10	9.2	8.5	7.8	7.2	6.6	6.1	5.6	5.2	4.8	4.4	4.0
7.6	18	17	15	14	13	12	11	10	9.3	8.6	7.9	7.3	6.7	6.2	5.7	5.2	4.8	4.4	4.1	3.8	3.5
7.7	15	14	13	12	11	10	9.3	8.6	7.9	7.3	6.7	6.2	5.7	5.2	4.8	4.4	4.1	3.8	3.5	3.2	2.9
7.8	13	12	11	10	9.3	8.5	7.9	7.2	6.7	6.1	5.6	5.2	4.8	4.4	4.0	3.7	3.4	3.2	2.9	2.7	2.5
7.9	11	9.9	9.1	8.4	7.7	7.1	6.6	3.0	5.6	5.1	4.7	4.3	4.0	3.7	3.4	3.1	2.9	2.6	2.4	2.2	2.1
8.0	8.8	8.2	7.6	7.0	6.4	5.9	5.4	5.0	4.6	4.2	3.9	3.6	3.3	3.0	2.8	2.6	2.4	2.2	2.0	1.9	1.7
8.1	7.2	6.8	6.3	5.8	5.3	4.9	4.5	4.1	3.8	3.5	3.2	3.0	2.7	2.5	2.3	2.1	2.0	1.8	1.7	1.5	1.4
8.2	6.0	5.6	5.2	4.8	4.4	4.0	3.7	3.4	3.1	2.9	2.7	2.4	2.3	2.1	1.9	1.8	1.6	1.5	1.4	1.3	1.2
8.3	4.9	4.6	4.3	3.9	3.6	3.3	3.1	2.8	2.6	2.4	2.2	2.0	1.9	1.7	1.6	1.4	1.3	1.2	1.1	1.0	0.96
8.4	4.1	3.8	3.5	3.2	3.0	2.7	2.5	2.3	2.1	2.0	1.8	1.7	1.5	1.4	1.3	1.2	1.1	1.0	0.93	0.86	0.79
8.5	3.3	3.1	2.9	2.7	2.4	2.3	2.1	1.9	1.8	1.6	1.5	1.4	1.3	1.2	1.1	0.98	0.90	0.83	0.77	0.71	0.65
8.6	2.8	2.6	2.4	2.2	2.0	1.9	1.7	1.6	1.5	1.3	1.2	1.1	1.0	0.96	0.88	0.81	0.75	0.69	0.63	0.58	0.54
8.7	2.3	2.2	2.0	1.8	1.7	1.6	1.4	1.3	1.2	1.1	1.0	0.94	0.87	0.80	0.74	0.68	0.62	0.57	0.53	0.49	0.45
8.8	1.9	1.8	1.7	1.5	1.4	1.3	1.2	1.1	1.0	0.93	0.86	0.79	0.73	0.67	0.62	0.57	0.52	0.48	0.44	0.41	0.37
8.9	1.6	1.5	1.4	1.3	1.2	1.1	1.0	0.93	0.85	0.79	0.72	0.67	0.61	0.56	0.52	0.48	0.44	0.40	0.37	0.34	0.32
9.0	1.4	1.3	1.2	1.1	1.0	0.93	0.86	0.79	0.73	0.67	0.62	0.57	0.52	0.48	0.44	0.41	0.37	0.34	0.32	0.29	0.27

Table 30(c): Ammonia Chronic Criteria Values (30-day Rolling Average*)

Temperature and pH-Dependent and expressed as Total Ammonia Nitrogen (mg/L TAN)

* The highest four-day average within the 30-day averaging period must not be more than 2.5 times the chronic value

Criteria cannot be exceeded more than once every three years

$$Chronic\ Criterion = 0.8876 \times \left(\frac{0.0278}{1+10^{7.688-pH}} + \frac{1.1994}{1+10^{pH-7.688}}\right) \times \left(2.126 \times 10^{0.028\times(20-MAX(T,7))}\right)$$

	Temperature (ºC)																							
pH	**0-7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**
6.5	4.9	4.6	4.3	4.1	3.8	3.6	3.3	3.1	2.9	2.8	2.6	2.4	2.3	2.1	2.0	1.9	1.8	1.6	1.5	1.5	1.4	1.3	1.2	1.1
6.6	4.8	4.5	4.3	4.0	3.8	3.5	3.3	3.1	2.9	2.7	2.5	2.4	2.2	2.1	2.0	1.8	1.7	1.6	1.5	1.4	1.3	1.3	1.2	1.1
6.7	4.8	4.5	4.2	3.9	3.7	3.5	3.2	3.0	2.8	2.7	2.5	2.3	2.2	2.1	1.9	1.8	1.7	1.6	1.5	1.4	1.3	1.2	1.2	1.1
6.8	4.6	4.4	4.1	3.8	3.6	3.4	3.2	3.0	2.8	2.6	2.4	2.3	2.1	2.0	1.9	1.8	1.7	1.6	1.5	1.4	1.3	1.2	1.1	1.1
6.9	4.5	4.2	4.0	3.7	3.5	3.3	3.1	2.9	2.7	2.5	2.4	2.2	2.1	2.0	1.8	1.7	1.6	1.5	1.4	1.3	1.2	1.2	1.1	1.0
7.0	4.4	4.1	3.8	3.6	3.4	3.2	3.0	2.8	2.6	2.4	2.3	2.2	2.0	1.9	1.8	1.7	1.6	1.5	1.4	1.3	1.2	1.1	1.1	0.99
7.1	4.2	3.9	3.7	3.5	3.2	3.0	2.8	2.7	2.5	2.3	2.2	2.1	1.9	1.8	1.7	1.6	1.5	1.4	1.3	1.2	1.2	1.1	1.0	0.95
7.2	4.0	3.7	3.5	3.3	3.1	2.9	2.7	2.5	2.4	2.2	2.1	2.0	1.8	1.7	1.6	1.5	1.4	1.3	1.3	1.2	1.1	1.0	0.96	0.90
7.3	3.8	3.5	3.3	3.1	2.9	2.7	2.6	2.4	2.2	2.1	2.0	1.8	1.7	1.6	1.5	1.4	1.3	1.3	1.2	1.1	1.0	0.97	0.91	0.85
7.4	3.5	3.3	3.1	2.9	2.7	2.5	2.4	2.2	2.1	2.0	1.8	1.7	1.6	1.5	1.4	1.3	1.3	1.2	1.1	1.0	0.96	0.90	0.85	0.79
7.5	3.2	3.0	2.8	2.7	2.5	2.3	2.2	2.1	1.9	1.8	1.7	1.6	1.5	1.4	1.3	1.2	1.2	1.1	1.0	0.95	0.89	0.83	0.78	0.73
7.6	2.9	2.8	2.6	2.4	2.3	2.1	2.0	1.9	1.8	1.6	1.5	1.4	1.4	1.3	1.2	1.1	1.1	0.98	0.92	0.86	0.81	0.76	0.71	0.67
7.7	2.6	2.4	2.3	2.2	2.0	1.9	1.8	1.7	1.6	1.5	1.4	1.3	1.2	1.1	1.1	1.0	0.94	0.88	0.83	0.78	0.73	0.68	0.64	0.60
7.8	2.3	2.2	2.1	1.9	1.8	1.7	1.6	1.5	1.4	1.3	1.2	1.2	1.1	1.0	0.95	0.89	0.84	0.79	0.74	0.69	0.65	0.61	0.57	0.53
7.9	2.1	1.9	1.8	1.7	1.6	1.5	1.4	1.3	1.2	1.2	1.1	1.0	0.95	0.89	0.84	0.79	0.74	0.69	0.65	0.61	0.57	0.53	0.50	0.47
8.0	1.8	1.7	1.6	1.5	1.4	1.3	1.2	1.1	1.1	1.0	0.94	0.88	0.83	0.78	0.73	0.68	0.64	0.60	0.56	0.53	0.50	0.44	0.44	0.41
8.1	1.5	1.5	1.4	1.3	1.2	1.1	1.1	0.99	0.92	0.87	0.81	0.76	0.71	0.67	0.63	0.59	0.55	0.52	0.49	0.46	0.43	0.40	0.38	0.35
8.2	1.3	1.2	1.2	1.1	1.0	0.96	0.90	0.84	0.79	0.74	0.70	0.65	0.61	0.57	0.54	0.50	0.47	0.44	0.42	0.39	0.37	0.34	0.32	0.30
8.3	1.1	1.1	0.99	0.93	0.87	0.82	0.76	0.72	0.67	0.63	0.59	0.55	0.52	0.49	0.46	0.43	0.40	0.38	0.35	0.33	0.31	0.29	0.27	0.26
8.4	0.95	0.89	0.84	0.79	0.74	0.69	0.65	0.61	0.57	0.53	0.50	0.47	0.44	0.41	0.39	0.36	0.34	0.32	0.30	0.28	0.26	0.25	0.23	0.22
8.5	0.80	0.75	0.71	0.67	0.62	0.58	0.55	0.51	0.48	0.45	0.42	0.40	0.37	0.35	0.33	0.31	0.29	0.27	0.25	0.24	0.22	0.21	0.20	0.18
8.6	0.68	0.64	0.60	0.56	0.53	0.49	0.46	0.43	0.41	0.38	0.36	0.33	0.31	0.29	0.28	0.26	0.24	0.23	0.21	0.20	0.19	0.18	0.16	0.15
8.7	0.57	0.54	0.51	0.47	0.44	0.42	0.39	0.37	0.34	0.32	0.30	0.28	0.27	0.25	0.23	0.22	0.21	0.19	0.18	0.17	0.16	0.15	0.14	0.13
8.8	0.49	0.46	0.43	0.40	0.38	0.35	0.33	0.31	0.29	0.27	0.26	0.24	0.23	0.21	0.20	0.19	0.17	0.16	0.15	0.14	0.13	0.13	0.12	0.11
8.9	0.42	0.39	0.37	0.34	0.32	0.30	0.28	0.27	0.25	0.23	0.22	0.21	0.19	0.18	0.17	0.16	0.15	0.14	0.13	0.12	0.12	0.11	0.10	0.09
9.0	0.36	0.34	0.32	0.30	0.28	0.26	0.24	0.23	0.21	0.20	0.19	0.18	0.17	0.16	0.15	0.14	0.13	0.12	0.11	0.11	0.10	0.09	0.09	0.08

TABLE 31: Aquatic Life Water Quality Guidance Values for Toxic Pollutants

Effective April 18, 2014

Water Quality Guidance Values Summary [A]

The concentration for each compound listed in Table 31 is a guidance value that DEQ may use in application of Oregon's Toxic Substances Narrative (340-041-0033(2)) to waters of the state in order to protect aquatic life. All values are expressed as micrograms per liter (µg/L) except where noted. Compounds are listed in alphabetical order with the corresponding EPA number (from National Recommended Water Quality Criteria: 2002, EPA-822-R-02-047), corresponding Chemical Abstract Service (CAS) number, aquatic life freshwater acute and chronic guidance values, and aquatic life saltwater acute and chronic guidance values.

Oregon Department of Environmental Quality
Table 31
Aquatic Life Water Quality Guidance Values for Toxic Pollutants
340-041-8033

EPA No.	Pollutant	CAS Number	Freshwater		Saltwater	
			Acute	Chronic	Acute	Chronic
56	Acenaphthene	83329	1,700	520	970	710
17	Acrolein	107028	68	21	55	
18	Acrylonitrile	107131	7,550	2,600		
1	Antimony	7440360	9,000	1,600		
19	Benzene	71432	5,300		5,100	700
59	Benzidine	92875	2,500			
3	Beryllium	7440417	130	5.3		
19 B	BHC (Hexachlorocyclohexane-Technical)	319868	100		0.34	
21	Carbon Tetrachloride	56235	35,200		50,000	
	Chlorinated Benzenes		250	50	160	129
	Chlorinated naphthalenes		1,600		7.5	
	Chloroalkyl Ethers		238,000			

Oregon Department of Environmental Quality
Table 31
Aquatic Life Water Quality Guidance Values for Toxic Pollutants
340-041-8033

EPA No.	Pollutant	CAS Number	Freshwater		Saltwater	
			Acute	Chronic	Acute	Chronic
26	Chloroform	67663	28,900	1,240		
45	Chlorophenol 2-	95578	4,380	2,000		
	Chlorophenol 4-	106489			29,700	
52	Methyl-4-chlorophenol 3-	59507	30			
5a	Chromium (III)	16065831			10,300	
109	DDE 4,4'-	72559	1,050		14	
110	DDD 4,4'-	72548	0.06		3.6	
	Diazinon	333415	0.08	0.05		
	Dichlorobenzenes		1,120	763	1,970	
29	Dichloroethane 1,2-	107062	118,000	20,000	113,000	
	Dichloroethylenes		11,600		224,000	
46	Dichlorophenol 2,4-	120832	2,020	365		
31	Dichloropropane 1,2-	78875	23,000	5,700	10,300	3,040
32	Dichloropropene 1,3-	542756	6,060	244	790	
47	Dimethylphenol 2,4-	105679	2,120			
	Dinitrotoluene		330	230	590	370
16	Dioxin (2,3,7,8-TCDD)	1746016	0.01	38 pg/L		
85	Diphenylhydrazine 1,2-	122667	270			
33	Ethylbenzene	100414	32,000		430	
86	Fluoranthene	206440	3,980		40	16
	Haloethers		360	122		
	Halomethanes		11,000		12,000	6,400
89	Hexachlorobutadiene	87683	90	9.3	32	
90	Hexachlorocyclopentadiene	77474	7	5.2	7	

Oregon Department of Environmental Quality

Table 31

Aquatic Life Water Quality Guidance Values for Toxic Pollutants

340-041-8033

EPA No.	Pollutant	CAS Number	Freshwater Acute	Freshwater Chronic	Saltwater Acute	Saltwater Chronic
91	Hexachloroethane	67721	980	540	940	
93	Isophorone	78591	117,000		12,900	
94	Naphthalene	91203	2,300	620	2,350	
95	Nitrobenzene	98953	27,000		6,680	
	Nitrophenols		230	150	4,850	
26 B	Nitrosamines	35576911	5,850		3,300,000	
	Pentachlorinated ethanes		7,240	1,100	390	281
54	Phenol	108952	10,200	2,560	5,800	
	Phthalate esters		940	3	2,944	3.4
	Polynuclear Aromatic Hydrocarbons				300	
	Tetrachlorinated Ethanes		9,320			
37	Tetrachloroethane 1,1,2,2-	79345		2,400	9,020	
	Tetrachloroethanes		9,320			
38	Tetrachloroethylene	127184	5,280	840	10,200	450
	Tetrachlorophenol 2,3,5,6					440
12	Thallium	7440280	1,400	40	2,130	
39	Toluene	108883	17,500		6,300	5,000
	Trichlorinated ethanes		18,000			
41	Trichloroethane 1,1,1-	71556			31,200	
42	Trichloroethane 1,1,2-	79005		9,400		
43	Trichloroethylene	79016	45,000	21,900	2,000	
55	Trichlorophenol 2,4,6-	88062		970		

The following chemicals/compounds/classes are of concern due to the potential for toxic effects to aquatic organisms; however, no guidance values are designated. If these compounds are identified in the waste stream, then a review of the scientific literature may be appropriate for deriving guidance values.

- Polybrominated diphenyl ethers (PBDE)
- Polybrominated biphenyls (PBB)
- Pharmaceuticals

- ❑ Personal care products
- ❑ Alkyl Phenols
- ❑ Other chemicals with Toxic effects

Footnotes:

A Values in Table 31 are applicable to all basins.

B This number was assigned to the list of non-priority pollutants in National Recommended Water Quality Criteria: 2002 (EPA-822-R-02-047).

TABLE 40: Human Health Water Quality Criteria for Toxic Pollutants

Effective April 18, 2014

Human Health Criteria Summary

The concentration for each pollutant listed in Table 40 was derived to protect Oregonians from potential adverse health impacts associated with long-term exposure to toxic substances associated with consumption of fish, shellfish, and water. The "organism only" criteria are established to protect fish and shellfish consumption and apply to waters of the state designated for fishing. The "water + organism" criteria are established to protect the consumption of drinking water, fish, and shellfish, and apply where both fishing and domestic water supply (public and private) are designated uses. All criteria are expressed as micrograms per liter (µg/L), unless otherwise noted. Pollutants are listed in alphabetical order. Additional information includes the Chemical Abstract Service (CAS) number, whether the criterion is based on carcinogenic effects (can cause cancer in humans), and whether there is an aquatic life criterion for the pollutant (i.e. "y"= yes, "n" = no). All the human health criteria were calculated using a fish consumption rate of 175 grams per day unless otherwise noted. A fish consumption rate of 175 grams per day is approximately equal to 23 8-ounce fish meals per month. For pollutants categorized as carcinogens, values represent a cancer risk of one additional case of cancer in one million people (i.e. 10^{-6}), unless otherwise noted. All metals criteria are for total metal concentration, unless otherwise noted. Italicized pollutants represent non-priority pollutants. The human health criteria revisions established by OAR 340-041-0033 and shown in Table 40 do not become applicable for purposes of ORS chapter 468B or the federal Clean Water Act until approved by EPA pursuant to 40 CFR 131.21 (4/27/2000).

DEQ
State of Oregon Department of Environmental Quality

Oregon Department of Environmental Quality

Table 40

Human Health Water Quality Criteria for Toxic Pollutants

340-041-8033

No.	Pollutant	CAS Number	Carcinogen	Aquatic Life Criterion	*Human Health Criteria for the Consumption of:* Water + Organism (µg/L)	Organism Only (µg/L)
1	Acenaphthene	83329	n	n	95	99
2	Acrolein	107028	n	n	0.88	0.93
3	Acrylonitrile	107131	y	n	0.018	0.025
4	Aldrin	309002	y	y	0.0000050	0.0000050
5	Anthracene	120127	n	n	2900	4000
6	Antimony	7440360	n	n	5.1	64
7	Arsenic (inorganic) [A]	7440382	y	y	2.1	2.1 (freshwater) 1.0 (saltwater)
	[A] The arsenic criteria are expressed as total inorganic arsenic. The "organism only" freshwater criterion is based on a risk level of approximately 1 x 10^{-5}, and the "water + organism" criterion is based on a risk level of 1 x 10^{-4}.					
8	Asbestos [B]	1332214	y	n	7,000,000 fibers/L	--
	[B] The human health risks from asbestos are primarily from drinking water, therefore no "organism only" criterion was developed. The "water + organism" criterion is based on the Maximum Contaminant Level (MCL) established under the Safe Drinking Water Act.					
9	*Barium* [C]	7440393	n	n	1000	--
	[C] The human health criterion for barium is the same as originally published in the 1976 EPA Red Book which predates the 1980 methodology and did not utilize the fish ingestion BCF approach. This same criterion value was also published in the 1986 EPA Gold Book. Human health risks are primarily from drinking water, therefore no "organism only" criterion was developed. The "water + organism" criterion is based on the Maximum Contaminant Level (MCL) established under the Safe Drinking Water Act.					
10	Benzene	71432	y	n	0.44	1.4
11	Benzidine	92875	y	n	0.000018	0.000020
12	Benz(a)anthracene	56553	y	n	0.0013	0.0018
13	Benzo(a)pyrene	50328	y	n	0.0013	0.0018
14	Benzo(b)fluoranthene 3,4	205992	y	n	0.0013	0.0018
15	Benzo(k)fluoranthene	207089	y	n	0.0013	0.0018
16	BHC Alpha	319846	y	n	0.00045	0.00049

Oregon Department of Environmental Quality

Table 40

Human Health Water Quality Criteria for Toxic Pollutants

340-041-8033

No.	Pollutant	CAS Number	Carcinogen	Aquatic Life Criterion	*Human Health Criteria for the Consumption of:* Water + Organism (µg/L)	Organism Only (µg/L)
17	BHC Beta	319857	y	n	0.0016	0.0017
18	BHC Gamma (Lindane)	58899	n	y	0.17	0.18
19	Bromoform	75252	y	n	3.3	14
20	Butylbenzyl Phthalate	85687	n	n	190	190
21	Carbon Tetrachloride	56235	y	n	0.10	0.16
22	Chlordane	57749	y	y	0.000081	0.000081
23	Chlorobenzene	108907	n	n	74	160
24	Chlorodibromomethane	124481	y	n	0.31	1.3
25	Chloroethyl Ether bis 2	111444	y	n	0.020	0.053
26	Chloroform	67663	n	n	260	1100
27	Chloroisopropyl Ether bis 2	108601	n	n	1200	6500
28	*Chloromethyl ether, bis*	542881	y	n	0.000024	0.000029
29	Chloronaphthalene 2	91587	n	n	150	160
30	Chlorophenol 2	95578	n	n	14	15
31	*Chlorophenoxy Herbicide (2,4,5,-TP)* [D]	93721	n	n	10	--
	[D] *The Chlorophenoxy Herbicide (2,4,5,-TP) criterion is the same as originally published in the 1976 EPA Red Book which predates the 1980 methodology and did not utilize the fish ingestion BCF approach. This same criterion value was also published in the 1986 EPA Gold Book. Human health risks are primarily from drinking water, therefore no "organism only" criterion was developed. The "water + organism" criterion is based on the Maximum Contaminant Level (MCL) established under the Safe Drinking Water Act.*					
32	*Chlorophenoxy Herbicide (2,4-D)* [E]	94757	n	n	100	--

Oregon Department of Environmental Quality

Table 40

Human Health Water Quality Criteria for Toxic Pollutants

340-041-8033

No.	Pollutant	CAS Number	Carcinogen	Aquatic Life Criterion	*Human Health Criteria for the Consumption of:* Water + Organism (µg/L)	Organism Only (µg/L)
	E *The Chlorophenoxy Herbicide (2,4-D) criterion is the same as originally published in the 1976 EPA Red Book which predates the 1980 methodology and did not utilize the fish ingestion BCF approach. This same criterion value was also published in the 1986 EPA Gold Book. Human health risks are primarily from drinking water, therefore no "organism only" criterion was developed. The "water + organism" criterion is based on the Maximum Contaminant Level (MCL) established under the Safe Drinking Water Act.*					
33	Chrysene	218019	y	n	0.0013	0.0018
34	Copper F	7440508	n	y	1300	--
	F *Human health risks from copper are primarily from drinking water, therefore no "organism only" criterion was developed. The "water + organism" criterion is based on the Maximum Contaminant Level (MCL) established under the Safe Drinking Water Act.*					
35	Cyanide G	57125	n	y	130	130
	G *The cyanide criterion is expressed as total cyanide (CN)/L.*					
36	DDD 4,4'	72548	y	n	0.000031	0.000031
37	DDE 4,4'	72559	y	n	0.000022	0.000022
38	DDT 4,4'	50293	y	y	0.000022	0.000022
39	Dibenz(a,h)anthracene	53703	y	n	0.0013	0.0018
40	Dichlorobenzene(m) 1,3	541731	n	n	80	96
41	Dichlorobenzene(o) 1,2	95501	n	n	110	130
42	Dichlorobenzene(p) 1,4	106467	n	n	16	19
43	Dichlorobenzidine 3,3'	91941	y	n	0.0027	0.0028
44	Dichlorobromomethane	75274	y	n	0.42	1.7
45	Dichloroethane 1,2	107062	y	n	0.35	3.7
46	Dichloroethylene 1,1	75354	n	n	230	710
47	Dichloroethylene trans 1,2	156605	n	n	120	1000

Oregon Department of Environmental Quality

Table 40

Human Health Water Quality Criteria for Toxic Pollutants

340-041-8033

No.	Pollutant	CAS Number	Carcinogen	Aquatic Life Criterion	*Human Health Criteria for the Consumption of:* Water + Organism (µg/L)	Organism Only (µg/L)
48	Dichlorophenol 2,4	120832	n	n	23	29
49	Dichloropropane 1,2	78875	y	n	0.38	1.5
50	Dichloropropene 1,3	542756	y	n	0.30	2.1
51	Dieldrin	60571	y	y	0.0000053	0.0000054
52	Diethyl Phthalate	84662	n	n	3800	4400
53	Dimethyl Phthalate	131113	n	n	84000	110000
54	Dimethylphenol 2,4	105679	n	n	76	85
55	Di-n-butyl Phthalate	84742	n	n	400	450
56	Dinitrophenol 2,4	51285	n	n	62	530
57	*Dinitrophenols*	25550587	n	n	62	530
58	Dinitrotoluene 2,4	121142	y	n	0.084	0.34
59	Dioxin (2,3,7,8-TCDD)	1746016	y	n	0.00000000051	0.00000000051
60	Diphenylhydrazine 1,2	122667	y	n	0.014	0.020
61	Endosulfan Alpha	959988	n	y	8.5	8.9
62	Endosulfan Beta	33213659	n	y	8.5	8.9
63	Endosulfan Sulfate	1031078	n	n	8.5	8.9
64	Endrin	72208	n	y	0.024	0.024
65	Endrin Aldehyde	7421934	n	n	0.030	0.030
66	Ethylbenzene	100414	n	n	160	210
67	Ethylhexyl Phthalate bis 2	117817	y	n	0.20	0.22
68	Fluoranthene	206440	n	n	14	14

Oregon Department of Environmental Quality

Table 40

Human Health Water Quality Criteria for Toxic Pollutants

340-041-8033

No.	Pollutant	CAS Number	Carcinogen	Aquatic Life Criterion	*Human Health Criteria for the Consumption of:* Water + Organism (µg/L)	Organism Only (µg/L)
69	Fluorene	86737	n	n	390	530
70	Heptachlor	76448	y	y	0.0000079	0.0000079
71	Heptachlor Epoxide	1024573	y	y	0.0000039	0.0000039
72	Hexachlorobenzene	118741	y	n	0.000029	0.000029
73	Hexachlorobutadiene	87683	y	n	0.36	1.8
74	*Hexachlorocyclo-hexane-Technical*	608731	y	n	0.0014	0.0015
75	Hexachlorocyclopentadiene	77474	n	n	30	110
76	Hexachloroethane	67721	y	n	0.29	0.33
77	Indeno(1,2,3-cd)pyrene	193395	y	n	0.0013	0.0018
78	Isophorone	78591	y	n	27	96
79	*Manganese* [H]	7439965	n	n	--	100
	[H] *The "fish consumption only" criterion for manganese applies only to salt water and is for total manganese. This EPA recommended criterion predates the 1980 human health methodology and does not utilize the fish ingestion BCF calculation method or a fish consumption rate.*					
80	*Methoxychlor* [I]	72435	n	y	100	--
	[I] *The human health criterion for methoxychlor is the same as originally published in the 1976 EPA Red Book which predates the 1980 methodology and did not utilize the fish ingestion BCF approach. This same criterion value was also published in the1986 EPA Gold Book. Human health risks are primarily from drinking water, therefore no "organism only" criterion was developed. The "water + organism" criterion is based on the Maximum Contaminant Level (MCL) established under the Safe Drinking Water Act.*					
81	Methyl Bromide	74839	n	n	37	150
82	Methyl-4,6-dinitrophenol 2	534521	n	n	9.2	28
83	Methylene Chloride	75092	y	n	4.3	59
84	Methylmercury (mg/kg) [J]	22967926	n	n	--	0.040 mg/kg

No.	Pollutant	CAS Number	Carcinogen	Aquatic Life Criterion	***Human Health Criteria for the Consumption of:***	
					Water + Organism (µg/L)	**Organism Only (µg/L)**
	[J] This value is expressed as the fish tissue concentration of methylmercury. Contaminated fish and shellfish is the primary human route of exposure to methylmercury.					
85	Nickel	7440020	n	y	140	170
86	*Nitrates* [K]	14797558	n	n	10000	--
	[K] The human health criterion for nitrates is the same as originally published in the 1976 EPA Red Book which predates the 1980 methodology and did not utilize the fish ingestion BCF approach. This same criterion value was also published in the 1986 EPA Gold Book. Human health risks are primarily from drinking water, therefore no "organism only" criterion was developed. The "water + organism" criterion is based on the Maximum Contaminant Level (MCL) established under the Safe Drinking Water Act.					
87	Nitrobenzene	98953	n	n	14	69
88	*Nitrosamines*	35576911	y	n	0.00079	0.046
89	*Nitrosodibutylamine, N*	924163	y	n	0.0050	0.022
90	*Nitrosodiethylamine, N*	55185	y	n	0.00079	0.046
91	Nitrosodimethylamine, N	62759	y	n	0.00068	0.30
92	Nitrosodi-n-propylamine, N	621647	y	n	0.0046	0.051
93	Nitrosodiphenylamine, N	86306	y	n	0.55	0.60
94	*Nitrosopyrrolidine, N*	930552	y	n	0.016	3.4
95	*Pentachlorobenzene*	608935	n	n	0.15	0.15
96	Pentachlorophenol	87865	y	y	0.15	0.30
97	Phenol	108952	n	n	9400	86000
98	Polychlorinated Biphenyls (PCBs) [L]	NA	y	y	0.0000064	0.0000064
	[L] This criterion applies to total PCBs (e.g. determined as Aroclors or congeners).					
99	Pyrene	129000	n	n	290	400
100	Selenium	7782492	n	y	120	420

Oregon Department of Environmental Quality

Table 40

Human Health Water Quality Criteria for Toxic Pollutants

340-041-8033

No.	Pollutant	CAS Number	Carcinogen	Aquatic Life Criterion	*Human Health Criteria for the Consumption of:* Water + Organism (µg/L)	Organism Only (µg/L)
101	*Tetrachlorobenzene, 1,2,4,5-*	95943	n	n	0.11	0.11
102	Tetrachloroethane 1,1,2,2	79345	y	n	0.12	0.40
103	Tetrachloroethylene	127184	y	n	0.24	0.33
104	Thallium	7440280	n	n	0.043	0.047
105	Toluene	108883	n	n	720	1500
106	Toxaphene	8001352	y	y	0.000028	0.000028
107	Trichlorobenzene 1,2,4	120821	n	n	6.4	7.0
108	Trichloroethane 1,1,2	79005	y	n	0.44	1.6
109	Trichloroethylene	79016	y	n	1.4	3.0
110	Trichlorophenol 2,4,6	88062	y	n	0.23	0.24
111	*Trichlorophenol, 2, 4, 5-*	95954	n	n	330	360
112	Vinyl Chloride	75014	y	n	0.023	0.24
113	Zinc	7440666	n	y	2100	2600

Summary and response to Public Comment

For public comments received by the close of the public comment period, the following document organizes comments into twelve topics. Each comment references to the commenter number from the table at the end of the document. DEQ's response follows the comment. Original comments are on file with DEQ.

TOPIC 1: General Comments

Comment 1.1

DEQ received comments in this category from commenters 1, 2, 3, 4, 6, 7, 8, 9, 10, 11

Commenters support replacing the current hardness-based criteria with the use of with the Biotic Ligand Model for copper criteria.

> **Response**
> DEQ acknowledges the support for using the BLM for the copper criteria.

Comment 1.2

DEQ received comments in this category from commenters 1, 3, 5, 6, 9

Commenters appreciate the extensive and thoughtful technical evaluations that the department conducted in support of the proposed criteria, including issues associated with applying the copper BLM to waters in Oregon. These evaluations could serve as a model for other states and EPA when adopting the copper BLM and other dynamic water quality criteria that account for variations in toxicity.

> **Response**
> DEQ appreciates the positive feedback on our evaluation of the copper BLM and its application to Oregon waters. DEQ would like to recognize the contributions and input of the Technical Review Panel and others to the review and analysis included in DEQ's Technical Support Document and the members of the Advisory Committee Panel and public who contributed to the Advisory Committee process.

Comment 1.3

DEQ received comments in this category from commenter 13

Commenter appreciates Oregon's efforts to establish and implement protective water quality criteria for freshwater copper and the efforts Oregon has made to coordinate with EPA staff on its proposed rulemaking.

> **Response**

DEQ appreciates this acknowledgement.

Comment 1.4

DEQ received comments in this category from commenter 12

Our representative served on the advisory committee to represent the “non-point source” community. We would like to thank DEQ for ensuring that the advisory committee included a wide range of stakeholders. The meetings were robust and resulted in a Draft rule that recognizes many of the suggestions and concerns from that process.

Response
DEQ appreciates this positive feedback on our advisory committee process.

Comment 1.5

DEQ received comments in this category from commenter 12

The copper standard is of particular interest to our members. Because many pesticide products contain copper, it is important that the WQS be protective of beneficial uses without being overly conservative in a manner that results in unnecessary restrictions on the use of copper-containing products.

The DEQ proposed standard does a good job of balancing protection of the beneficial uses, while providing a defensible standard that is not overly conservative.

Response
DEQ agrees that it is important to strike an appropriate balance. Our goal is to protect aquatic organisms from toxicity and make conservative assumptions where there is uncertainty, but not to be so overly conservative that unnecessary restrictions or costs are incurred when there is a very small probability that toxic conditions will occur.

Comment 1.6

DEQ received comments in this category from commenter 12

It was disappointing to have the EPA proposal released right before the final AC meeting with seemingly no consideration of the quality work being done by that group. This was particularly troubling because EPA representatives attended the AC meetings and were well aware of the work. It is clear that the EPA did not take into account or consider the AC process.

Response
DEQ acknowledges this comment.

Comment 1.7

DEQ received comments in this category from commenter 13

Given Oregon's expected rule adoption and submittal schedule, it is likely that EPA will have to promulgate (finalize) criteria pursuant to the court order.

Response

DEQ is accelerating our schedule in order to recommend adoption of the revised copper standard to the Environmental Quality Commission on November 2. Should the commission adopt the rule on that date DEQ will submit it to EPA before or on November 16, 2016. This will provide EPA a full 60 days to approve the standard before the court deadline of January 16, 2017. In addition, DEQ will be in close communication with EPA and will share the results of the commission action and final package as soon as possible so that EPA has more time to consider the final rule.

TOPIC 2: Protectiveness and Accuracy of the BLM

Comment 2.1

DEQ received comments in this category from commenters 6, 9

Commenters support using the copper BLM as Oregon's freshwater copper criteria. The BLM provides a much more accurate assessment of copper toxicity to aquatic organisms than the existing hardness-based copper criteria.

> **Response**
> DEQ agrees that the BLM more accurately reflects copper toxicity than the current hardness-based equation.

Comment 2.2

DEQ received comments in this category from commenters 1, 6, 7, 9, 11, 12

Commenter strongly prefers DEQ's proposed copper criteria to the draft criteria proposed by the EPA for Oregon. DEQ's proposal is more consistent with the intended application of the copper BLM and is based on extensive evaluation of Oregon-specific water quality data. Accordingly, DEQ's proposed criteria would more accurately reflect copper toxicity in Oregon waters than EPA's proposed criteria.

The proposed EPA rule is different from the DEQ proposal in significant ways which will result in less defensible, overly conservative water quality standards.

> **Response**
> DEQ agrees that EPA's proposed rule does not match our understanding of the intent of the BLM to be used as a performance-based standard, and is more conservative than necessary to protect aquatic life.

Comment 2.3

DEQ received comments in this category from commenter 12

There is general agreement that the BLM is a reliable model when all of the input parameters are measured from a given water sample. The concern comes in when not all parameters were measured in a particular sample.

> **Response**
> DEQ agrees that the BLM is considered a reliable method for determining the value of protective criteria when measured input parameter data are used. We address concerns about missing parameter data in Topic 5 below.

Comment 2.4

DEQ received comments in this category from commenter 13

In order to be protective through time at a particular site, the EPA recommends that ODEQ calculate the numeric expression(s) of the criteria for the site through one of the following methods to represent and protect for the most bioavailable conditions at that site. The EPA recommends inclusion of all three types of site-specific calculations as options in the rule language: (1) the selection of a conservative percentile (e.g., the 10th percentile) of multiple IWQCs or lowest IWQC, (2) the use of conservative default inputs when site specific measured input data do not capture the most bioavailable conditions at a site, or (3) the use of multiple input parameter datasets measured at the site that capture the range of variability over time including the most bioavailable conditions to calculate a suite of IWQCs that apply to a site. The EPA also recommends that ODEQ indicate in rule how ODEQ would select the method that best represents site variability, including the most bioavailable time period given the available data.

Response
DEQ is unclear what EPA means by "calculate the numeric expression(s) of the criteria for the site…?" DEQ's understanding of the BLM is that the instantaneous water quality criteria (IWQC) are the numeric expression of the criteria.

If EPA is suggesting that DEQ calculate one single chronic criterion and one single acute criterion for a site, based on the most bioavailable conditions, and then apply those numeric criteria to the site at all times, DEQ disagrees that in order to protect aquatic life one numeric criterion value based on the most bioavailable conditions must be applied at a site at all times, even when the bioavailable conditions are not present. DEQ does not agree that is necessary to protect aquatic life. And DEQ does not agree that is the intent of the BLM freshwater copper criteria document published by EPA in 2007 nor the recently publication of draft marine copper criteria document, which is also based on the BLM.

DEQ would like more information about why EPA recommends including three types of site-specific calculations in the water quality standard rule. DEQ does not understand the benefit to including three methods rather than selecting one. It is also apparent that each method will result in different criteria values. DEQ is uncertain how it would determine which calculation to use for any given application? Because this is a performance-based standard, it is important to include a clear set of procedures in the rule language that can be consistently applied throughout the state.

DEQ does not agree that options (1) or (2) above are necessary to protect beneficial uses and rejects these methods of criteria calculation. The IWQCs derived by the BLM protect the use and the most accurate method to derive the criteria is to use measured input parameter values for a specific site and time. Conservative default input parameter values will be used where measured data is not available, but it is not necessary to use them when measured data is available.

DEQ agrees that it must protect a site throughout the range of conditions reasonably expected to occur at a location over time when implementing the standard in water quality control programs. The IWQC will vary through time based on the water chemistry conditions at the site. All the IWQCs derived for a location, including the most stringent IWQCs must be met (with the once in three year exception). For example, when analyzing the "reasonable potential" for a discharge to exceed the criteria, DEQ will need to have sufficient data available to derive IWQCs for the range of conditions reasonably expected to occur at the site. DEQ suggests that 24 months of data over 2 years would be sufficient. If sufficient data is not available, DEQ will derive default IWQC values based on conservative default input parameter values for the missing parameters until sufficient measured data are collected and accurate IWQCs representing the range of conditions at the site can be calculated.

Comment 2.5

DEQ received comments in this category from commenter 2

DEQ's insistence that it must "maintain the model as the method to define the criteria," *id*. at 14, ignores the *purpose* of criteria under the statute, which to protect, restore, and maintain water quality, not to run models.

Response
Specific water quality criteria, such as the freshwater criteria for copper, are designed to protect designated beneficial uses, in this case aquatic life. After much scientific review, EPA concluded that the Biotic Ligand Model results protect aquatic life from toxicity due to copper and that the BLM is more scientifically robust than the current hardness-based criteria. EPA recommends the BLM as their 304(a) criteria, which was published in 2007. They also propose a BLM criteria in their recently published (2016) draft marine copper aquatic life criteria document.

Comment 2.6

DEQ received comments in this category from commenter 2

There are plenty of instances in this proposed rule and its issue paper in which DEQ avoids taking advantage of the accuracy of the model in favor of allowing more pollution.

Response
DEQ disagrees with this assertion. DEQ's proposal is to take full advantage of the accuracy of the Biotic Ligand Model. The proposed rule states that the instantaneous water quality criteria (IWQC) results from the BLM based on measured input parameter values is the water quality standard. This is the most accurate way to apply the model. Estimated and default input parameter values are only used when measure values are not available and are only to be used until measured data becomes available. The need to use default values will become less frequent over time as collection of the required input parameter data is now a mandatory part of DEQ's monitoring efforts and NPDES monitoring. DEQ now collects all the BLM input parameters whenever a copper concentration is measured by its monitoring staff, so that the input parameter data needed to derive IWQC will be available. DEQ will also require that major NPDES permittees provide the data necessary to conduct permitting analyses based on accurate measured input data.

Comment 2.7

DEQ received comments in this category from commenter 2

DEQ's proposed rule does not include sufficient information to know where and when the criteria apply.

Response
The copper BLM is a freshwater aquatic life criterion that applies at the same times and locations as all the other freshwater aquatic life criteria in Table 30. Because it is a performance-based approach, the site-specific outputs of the model will vary, just like the hardness-based metals criteria equations and the pH and temperature depended ammonia criteria equations, in a predictable and repeatable manner.

Comment 2.8

DEQ received comments in this category from commenter 2

If no criteria have been derived, do no criteria apply? The rule is not clear. It seems obvious that derived criteria could change over time based on, for example, seasonal changes in runoff of the input parameters.

Response
The BLM criterion is a performance-based or equation-based criterion. The model does not change and it applies at all times. It works like the hardness-based equations for other metals criteria, or the pH and temperature dependent ammonia criteria, which also calculate instantaneous criteria values. The model output, the instantaneous criteria (IWQC), will change if the input parameter values change. The model results are predictable and repeatable; given the same input values the model output will be the same.

Any time a copper sample is available to be evaluated, the BLM readily accepts the input parameter data to calculate an acute and chronic IWQC. The IWQC values will be compared to the copper concentration to determine whether the criteria are being met. Similarly, in order to conduct a reasonable potential analysis, IWQC will be derived for the site in order to conduct this analysis. If sufficient measure data is not available, default values will be used as specified in the water quality standard rule. Even with fixed numeric criteria that do not vary through time, whether or not the criterion is being met is not known until there is a measurement of the pollutant to compare to the criteria. The difference with the BLM is that a water quality sample must measure not only the pollutant, but also the model input parameters. Then both the pollutant concentration and the IWQC are known and can be compared to determine whether the BLM criteria are being met.

Comment 2.9

DEQ received comments in this category from commenter 2

Where criteria may be derived from different parts of the rule, based on what data are and are not available, to which locations do these criteria apply? A more specific example of this problem is that the rule states that BLM criteria based on measured input data "take precedence over criteria based on estimated input[s]," yet it is unclear where, physically, these specific criteria will "take precedence."

Response

The BLM output, the IWQC, are based on a set of input parameters that represent the water chemistry conditions that determine the toxicity of copper to aquatic organisms under those conditions. Once measured data is available and accurate criteria can be calculated, those accurate IWQC take precedence for the physical location and at the time that the input parameter values correctly represent the water chemistry conditions at the site. Estimates and conservative default action values are used so that DEQ is able to apply conservative, protective chronic and acute criteria when local water chemistry conditions are unknown.

Comment 2.10

DEQ received comments in this category from commenter 2

The copper criteria are derived from a wide variety of parameters, some of which can and will be affected by pollution and natural sources. Therefore, the location of where the derived criteria apply can be influenced, intentionally or inadvertently, by the location of the data collected. Yet there is nothing in the proposed rule that prevents various results such as a discharge or other input of alkalinity that affects the calculation of copper toxicity in one location that should not apply to evaluating its toxicity downstream.

Response

It is not the role of the water quality standard to prevent the discharge or natural input of another water quality constituent, such as alkalinity, to the waterbody. It is used to control discharges of copper to the waterbody that would be toxic to aquatic organisms.

Comment 2.11

DEQ received comments in this category from commenter 2

We appreciate the flexibility to explore different percentiles of the instantaneous water quality criteria (IWQC) distribution as the basis of the criteria, but we ask for clarification on what would be a "protective value" to select. Additionally, the paper states, "[numeric criteria are] set at the level of the most sensitive conditions." However, the "most" sensitive conditions would likely be expected to be associated with the lowest IWQC, not a higher percentile (e.g., 10th, 25th) of the distribution. Again, we seek clarification on what would constitute "protective value."

Response

The comment appears to confuse discussion to use a percentile of DOC concentration as a default input parameter to the BLM with using a percentile of the calculated IWQC (the model results) as the criteria. DEQ does not propose to set numeric criteria at the level of the most sensitive condition. The Instantaneous Water Quality Criteria (IWQC), the acute and chronic criteria values, derived by the BLM for a given set of measured input parameters are by definition protective of the use under the conditions represented by the input parameter values. DEQ will ensure when implementing the standards in pollution control programs, such as NPDES permitting, that the permitting analysis and effluent limits if needed are based on the most sensitive or bioavailable conditions reasonably expected to occur at the site.

The issue paper has been revised to provide supporting information for DEQ's final proposed default values for DOC of the 20^{th} and 15^{th} percentile of all available high quality data. Please see the final Issue Paper, Section 6.5

Comment 2.13

DEQ received comments in this category from commenter 13, 2

Downstream waters and designated uses (e.g., salmonid migration) must be considered when calculating a protective criterion in upstream waters such that the criteria expressions are protective of the whole site and downstream waters. We recommend that the State develop methods for determining downstream protectiveness of the criteria and include the methods in the rule and/or implementation methods.

Response

In the case of toxics criteria for aquatic life, the aquatic life use is designated throughout all waterbodies in Oregon with very few exceptions. In the case of copper, the criteria are based on toxicity to 2 genera of daphnia, which are the most sensitive species. Therefore, we do not expect more sensitive aquatic life uses to occur downstream of any location where the copper criteria apply.

DEQ includes in our implementation methods for permitting, for example, that the permitting analysis must evaluate downstream criteria and protect downstream uses. That review happens in the permitting analysis and the implementation of other pollution control programs and in the process of developing total maximum daily loads for a water body.

Comment 2.14

DEQ received comments in this category from commenter 2

DEQ does not specify how it will *ensure* protectiveness in downstream locations, contrary to the requirements of 40 C.F.R. § 131.10(b) ("In designating uses of a water body and the appropriate criteria for those uses, the State shall take into consideration the water quality standards of downstream waters and shall ensure that its water quality standards provide for the attainment and maintenance of the water quality standards of downstream waters.").

Response
See response to comment 2.13 above.

Comment 2.15

DEQ received comments in this category from commenter 2

As noted, the time during the day can have a significant effect on input parameters and metals levels. In the paper cited *supra*, the stream showed that dissolved Zn concentrations increased by 300 percent from late afternoon to early morning, while dissolved As concentrations exhibited the opposite pattern, increasing 33% between early morning and late afternoon. See also ODEQ, *Final Issue Paper: Hydrogen Ion Concentration: 1992-1994 Water Quality Standards Review* (June 1995) at 2-4. Alkalinity is also known to be variable throughout the seasons. *See id.* at 2-1 – 2-4. There is nothing in the rule that ensures that the data used in the derivation of criteria have been collected at the time of day or the season and condition in which the metals will have the most availability and toxicity to aquatic life.

Response

The rule establishes that the BLM results provide an protective acute and chronic instantaneous water quality criterion that applies whenever a set of input parameters are measured, or when applying a conservative default value for missing input parameters.

While the bioavailability of copper may change at a site with variability in the BLM input parameters, the concentration of Cu is not expected to fluctuate appreciably throughout the day. The diel concentration changes that occur for Zinc (Zn) and Arsenic (As) presented in the comment are not relevant to Copper (Cu). Copper has a strong affinity for DOC[1], and if bound with DOC, Cu has different sorption behavior than other divalent cations such as Zn[2]. Unlike Zn or As, Cu does not display distinct diel concentration cycles, with the range of diel changes in concentration of less than 10%.[3,4,5]

In addition, the implementation of the criteria in water pollution control programs, such as conducting Reasonable Potential Analyses for NPDES permits, provides for monitoring requirements that ensure the most bioavailable conditions at a site will be represented as the water quality parameters affecting copper bioavailability fluctuate at a site over time.

Comment 2.16

DEQ received comments in this category from commenter 2

DEQ appears to rely as a justification for not using protective values on a letter written by the National Marine Fisheries Service (NMFS) that stated that site-specific values calculated using the BLM would be

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[1] Cabaniss, S.E., Shuman, M.S., 1988. Copper binding by dissolved organic matter: 1. Suwannee River fulvic acid equilibria. Geochim. Cosmochim. Acta 52, 185–193.

[2] Nimick DA, Gammons CH, Parker SR (2011) Diel biogeochemical processes and their effect on the aqueous chemistry of streams: A review: Chem. Geol. 283, 3-17.

[3] Nimick, D.A., Gammons, C.H., Cleasby, T.E., Madison, J.P., Skaar, D., Brick, C.M., 2003. Diel cycles in dissolved metal concentrations in streams: occurrence and possible causes. Water Resour. Res. 39

[4] Tercier-Waeber, M.-L., Hezard, T., Masson, M., Schäfer, J., 2009. In situ monitoring of the diurnal cycling of dynamic metal species in a stream under contrasting photobenthic bio film activity and hydrological conditions. Environ. Sci. Technol. 43, 7237–7244.

[5] Balistrieri LS, Nimick DA, Mebane CA (2012) Assessing time-integrated dissolved concentrations and predicting toxicity of metals during diel cycling in streams. Sci. Total Environ.425, 155-168.

sufficiently protective as the 1.45 µg/L chronic value the agency first set out in its biological opinion. *Id*. at 25. The fact that NMFS endorsed the use of site-specific data to evaluate toxicity of copper to aquatic species based on the BLM does not translate into the use of a less conservative default where site-specific data do not exist. In addition, the issue paper relies on an October 8, 2015 letter from EPA to NMFS despite the fact that NMFS issued a December 3, 2015 letter and a correction to that letter dated January 19, 2016. It is unclear what DEQ thinks of either NMFS letter because they are not cited and only DEQ's odd conclusion comparing the results is mentioned.

Response
DEQ does not agree with the assertion that it is attempting to justify using defaults less protective than noted by NMFS in its Biological Opinion. Rather, DEQ has developed an approach that makes use of the Oregon data to establish statistically-based default inputs at an appropriate level of stringency so as to be protective while still providing a reasonable measure of accuracy. The NMFS Biological Opinion stated that based on toxicity data for salmonids, a chronic criterion of 1.45 µg/L copper concentration may be protective at all times. NMFS refers to the 1.45 µg/L numeric criteria as a suitably protective level in the Biological Opinion, and DEQ refers to this statement as quoted in EPA's October 8, 2015 letter to NMFS regarding the Reasonable and Prudent Alternatives. The correction letter from NMFS to EPA dated January 19, 2016, is a clarification to EPA that establishes that the BLM IWQC would also be sufficient to protect threatened and endangered species (i.e., salmonids and other finfish), even if they differ from the 1.45 µg/L numeric criterion. Given this, DEQ's discussion of its approach attempts to connect its analysis and derivation of default BLM input parameter values that result in IWQC values to NMFS' statement regarding the protectiveness of 1.45 µg/L for threatened and endangered species.

DEQ will change the reference to the 1.45 µg/L in the Issue Paper from the October 8, 2015 letter to the actual statements contained in the NMFS Biological Opinion[7]. However, the substance of NMFS' findings is not changed. Given NMFS' statements, DEQ concludes that default action IWQCs at or below 1.45 µg/L protect threatened and endangered species. In fact, EPA's 2007 criteria recommendation, the 1.45 µg/L chronic criteria value is identified as protective of the most sensitive species to copper, which are *Daphnia,* under specified water chemistry conditions. The salmonids and other finfish are significantly less sensitive to copper toxicity[6].

Comment 2.17

DEQ received comments in this category from commenter 13

EPA is confused by the reference to a NOAA letter that ODEQ indicates states that a less stringent criterion could be protective. It would be helpful for ODEQ to excerpt the statement from that letter and provide the citation in the issue paper so that the context for that statement is clearer. The current citation is to an EPA (not NOAA) reference.

Response
DEQ is referring to the Reasonable and Prudent Alternatives (RPAs) in the NMFS Oregon

[6] EPA 2007, Aquatic Life Ambient Freshwater Quality Criteria – Copper 2007 Revision. United States Environmental Protection Agency. Office of Water 4304T. EPA-822-R-07-001. February 2007.

Toxics Biological Opinion[7], p. 548, which states:

> *"The EPA shall recommend that the State of Oregon adopt, and EPA will promulgate if necessary, a new chronic criterion of 1.45 µg/L for freshwater copper using EPA's 2007 BLM-based aquatic life criteria."*

The passage above is quoted in the letter from EPA to NMFS regarding the RPAs dated October 15, 2014. DEQ has corrected this reference in the Issue Paper to directly cite the Biological Opinion.

The January 19, 2016 letter from NMFS to EPA clarifies that the BLM IWQC would be protective of threatened and endangered species even when they differ from the 1.45 µg/L value. The chronic numeric criteria of 1.45 µg/L criteria was proposed by NMFS as a protective statewide numeric criteria that could be use where the data to derive BLM criteria are not available. Therefore, while the BLM may predict toxic conditions to aquatic life, notably *Daphnia* species, due to increased bioavailability of copper below 1.45 µg/L as input parameter concentrations affecting the bioavailability of copper change, the salmonid species are considerably less sensitive to copper than *Daphnia*. As a result, it is uncertain whether it is necessary to use default BLM input parameter values that result in chronic IWQC values excessively below 1.45 µg/L in order to protect threatened and endangered salmonid species.

Please also see our response in Comment 2.16, above.

[7] NMFS, 2012. Destruction or Adverse Modification of Critical Habitat Endangered Species Act Biological Opinion for Environmental Protection Agency's Proposed Approval of Certain Oregon Administrative Rules Related to Revised Water Quality Criteria for Toxic Pollutants, NMFS Consultation Number: 2008/00148. National Marine Fisheries Service. August 14, 2012.

TOPIC 3: Performance-Based Criteria

Comment 3.1

DEQ received comments in this category from commenters 1,3,4,5,7,11

Using a performance based approach with site-specific data is the most scientifically defensible method for determining toxicity and is most consistent with the original intent of the BLM.

Response
DEQ agrees with this comment.

Comment 3.2

DEQ received comments in this category from commenters 1, 4, 11

A performance-based approach for the new proposed criteria would appropriately avoid application of overly conservative copper criteria to entire stream reaches, waterbodies, or regions of the state based on more generally available or conservatively applied regional BLM data.

Response
DEQ agrees that applying the BLM IWQC as a performance-based criterion most accurately identifies the criteria necessary to protect against copper toxicity. Selecting the lowest criteria value that may occur at a site or in a region and applying it to all water conditions would significantly over-estimate the stringency of criteria necessary to protect aquatic life from copper toxicity under actual water quality conditions. DEQ analysis in this regard is contained in the DEQ Technical Support Document and was also discussed during the Advisory Committee process[8].

Comment 3.3

DEQ received comments in this category from commenters 7, 8

We would like more information on what a performance-based standard approach would look like. Additional information will be needed in regard to programs that have traditionally used criteria based on a single, numeric limit.

Response
DEQ understands that additional information would be helpful to understand how the BLM would be applied as a performance-based standard.

DEQ utilizes similar types of performance-based criteria in its water pollution control programs, including the hardness equation-based criteria for copper, cadmium, chromium III, lead, nickel, silver, and zinc (OAR-340-041 Table 30, Endnotes E and F), and the pH and temperature equation-based ammonia criteria (OAR-340-041 Table 30, Endnote M).

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[8] DEQ 2016. Technical Support Document: An Evaluation to Derive Statewide Copper Criteria Using the Biotic Ligand Model. http://www.oregon.gov/deq/RulesandRegulations/Pages/2015/Rwqcopper.aspx

While this approach is somewhat similar, implementation of the BLM-based criteria differs from the other equation-based standards in that there are more input parameters required.

Recognizing this distinction, DEQ has included specific procedures in the proposed rule to apply default BLM input parameter values where those data are not available and a criteria value must be evaluated. These procedures are also described in the Issue Paper Section 6. DEQ is committed to developing procedures for writing permits and implementing the criteria in other CWA programs.

Comment 3.4

DEQ received comments in this category from commenter 13

An instantaneous water quality criterion (IWQC) is an instantaneous chemical concentration magnitude that is calculated at a specific point in time. Therefore, ODEQ should clarify how criteria will be derived using the BLM to protect a waterbody at all times and under the full range of conditions that could be expected for the waterbody.

Response

The BLM is protective of the water body at all times as a performance-based criterion, even though the model results, that is, the instantaneous criteria (IWQC), for a given location and time will vary based on the water chemistry conditions present when a sample to be evaluated is collected. The model is readily able to accommodate the full range of input parameter data likely to occur and adjust the criteria values for any combination of water chemistry conditions evaluated by the model. The purpose of using the BLM is that it more accurately identifies the copper criteria necessary to avoid toxicity to aquatic life than the current hardness-based criteria for copper.

There are a myriad of scenarios in which DEQ will use the IWQCs to ensure attainment and protection of the waterbody. For example, when conducting NPDES permitting analysis, DEQ will evaluate a set of data that characterizes the range in water quality conditions at the site. In addition, for assessment, DEQ will use all the data available to evaluate whether the waterbody is attaining the appropriate criteria for a concurrent set of copper and water chemistry data. In TMDLs, DEQ has likely the greatest opportunity to evaluate multiple water chemistry conditions that will occur in the waterbody and establish TMDLs, wasteload allocations and load allocations on meeting the IWQC throughout the range of conditions.

Comment 3.5

DEQ received comments in this category from commenters 3, 5

We recommend using a conservative percentile to summarize the IWQC as one option over existing hardness-based methods. The Issues Paper seems to conflate a centile of the IWQC with the “most sensitive” conditions on site, which is not necessarily true. While selecting a reasonably conservative centile of IWQCs is a pragmatic solution, not all stakeholders would necessarily agree this would represent a “most sensitive” condition. Further clarification by DEQ in these respects would be helpful.

Response

DEQ does not understand the comment. DEQ is not proposing to use a centile of the IWQC to represent most sensitive conditions at a site. Rather, DEQ is proposing to use a percentile of the input parameter data to calculate default input parameter values where measured data does not exist. Separately, DEQ has some initial discussion in the Issue Paper regarding its current thinking about conducting reasonable potential analyses and the derivation of effluent limits for permittees to ensure any needed limits are set to protect the range of conditions that may occur at the point of discharge and downstream of the discharge, including sensitive or bioavailable conditions.

Comment 3.6

DEQ received comments in this category from commenter 4

The rule proposes how "IWQC" are to be calculated but does not define or explain the meaning of "IWQC." The rule should be revised to include a definition of "IWQC" (i.e., assumed to be "instantaneous water quality criteria" based on DEQ supporting material provided with the rule).

Response

The acronym "IWQC" is defined in the rule as the instantaneous water quality criteria. The rule further defines IWQC as the BLM model outputs for a given set of measured input parameter values and as the numeric expression of the BLM criteria. In addition, the term "instantaneous water quality criterion", and "IWQC", are referenced and defined on page 1 of the Issue Paper; the definition of IWQC is repeated, and a discussion of the meaning of the criteria, is also provided, as part of the model introduction on page 8 of the Issue Paper.

Comment 3.7

DEQ received comments in this category from commenter 2

DEQ states that the water quality standards rule specifies the equation as the criteria. In this case, the copper BLM is adopted by reference to the model software. If these numeric outputs that will be calculated in the future are the criteria, what criteria, if any, apply before DEQ calculates or derives specific numeric criteria? In addition, we strongly object to any language or the absence of language that suggests that at any given time for any particular Oregon waterbody the public cannot readily identify which criteria apply to protect aquatic life from copper toxicity and that there is a possibility that no criteria apply.

Response

Like hardness-based criteria, the criteria for any given water body at any given time are the chronic and acute IWQC calculated by inputting the water quality parameter data for that waterbody and time into the BLM, which readily accepts the data and calculates the IWQC. The BLM software calculates appropriate and protective instantaneous water quality criteria (IWQC) that reflects the bioavailability of copper given the water quality conditions defined by a set of input parameters. In this way the instantaneous criteria are identical in function to the criteria derived from use of a hardness-based metal or ammonia equation.

The instantaneous criteria calculated by the model are accurate, repeatable, and available to anyone who wishes to access the model software and the necessary input data. If measured BLM input parameter data is not available, DEQ has provided repeatable procedures for applying conservative default input values to derive a default action value that will be applied until measured parameter data can be obtained.

In order to provide additional transparency and easier access to the information, DEQ will publish tables of IWQC that result from common combinations of water chemistry conditions, including pH, temperature, DOC and specific conductance (for simplification). EPA provides such tables in their recently published draft marine BLM criteria document and they seem helpful.

See responses to comments 2.6, 2.7, 2.8 and 2.9 above.

Comment 3.8

DEQ received comments in this category from commenter 2

The options in the rule to be chosen by staff result in a lack of replicability, which is at the heart of the concept of a performance-based standard. With the ambiguity and judgment calls that are built into the rule, it is not possible to ensure that the end results would be as consistent as they must be to avoid the need for subsequent EPA review and action.

How will DEQ ensure that estimates of alkalinity and the ions per Endnote N(1)(b) are done in a consistent fashion? The same is true of references in the rule language to data sufficiency, how to handle a lack of data and making assumptions (see (1)(a) and (1)(c).
Even where the rule specifies that there be 30 samples to calculate default values, the geographic area they are to come from is unknown.

Response
In response to the comments received, DEQ has revised the rule to reduce the number of choices and to clarify the procedures that will be used to substitute estimates or default values where measured data is not available. DEQ has removed the allowance for calculating site-specific or waterbody specific defaults values based on a minimum of 30 samples. Rather DEQ will consistently use the regional default DOC percentile values provided in Endnote N (2), table N-2. The resultant DOC concentration values for each region based on the currently available data will be published on DEQ's website.

Estimates of alkalinity and ions are calculated using the equations provided in Endnote N (1), table N-1. The result of the equation for a given specific conductance value is always identical, hence it is a repeatable and consistent method for producing estimates of the geochemical ions and alkalinity required to derive a criteria using the BLM.

Comment 3.9

DEQ received comments in this category from commenter 2

One significant hole in the standard is that apparently DEQ has not yet decided how to handle an impairment in pH, which is a model input variable. Issue Paper p. 17. DEQ has not explained how the use of best professional judgment to evaluate available pH data will result in replicable results such that the agency can claim that this standard is performance-based.

Response

DEQ recognizes the rule and implementation procedures do not define a simple method to calculate pH and temperature input values when these data have not been collected.

However, pH and temperature data are available for the vast majority of samples where copper data is available; only 8% of the current number of copper samples do not have concurrent measurements of pH, and 7% do not have concurrent measurements of temperature. As pH and temperature data are widely and routinely collected, DEQ's method uses measurements of pH and temperature that are available and relevant. Methods include use of data that have been collected at the same site but at different times, or nearby sites at the same time, to interpolate a reasonable pH and temperature value to be used for a sample where these had not been collected concurrently. DEQ acknowledges that such an estimation process relies on best professional judgement and the amount and quality of data available, which cannot be predicted for every circumstance. However, DEQ conducts these types of interpolations routinely and they are scientifically credible. DEQ will provide technical assistance and examples to permit writers and others needing to determine the appropriate criteria in these circumstances to help ensure consistency.

The EPA did not provide any guidance on how to determine an appropriate missing pH and temperature value in either their draft rule for Oregon, or any of their technical support documents for the Copper BLM. In fact, the EPA Missing Parameters Technical Support Document directs potential users to return to the field and collect these data instead of proceeding to calculate criteria for the given sample using the BLM.

DEQ will use the most accurate value for pH for the site, regardless of whether the site is impaired for pH because the value influences the toxicity of copper. DEQ will separately evaluate pH data for determination of pH impairments.

Comment 3.10

DEQ received comments in this category from commenter 2

But we are equally concerned that DEQ could accept violations of other criteria, and factor them into evaluating copper toxicity, where those violations should be removed and should not be the basis for finding that more copper is acceptable than would otherwise be if there were no other violations.

Response

DEQ is unsure what the commenter means by DEQ would "accept violations of other criteria." Nothing in the proposed copper rule changes how other water quality parameters are evaluated in terms of compliance with their criteria. Whether a sample of BLM input parameters includes a value that violates a criteria specific to that parameter has no bearing on whether that parameter concentration influences the bioavailability of copper. Additionally, decreases in pH and increases in temperature result in more conservative BLM IWQC values. The most sensitive model parameter, DOC, has no water quality criteria. DEQ will use the actual input parameter values to ensure that the IWQC protective of aquatic life according to the prevailing water quality conditions.

If water quality conditions change in response to a regulatory action affecting the concentration of one of the BLM input parameters, the BLM is adaptive and will provide a new IWQC that is also protective of copper for any new water quality conditions. The BLM does not establish criteria for any pollutants other than copper.

Comment 3.11

DEQ received comments in this category from commenter 2

There is nothing in the rule that establishes what the *goal* of using the BLM model is, namely to obtain the most protective criterion that is required to cover a geographic range and a time range to which the criterion applies. Instead, it simply talks about derivation using data or defaults where data are not available. Based on the variability of BLM inputs described above, there appears to be a significant opportunity for gaming the system: collecting data from a system that fail to represent the worst case for toxicity in the system. There is nothing in the proposed rule that protects against that or that even directs the opposite outcome. Yet even in the absence of such language, DEQ proposes to use the non-conservative 25th percentile of default inputs for missing data.…

Response

The rule specifies the freshwater aquatic life criteria for copper - the BLM as a performance based standard in accordance with to the 2007 EPA Aquatic Life Ambient Freshwater Quality Criteria for Copper. The goal of all the aquatic life criteria in Table 30 is to protect fish and aquatic life from toxic pollutants. The draft rule language introducing the model may not have been specific enough about this intent. In order to clearly indicate that the BLM is being adopted as a performance-based criteria DEQ clarified that the criteria that apply at any given time are the BLM-derived instantaneous water quality criteria based on a concurrently measured set of model input parameter values.

DEQ also added language that indicates the intent for water pollution control programs, such as NPDES and TMDLs, to monitor water quality conditions to ensure that the most bioavailable conditions are represented.

DEQ and other entities collect data for many purposes. DEQ’s data collection occurs routinely within its ambient network and other monitoring occurs within various basins based on maximizing resources, holding times, and other logistics. For regulated entities, DEQ will evaluate data collected by sources to ensure the data reasonably captures variability and spans the range of conditions.

TOPIC 4: Rule Language

Comment 4.1

DEQ received comments in this category from commenter 13

The following statement, “The freshwater copper criteria to protect aquatic life are calculated using the Biotic Ligand Model (BLM) with measured input parameter data.” does not completely align with ODEQ’s procedures for calculating criteria using the BLM. Because estimates will be used to substitute for measured data when data are absent, EPA recommends that ODEQ make the statement more general, such as “The freshwater copper criteria to protect aquatic life are calculated using the Biotic Ligand Model (BLM) with measured or estimated input parameter data as described in (1) and (2), below.”

Response
DEQ revised the rule language in order to make this clear. The copper criterion is the BLM and the output of the model--the IWQC--based on accurate input parameter data that is, measured input parameter values or accurate estimates. Default values are not equal to the criteria. Default values must be used for Clean Water Act purposes when the input data are missing and an accurate IWQC cannot be calculated in order to protect aquatic life.

Comment 4.2

DEQ received comments in this category from commenter 13

Please add a clarifier that the software versions must result in consistent outputs to this statement, “The acceptable BLM software includes version 2.2.3 or a subsequent version of the model based on the toxicity data described in the EPA document, “Aquatic Life Ambient Freshwater Quality Criteria – Copper”: EPA-822-R-07-001, February 2007.”

Response
DEQ revised the rule language regarding the model versions that may be used.

Comment 4.3

DEQ received comments in this category from commenters 3, 5

Change “Endnote G (1)” to “Endnote N (1)”. We cannot find Endnote G in the rulemaking package, so assume this is a typographical error.

Response
DEQ will correct the typographical error where Endnote N was referenced as Endnote G.

TOPIC 5: Missing Input Parameter Data, Use of Estimates and Default Values

General Comments

Comment 5.1

DEQ received comments in this category from commenter 2

Where there are no data, DEQ is still required to regulate copper toxicity.

> **Response**
> DEQ agrees that it must have protective criteria at all times in our regulatory programs. DEQ's procedures in the rule to either estimate input parameter values or to use conservative default values, where appropriate, achieve this requirement.

Comment 5.2

DEQ received comments in this category from commenters 1, 11

The standard should focus on efforts to ensure adequate data collection, rather than the application of overly conservative defaults.

> **Response**
> The role of the standard is to define the criteria and ensure that protective criteria are applied at all times in our regulatory programs. While DEQ agrees that adequate data collection is important to the application and implementation of the criteria, DEQ disagrees that the rule itself is the proper forum to include monitoring requirements.
>
> DEQ has expanded monitoring of BLM parameters, and will be measuring the input parameters whenever copper data is collected. DEQ will require major permittees and sources that may contribute copper at levels that may contribute to an exceedance of the criterion to monitor for BLM parameters. In addition, sources that discharge to waters impaired for copper will likely be required to collect data. DEQ must also address the situations where data is not available and use methods that result in protective criteria.

Comment 5.3

DEQ received comments in this category from commenter 8

The Tribe believes DEQ's combination of statistically similar water quality data into broader physiographic areas to cover areas lacking site specific monitoring is reasonable, but encourage DEQ to increase monitoring efforts in areas lacking data to verify that these are reasonable groupings.

> **Response**
> DEQ acknowledges the commenter's assessment that the approach is reasonable. The data used in DEQ's biotic ligand model database, as described in the Technical Support

Document, represents the best available data currently available for Oregon at this time. As described in other responses, due to a number of efforts DEQ expects data to increase over time and will re-evaluate the basis for deriving regional estimates for default BLM input parameters.

Comment 5.4

DEQ received comments in this category from commenter 2

Given the minimum 2-year delay that DEQ has built in to the use of default parameters identified in Endnote N(2)(a), (b), where input data are missing/not available and cannot be estimated, what are the copper criteria that apply? Do no copper criteria apply until the conclusion of this data gathering? If so, for which waterbodies does DEQ propose to have copper criteria through this proposed rule?

Response
The commenter refers to Endnote N(2)(a) and (b) in the proposed rule referring to using at least 30 samples, spread over at least a 2-year time period to calculate a water-body or site-specific default. DEQ has removed the provision allowing the use of water-body specific DOC defaults as a substitute for regional DOC default, as regional defaults are sufficiently conservative to provide the required level of protection for a wide range of conditions for waterbodies within the regions.

As the BLM is being applied as a performance-based standard similar to ammonia and hardness-based metals criteria, DEQ has clarified the method by which the BLM is applied in any circumstance given the availability of data ensuring that protective values are available under any circumstance.

Comment 5.5

DEQ received comments in this category from commenter 13

EPA strongly recommends that ODEQ identify the initial dataset from which it will calculate the estimated defaults in the rule language (such as, “data included in ODEQ’s TSD 2016”), even if ODEQ expects to recalculate the criteria from time to time based on newly collected data that will be added to the dataset. Adding a citation to the database or TSD in the rule language will provide assurance that the dataset used to derive the default input parameters is transparent, and that stakeholders can evaluate the resultant criteria from the model. This request is similar to ODEQ’s inclusion of the software BLM version citation in the rule language. ODEQ could include an additional caveat in the rule language for any updates to the database, such as “and any additional data that meets ODEQ’s QAQC level of high quality.”

Response
DEQ did not explicitly revise the rules to include such a reference, however, DEQ made clarifications in the rule language about the data that will be used for calculating default values. In addition, DEQ’s intent is to use all high quality data from surface water bodies contained in the DEQ database, which includes data collected by DEQ, USGS and others, to derive input parameter default values. The data sources and quality assurance / quality

control procedures for the database used to analyze and derive IWQC, and determine default input parameters, has been described in detail in Oregon's technical support document.

Specific Conductance Regression Equations

Comment 5.6

DEQ received comments in this category from commenters 1, 7

Agrees the standard should include reasonable methods to fill missing data for those parameters to which the BLM is not sensitive. These parameters include calcium, magnesium, sodium, potassium, sulfate, chloride, and alkalinity.

Response

DEQ agrees with the commenter and will continue to include an equation for estimating the concentration of missing ions and alkalinity from specific conductance data for samples where one or more of these parameters is missing. The findings detailed in DEQ's technical support document show that the accuracy of IWQC was not degraded when estimates of calcium, magnesium, sodium, potassium, sulfate, chloride, and alkalinity were calculated from equations using specific conductance.

Comment 5.7

DEQ received comments in this category from commenters 6, 9

Given the ability to use specific conductance to derive accurate values for alkalinity and the ions, it is primarily the DOC data that have not been collected in the past. This should enable the permittee to collect the needed data quickly.

Response

Major permittees and sources that may contribute copper at levels that may contribute to an exceedance of the criterion will be required to collect all BLM input parameters, including calcium, magnesium, sodium, potassium, sulfate, chloride, alkalinity, and DOC. The regression equations are being reserved only as a means to estimate the concentration of calcium, magnesium, sodium, potassium, sulfate, chloride, or alkalinity in the case one or more of these parameters is missing from a sample.

Comment 5.8

DEQ received comments in this category from commenter 7

DEQ should remove the regression equations for calcium, magnesium, sodium, potassium, sulfate, chloride, and alkalinity from the standard and include them by reference, so they can be updated with new data without going through a rule making process to change the standard.

Response

The accuracy of IWQC was not degraded when estimates of calcium, magnesium, sodium, potassium, sulfate, chloride, and alkalinity were calculated using the existing specific conductance equations as stated in the rule. The relationships between ions and specific conductance are based on a large dataset, are robust, and are not expected to change significantly over time. While DEQ will periodically update these relationships as more data is collected, the current equations will remain in the proposed rule in order to provide for repeatable and reproducible derivation of criteria and in order to be transparent to the public about the criteria procedures.

Comment 5.9

DEQ received comments in this category from commenters 3, 5

We appreciate the allowance of geochemical estimation of some of the BLM-required parameters. We ask for clarification on whether other methods, such as a sensitivity analysis, would preclude the need to sample some of the parameters in future monitoring if their two years of data show that variability in these parameters do not markedly affected the IWQC (and can be reliably estimated, such as through the geometric mean of measured values)? Or, will specific conductance always have to be collected to estimate these parameters?

Response

As the commenter acknowledges, DEQ expects to require the collection of both specific conductance and alkalinity and the ions by major dischargers for the first two years in order to validate the expected relationships for the specific site. DEQ expects that if the relationship is validated, the discharger will be able to monitor specific conductance rather than all the ions. Specific conductance is an inexpensive, widely collected water quality parameter. DEQ conducted a sensitivity analysis of calcium, magnesium, sodium, potassium, sulfate, chloride, and alkalinity as part of the analysis for the Technical Support Document. While the model is not particularly sensitive to any of these parameters individually, a sufficiently accurate value of the concentration for each of these parameters must be entered into the current versions of the BLM in order to evaluate an instantaneous water quality criteria.

If a discharger would prefer to monitor alkalinity and the ions instead of specific conductance that would also be acceptable.

Comment 5.10

DEQ received comments in this category from commenter 7

DEQ should allow for regional or site-specific regression equations to replace endnote N, Table 1 if site-specific data exists that were collected at different times than the other BLM parameters.

Response

DEQ found that, given the relatively low sensitivity of the BLM to the concentration of individual measurements of calcium, magnesium, sodium, potassium, sulfate, chloride, and alkalinity, the current regression equations provide for accurate IWQCs when applied on a statewide basis.

Development of regional regression equations to refine estimates of these input parameters is not a priority at this time.

Comment 5.11

DEQ received comments in this category from commenter 2

Regarding the use of specific conductivity in estimating inputs, ODEQ has included specific conductivity regression relationships for estimating alkalinity, calcium, sodium, magnesium, potassium, chloride and sulfate in the proposed rule. These methods are consistent with the recommendations of the EPA's draft "Technical Support Document: Recommended Estimates for Missing Water Quality Parameters for Application of EPA's Biotic Ligand Model" (EPA, 2016). Although we realize that current data may be limited to develop ecoregion and stream-order based relationships, as the State collects more data, over time and at intervals such as at the triennial reviews, we recommend that ecoregion- and stream order-based translators be developed and adopted into the rule language.

Response
Please see response to comment 5.10, above, and 5.22, below.

Use of Default DOC Percentiles

Comment 5.12

DEQ received comments in this category from commenters 1, 3, 5, 7, 10

Given the sensitivity of the BLM to DOC, recommend removing use of default values for DOC from the standard.

Response

DEQ must have the ability to apply protective criteria at all times in our regulatory programs, such as NPDES permits. Therefore, we must include provisions in the rule in order to provide a conservative estimate of DOC concentration for derivation of criteria when this data is not available.

Comment 5.13

DEQ received comments in this category from commenter 12

EPA proposes that an extremely conservative 10^{th} percentile of the default values be used for missing parameters. These result in extremely low IWQC that are overly protective and not necessary to protect the designated uses. In contrast, the 25^{th} percentile regional default criteria DEQ proposes will be sufficiently protective. There is no biological reason for the IWQC based on default values to be so low when in almost all circumstances, the results using actual measured values are much higher.

Response

DEQ agrees that the EPA Ecoregion 10th percentile of DOC results in IWQC values that are inaccurate, because they are based, in DEQ's view, on an insufficient number of samples to develop a reliable or representative estimate of the 10th percentile of DEQ acknowledges the commenter's support for the proposed 25% percentile and refers to Comments 5.12 – 5.26 for DEQ's response to other comments and rule revisions in response.

Comment 5.14

DEQ received comments in this category from commenters 4, 7, 11

Using the 25th percentile of DOC will result in approximately the correct number of exceedances being detected across the state, lower percentiles overestimate toxicity and would be extremely costly to the state with no environmental benefit.

Response
While the 25th percentile was initially selected because it seemed to approximate the measured IWQC values well, while still being conservative, DEQ has conducted additional analysis of the accuracy and relative protectiveness of various percentiles of regional DOC concentration. These are provided in the revised Section 6 of the Issue Paper. DEQ has determined that in order to ensure a suitable level of protection for sensitive conditions, even if rarely occurring, it will need to use the slightly more conservative 20th percentile of regional DOC concentration as a default for all regions except the Eastern region, where it will apply the 15th percentile of DOC.

Comment 5.15

DEQ received comments in this category from commenters 3, 5

Although it is clear that the 10th percentile will be conservative, it is not clear that the 10th percentile will be reasonable in all cases. If the distributions in Figure 6.3 are an indication, the distribution of IWQC values is relatively flat from the 10th to the 90th percentile (i.e., most IWQC values are close to the median). At the tails of this distribution, IWQC values tend to deviate sharply from the median, but these deviations are isolated to the extreme portions of the distribution (i.e., less than 10th and greater than the 90th). This shape is apparent because Figure 6.3 includes data from the entire state. For a given site, where the number of available observations will be much fewer, a small number of low values could have a large effect on the apparent value of the 10th percentile. In these cases, using the 10th percentile may represent concentrations that are 10-fold less than the median (based on Figure 6.3), and therefore may result in very low estimates for the IWQC. Therefore, DEQ should consider either providing additional clarification as to why the 10th percentile represents the most appropriate level of conservatism, or the option for flexibility to use different centiles depending on the distribution of available data.

Response
DEQ agrees that using the EPA Ecoregional 10th percentile of DOC as a default input parameter is conservative, but is not reasonable, for the majority of conditions likely to be encountered. The tails of the distribution referred to in the comment (Issue Paper, Figure 6.3) are highly skewed for samples below the 10th percentile and above the 90th percentile.

DEQ does not consider that the EPA 10th percentile of DOC represents the most appropriate level of conservatism, which is why DEQ proposed the 25th percentile of regional DOC as a default at the time of public comment. DEQ has conducted additional analysis of the accuracy and relative protectiveness of various percentiles of regional DOC concentration. An in-depth analysis of the relative protectiveness, conservatism, and accuracy of using DOC default concentration from the 15th to the 25th percentile have been added to the issue paper, Section 6.5.

Comment 5.16

DEQ received comments in this category from commenter 2

DEQ rejects EPA's use of the 10th percentile as overly conservative. It also rejects use of the 10th percentile because "many DOC samples are clustered near the limits of quantitation from USGS and DEQ data sources. This reduces accuracy and introduces bias towards very low DOC concentrations at the low end of the distribution." More explanation is required. If the data are within the limits of quantitation, they are as valid as any other data that are within the limits of quantitation. That's the whole point of having limits; to ensure that all data samples within those boundaries are reliable. Now DEQ is suggesting that they are not. Where does DEQ draw the line of quantitation reliability inside quantitation boundaries? How does DEQ know that bias has been introduced rather than the data representing an accurate reflection of low DOC concentrations? There is no basis for DEQ's assertion.

Response

As presented in DEQ's Technical Support Document, over 24% of the DOC samples in the database are below the quantification limit (QL). The percentile for default DOC distribution were calculated using the raw reported value for the concentration, even where that value was below the QL, signifying it is known to be inaccurate, but likely to be conservative. DEQ has purposely introduced a conservative bias into its database to ensure estimates had a high probability of being protective.

DEQ provided analysis of this bias that is detailed in the DEQ Technical Support Document, pp.39-42.The median of DOC concentration when including these below-QL samples is lower than the unbiased mean calculated using the maximum likelihood. This introduces a bias toward more conservative concentration values for the percentiles of DOC to be used as defaults. DEQ incorporated DOC samples that were below the QL, even though the concentrations are biased low and have a high degree of uncertainty, precisely because it ensure an additional measure of conservatism to its estimates.

Comment 5.17

DEQ received comments in this category from commenters 3, 5

Exceedance of an IWQC is not in itself indicative of "toxic conditions," which is a non-specific term, but implies a severe effect. Suggest DEQ revise Issue Paper Section 6.2.4, last paragraph, last sentence: "Using the 25th percentile of DOC as a default input value provides a scientifically defensible method that protects aquatic life without greatly overestimating the likelihood of exceeding the IWQC."

Response

DEQ agrees that when an IWQC calculated using a default DOC value is higher than the corresponding IWQC value using measured parameter data, it does not indicate that conditions are toxic. This merely indicates that the IWQC calculated using a default DOC value is not as stringent as the corresponding IWQC value when calculated using a measured DOC value. A copper sample would have to be available to be compared to a concurrent IWQC in order to evaluate whether toxic conditions for copper occurred at the site at the time the copper sample was collected.

DEQ has revised this section of the Issue Paper. Please see changes to Section 6.5. This comment was taken under consideration on the Issue Paper, p. 35.

Comment 5.18

DEQ received comments in this category from commenter 2

In addition, while DEQ harps on the importance of accuracy, it acknowledges that many of the data available will be flawed. So, for example, it has come up with a set of translators (site-specific, regional, and statewide) for converting total recoverable concentrations of input parameters into the dissolved concentration inputs that the BLM model uses. *Id*. at 21-22. DEQ recognizes that there are not sufficient data to determine the relationships between total and dissolved parameters in two of four Oregon regions, the Coastal and Cascades regions. *Id*. at 22. Likewise, DEQ proposes to use estimates of geochemical ions or alkalinity when actual data are not available, one option being the use of the 25th percentile of the distribution of concentration for each parameter. *Id*. at 22-23. Again, DEQ concedes that with an imperfect data set, use of the BLM model requires a range of assumptions for its use. Yet it continues to rely as an excuse for choosing non-conservative assumptions the rationale that use of the BLM model should aim for perfection. The results appear to be inconsistent and illogical.

Response

DEQ is proposing to use the statewide translator of 0.83 to convert measurements of total dissolved carbon (TOC) to an estimate of the corresponding dissolved organic carbon (DOC). The analysis provided in the Technical Support Document was exploratory, to determine whether sufficient data on the regional level was available, using data from Oregon, that may provide a more accurate estimate based on geography than the EPA translator. DEQ concluded that in the absence of sufficient data within regions, it would apply the 0.83 value based on data from all regions of the state. This translator is conservative relative to the two regions where there was sufficient organic carbon data to derive a reliable regional translator.

The DEQ database of BLM parameters for Oregon represents all of the best available data that meets a minimum quality assurance and quality control. The commenter appears to mistake the percentile used for a default input parameter, with the percentile of the resulting IWQC values produced by the model when these default parameters are used. The IWQC resulting from the model are based on the non-linear interaction of 13 individual water quality parameters with varying sensitivity, such that conservative IWQC are derived when applying default input parameter concentrations, such as DOC, that may be from a less-conservative percentile of their distribution.

Comment 5.19

DEQ received comments in this category from commenters 1, 11

To the extent that DEQ elects to use defaults for the 25 percentile as described in the DEQ-TSD, additional detail is needed in the rule to more fully consider the variation observed throughout the defined regions and proposed defaults that were included in the EPA proposal.

> **Response**
> DEQ initially proposed the 25^{th} percentile of regional DOC as a default at the time of public comment. DEQ has performed additional evaluation of the protectiveness of using the 25^{th} percentile of DOC as a default input with respect to variability in different regions of the state. DEQ has also evaluated alternative default DOC percentiles at the 15^{th} and 20^{th} percentile of DOC. The results of this analysis are in a revised Section 6 of the Issue Paper.

Comment 5.20

DEQ received comments in this category from commenter 2

DEQ further asserts that using the 25th percentile of DOC values is more stringent than calculating criteria based on measured DOC values and therefore is fully protective. This makes no sense since the 25th percentile of DOC values are from measured DOC values.

> **Response**
> IWQC calculated by the BLM predict copper toxicity based on the interaction of 13 separate water quality parameters that affect the bioavailability of copper in a given sample. The concentration of DOC is only one of these parameters, and the response of IWQC to changes in DOC is non-linear. The use of any given percentile of measured DOC concentrations as a default does not equate to the same percentile of the resulting IWQC values.

Comment 5.21

DEQ received comments in this category from commenters 9, 10, 11

Commenter expressed substantial concern with using default values when there is insufficient site-specific data for dissolved organic carbon (DOC) and other BLM input parameters. The model is especially sensitive to DOC and only measured data should be used and ample opportunity should be given to collect the data needed.

> **Response**
> DEQ recognizes the concern that the default DOC concentration results in IWQC values that are generally much more stringent than the corresponding IWQC value would be using measured data. Due to the sensitivity of the model to changes in DOC, and the

variability in DOC in the environment, a high level of conservatism is required to protect sensitive conditions given uncertainty when the required input parameters to calculate an IWQC have not been measured.

DEQ must have the ability to apply a protective criteria at all times in our regulatory programs, so that even where BLM input parameter data is not available, a protective BLM based Instantaneous Water Quality Criteria (IWQC) can always be determined.

Comment 5.22

DEQ received comments in this category from commenters 3, 5

As additional support for the 25th percentile, have any evaluations of how DOC varies by stream order been conducted in Oregon? Use of a percentile lower than the 25th could be driven by lower order streams that are of a lesser regulatory interest.

Response
DEQ addressed the impact of stream order on the distribution of DOC concentrations in the Technical Support Document that was completed in January 2016. DEQ found that there were not statistically significant differences in the distribution of dissolved organic carbon (DOC) concentration among higher and lower order streams within the same region. Inter-regional variability was more important for DOC concentration than stream order[9].

Comment 5.23

DEQ received comments in this category from commenter 13

EPA appreciates that ODEQ has largely followed the procedures identified in EPA's Draft Missing Parameters Document (EPA 2016) in compiling a dataset for deriving estimated defaults. In the Draft Missing Parameters document, the EPA recommends that a 10th percentile or similarly protective percentile of the Ecoregional IWQC distribution be used to establish the defaults. In the State's rule documentation, Oregon has provided a rationale based on the false negative rate for the ODEQ-compiled dataset to demonstrate that the 25th percentile of the distribution results in adequately protective site-specific numeric criteria. As explained in more specific comments below, EPA recommends that ODEQ recalculate the false negative rate, relying on data above the detection limit. Also, the EPA recommends that ODEQ further evaluate whether temporal sampling bias is a statistically significant influence on the resultant default inputs and criteria. If after the above analyses, ODEQ cannot provide sufficient rationale that the 25th percentile is adequately protective, we recommend that the State use the 10th or other conservative percentile of the distribution as estimates to be used when data are absent.

Response
DEQ recalculated the false negative rate using only IWQC values above the copper quantification level of 1.5 µg/l as requested (see also Comment 5.24, below). DEQ also

[9] DEQ 2016. Technical Support Document: An Evaluation to Derive Statewide Copper Criteria Using the Biotic Ligand Model. Section V.B.5 and VI.A.2.
http://www.oregon.gov/deq/RulesandRegulations/Pages/2015/Rwqcopper.aspx

conducted an analysis to determine whether there is a temporal sampling bias in the database that influences the resultant default criteria. DEQ found that while there are more samples collected in the May to October time frame than in the winter months, the IWQC values for that time period are slightly lower than the November to April period. So there is a slight bias toward representing more bioavailable conditions.

DEQ has decided, based on additional analysis and EPA's comment to reduce the default rate to the 20th percentile. We include the rationale for this in the Issue Paper. The reasons, in summary, that DEQ believes this is sufficiently protective include:

1. IWQCs calculated using 20th percentile defaults values for DOC are the same or lower (more stringent) than IWQCs calculated using measured DOC in 85% of samples.
2. The magnitude of the divergence when the default IWQC is higher (less stringent) that the true IWQC is within the margin of error of the BLM to predict the IWQC for copper.
3. The DOC value at the 20th percentile in the Willamette basin is 0.83 μg/l. Because that is the reporting limit for DOC in DEQ's database, the DOC value for any lower percentile is the same value.
4. The criteria are based on toxicity data for the two most sensitive genera of organisms; both invertebrates. Fin fish, including salmon and trout, are less sensitive to copper by a minimum of a factor of 15 times. Therefore, if 85% of the IWQC values based on default DOC values are protective of the invertebrates, a much higher rate, if not all of them, are protective of Oregon's threatened salmon and steelhead and other fish species.
5. Statewide, the instances wherein the default based IWQCs are higher (less stringent) that the true IWQCs are limited to about 5% of all samples and are limited to samples where the IWQC is about 1μ/l. Because this value is below the quantification limit for copper, there would be no practical consequence to this difference because the copper concentration is not measurable with current methods. In either case, any quantifiable samples of copper would be exceeding both the measured IWQC, and the default action IWQC value.

Comment 5.24

DEQ received comments in this category from commenter 13

Pages 25-27: ODEQ states that using the 25th percentile default inputs results in a low "false negative rate" – such that it is protective in 95% of cases. ODEQ's argument is that using the 25th percentile of input parameters (estimates) results in predicted IWQCs protective of 95% of the samples (in time and space). A 5% false negative rate is not protective as defined by the allowable frequency of exceedance (i.e., the defaults should result in a very low false negative rate, with a frequency of exceedance of not more than once in three years). ODEQ further states that the lower end of the percentile estimates that are false negatives are near the detection limit. We strongly recommend that ODEQ reanalyze the data with samples above the detection limit and confirm that the false negative rate is sufficiently low.

Response
As shown in the Issue Paper, Figure 6.3, the distribution of IWQCs resulting from application of the 15th–25th percentile of DOC as a default is more conservative (lower)

than the distribution of measured IWQC values until less than the 5th percentile of the distribution of measured IWQCs is reached.

There is no basis for EPA's claim that a frequency of exceedance of 1 in 3 years is less than 5% of samples. There is no definite number of samples defined in the allowable frequency of exceedance from which EPA can claim the 1 in 3 year frequency is less than 5% of samples. Any number of samples may have been collected within that period. Additionally, the frequency of exceedance is assessed *at an individual site*, while DEQ is reporting that *statewide*, 95% of criteria using the defaults are more conservative than the corresponding criteria using measured DOC data.

DEQ has provided additional analysis in the Issue Paper, Table 6.13, that shows the default IWQC values are protective of toxic copper concentrations, on a sample per sample basis, of 96% of samples when substituting the 25th percentile of DOC, >96% of samples when substituting the 20th percentile of DOC, and >97% of samples when substituting the 15th percentile of DOC in place of the measured DOC concentration. This is a separate analysis from whether the copper concentration is exceeding the default value or the criteria.

Comment 5.25

DEQ received comments in this category from commenter 2

DEQ does not explain why it is acceptable to derive criteria using the 25th percentile value and why that is considered sufficiently conservative to provide the level of protection required.

Response
DEQ provided initial justification for the use of the 25th percentile of regional DOC concentration as a default in the Draft Issue Paper at the time of public comment. DEQ has since conducted additional analyses and justification to support the selection of the 20th and 15th percentiles of Regional DOC concentration to be used as a default DOC input parameter values. Please see the revised Issue Paper, Section 6.5, and the response in Comments 5.22, 5.23, and 5.24, above.

Comment 5.26

DEQ received comments in this category from commenter 4

DEQ is using outdated information to support its rulemaking and, in doing so, underestimates the potential differences in resulting criteria calculated by EPA versus DEQ's default values for at least some of its regions.

We agree with DEQ that water quality criteria and associated effluent limits should be established based on site-specific data. We further acknowledge that with implementation of the BLM for copper, where site-specific data are lacking, default input parameters may be required until such site-specific data can be collected. DEQ summarizes EPA regional BLM parameters both in its July 2016 Issue Paper (provided with the rulemaking) and in the January 2016 DEQ TSD. DEQ uses EPA's 10th percentile default parameters to calculate possible BLM criteria and compares them to DEQ's criteria based on regional data. We have specific concerns about the data on which DEQ relies and the discrepancies that those data may create as applied to DOC.

The BLM is particularly sensitive to DOC. As an example, for the Willamette Valley region, based on the comparison made by DEQ in the supporting material, EPA's 10th percentile DOC is 1.07 milligrams per liter (mg/L). This estimate of DOC yields a chronic BLM copper criterion of 2.3 micrograms per liter (μg/L) according to Table 6.6 in DEQ's July 2016 Issue Paper, which is fairly similar to DEQ's potential criterion of 2.8 μg (using DEQ's 25th percentile estimate of DOC), suggesting that the differences in EPA and DEQ DOC datasets do not have a significant impact on the potential criteria. However, EPA has proposed a different value for this region in its draft rule 1 for the 10th (and also the 25th) percentile default estimate for DOC (0.4 mg/L). This lower DOC value could result in a chronic BLM criterion of 0.45 μg/L, which is substantially less than what DEQ is showing for parallel EPA criteria. If DEQ's analysis included EPA's most current proposed defaults, the results would further support the appropriateness of using DEQ regional data over EPA's because EPA's DOC estimate of 0.4 mg/L is not representative of the region to which the default value is being applied. In fact, DOC ranged from approximately 0.6 mg/L to 2.3 mg/L, as reported in Figure 5.4-8 of the Portland Harbor Final Remedial Investigation Report (February 2016).

Response

It is unclear why the commenter states that DEQ is using outdated data to support its derivation of default DOC concentrations; the comment's details focus on concerns with regard to EPA's data used as the basis of its proposed rule. The relative value of EPA defaults has no bearing on whether DEQ's proposed default DOC values provide a reasonable level of protection. The DEQ database contains all current data for BLM input parameters collected from 2000-2014 of sufficient quality that are available in Oregon. This includes the USGS data used by the EPA for their missing parameters evaluation, in addition to data from DEQ's monitoring program.

The EPA 10th percentile value for the Willamette Valley was initially reported as 1.07 mg/L in the 2012 EPA draft version of the EPA missing parameters document, which was the version available to DEQ at the time of the analysis presented in the Draft Issue Paper. EPA changed the proposed 10th percentile DOC estimate from 1.07 mg/L to 0.44 mg/L in the subsequent 2016 version of the Draft Missing Parameters Technical Support Document. The current value of the EPA 10th percentile Ecoregional value is 0.4 mg/L, and is adopted by reference in the EPA draft rule[10]. DEQ has taken EPA's revised value of 0.44 mg/L into account when it revised the Issue Paper in response to public comments.

DEQ is unsure what data the commenter used for the other 12 water quality parameters to derive the IWQC values cited in their comment. However, DEQ agrees that IWQC calculate using 0.44 mg/L DOC as a default for EPA's 10th% default value for the Willamette would result in a more conservative value than the 1.0 mg/L 10th percentile DOC estimate they initially cited in the draft 2012 Missing Parameters document DEQ had available at the time of its analysis. DEQ further agrees that EPA's 10th percentile default DOC value is not accurate, nor representative of the region.

[10] EPA, 2016. U.S. Environmental Protection Agency. 40 CFR Part 131 [EPA–HQ–OW–2016–0012; FRL–9944–70–OW] RIN 2040–AF60 Aquatic Life Criteria for Copper and Cadmium in Oregon Federal Register Vol. 18, No. 74, April 18, 2016 / Proposed Rules. [EPA-HQ-OW-2016-0012]

According to EPA's 2016 Missing Parameters Technical Support Document, the 10th percentile value for the Willamette Valley region (now 0.4 mg/L) is calculated using only 12 samples from the Wadeable Streams Assessment database, to represent the entire Willamette Valley Ecoregion. Presumably, the Wadeable Stream Assessment is limited to data collected from 1st and 2nd order streams that may be crossed on foot by a person. DEQ is unsure why EPA is relying on such an unreasonably small dataset to characterize the DOC in the entire Willamette Valley region. DEQ cannot provide insight into EPA's conclusion that these 12 data points represent the larger valley bottom streams, not least of which is the Willamette Main stem. The DEQ database of BLM data provides a more complete cross-section of streams of different sizes and geographic locations throughout the regions of Oregon.

DEQ agrees that use of EPA's updated DOC default of 0.4 mg/L would result in a comparatively lower distribution of IWQC values. DEQ will update the statistics reported in the Final Issue Paper to reflect the default DOC values as published in EPA's proposed rule. While this will result in more stringent estimates of the IWQC calculated by applying EPA's default DOC, the protectiveness of DEQ's defaults are evaluated by comparison to the true IWQC values calculated using measured DOC data, not their conservativeness relative to the IWQC values using EPAs defaults.

DEQ has provided additional analysis of the protectiveness of several alternative percentiles of conservative default DOC concentrations in revisions to Section 6.5 of the Issue Paper. Their relative conservativeness can be compared to the corresponding value of accurate IWQC calculated from measured DOC data. Evaluating the protectiveness of the DEQ defaults is not contingent on how conservative EPA's proposed default percentiles are in comparison.

pH and Temperature Estimation

Comment 5.27

DEQ received comments in this category from commenters 1, 7

Given the sensitivity of the model to pH, recommend removing the method for estimating a representative pH value when this data is missing from the standard.

Response
DEQ must have the ability to apply protective criteria at all times in our regulatory programs, such as NPDES permits. Therefore, we must include provisions in the rule in order to provide an estimate of pH for derivation of criteria when this data is not available. As pH data is widely collected, DEQ expects few cases where using an estimate of pH is necessary. Please also see response to comment 5.29, below.

Comment 5.28

DEQ received comments in this category from commenters 1, 3, 5

DEQ should provide greater rationale and clarification for the process used for estimating pH. We recommend addition of a bullet stating the same procedure would be used as described in (Endnote N (1)).

Response
Please see response to comment 5.29, below.

Comment 5.29

DEQ received comments in this category from commenter 13
Default inputs for pH and temperature: For pH and temperature, EPA strongly recommends that these data be collected at the site where the BLM is used to derive site specific numeric criteria. However, the estimation methods that ODEQ has included could be acceptable if more conservative factors are included, such as a conservative percentile of the distribution of the pH data (if pH input data is sourced from measurements from a nearby best estimate site).

Response
DEQ agrees that pH and temperature data should be collected at any site where the BLM is used to derive site specific numeric criteria. Only 8% of the samples in the current Oregon BLM database that have copper data are missing concurrent pH data, so default values for pH will be used very seldom. DEQ has updated its sampling protocol to ensure that pH data is collected along with every copper sample. Generally dischargers do collect pH and temperature data routinely. DEQ will continue to require that major permittees, and other sources with copper discharges that may result in exceedance of the standard, collect pH data in order to calculate BLM based copper criteria and conduct a reasonable potential analysis that evaluates the range of pH conditions expected to occur at the site.

Temperature data is only missing for 7% of the samples where there is copper data that requires evaluation with an IWQC. Additionally, the BLM is not sensitive to variability in temperature. In the rare case that concurrent temperature data is not available for a sample, substituting the geometric mean of temperature measurements available within a site, waterbody, or region will be adequate to calculate an IWQC without affecting its accuracy or protectiveness.

Comment 5.30

DEQ received comments in this category from commenter 2

DEQ spurns use of any “widespread application of conservative assumptions to IWQC values [that] will erroneously lead to indication of toxic conditions, conclusions of impairment, and other regulatory actions where these conditions do not actually exist.” *Id*. at 14. The opposite of widespread use of conservative assumptions is widespread rejection of conservative assumptions, leading to the greater likelihood of DEQ’s under-identifying copper toxicity in Oregon’s waters.

Response
DEQ disagrees with this characterization of the proposed rule and descriptions of the rule. The proposed rule includes the application of conservative assumptions whenever the data

needed to derive criteria values using the BLM has not been measured and cannot be estimated with a high degree of accuracy.

Use of IWQC calculated using defaults / Action values

Comment 5.31

DEQ received comments in this category from commenters 1, 6, 7, 9

The standard should not use default values that result in criteria that are likely to be an extremely inaccurate reflection of copper toxicity and may result in regulatory decisions that are difficult or impossible to reverse. Such criteria would not satisfy requirements of either CWA subsection 303(c) or ORS 468B.048 – water quality criteria must be "necessary" to protect designated uses.

Response
DEQ agrees that the use of conservative default input parameter values result in highly conservative BLM criteria values in many cases. However, such conservative assumptions are necessary to ensure an adequate level of protection to sensitive conditions where there is uncertainty due to a lack of input parameter measurements. DEQ has attempted to balance the need to be conservative and protective, with the need to be accurate, in regards to the establishment of default input parameter estimates and values. Please see the revised Section 6 in the Issue Paper and the EQC staff report for further discussion of the tradeoffs that were considered. Ultimately, derivation of BLM copper criteria are necessary to protect the use. Therefore, in the case where there is not sufficient input parameter data available to calculate criteria, estimates and default values for those missing parameters are necessary to protect the use.

Comment 5.32

DEQ received comments in this category from commenters 6, 7, 9, 10

IWQC calculated using DOC defaults should be used as screening criteria to determine whether the collection of additional data is needed.

Response
DEQ agrees that the default action IWQC values derived when applying a regional default DOC concentration can be used to identify locations where there is a possibility that copper could be exceeding the standard. However, DEQ must apply the defaults as a protective criteria value when there is not sufficient data to derive accurate acute and chronic IWQC values from measured input parameter data, in order to ensure the protection of aquatic life from copper toxicity. DEQ has prioritized the collection of BLM input parameters when sampling copper concentration for its ambient water quality monitoring program, and will require major permittees, and other sources with discharges of copper that may exceed the standard, to collect the input parameters, so that accurate IWQC values are likely to be available in critical applications.

Comment 5.33

DEQ received comments in this category from commenter 9

Criteria using defaults would likely deviate substantially from criteria using site-specific data, resulting in two adverse consequences:

1. NPDES permits, 303d listings and other regulatory decisions would not be based on an accurate assessments of copper toxicity – even though such accuracy is the purpose of adopting BLM criteria.
2. The inaccurate regulatory decisions, once made, would be legally and practically difficult or impossible to correct using new data. The CWA's anti-backsliding provisions limit the ability to increase water quality-based NPDES permit discharge limits based solely on new information and subsection 303(d) listing policies impose a high evidentiary burden on removing waterbodies from the list.

Response

DEQ agrees that regulatory permits and impairment listings should be based on accurate BLM criteria (IWQC) based measured data or accurate estimates rather than default values wherever the necessary data exist. However, if sufficient data is not available to develop a permit based on accurate data, DEQ must ensure the site is protected by relying on default values until sufficient data becomes available to ensure that the discharge will attain the criteria through the range of conditions expected to occur at the site. For assessment, DEQ agrees that if sufficient data is available to assess a site based on accurate IWQCs, the assessment should be based on the criteria, not on default values.

DEQ will develop additional procedures to address the accumulation of additional data over time in both the permitting and assessment programs and how it will be brought into those programs to update regulatory conclusions and actions.

Comment 5.34

DEQ received comments in this category from commenters 1, 3, 4, 5, 7

We agree with DEQ's assessment and emphasis on IWQC derived from measured data outweighing IWQC derived using estimated data. Recommends that DEQ clearly state that criteria derived using default values shall not be considered final or permanent criteria. We recommend that default action levels not be used for compliance determinations or enforceable actions or subject to anti-backsliding restrictions. Please provide clarification on how the default action values may be used.

Response

DEQ must have the ability to apply protective criteria at all times in our regulatory programs, such as NPDES permits. While recognizing that IWQC calculated using conservative default estimates for missing parameter inputs are not accurate calculations of the criteria, DEQ must be able to derive a conservative action value to be used in regulatory programs in place of the criteria when the necessary data are not available to calculate the criteria.

Since major permittees, and other sources with discharges of copper that may lead to exceedance of the standard, will be required to collect BLM parameter data, and DEQ's monitoring program is collecting BLM parameters when collecting copper samples, DEQ expects have measured data available to calculate the IWQC the majority of the time.

Comment 5.35

DEQ received comments in this category from commenter 2

DEQ defines outputs derived from default inputs for BLM parameters as "action values" not criteria. Endnote N (2). The note language says that these "default action value[s] will be used for Clean Water Act purposes until sufficient measured or estimated input parameter data are available to derive accurate copper criteria[.]" By specifically terming the results of using default inputs as "action values" Oregon is saying they are not criteria in the meaning of the Clean Water Act and its implementing regulations. It is irrelevant that DEQ states that it may use them "for Clean Water Act purposes" when it has stated they are not legal water quality standards.

Response
EPA has communicated to DEQ that they view these values to be water quality criteria and will review them as such. Further, because they are included in our water quality standards rule they are legal standards and are binding in the manner stated. DEQ has used different terminology to refer to these values to make clear the hierarchy within the stand– that the accurate and ultimate criteria are those derived by the model using accurate input parameter values. Default action values will be used to ensure that aquatic life is protected even when the required input parameter data is not available and will be superseded by the IWQC based on measured data once sufficient data are available.

Comment 5.36

DEQ received comments in this category from commenters 6, 9

Criteria using defaults would likely deviate substantially from criteria using site-specific data, resulting in two adverse consequences:

NPDES permits, 303d listings and other regulatory decisions would not be based on an accurate assessment of copper toxicity – even though such accuracy is the purpose of adopting BLM criteria.

The inaccurate regulatory decisions, once made, would be legally and practically difficult or impossible to correct using new data. The CWA's anti-backsliding provisions limit the ability to increase water quality-based NPDES permit discharge limits based solely on new information and subsection 303(d) listing policies impose a high evidentiary burden on removing waterbodies from the list.

Response

DEQ agrees that criteria using defaults will be conservative by nature, and lower, sometimes significantly, than what the IWQC from measured parameter data would be. DEQ is requiring major dischargers to collect the necessary biotic ligand model parameters as part of their permit applications. In this way, reasonable potential analyses and permit limits should be based on measured data the majority of the time.

DEQ's understanding from discussions with EPA is that the backsliding prohibition does not apply to effluent limits that have not yet become effective because of a compliance schedule. It is also DEQ's understanding from discussion with EPA that interim limits included as part of a compliance schedule are not subject to the backsliding prohibition. In cases where additional data collection demonstrates an effluent limit is not needed or a less stringent limit will ensure compliance with the criterion, a permit may be modified to remove or modify the limits if this modification occurs prior to the effluent limits becoming final per the compliance schedule.

Rule Language Adjustments

Comment 5.37

DEQ received comments in this category from commenter 2

The default values for DOC, the ions and alkalinity should be part of the rule, not on the website or in a guidance document. Posting the default values on the website provide no information on the derivation of the default values or how DEQ might change them over time. The default values should be reviewed and approved by EPA.

Response
The BLM is a data-intensive method for determining water-quality based criteria for copper. In preparation for having copper BLM-based criteria, DEQ initiated monitoring in 2013 to ensure it had data to analyze as part of the water quality standards review. Prior to that time, the 13 parameters required for the model were not widely collected by DEQ or any other agency with the frequency required to analyze all available copper data. While DEQ has one of the most robust DOC data sets, it continues to be limited for evaluating copper samples collected prior to 2013 or by third parties.

Due to ongoing data collection efforts, this data set will continue to grow over time, which will improve the accuracy of the default values calculated in the future based on additional data. As a result, DEQ did not include fixed default values for DOC or other parameters in the rule.

By defining in the rule a repeatable procedure for deriving conservative defaults from the best available data set, instead of fixing the value of estimates in rule as they currently stand given the available data, DEQ will be able to periodically update the default values which DEQ would expect to do as part of its Triennial Review, if not more frequently, with better and more current data, without relying on a formal rulemaking process.

Comment 5.38

DEQ received comments in this category from commenter 4

The proposed rule also lists the same data requirement conditions to establish default values for dissolved organic carbon (DOC) like the other BLM parameters in this endnote, yet it separates the DOC requirements out into separate bullets. We request that the proposed rule be revised to clarify that the same conditions apply to DOC as other BLM parameters.

> **Response**
> DEQ decided to remove the use of water-body specific DOC defaults as a substitute for regional DOC default. Regional defaults are sufficiently conservative to provide the required level of protection for a wide range of conditions for waterbodies within the regions and the revision clarifies and simplifies the procedure, increasing the reproducibility of the results. If site-specific input data is not available, the conservative regional defaults will be applied to calculate default action values using the BLM. Therefore, the passage referred to in this comment will be removed in the revised Endnote N.
>
> Please see Table N-2 in the final proposed rule where we have addressed the concern that the same conditions for percentile values of default input parameters for DOC and the other parameters.

Comment 5.39

DEQ received comments in this category from commenter 2

DEQ should not use the word "may" in Endnote N (1) because it would allow DEQ to not use a default value.

> **Response**
> DEQ has clarified to rule to state that it will use an estimated input value as specified in N(1) when the data needed is available and it will use default input values as specified in N(2) when estimates under N(1) are not possible.

Comment 5.40

DEQ received comments in this category from commenter 13

For subpart 2(a)(i), later in the Issue Paper ODEQ does not provide a justification for the numbers of samples it specifies in the rule language (i.e., at least 30) to capture the variability in DOC throughout a waterbody. Please provide a justification and methods for determining sufficiency of the number of samples based on Oregon data in the Issue Paper.

> **Response**
>
> Upon further review, DEQ has decided to remove the use of water-body specific DOC defaults as a substitute for regional DOC default, as the regional defaults are sufficiently conservative to provide the required level of protection for a wide range of conditions for waterbodies within the regions.

TOPIC 6: Metrics for the Criteria

Comment 6.1

DEQ received comments in this category from commenter 2

The definition of "acute" has not changed for decades, yet DEQ is proposing to change it here and provides no explanation of its basis.

Response
EPA's 2007 freshwater copper criteria document, in which EPA recommends the BLM as the criteria, specifies that metric for the acute values generated by the model is the 24-hour average.

Comment 6.2

DEQ received comments in this category from commenter 13

The duration for the acute criteria should be 1 hour per EPA's 1985 Guidelines. Although EPA's 2007 304(a) criteria recommendation was to express the acute copper criteria as a 24-hour duration, the recommendation was insufficiently justified. The version of the copper biotic ligand model (BLM) recommended by EPA calculates acute criteria that are protective of a 1-hour duration, in accordance with the 1985 Guidelines.

Response
DEQ has changed the rule to reflect EPAs finding that the acute criteria be expressed as a 1-hour duration rather than a 24-hour average duration.

Comment 6.3

DEQ received comments in this category from commenters 1, 7, 9, 10, 11

Support for the 24-hour average rather than 1-hour average expression of the acute criterion.

- This is consistent with EPA's 2007 guideline for copper criteria pursuant to CWA subsection 304(a).
- In EPA's *Technical Support Document for Water Quality-Based toxics Control 35* (Mar.1991) they clarified that the 1985 recommendation for a 1-hour average was based primarily on ammonia, a fast-acting toxicant, and that scientifically justified alternative averaging periods could be derived for other pollutants. EPA's 2007 copper criteria document is a scientifically justifiable alternative.
- OWQSG commissioned Windward Environmental to evaluate the scientific basis for expressing the acute criterion as a 24-hour average. Windward found that the longer duration in EPA's 2007 criteria document was based on a 1995 EPA analysis of metal toxicity, including copper, which demonstrated a strong dependence of toxicity on exposure duration.
- Windward also reevaluated the toxicity studies included in the 1995 EPA analysis as well as more recent studies of invertebrates – the species particularly sensitive to

copper – and found that expressing the acute as a 24-hour average will protect aquatic life and that a 1-hour average is unnecessarily conservative.

Response

DEQ forwarded these comments and the supporting documentation provided by Windward Environmental, LLC to the EPA for consideration. EPA has concluded that the proper duration for the acute criteria be a 1-hour average of the concentration. Please also see Comment 6.2, above.

DEQ received a detailed response from EPA to the Windward analysis, which DEQ paraphrases below. EPA's full evaluation is on file with DEQ and available on request.

EPA acknowledged that it specified an averaging period of 24 hours in its 2007 304(a) recommended freshwater acute criterion for copper. But that EPA has included further discussions in its updated 304(a) criteria for cadmium, and draft updated 304(a) saltwater copper criteria, explaining that it has re-evaluated the 24-hour duration previously recommended for copper and cadmium, and determined that the available scientific information does not sufficiently support such an extended acute criterion duration. The main points of EPA's argument are as follows:

1. The BLM is premised on rapid ligand binding of metal and slower internalization

2. Studies on cationic metal binding to the biotic ligand indicates that this critical metal-binding step occurs rapidly.

3. There are few early post-exposure observation data available to support increasing the averaging period to 24 hours for copper.

4. An averaging period of 24 hour is not supported by 1985 Guidelines and by most criteria that have been developed

Additionally, EPA considers adjustments to EPA's 304(a) criteria are warranted to account for local circumstances. Given the recreational and commercial importance of salmonids in Oregon, and the potential for impacts of copper on salmonids in particular, EPA believes a 1-hour averaging period is more appropriately protective than a 24-hour period, given the available evidence and because of specific threatened and endangered species considerations concerning copper in Oregon.

TOPIC 7: Other Procedures

Comment 7.1

DEQ received comments in this category from commenter 10

Agrees that at least 30 samples collected over a 2 year period are adequately capture expected variation in DOC concentration, including the most sensitive conditions, likely to occur in site-specific natural waters between the wet and the dry season.

> **Response**
> Upon further review, DEQ has decided to remove the use of water-body specific DOC defaults as a substitute for regional DOC default, as the regional defaults are sufficiently conservative to provide the required level of protection for a wide range of conditions for waterbodies within the regions

Comment 7.2

DEQ received comments in this category from commenter 2

It is unclear how DEQ will determine which of the 30 samples are sufficient to ensure that they represent the seasonality and variability, particularly if the geographic unit to which the 30 samples applies is large. Nor is it clear why DEQ suggests that this number of samples is sufficient to represent seasonal variations when DEQ observes elsewhere that "[*a]dditional sampling* may be necessary if seasonal limits are requested" and "[i]f there is [sic] *enough data* to identify seasonal or hydrographic patterns, seasonal limits may be warranted." Clearly DEQ believes that its monthly so-called requirement for data may not be enough to support a permittee's request for seasonal limits or to identify seasonal patterns that may exist. Not in the rule but in the non-binding issue paper, DEQ states that it "will require 24 monthly effluent and ambient samples be collected for all BLM input parameters and for total and dissolved copper, evenly distributed over two consecutive years, to conduct reasonable potential analysis and if needed, to establish permit limits for NPDES discharges." *Id*. at 32. With the minimum 24 and 30 samples described in the issue paper and the rule respectively, in order to obtain the monthly samples, it's quite clear that the geographic scope of the samples will be severely curtailed.…

> **Response**
> Upon further review, DEQ decided to remove the use of water-body specific DOC defaults as an option and will rely on the regional DOC default values. Thus the reference to a minimum of 30 samples has been removed. The regional defaults are sufficiently conservative to provide the required level of protection for a wide range of conditions for waterbodies within the regions.

Comment 7.3

DEQ received comments in this category from commenter 2

DEQ does not explain how its chosen option will accurately reflect copper toxicity in the times—seasons or flow conditions—for which it may or may not choose to make calculations. Instead, DEQ simply makes a statement that "[s]ufficient data will be at least

30 samples that adequately represent the seasonality and variability in parameter concentration for the geographic unit . . . . [that] should adequately represent the most sensitive and bioavailable conditions that occur."

Response
See response to comment 7.2 above.

Comment 7.4

DEQ received comments in this category from commenters 1, 6, 9, 11

Commenter requests that the criteria expressly provide that if there is sufficient data on the humic acid percentage in the waterbody, that data must be used in lieu of the conservative 10 percent default value used in the model. Suggest adding this in Endnote N (1) (d). If DEQ is aware of available information related to humic acid, DEQ should summarize the available data describing the humic acid proportion of DOC for Oregon streams and make that information available on its website.

Response
Data on humic acid percentage is not routinely collected by DEQ or other agencies and DEQ did not identify any humic acid data from the USGS or DEQ's databases. The BLM model uses a default value of 10% which DEQ expects to be adequate for all uses for waters in Oregon. Given this, DEQ does not plan to collect humic acid data as part of its monitoring efforts.

If data on humic acid percentage is available for a sample, it will be input into the model as any other parameter and the resulting IWQC will be a viable instantaneous criteria value. This is not different than the provision for any other parameter with a built-in default input value, such as sulfide and dissolved inorganic carbon. DEQ will review the suggestion for Endnote N (1) (d), and will ensure there is no part of the rule precludes measured percentages of humic acid to be used as input into the BLM when available.

DEQ will continue to include any data on humic acid in the BLM database as data becomes available. Permittees will not be required to monitor humic acid as part of their monitoring requirements, but may voluntarily provide this data as part of their monitoring.

Comment 7.5

DEQ received comments in this category from commenters 3, 5, 9

Please reconcile all references to sufficient data. In the Statement of Fiscal and Economic Impact there are both references to monthly and bi-monthly sampling; the draft issue paper variously references 30 samples over 2 years, and both 12 and 24 sample requirements. DEQ should clearly state the time frame over which these samples are to be collected

Response

After review, DEQ has abandoned the option to calculate waterbody default input parameters based on at least 30 samples. Instead, the regional default values will be used for all missing input parameter estimation purposes.

The statement of fiscal impact references this NPDES sample requirement when it specifies monthly sampling (12 samples) or bi-monthly sampling (24 samples). DEQ expects that 24 samples collected over a two year period would adequately characterize the variability of conditions at a site and will revise the Issue Paper accordingly, but permitting requirements have not yet been finalized.

Comment 7.6

DEQ received comments in this category from commenters 1, 3, 5, 11

Agrees with basing appropriate BLM model versions on the toxicity information contained in the 2007 EPA Guidance. Modification to the model software should be acceptable as long as the fundamental toxicity calculations do not change from this guidance.

Suggest changing “The acceptable BLM software includes version 2.2.3 or a subsequent version of the model based on the toxicity data described in the EPA document” to “The acceptable BLM software includes version 2.2.1, 2.2.3, or a subsequent version of the model that reproduces the criteria statement and calculated criteria values described in USEPA (2007).”

Response

DEQ has been advised that we cannot legally adopt by reference a model version that would be developed in the future. Therefore DEQ has revised the relevant rule language adopt by reference BLM software versions 2.2.3 and 2.2.4 for the purpose of calculating the BLM based criteria, the IWQC.

Comment 7.7

DEQ received comments in this category from commenters 1, 11

Recent research conducted by Oregon State University found that the binding of copper to organics was much stronger by orders of magnitude in wastewater treatment facilities (WWTFs) than in receiving waters. Most of the copper discharged from WWTFs enter receiving streams as strongly-bound complexes and data showed this copper remained complexed in the stream. DEQ should work with EPA to update the BLM to accept site-specific binding coefficients that better represent the observed complexation of copper to organic matter when WWTF effluent is a significant portion of total flow in receiving streams, which provides a better measurement of the potential toxicity of copper. Recommends that DEQ include a review of the OSU research as the implementation strategy is developed.

Response

The effect of the quality and composition of different types of dissolved organic carbon (DOC) on complexation of copper is an emerging area of research. While

DEQ recognizes the important role that DOC has in determining copper bioavailability, actions EPA may take to incorporate emerging research within the BLM model in the future is outside the scope of this rulemaking. DEQ's proposed copper criteria are based on the most recent guidelines for criteria that have been published by EPA.

Comment 7.8

DEQ received comments in this category from commenter 2

If DEQ's interpretation of its standard is that it is up to the individual staff person at DEQ to decide whether to use parameters outside of the published range, not only is the standard not clear but it may not be protective of designated uses at times and locations when those parameters are exceeded.… Will DEQ simply suspend the copper criterion when temperatures are outside of the calibration range?

Response
DEQ will use the input parameter value that is reported and is rated as high quality data, thereby resulting in a consistent use of input data. DEQ was assured by the EPA and the model developers that IWQC calculated using values outside the ranges published in the model documentation are valid and protective.

TOPIC 8: Public Access to Criteria Information

Comment 8.1

DEQ received comments in this category from commenter 2

DEQ has not stated where the public will be able to find the derived numeric criteria. Presumably DEQ will be deriving these numeric criteria for a variety of reasons, such as for NPDES permitting and for 303(d) listing. How will the public know the extent to which DEQ has derived criteria? How will EPA know?

Where criteria have been calculated or derived, they must be made available to the public and not be hidden in DEQ files after DEQ has made some calculations.

Response
The model is available to the public and default values will be available to the public. In addition, DEQ will publish look-up tables that show the IWQC outcomes of various common water chemistry conditions in the state. In addition, when a permit evaluation is completed this information will be available in the permit evaluation report published with the permit. Similarly, when an assessment is completed the IWQC that were calculated for the site will be available to the public. Similarly, any future TMDLs will include documentation regarding BLM derived values and how they were considered in developing allocations. DEQ will continue to consider how to make this information available in a practical manner.

Comment 8.2

DEQ received comments in this category from commenter 13

We strongly recommend that ODEQ publish the numeric site-specific criteria and input data on a public website as a GIS layer that is updated as criteria are updated. This is important for transparency for the public and regulated community.

Response
DEQ will publish look up tables, similar to the tables EPA included in their draft marine copper criteria document, that show what the criteria are for various combinations of common input parameter conditions. This will enable members of the public to have information about the range of copper conditions that will be protective at a site. The IWQC for a site will vary based on water chemistry conditions. As a result, publishing and updating information in a GIS layer would not be practical. We are happy to hear more about what EPA is suggesting and on how this could practicably be done.

Comment 8.3

DEQ received comments in this category from commenters 1, 3, 5

We recommend DEQ consider maintaining an appropriate version of the BLM to be available for download from their website.

Response
DEQ will provide a link to the model and the related documentation from our website.

Comment 8.4

DEQ received comments in this category from commenter 4

DEQ states in the proposed rule that if no site-specific dataset is available, DEQ data from physiographic regions will be used. The rule states that these physiographic data distributions are available "on DEQ's website." It is unclear if this physiographic dataset "on DEQ's website" refers to the supporting material provided in the rulemaking or is a placeholder for a website that will be updated regularly when more data is collected.

Response
DEQ will add information on the copper BLM default values to its website for toxics water quality standards once the rule is adopted. We will be able to publish the default DOC values for each region, for example, that are derived based on the current database and will update the database when those values are recalculated. The rule has also been updated to better define the regions in the rule.

Comment 8.5

DEQ received comments in this category from commenters 3, 5

It is noted that the regional default dissolved organic carbon (DOC), ion, and alkalinity data are available on DEQ's website. Could the location of those data be specifically identified? Are those datasets from which 25th percentiles can be calculated or have they already been calculated by region?

Response
See the response to comment 8.4 above.

TOPIC 9: Implementation in NPDES Permits

Comment 9.1

DEQ received comments in this category from commenter 4

It is unclear based on the rule and supporting information if and when dischargers will have to meet limits set by DEQ's default values.

Response
Permit limits will be based on default values if: 1) there is not sufficient data to conduct reasonable potential analysis based on IWQCs (BLM results based on measured input parameter data), and 2) the discharge has the potential to exceed the default action values.

Sufficient data means enough data to calculate IWQCs for the range of water chemistry conditions reasonably expected to occur at the site so that DEQ can ensure that the permit limit, if needed, will protect the most bioavailable or toxic conditions. DEQ expects to require 24 monthly samples over 2 years in order to understand the range of variability at the site, including seasonal variability.

Evaluation of a permittee's ability to meet the effluent limits will occur on a fact-specific basis. If needed, DEQ will include compliance schedules or other means by which the facility can make progress toward meeting the effluent limit over time.

Comment 9.2

DEQ received comments in this category from commenters 9, 11

If it is necessary to adopt a rule to ensure that the needed data is collected and used expeditiously, we suggest a rule that requires permittees to either accept (1) copper reasonable potential analysis and discharge limits based on the conservative default values, or (2) permit conditions that require collection of the needed data within a specified time and allow the Department to reopen the permit, if necessary, to incorporate copper discharge limits based on the new data. (Commenter provided specific suggested revisions to Endnote N.) This approach would ensure that regulatory decisions based on the new copper criteria are both timely and accurate.

Response
DEQ must conduct reasonable potential analysis based on the water quality standard and the proposed standard rule states that if the data needed to derive the IWQC for any given sample is not available, DEQ will use default values for the BLM input parameters. However, the rule also says that the IWQC based on measure input parameter values supersedes default values once the measured data is available. Therefore, DEQ may provide a compliance schedule to meet a permit limit based on conservative default values. During this time, the permittee could collect the data and the permit could be modified if the new information shows that the permit limit should be adjusted or removed.

Comment 9.3

DEQ received comments in this category from commenters 1,7,11

Recommends that defaults not be used for permitting purposes. DEQ should work with permittees to ensure adequate data is collected in a timely manner for developing criteria using the BLM.

Response
DEQ will work with permittees and encourage them to collect adequate data to derive the IWQC for their discharge location. DEQ expects to require major permittees, who are already to monitor copper, to provide the BLM input parameter data as well so that we can conduct the permitting analysis based on measured data and IWQC. However, if the measured input data is not available for any sample, the proposed rule language states that DEQ will use estimates or conservative default values as specified to derive the IWQC.

Comment 9.4

DEQ received comments in this category from commenters 1

Commenter recommends that the BLM criteria be evaluated solely with dissolved copper measurements for the development of reasonable potential analysis (RPA) or permit limits. When dissolved copper data is not available, additional data should be collected prior to running RPA calculations.

Response
DEQ must evaluate the data we are provided. We strongly suggest that the permittee collect and submit dissolved organic carbon data, but if they do not, we will use TOC data if it is available. If neither DOC nor TOC data is available, DEQ must use conservative default DOC values as inputs to the BLM to derive copper criteria.

Comment 9.5

DEQ received comments in this category from commenters 4

The criteria calculated as part of the proposed rule are likely to be at or below background for some sites. It would be inappropriate to enforce criteria below background as a part of NPDES permits. We recommend that DEQ considers the role of background in attainment of water quality criteria, where specific discharges may be unable to attain extremely low water quality criteria as measured in receiving waters.

Response
Water quality criteria must be established to protect the designated beneficial use, based on scientific information.

The point of compliance for permittees is based on achieving the effluent limits contained in the permit. These limits are derived based on a number of factors, including the availability of assimilative capacity within the receiving waterbody. In the event effluent limits are not immediately attainable, DEQ will include compliance schedules, variances, or other means by which the facility can make progress toward meeting the effluent limit over time. If the natural background copper level is higher than the criteria, this could be justification for a site specific criterion or a variance.

Comment 9.6

DEQ received comments in this category from commenters 13

EPA strongly recommends that implementation methods be developed and incorporated into the permitting Implementation Management Directives (IMDs) as soon as possible.

Response
DEQ agrees that it will be essential to have standard procedures for conducting reasonable potential analysis and calculating permit effluent limits as soon as possible.

Comment 9.7

DEQ received comments in this category from commenters 8, 2

The implementation of the criteria is the key. More information is needed about how the criteria will be applied (particularly during NPDES permitting, TMDL development, and 401certifications).

Response
DEQ agrees with the commenter regarding the importance of having procedures for implementing the copper criteria in regulatory programs. The Issue Paper is intended to provide initial information on the agency's approach. However, given the consent decree timeframe for EPA's process to promulgate a revised copper standard and DEQ's efforts to complete its rulemaking in advance of EPA's deadline, DEQ will not have enough time to develop detailed procedures prior to adoption of the standard.

Comment 9.8

DEQ received comments in this category from commenters 13

Under the options for the NPDES program's reasonable potential analysis, ODEQ would allow for the direct comparison of an individual effluent copper concentration, collected on a specific date, to the individual ambient IWQC calculated on that same date. The paired RPA approach inherently assumes effluent copper concentrations and ambient IWQCs will not vary independently, which is not the case. The EPA recommends that RPA analysis be based on a reasonable worst case scenario to accurately predict whether water quality-based effluent limits are needed. Reasonable worst case scenarios used for RPA typically use an estimate of the 95th percentile effluent concentration at low receiving water flows and conditions that will ensure the analysis will result in permit limits that are needed to protect water quality at all times of the year (within the allowable frequency of exceedance, magnitude, and duration of the criteria).

Response

DEQ agrees that reasonable potential analysis (RPA) for copper must be evaluated based on worst case scenarios, as it would for any other aquatic life criteria, including the evaluation of low stream flow conditions. DEQ agrees that the effluent copper concentration may vary independently of the parameters influencing the criteria and DEQ will take this into consideration when conducting the reasonable potential analysis.

Comment 9.9

DEQ received comments in this category from commenters 13

ODEQ suggests collecting two years of monthly samples prior to conducting RPA. EPA's TSD for water quality-based permitting offers a methodology to conduct RPA based on limited data and inclusion of limits in permits in a timely manner. We understand ODEQ's concerns about variability in the criteria due to different receiving water conditions and, therefore, the State's recommendation to collect two years of monthly samples prior to conducting RPA; however, most criteria, such as hardness dependent metals criteria, have variability. The variability potentially inherent in the BLM copper criteria is not a sufficient reason to forego normally accepted statistical and analytical methods for conducting RPA, including the use of low flow statistics to analyze the probability of exceeding the criteria. While ODEQ may continue to refine its input datasets for calculating criteria using the BLM over time, RPA calculations and permit issuance should not be unduly delayed.

Response
EPA appears to be confusing the collection of effluent pollutant data with the collection of the BLM input parameter data. EPA has encouraged DEQ to ensure that the BLM input parameter data represent the range of conditions at a site, including the conditions when the bioavailability and thus the toxicity of copper will be greatest at the site, which we agree must be included in DEQ's analysis.

DEQ does not intend to unduly delay RPA calculations and permit issuance or forego normally accepted methods that are appropriate to a model-based standard and is committed to using appropriate methods for RPA calculations for scenarios when the full desired set of data has not yet been collected. DEQ will continue to work with EPA as we develop procedures for implementing the BLM standard in permits.

Comment 9.10

DEQ received comments in this category from commenters 13

The Issue Paper (page 32) states "ODEQ expects that 24 monthly samples of measured upstream ambient and effluent data are sufficient to represent the variability of conditions at the site and conduct reasonable potential analysis based on accurate site-specific IWQC." Please provide a citation or justification for the 24 monthly samples based on Oregon data, such as a citation to the 2016 TSD. Please clarify the statement in terms of the sufficiency needed for permitting.

Response

Given the consent decree timeframe for EPA's process to promulgate a revised copper standard and DEQ's efforts to complete its rulemaking in advance of EPA's deadline, DEQ does not have time to finalize the details of permitting analysis procedures or other implementation procedures before the water quality criteria are adopted. DEQ will continue to work with EPA on the details of implementing the BLM based copper criteria, such as the number of samples required to evaluate a discharge and develop permit limits. This information will be included in the permitting procedures.

DEQ added an implementation policy to the rule stating that the agency will apply the criteria in a manner that protects the aquatic life during bioavailable or toxic conditions. DEQ recognizes that in order to do this data must be available that represents the range of conditions reasonable expected to occur at the site and that if this data is not available, that default values would be used in place of measured data.

Comment 9.11

DEQ received comments in this category from commenters 2

Seasonal variability is important to use of the BLM. However, the issue paper does not explain how DEQ's proposed approach for NPDES permitting addresses the need to identify and then use the worst case scenario to derive water quality-based effluent limits. (Cites EPA's NPDES Permit Writer's Manual at p. 108)

Response
See the response to comment 9.10 above.

Comment 9.12

DEQ received comments in this category from commenters 13, 2

Several comments were submitted on the procedures to analyze discharges and develop NPDES permit limits.

Response
DEQ understands that there are details and procedures still to be decided and defined regarding the reasonable potential analysis and the calculation of permit limits to meet the copper BLM standard.

Given the short timeframe for adopting the water quality standard revisions, due to a court ordered schedule, DEQ cannot finalize the details of permitting procedures and other implementation procedures before the water quality criteria are adopted. DEQ will continue to work with EPA on the details of implementing the BLM based copper criteria and will include these details in a permitting procedures document as soon as possible.

DEQ added an implementation policy to the rule stating that DEQ will apply the BLM standard in a manner that protects aquatic life during bioavailable or toxic conditions. In order to do this, DEQ must evaluate data that represents the range of conditions reasonable expected to occur at the site. If this data is not available, DEQ will use conservative default values until sufficient measured data becomes available.

Comment 9.13

DEQ received comments in this category from commenters 13, 2

ODEQ also mentions the use of interim limits. The EPA would like to reiterate that a final WQBEL is needed in a permit, but if it cannot be met upon permit issuance, ODEQ can allow for a compliance schedule in the permit. While data collection cannot be a part of the compliance schedule, ODEQ could review and analyze data that are collected subsequent to the permit issuance that might inform the need for revised limits or modification of the compliance schedule while it is still in effect.

Response
DEQ agrees with this comment.

Comment 9.14

DEQ received comments in this category from commenters 2

In some instances, data are only required to be collected by a permittee where the waterbody has been identified as impaired. But the absence of data may mean the status of a waterbody is unknown.

Response
This situation is not different for copper than it is for any other pollutant. DEQ can only know the status of a waterbody where data has been collected. Minor dischargers are not typically required to collect data for toxic pollutant concentrations in their effluent unless they discharge to an impaired water or there is another reason to expect the levels of concern for that pollutant in their discharge.

Comment 9.15

DEQ received comments in this category from commenters 2

DEQ does not include irrigation districts under the 2300A Pesticide general permit, which are known dischargers of copper, on the list of facilities DEQ expects to be affected by the adoption of the standard and does not identify them as facilities DEQ expects to require to collect BLM input parameter data.

Response
Irrigation systems that already have an NPDES permit for pesticide application activities do not need additional permit coverage for that same activity. Irrigation systems excluded from coverage under the 2300A pesticide general permit are

irrigation systems that already have individual NPDES permits. More recently, in June of this year, DEQ proposed revisions to the 2300A pesticide general permit to include permit coverage for irrigation districts currently operating under individual permits in order to have one general permit available for pesticide application. As proposed, there is a copper limit that is not based on BLM input. DEQ is considering the public comments received including those received on the proposed copper limit, but has not taken final action on the permit. More information on the 2300A pesticide general permit is available on DEQ's web page at http://www.deq.state.or.us/wq/wqpermit/pesticides.htm .

Comment 9.16

DEQ received comments in this category from commenters 2

With regard to stormwater permits, it is unclear why DEQ would state that "it is unlikely that the 1200-Z copper benchmark would be lowered as a result of the new water quality standard" simply because the existing benchmark is based on technology.

Response
The commenter raises questions related to the implementation that does not relate directly to provisions contained in the proposed rule.

DEQ will prepare additional evaluation and documentation for approaches it takes within General Permits at the time those permits are evaluated and developed.

Comment 9.17

DEQ received comments in this category from commenters 2

It is unclear why DEQ states that some facilities may choose to use composite sampling to obtain a 24-hour average concentration or storm event average concentration. In the issue paper, DEQ should examine what it would mean for use of the BLM to allow permittees to use composite sampling.

Response
The commenter raises questions related to the implementation discussion contained in the issue paper and does not relate directly to provisions contained in the proposed rule.

DEQ recognizes the importance of implementation related to this rulemaking and notes that more detailed procedures regarding sampling will be addressed in future development of procedures. Where elements of the BLM criteria do not differ from considerations for other toxic substances criteria, DEQ will continue to rely upon existing practices and procedures.

Comment 9.18

DEQ received comments in this category from commenters 2

DEQ does not explain why the new standard will only be incorporated into permits “as appropriate.” Does this mean only if there are copper discharges or is this carte blanche for DEQ permit writers to ignore the copper standard for some other reasons of purported appropriateness? It seems that DEQ thinks that it can derive effluent limits that are not related to its actual water quality standards.

Response
The commenter raises questions related to the implementation discussion contained in the issue paper and does not relate directly to provisions contained in the proposed rule.

DEQ does recognize the importance of implementation related to this rulemaking and notes that certain types of permittees are required to monitor for copper due to the potential for it to be in their processes, collection system or otherwise be in the effluent as described in the issue paper. Not all permittees are likely to have copper in their effluent. DEQ will follow federal regulations regarding when an effluent limit for copper must be included in an NPDES permit.

Comment 9.19

DEQ received comments in this category from commenters 1, 2

It is critically important that there be agreement between DEQ, affected sources, and those familiar with the BLM model on the type and manner of ambient and effluent data adequate to accurately run the BLM model. This information is critical to successful implementation of the proposed copper criteria.

Given the importance of input parameter data to the outcome, it is essential that the gathering of the data be scientific and unbiased. We strongly urge DEQ to establish guidance on how data should be gathered and to require permittees to submit data sampling plans.

Response
The commenter raises questions related to the implementation discussion contained in the issue paper and does not relate directly to provisions contained in the proposed rule.

DEQ does recognize the importance of implementation related to this rulemaking and agrees that the availability and quality of input parameter data to run the BLM is important. There are approved sampling and analytic methods for all of the parameters that must be followed to ensure the data is of high quality.

Comment 9.20

DEQ received comments in this category from commenters 3, 5

Support for DEQ’s recommendation of 24 samples collected over two years for NPDES permits. In our experience, this size dataset is needed to derive either IWQC- or FMB-based criteria that make numeric and ecological sense. Furthermore, other states (e.g., Colorado) are recommending similar dataset sizes and requirements, so would demonstrate consistency across states.

Response
DEQ acknowledges the support and agrees that consistency across states lends support to this proposal.

Comment 9.21

DEQ received comments in this category from commenters 1

DEQ has seriously underestimated the costs for data collection (24 monthly samples of BLM parameters, copper, and Total Suspended Solids) upstream and in the effluent.

Response
DEQ solicited input from the Advisory Committee and looked to other available sources for the information that was included in the fiscal impact statement.

Comment 9.22

DEQ received comments in this category from commenters 3, 5

Regarding sampling locations, it appears only upstream and effluent samples are required and downstream conditions will be estimated from these data. We recommend that downstream conditions also be characterized using measured data, rather than by estimation. We believe this would provide the most accurate prediction of protective water quality criteria.

Response
The commenter raises questions related to the implementation discussion contained in the issue paper and does not relate directly to provisions contained in the proposed rule.

DEQ does recognize the importance of implementation related to this rulemaking and will consider this issue as it develops its implementation procedures and data requirements.

Comment 9.23

DEQ received comments in this category from commenters 3, 5

The issue paper does not explain DEQ’s proposed approach to identify and then use the worst case scenario to derive water quality-based effluent limits.

While worst-case dilution may be associated with the greatest metals concentrations, this time is not always the worst-case scenario for BLM-derived IWQC, as other toxicity-modifying factors, such as DOC, may be enriched when dilution is lowest.

Response
DEQ agrees that the worst-case scenario for applying the BLM criteria in permitting analysis may be different and that DEQ must take into account the possibility that other scenarios may present the worst-case conditions. This will be described in the agency's permitting implementation procedures.

Comment 9.24

DEQ received comments in this category from commenters 4

We have concerns regarding the BLM-based criteria described in the rule's supporting materials and the potential implications to National Pollutant Discharge Elimination System (NPDES) permitting. DEQ needs to provide more information on the options for setting effluent limits. Future guidance should clarify the implementation details and DEQ should allow the regulated community the opportunity to comment on these procedures before the rule is finalized.

Response
The commenter raises questions related to the implementation discussion contained in the issue paper and does not relate directly to provisions contained in the proposed rule.

DEQ agrees with the commenter regarding the importance of having procedures for implementing the copper criteria in the NPDES program. However, given the consent decree timeframe for EPA's process to promulgate a revised copper standard and DEQ's efforts to complete its rulemaking in advance of EPA's deadline, DEQ will not have enough time to develop detailed procedures prior to adoption of the standard.

DEQ expects to develop detailed implementation procedures for the permitting process and will follow relevant Administrative Procedure Act requirements in determining which procedures and related documentation may be subject to public review and comment.

Comment 9.25

DEQ received comments in this category from commenters 2, 7

Commenter agrees that seasonal variability is important to use of the BLM.

Response
DEQ has the ability to consider seasonal variability in implementing the BLM.

Comment 9.26

DEQ received comments in this category from commenters 2

Commenter strongly urges DEQ to establish in rule how it will obtain data necessary to perform the permitting analysis and to use one consistent method for every permit. DEQ should use a method to require that is enforceable.

Response
DEQ currently has the authority to require permitted sources to collect the data needed to determine compliance with the copper criterion. As such, additional provisions in the rule are unnecessary.

Comment 9.27

DEQ received comments in this category from commenters 2, 4

DEQ needs to clarify the timeframe over which a discharger might have to comply with regionally established effluent limits.

Response

See the response to comment 9.1.

Comment 9.28

DEQ received comments in this category from commenters 3, 5

It is not clear how the BLM would be incorporated into General Permits.

Response
The commenter raises questions related to the implementation discussion contained in the issue paper and does not relate directly to provisions contained in the proposed rule.

A general permit is one option for permit coverage, another option is an individual permit. As DEQ renews and revises stormwater and non-stormwater general permits, DEQ will incorporate the new BLM copper criteria, as appropriate. Options for implementation of water quality criteria are discussed but not a final part of this rulemaking. A separate public comment opportunity will be provided on proposed general permits including those with proposed implementation of copper criteria.

Comment 9.29

DEQ received comments in this category from commenters 2

Why then is DEQ assuming that general permits will contain only BMPs? Numeric effluent limits are the first stop, with BMPs only allowed if those effluent limits are not feasible to calculate.

Response
The commenter raises questions related to the implementation discussion contained in the issue paper and does not relate directly to provisions contained in the proposed rule.

DEQ will prepare additional evaluation and documentation for approaches it takes within General Permits at the time those permits are evaluated and developed to ensure they meet all applicable state and federal requirements.

BMPs are an option. General permit writers will incorporate the new standard into general permits, as appropriate. Also see the response above in 8.X.

Comment 9.30

DEQ received comments in this category from commenters 3, 5

We ask for clarification on how DEQ plans to use the BLM, if at all, to evaluate storm water.

Response
The commenter raises questions related to the implementation discussion contained in the issue paper and does not relate directly to provisions contained in the proposed rule.

There is some discussion of stormwater permits in the copper standard Issue Paper available on DEQ's website. DEQ will prepare additional evaluation and documentation for approaches it takes within General Permits at the time those permits are evaluated and developed.

Comment 9.31

DEQ received comments in this category from commenters 13

The Issue paper includes the FMB (fixed monitoring benchmark) approach as an option for determining reasonable potential. EPA strongly recommends that ODEQ not include the FMB approach as a method for evaluating RP, unless and until EPA endorses the approach nationally.

Response
DEQ has removed discussion of the FMB approach from the Issue Paper pending further discussion with EPA.

Comment 9.32

DEQ received comments in this category from commenters 2, 3, 4, 5

In the Issue Paper, DEQ refers to using the fixed monitoring benchmark (FMB) methodology for permitting. Additional information and a clear approach for FMB implementation is needed.

Is the benchmark consistent with EPA guidance on NPDES permitting?

Response
See response to comment 9.29 above regarding the FMB.

TOPIC 10: Implementation in 303d assessment and TMDLs

Comment 10.1

DEQ received comments in this category from commenter 2

DEQ has not explained how it will use the new criterion to develop TMDLs.

> **Response**
> DEQ will need to work with the TMDL program and with EPA to develop any methods for TMDL development that are unique to the copper BLM standard. DEQ has other equation based criteria, including the hardness-based metals criteria and the pH and temperature dependent ammonia criteria. We expect that developing TMDLs for those criteria and for the copper BLM will present similar issues and solutions. It is not possible to develop the details of the TMDL development methods prior to adoption of the water quality standard. DEQ submits each TMDL to EPA for approval, so there is an opportunity for EPA oversight.

Comment 10.2

DEQ received comments in this category from commenter 2

DEQ states that “[i]f there is insufficient data to assess the site based on IWQC (Section 6.3, Methods 1-4), DEQ *may* evaluate copper samples results using default action values[.]” DEQ does not explain why it only *may* use default values as opposed to making a commitment to use them. Perhaps this is partly why DEQ is suggesting that the calculated results will be “action values” rather than criteria. We strongly object to DEQ’s reducing the copper criterion to a water quality standard that can only be used under narrow circumstances and that leaves DEQ with the discretion to consider the results of any derivations using defaults as not water quality criteria.

> **Response**
> DEQ’s intention is to use default action values as a conservative estimate of the criteria value whenever there is not sufficient data to derive an acute and chronic IWQC value from measured input parameter data. The Rule Language and Section 6.3 of the Issue Paper have been revised to make this clear. The proposed copper standard is to be used under all circumstances to protect aquatic life from toxic effects of copper. Because the default action values must be extremely conservative in order to ensure protection of sensitive locations and times, it is important to note that while they are protective, they are highly inaccurate, and do not reflect the true bioavailability and toxicity of copper that can only be determined by the use of measured input parameter data.

Comment 10.3

DEQ received comments in this category from commenter 13

EPA strongly recommends that implementation methods be developed and incorporated into the assessment and listing Implementation Management Directives (IMDs), and shared with the TMDL program, as soon as possible.

a) Statistical methods for determining spatial and temporal representativeness of an input dataset: Methods (such as Monte Carlo or other trend analysis) should be provided in procedures outside of rule to verify that ambient input data used to derive the BLM criteria sufficiently capture spatial, seasonal, and hydrologic variability at a site. Should the results of such analyses justify that the sampling regime sufficiently captures the most bioavailable condition for copper over time at a site, the suite of IWQCs could be used in CWA program implementation, rather than one final numeric criterion. In this way, the site-specific numeric criteria could vary to the degree allowed by the site variability and input data availability, while ensuring that the criteria in place are adequately protective.

Response
See the response to comment 10.2 above. As DEQ develops assessment and TMDL development methods, EPA will have an opportunity to provide suggest helpful analyses.

Comment 10.4

DEQ received comments in this category from commenter 13

For 303(d) assessment and listing, it is unclear how ODEQ will list a waterbody when calculating multiple IWQCs at a site. For example, if monthly IWQCs are calculated over three years, and concurrent monthly copper values are higher than the corresponding IWQCs at the site more than once in that time period, will the waterbody be listed? Or will a waterbody be listed only for the period of time at which the paired copper is higher than the IWQC? We recommend that these and other related issues be clarified during IMD development.

Response
When assessing copper samples, the corresponding IWQC values, or default action IWQC values as needed, are the water quality criteria that shall be applied. If there are at least 2 copper samples that exceed the magnitude and duration of their corresponding acute or chronic criteria values within a 3-year period, the waterbody will be found not to be attaining the water quality standard, and will be listed. This is consistent with the assessment methodology for toxic substances in Oregon, and identical assessment methods for the other performance-based criteria for ammonia or hardness-based metals. DEQ is continuing to work with EPA to further develop and clarify implementation procedures for BLM-based criteria in Oregon’s 303(d) program.

Comment 10.5

DEQ received comments in this category from commenter 12

A preponderance of the data used to make a listing determination should be from samples that include actual data for a majority of the parameters, especially DOC and pH. It should be a priority that water samples have data for the parameters needed to most accurately run the BLM.

Response

DEQ agrees that when a sufficient number of copper samples with measured parameter data for the derivation of IWQC are available, they should be the basis for assessment and any 303(d) listing determinations. This is why DEQ has prioritized collection of all the BLM input parameters whenever copper samples are collected in its monitoring program, so that accurate, measured, IWQC values will be available.

Comment 10.6

DEQ received comments in this category from commenter 2

Without data there are no criteria against which the waterbody can be assessed.

Response

The commenter has identified a consideration common to all equation-based water quality standards, including ammonia and the hardness-based metals criteria already in use. When the criteria is defined as a function of one or more water quality parameters, the exact value of the criteria at a given time and location is not known until the water quality parameters are measured.

In order to ensure that, in the absence of measurements of these parameters, a conservative, protective criteria value shall always be available, DEQ shall apply conservative default values for the BLM input parameters. Please see comments in Topic 5 of this document, and the revised Issue Paper, Section 6, for further description and justification of these defaults.

Comment 10.7

DEQ received comments in this category from commenter 13

For all of the options, it is stated that the 1X in three years frequency of exceedance will be evaluated, but this is not explained or shown in the examples given. Please describe these methods.

Response

Copper samples are evaluated according to the criteria, which is the corresponding IWQC or default action value for the copper sample. Please see response to Comment 10.5, above.

Comment 10.8

DEQ received comments in this category from commenter 13

Option 1 does not provide an example where the criterion would be exceeded. This is unclear from the example given – if one IWQC is exceeded, would the site be exceeding just for that time point or exceeding year-round? Please explain.

Response
A waterbody that is exceeding the criteria is listed year-round unless the criteria has a season component. DEQ does not currently apply a seasonal component to toxic substances, so a site with two or more copper samples exceeding their corresponding IWQC or default action value would be listed. DEQ will add a figure to the revised issue paper demonstrating a site that is not attaining the BLM standard.

Please also see response to Comment 10.5, above.

Comment 10.9

DEQ received comments in this category from commenter 3

The text does not include discussion of acute and chronic IWQC for copper. Which would apply in a 303(d)/305(b) context? For assessment of chronic effects, would the copper concentration be measured in a grab sample or a 96-hour composite? Is the 1 in 3 year exceedance frequency considered (this is noted under Option 2, but not under Option 1)?

Response
When composite samples are collected that allow for comparison of 1-hour or 96-hour duration to the chronic and acute criteria, the duration of the observed copper concentration will be compared to the criteria. However, for grab samples collected on a monthly basis, the concentration of the grab sample shall be considered to represent the concentration for either a 1-hour or 96-hour duration. Thus, any copper sample with a concentration in exceedance of the corresponding BLM IWQC values shall be considered exceeding the criteria.

A 1 in 3 year exceedance frequency is applied to all toxic substances, including copper. Option 1 and 2 under Issue Paper Section 8 will be revised to more clearly identify the continued applicability of this exceedance frequency to the BLM copper criteria.

TOPIC 11: Technical Support Document and Issue Paper

Comment 11.1

DEQ received comments in this category from commenter 13

The EPA peer reviewers reviewed the "Final 2015/16 version of the TSD, not the version updated in July 2016. Please either submit the July 2016 version for their review or delete the names of the EPA peer reviewers from the document.

Response
The TSD document is dated "January 2016 – Updated July 2016" because in July minor updates were made only to formatting and a few non-substantive "plain language" revisions to make the report consistent with DEQ's report template for documents posted to DEQ's website. For example, the initial .pdf version that was posted in February 2016 had some errors where figures were not converting from MS Word to the .pdf file properly, and were unreadable. There were no substantive or content changes. The July 2016 version of the document is available on DEQ's copper rulemaking web page.

Comment 11.2

DEQ received comments in this category from commenters 3, 11

Various non-substantive editorial comments to the Issue Paper for clarity or brevity that do not change the intent of the passage.

Response
DEQ has considered the editorial suggestions for clarity in the revision of the Issue Paper.

Comment 11.3

DEQ received comments in this category from commenters 3, 5

If DEQ is not planning on developing further NPDES guidance to be provided to permittees in the future, Issue Paper Section 7 would benefit from additional details on the appropriate data quality and data handling issues to ensure consistency in the data used to derive permit limits.

Response
DEQ is continuing to develop the implementation procedures for the BLM-based copper criteria, and is in ongoing discussion with EPA regarding further details for the implementation of the BLM into NPDES programs. The proposed rule for copper establishes how the magnitude, frequency, and duration of copper criteria will be determined. While DEQ has attempted to outline as much as possible the potential application of the BLM-based copper criteria for NPDES programs, the exact procedures are still being finalized, and are not necessary for the adoption of the BLM-based criteria as part of this rule.

DEQ will continue to work individually, and with EPA, to update guidance for implementation of BLM-based criteria it its NPDES programs.

Comment 11.4

DEQ received comments in this category from commenters 13, 3

Issue paper Section 6.2.4, Figure 6.3: The information in this figure would be more useful if pair-wise comparisons were made (i.e., how would IWQC based on measured DOC compare to IWQC based on 10th and 25th percentile DOC concentrations on a sample-by-sample basis?). This pair-wise comparison could be made by calculating the pair-wise ratio of IWQC based on measured DOC, with IWQC based on a percentile DOC concentration. The probability plot would then show the distribution of this ratio. The percentile associated with ratio values above 1 would then clearly show the likelihood that IWQC based on a percentile DOC concentration is higher or lower than IWQC based on measured DOC.

Response
DEQ has conducted these additional analyses. The pairwise comparison of the ratio between measured IWQC values and default action IWQC values derived using various regional percentiles of DOC concentration as a default input parameter value is shown in the final revised Issue Paper, Figure 6.5. This analysis shows that a high proportion of default action values are lower, more stringent, than the corresponding IWQC based on measured input parameter values. The IWQC identify the value be required to protect aquatic life.

TOPIC 12: Public Notice Document

Comment 12.1

DEQ received comments in this category from commenter 13

EPA made several comments on the public notice document.

Response

DEQ does not go back and revise the public notice document after the public comment period. To the extent that the substance of the comment is relevant to the Issue Paper or staff report, DEQ has included it above and will consider the comments as we finalize those documents.

List of Commenters		
#	Name	Organization
1	Janet Gillaspie	Oregon Association of Clean Water Agencies
2	Nina Bell	Northwest Environmental Advocates
3	Carrie Claytor[1], Robert W. Gensemer, Ph.D.[2], John Gondek[2], Robert Santore[3], Scott Tobiason[3], David DeForest[3]	Copper Development Association[1], Inc., GEI Consultants, Inc.[2], Windward Environmental, LLC[3]
4	Amy Nelson, Ben Hung, and Joe Volosin	Anchor QEA, LLC
5	Kathleen Roberts	North American Metals Council
6	Kathryn VanNatta	Northwest Pulp and Paper Association
7	Kim Cox	City of Portland Bureau of Environmental Services
8	Brandy Humphreys	The Confederated Tribes of the Grand Ronde Community of Oregon
9	Michael Campbell	Oregon Water Quality Standards Group
10	Barry Malmberg	National Council for Air and Stream Improvement, Inc.
11	Robert Baumgartner	Clean Water Services
12	Scott Dahlman[1]	Oregonians for Food and Shelter[1], Oregon Farm Bureau, Oregon Dairy Farmer's Association, Oregon Forest & Industries Council, Oregon Water Resources Congress, Oregon Cattlemen's Association
13	Rochelle Labiosa	US Environmental Protection Agency, Region 10

Oregon Dept. of Environmental Quality

Issue Paper: Water Quality Standards Revisions for Freshwater Copper

October 2016

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

State of Oregon Department of Environmental Quality

Item G 000186

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This issue paper was prepared by:
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We acknowledge and express our appreciation for the review and assistance provided by many DEQ staff and others, including: Andrea Matzke, Jennifer Wigal, Roxann Nayar, Dave Feldman, Karla Urbanowicz, and Larry Knudsen

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Alternative formats (Braille, large type) of this document can be made available. Contact DEQ, Portland, at 503-229-5696, or toll-free in Oregon at 1-800-452-4011, ext. 5696.

Table of Contents

Executive Summary

In 2013, the U.S. Environmental Protection Agency (EPA) disapproved Oregon's aquatic life criteria for copper based on findings from a 2012 National Marine Fisheries Service (NMFS) biological opinion that the criteria would jeopardize the continued existence of endangered species. The EPA also determined that Oregon's aquatic life toxics criteria for copper were inconsistent with the EPA's revised 2007 national copper criteria recommendation based on the Biotic Ligand Model (BLM). EPA advised Oregon to revise its copper standard to be consistent with the national recommendations and address the concerns of the NMFS biological opinion. Details on the background of the biotic ligand model and the history of copper aquatic life criteria in Oregon are provided in Sections 1-3 of this paper.

This issue paper provides information about DEQ's process to develop proposed freshwater aquatic life criteria for copper based on the biotic ligand model. DEQ evaluated three approaches to using the biotic ligand model as the basis for a statewide standard. The first approach is to adopt the BLM as a performance-based standard. The model produces predictable, repeatable site and time-specific results. This option uses the same approach as the equation-based criteria for the hardness-dependent metals and ammonia. The second approach is to use the BLM to derive site-specific numeric criteria for specified stream reaches, waterbodies, or other geographic units of the state. Finally, DEQ could elect to take no action, which would result in EPA adopting a federal rule for copper criteria for Oregon. These options are discussed more fully in Section 4.

DEQ has concluded that the most scientifically defensible and accurate approach is to use the BLM as a performance-based standard, as described in the first option. The model results, expressed as instantaneous water quality criteria for the acute and chronic toxicity of copper, define the protective criteria for a given set of input parameters. Application of the model to derive these instantaneous criteria is consistent with the EPA 2007 Clean Water Act section 304(a) National Criteria Document for Aquatic Life for Copper, and consistent with the application of other equation-based or water chemistry-dependent criteria, such as toxic metals (hardness-dependent) and ammonia (pH and temperature-dependent). DEQ also finds that this approach will satisfy the requirements of the reasonable and prudent alternatives of the NMFS biological opinion and the EPA's Jan. 2013 disapproval of Oregon's 2003 copper standard. DEQ outlines its recommendation for a performance-based standard following this option in Section 5.

Information and procedures for using the BLM to derive Instantaneous Water Quality Criteria (IWQC) is provided in Section 6. This section discusses data availability and the sensitivity of the model to the input parameters at ranges and combinations encountered in Oregon waters. In addition, Section 6 provides the methods DEQ will use to estimate input parameter data if it is not available. The most accurate method for determining BLM-based copper criteria is to use measured input parameter data, however some input parameters may be estimated and result in accurate IWQC results. However, in other cases conservative assumptions may need to be used as default input parameters. This ensures that a conservative instantaneous default value can always be calculated and implemented to protect beneficial uses where the input data are not available. Due to the conservative nature of default values, DEQ will give precedence to IWQC derived from the model using accurate, measured input data for implementation in Clean Water Act programs. These accurate IWQC, once available, will supersede previous default values.

Sections 7 and 8 describe in general terms how the biotic ligand model standard will be implemented in NPDES permitting, general permits and stormwater benchmarks, and the water quality assessments required under sections 305(b) and 303(d). This information is provided in order that the public and interested state and federal agencies may more fully understand how the BLM standard will be applied to protect aquatic life, as well as how it may affect regulated parties. These outlines represent DEQ's current thinking and discussions to date and are not an Internal Management Directive or part of the rule.

1. 1. Introduction

DEQ initiated a rulemaking process to revise Oregon's water quality standard for copper in Dec. 2014 and plans to propose revised criteria to the Environmental Quality Commission in Nov. 2016. This rulemaking is needed to meet the federal Clean Water Act requirement that states establish water quality standards to protect aquatic life and other beneficial uses of state waters. In addition, the rule revisions respond to a biological opinion by the National Marine Fisheries Service that the previous criteria is not protective of threatened or endangered salmon and steelhead species.

DEQ's currently effective aquatic life criteria for copper are dependent on water hardness, which was the basis of United States Environmental Protection Agency's recommendations for copper criteria until 2007. At that time, EPA revised its recommendation and now recommends the use of the Biotic Ligand Model, which more accurately accounts for the toxic concentration of copper based on bioavailability due to interaction with multiple site-specific water chemistry parameters. In Jan. 2013, EPA disapproved Oregon's copper criteria due to Endangered Species Act concerns. To address EPA's disapproval, DEQ must revise the state's aquatic life criteria for copper. Pursuant to litigation and a subsequent consent decree between EPA and the plaintiff, if DEQ does not adopt revised copper standards addressing EPA's disapproval, EPA must promulgate freshwater aquatic life criteria for copper by Jan. 16, 2017.

This issue paper includes information about DEQ's process to develop proposed freshwater aquatic life criteria for copper based on the BLM. It also describes the methodology to calculate criteria and DEQ's rationale for the specific procedures being proposed. General information on how the criteria will be implemented in Clean Water Act programs, such as National Pollutant Discharge Elimination System permits and the assessment of waters under Clean Water Act sections 305(b) and 303(d) are also included in this document, which DEQ will use as a starting point for any additional documentation needed to identify relevant procedures for implementation in those programs. The proposed amendments to OAR 340-041-0033, Oregon's water quality standards rule for toxic substances, revise the criteria contained in Table 30 and add an Endnote N.

2. Background

2.1 A History of Oregon’s copper standard

In 2004, DEQ adopted new and revised aquatic life toxics criteria, including criteria for copper, and submitted the revisions to the EPA for approval. The revised copper criteria were based on EPA’s 1995 Clean Water Act section 304(a) recommendations for the freshwater acute and chronic copper aquatic life criteria. EPA had not yet approved Oregon’s standards in 2007 when it released updated national recommendations to use the BLM to derive freshwater aquatic life criteria for copper. In part, the delay in EPA approval was due to consultation with the National Marine Fisheries Service (NMFS) and the U.S. Fish and Wildlife Service (USFWS). The purpose of the consultation was to analyze the effects of the state’s 2004 criteria on Oregon’s threatened and endangered species.

On July 31, 2012, the USFWS provided a biological opinion[1] to EPA that found that Oregon’s copper criteria would not negatively affect the continued existence of the endangered species for which USFWS was responsible. Conversely, the August 14, 2012, NMFS’ biological opinion concluded that the state’s copper criteria would jeopardize the continued existence of endangered species. In January 2013, EPA disapproved aquatic life toxics criteria associated with four pollutants based on NMFS’ findings. As part of the disapproval action, EPA determined that Oregon’s aquatic life toxics criteria for copper was inconsistent with the EPA’s revised 2007 national copper criteria recommendations and Oregon must revise its standards to become consistent with the national recommendations and the biological opinion.

Because EPA disapproved Oregon’s 2004 criteria, the previous criteria remain in effect until they are revised by the state and the revised criteria are either approved by EPA, or superseded by EPA-promulgated criteria. The currently effective criteria are based on water hardness and are expressed as total recoverable copper. The disapproved criteria (that DEQ adopted in 2004 based on the 1995 EPA recommendations) were also dependent on water hardness, but were expressed as dissolved copper.

In April 2015, the Northwest Environmental Advocates (NWEA) filed a lawsuit against the EPA for failing to develop aquatic life criteria for copper and three other pollutants for Oregon following its 2013 disapproval. The lawsuit sought a court order requiring a deadline for EPA to promulgate revised water quality criteria for copper and the other three pollutants. In response to this litigation and subsequent consent decree specifying dates for EPA promulgation, EPA began a rulemaking process.

On April 18, 2016, EPA proposed a rule to establish federal Clean Water Act aquatic life criteria for freshwaters under Oregon’s jurisdiction (81 FR 22555). EPA’s preamble to the rule stated that “if Oregon adopts and submits aquatic life criteria for cadmium and/or copper and receives EPA approval before the finalization of the federal rule, EPA would not continue with the promulgation of the criteria for these pollutants.” DEQ believes it is in Oregon’s best interest to have its own rule and is working to revise the state’s water quality criteria for copper before the EPA’s deadline to promulgate the final revised federal copper criteria.

[1] NMFS, 2012. Destruction or Adverse Modification of Critical Habitat Endangered Species Act Biological Opinion for Environmental Protection Agency’s Proposed Approval of Certain Oregon Administrative Rules Related to Revised Water Quality Criteria for Toxic Pollutants, NMFS Consultation Number: 2008/00148. National Marine Fisheries Service. August 14, 2012.

A summary timeline of actions related to Oregon's copper criteria is as follows:

Pre-1987: A 5 µg interim/L "guide concentration" is in effect for copper

1986: EPA publishes recommended freshwater and saltwater criteria; freshwater criteria vary with water hardness

1987: Oregon adopts 1986 EPA recommendations; EPA approves criteria

1995: EPA revises freshwater hardness-based copper criteria recommendations (values are more stringent)

1999: EPA revises saltwater copper criteria recommendations

2004: Oregon adopts revised freshwater and saltwater copper criteria based on EPA's revised recommendations

2007: EPA recommends criteria based on the biotic ligand model for copper in freshwater

2008: Consent decree in NWEA v. EPA requires EPA to act on Oregon aquatic life toxics criteria after the NMFS and USFWS issue biological opinions

2012: USFWS issues biological opinion and finds no jeopardy; NMFS' biological opinion finds jeopardy for select criteria, including copper

2013: EPA disapproves Oregon's 2004 freshwater copper criteria but approves 2004 saltwater copper criteria. Oregon's hardness-based criteria based on the 1986 EPA recommendations remain in effect.

2014-17: Oregon is developing revised freshwater copper criteria based on the BLM, EPA's 2007 national recommendations.

2.2 Rulemaking process and public involvement

The Oregon Environmental Quality Commission must adopt and EPA Region 10 must approve any revised copper aquatic life criteria before the criteria are effective for Clean Water Act purposes. DEQ expects to submit the rule for public comment August 1 through September 15, 2016. DEQ originally planned to propose the final rule amendment to the EQC for adoption at a specially scheduled meeting in December 2016. Based on feedback from EPA regarding their expected timeline and likelihood of being able to review and act upon DEQ's submission within that timeframe, DEQ expedited its schedule and is bringing the final proposed rule package to the EQC at its regularly scheduled Nov. 2-3 meeting. Following EQC adoption, DEQ will submit the revised criteria to EPA for their evaluation and approval.

2.2.1 Technical Review

In response to EPA's disapproval of Oregon's copper standard in early 2013, DEQ began evaluating how the BLM could be applied statewide to replace the existing water hardness-based copper criteria. EPA's action letter indicated that Oregon could develop BLM copper criteria where data are sufficient, or Oregon could establish default BLM criteria applied on a statewide or regional basis. The resulting criteria would need to incorporate sufficient data to account for temporal and spatial variability to ensure that the derived criteria protect designated uses.

In preparation for replacing the state's aquatic life water quality standard for copper, DEQ began conducting an analysis of the BLM in early 2015. DEQ convened a technical review panel to advise staff on the technical analysis and evaluation conducted to provide the scientific basis for the proposed criteria. The list of panel members, the information compiled and analysis conducted by DEQ during the technical review, and the comments of the panel are all described in the Technical Support Document [2], available on DEQ's web site. The technical review panel provided input through written comments, contacting DEQ staff directly, and during two conference calls (August and December of 2015).

2.2.2. Stakeholder Advisory Committee

DEQ also convened a stakeholder group, the Copper Rulemaking Advisory Committee. The committee included representatives from local government, non-profit, agriculture, industry and recreational user associations as shown in the table below. Further information about the committee meetings may be found at: http://www.oregon.gov/deq/RulesandRegulations/Pages/Advisory/AMwqcopper.aspx .

Name	Representing
Robert Baumgartner	Clean Water Services
Alice Brawley-Chesworth	City of Portland, Bureau of Environmental Services, ACWA
Michael Campbell	Oregon Water Quality Standards Group[3]
Scott Dahlman	Oregonians for Food & Shelter
Glen Spain	Pacific Coast Federation of Fishermen's Associations
Kathryn VanNatta	Northwest Pulp & Paper Association
Brian Wegener	Tualatin Riverkeepers

DEQ held four stakeholder advisory committee meetings to discuss and provide input to DEQ on the options for adopting the BLM into Oregon's water quality standards rules. The committee focused on how the rules would be implemented in Clean Water Act programs and helped DEQ understand and evaluate the implications of implementing the copper BLM standard. In addition, advisory committee members were invited to provide input on the draft Statement of Fiscal and Economic Impact analysis completed by DEQ during a conference call on June 16, 2016, and in writing by June 22, 2016.

Over the course of the meetings, the advisory committee received information from DEQ on:

1. the background and scope of the rulemaking;
2. the history of Oregon's previous and current copper standard, EPA's disapproval of DEQ's 2004 criteria and the NMFS biological opinion;
3. the scientific basis for the Biotic Ligand Model and the data that is used by the model;
4. findings from the Technical Support Document;
5. permitting procedures;
6. implementing the standard for 303(d) assessment;
7. draft rule language; and
8. the rulemaking process.

[2] DEQ 2016. Technical Support Document: An Evaluation to Derive Statewide Copper Criteria Using the Biotic Ligand Model. http://www.oregon.gov/deq/RulesandRegulations/Pages/2015/Rwqcopper.aspx
[3] A coalition of industrial and port clients, who hold, or have members who hold, NPDES permits for facilities in Oregon.

During the first meeting, Dec. 17, 2015, the committee expressed concern regarding the timeline for the rulemaking and the opportunity to provide feedback. Specifically, committee members pointed out that the complexity of the standards will require adaptability and resources to be properly implemented. Some committee members questioned whether DEQ had identified all relevant sources of copper. Members provided input that copper is sometimes primarily a stormwater runoff issue rather than a permitted NPDES discharge issue and that knowing the sources would be important for future mitigation and reduction strategies. Additionally, members stated that BLM implementation considerations for permitting and 303(d) listings would need to be a focus of advisory committee discussions.

On Jan. 27, 2016, the committee convened to discuss three topics: the Technical Support Document, use of a performance-based standards approach, and the procedures to derive BLM criteria, particularly when some of the input parameter data is not available. The committee discussed these procedures and draft documents, providing suggestions and questions on how to address missing data.

On Feb. 25, 2016, the committee met to discuss draft BLM criteria procedures, provide input on how to implement the BLM standard in NPDES permitting and review draft rule language. Committee members expressed concerns about creating anti-backsliding problems if default values or conservative assumptions are used for NPDES permit analysis prior to the collection of site-specific data. In addition, the committee raised considerations about anti-degradation, using conservative criteria, and questions about the Municipal Separate Storm Sewer System (also known as the MS4) program. Members asked DEQ to provide a plan on how to clearly communicate to major sources about what BLM data they will need to collect.

During the last meeting, held on April 26, 2016, the committee learned about and discussed EPA's draft proposed rule for freshwater copper criteria for Oregon. DEQ presented information that compared different methods to estimate missing BLM parameters. The committee provided input on DEQ's draft approach to implement BLM criteria in NPDES permitting and the Assessment Methodology for the Integrated Report development, as well as DEQ's initial draft rule language. Three members of the committee provided a joint draft proposal to DEQ with suggested rule language and there was discussion about what should be included in the water quality criteria rule language. DEQ was asked to consider and provide information regarding back-sliding issues, how to ensure permittees collect the required data, implications for pre-treatment, and future outreach and guidance.

2.3 NMFS and EPA recommendation to use biotic ligand model

NMFS's August 14, 2012 biological opinion concluded the Oregon's 2004 copper criteria would cause jeopardy to sensitive life stages of a number of threatened or endangered species. Criteria developed using the BLM more accurately reflect copper toxicity to aquatic life, which depends on the water chemistry at a specific site and time. In EPA's 2013 letter to DEQ disapproving Oregon's 2004 copper criteria, EPA recommended adoption of the BLM to remedy the disapproval action. Both NMFS and EPA concurred that copper criteria based on the BLM would be sufficiently protective. A letter from NMFS to EPA states, "the use of the copper BLM to derive copper criteria that are specific to individual locations or ecoregions is appropriate under the RPA, provided that the state of Oregon has the appropriate data to input into the BLM and appropriate procedures to use the BLM."[4]

2.4 Use in other states

Some states, including Colorado, Georgia, Maine, Michigan, and Iowa are developing site-specific numeric criteria using the BLM. Colorado is using the BLM to adopt site-specific criteria for specific locations while retaining the hardness-based criteria as their statewide standard. Other states, including Kansas, Delaware and Idaho are in various stages of developing revisions to their standards that will replace their hardness-based criteria with the BLM as a performance-based standard, similar to Oregon's approach. As of July 2016, EPA has not yet approved criteria revisions that have been submitted by Kansas or Delaware. Idaho's rulemaking is still in progress.

[4] Letter from Dr. Kim Kratz, Oregon and Washington Coastal Office, National Marine Fisheries Service, to Ms. Christine Psyk, Office of Water and Watersheds, United States Environmental Protection Agency, Region 10. RE: Corrections to December 3, 2015 Letter on Implementation of Reasonable and Prudent Alternative for Acute and Chronic Copper in 2012 Biological Opinion on Oregon's Toxic Water Quality Criteria. January 19, 2016.

3. The Biotic Ligand Model

3.1 General Description

The Biotic Ligand Model is a product of almost 15 years of development, incorporating decades of copper toxicity research, and is EPA's current recommended methodology to derive freshwater copper criteria. This document does not evaluate the basis of the model, its underlying toxicity models, or aquatic life protectiveness. For context relevant to DEQ's rule development efforts, some basic principles of the model are described below. DEQ referenced most of the following information from EPA's guidance and technical support documents.[5,6]

The BLM is a mechanistic model, which predicts the accumulation of copper at a biotic ligand at or above a critical threshold that leads to toxicity. A "biotic ligand" is the biochemical receptor on an organism, such as a fish gill. Copper toxicity results primarily from the cupric ion, Cu^{2+}, and to a lesser extent copper monohydroxide, $CuOH^{+}$. The BLM accounts for inorganic and organic copper speciation and competitive complexation with the biotic ligand because the amount of copper that accumulates on the biotic ligand will vary depending on site-specific water chemistry. The "three C's" summarize the drivers of copper toxicity: (1) Concentration of copper; (2) Complexation of copper; and (3) Competition of copper with other cations at the site of toxicity. Therefore, applying these principles, the model predicts the concentration of copper in water that would result in acute and chronic toxicity to aquatic species. There are a total of 13 BLM water chemistry parameters. Ten of the parameters are directly measured from a water sample: temperature, pH, Dissolved Organic Carbon (DOC), Ca^{2+}, Mg^{2+}, Na^{+}, K^{+}, SO_4^{2-}, Cl^{-}, and alkalinity. The other three parameters are humic acid percentage, sulfide, and dissolved inorganic carbon (DIC). The model typically uses built-in default values for humic acid and sulfide; dissolved inorganic carbon (DIC) is automatically calculated by the model from the inputs for alkalinity and pH. However, measured values for these three parameters may also be used directly if they are available, and will result in valid criteria.

The EPA BLM Technical Support Document indicates that even if the biotic ligand (the biochemical receptor where the mode of toxicity occurs) of an organism is not a gill, the principles of the model should apply to any other site of toxic action on an organism. Therefore, BLM criteria are generally protective of aquatic species despite differences in the toxic site of action.

To date the BLM for copper has been calibrated with acute toxicity datasets for many aquatic organisms, including, but not limited to, the following species:

> **Freshwater:** fathead minnow (*P. promelas*), rainbow trout, (*Oncorhynchus mykiss*), Daphnia (*Daphnia magna, D. pulex, D. pulicaria, Hyallela azteca, Ceriodaphnia dubia)*, freshwater mussel (*Lampsilis siliquoidea*), rotifer (*Brachionus calyciflorus*), pond snail (*Lymnaea stagnalis*), apple snail (*Pomacea paludosa*), white sturgeon (*Acipenser transmontanus*), and three-spined stickleback (*Gasterosteus aculeatus*).

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[5] EPA 2007, Aquatic Life Ambient Freshwater Quality Criteria – Copper 2007 Revision. United States Environmental Protection Agency. Office of Water 4304T. EPA-822-R-07-001. February 2007.

[6] EPA, 2016. EPA Draft Technical Support Document: Recommended Estimates for Missing Water Quality Parameters for Application in EPA's Biotic Ligand Model. Docket ID Number EPA-HQ-OW-2015-0469.

Saltwater: Blue mussel (Mytilus edulis, and M. galloprovincialis), sand dollar (Dendraster), oyster, (Crassostrea gigas, C. virginica), and urchin (Strongylocentrotus purporatus).

Although EPA's 2007 copper recommendations are based on BLM software version 2.2.1, additional BLM software versions have since been developed. Oregon DEQ developed its criteria with model software version 2.2.3. Differences between software versions are minor and mostly comprised of changes to the interface. The underlying toxicity data and water quality relationships affecting criteria are unchanged. Any version of the model software may be used that is based on the toxicity data used in the EPA 2007 criteria recommendation and provides consistent results, i.e., the software versions will return the same acute and chronic criterion value for a given set of input parameters.

EPA has only recommended the use of the model for freshwater systems to date. On July 29, 2016, EPA published draft marine copper criteria for public comment that uses the BLM to predict copper toxicity to saltwater aquatic organisms.

The BLM calculates an acute and chronic criterion based on the model input parameters. The model derives the acute criterion based on EPA's general aquatic life criteria methodology which divides the final acute value by two to calculate the criterion. The final acute value represents the 5th percentile of genus sensitivities. The chronic criterion is then calculated using an acute-to-chronic ratio of 3.22 to arrive at a chronic criteria value. The model refers to these criteria derived for a given water sample or set of input parameters as the "instantaneous water quality criteria" or IWQC. The model uses the term "instantaneous" because it is a criterion that is based on one sampling event and therefore, reflects the criterion at that point of time based on the concurrent water chemistry. Because the BLM input parameters, such as pH and DOC, vary temporally (e.g., diurnally, seasonally and hydrologically) and have a strong effect on copper bioavailability, EPA recommends BLM monitoring that sufficiently captures the variability of the model input parameters for a site.

Copper data are not required to develop an IWQC because the model is only predicting what the toxic concentration would be based on water chemistry at that site. The model generates the IWQC that results from the water chemistry and DEQ must determine how to apply results over time to regulatory actions and assessments. For example, methods that could be used to set site targets for permit limits could include a statistic of the distribution of multiple IWQC at a site over time, such as a 10th percentile or median, Monte-Carlo modeling, fixed benchmarks or other defensible procedures.

Hardness-based copper criteria do not explicitly account for the effects of DOC and pH, two of the more important parameters affecting copper bioavailability and thus toxicity. Because the hardness-based approach does not consider these and other chemical parameters, the use of this approach results in copper criteria that are potentially under-protective at low pH and DOC, and potentially overly stringent at higher DOC and pH levels as compared to BLM criteria. By contrast, BLM criteria will more accurately result in values protective of aquatic life uses over various water chemistry conditions.

3.2 Technical Support Document

DEQ published a technical support document, *Technical Support Document: An Evaluation to Derive Statewide Copper Criteria Using the Biotic Ligand Model* in January 2016. DEQ's objectives for this document were to:

1. Gather and evaluate existing parameter data for Oregon;
2. Evaluate the sensitivity of the model to water quality conditions specific to the state;
3. Understand relationships among parameters that affect model results;
4. Evaluate methods for preparing data for use as model inputs;

5. Project the range of instantaneous criteria (IWQC) resulting from the model; and
6. Identify issues for applying model results to implement Clean Water Act programs in Oregon.

Specific analyses include:

1. Description of DEQ's data sources, spatial coverage, and quality assurance;
2. Rationale for using total recoverable measurements of BLM input parameters when dissolved measurements for the BLM input parameters are absent;
3. Sensitivity of model parameters based on Oregon data;
4. Methodology to estimate missing BLM parameters using specific conductance;
5. Methodology to delineate potential BLM georegions for applying default input parameter values;
6. General statewide comparison showing where hardness-based criteria are under-protective or overly stringent when compared to BLM instantaneous criteria.

The Copper BLM Technical Support Document is available on DEQ's website: http://www.oregon.gov/deq/RulesandRegulations/Pages/2015/Rwqcopper.aspx

4. Copper Standard Options

In order to address the reasonable and prudent alternatives from the National Marine Fisheries Service biological opinion on Oregon's aquatic life toxics standard for copper, and EPA's subsequent disapproval of Oregon's hardness-based copper criteria, DEQ only considered a BLM-based standard for Oregon's revised copper criteria.

DEQ evaluated three different approaches to using the biotic ligand model as a statewide standard:

Option 1: Adopt the BLM as a state-wide performance-based standard.

Option 2: Select a conservative chronic and acute BLM result (instantaneous water quality criterion or IWQC) for a site and establish those as site-specific numeric criteria for a stream reach, waterbodies, or regions of the state. These numeric criteria would then apply at all times for the specified location and would not vary with local water chemistry conditions.

Option 3: Take no action and be subject to the statewide copper criteria for Oregon promulgated by EPA. If Oregon took no action, EPA would finalize a federal rule for Oregon by January 2017. Oregon DEQ would then implement the federal criteria in Clean Water Act actions. EPA's proposed approach established a fixed numeric criteria defined by the 10^{th} percentile of multiple BLM-based IWQC for a site. The approach ensures protection at all times regardless of parameter data availability by utilizing a conservative 10^{th} percentile default values for all missing input parameters values to determine IWQC.

4.1 Performance-based standard

The performance-based approach (Option 1) recognizes that individual biotic ligand model results provide protective acute and chronic instantaneous water quality criteria given the water quality conditions described by a given set of input parameter data. The magnitude of the copper criteria is expressed by the IWQC derived by the BLM. The IWQC are the most accurate and appropriate measure to protect against copper toxicity for the water quality conditions that prevail at the time a sample is collected. The IWQC will vary with changes in water quality conditions.

This approach is analogous to the utilization of other model-based water quality standards, such as the hardness-dependent equation for other toxic metals, and the pH and temperature-dependent equation for ammonia. For these types of standards, the water quality standards rule specifies the equation as the criteria. In this case, the copper BLM model software is adopted by reference. In this approach, each individual acute and chronic IWQC represents the criteria magnitude and is valid for the water chemistry conditions used to derive the criteria. Each acute and chronic IWQC is applied as a numeric criterion for Clean Water Act purposes, such as the 303(d)/305(b) Integrated Report. DEQ will specify implementation procedures for establishing NPDES effluent limits to ensure that the copper standard is attained at a site and in downstream locations throughout the range of conditions that may occur at the site over time, including the most sensitive water quality conditions when the IWQC for copper will be most stringent.

4.2 Using biotic ligand model to establish site-specific or regional numeric criteria

This approach (Option 2) would establish a single, fixed, numeric, site-specific acute and chronic copper criterion value based on the distribution of multiple IWQCs for the site over time. These site-specific criteria might represent the variability in conditions experienced by locations on the scale of a single site, a waterbody, or region, depending on the availability of input parameter data. A conservative numeric copper criterion would be established based on the 10^{th}, 25^{th}, or another protective value from the distribution of IWQC for the area. The conservative numeric criteria would be expected to be protective of aquatic life through time because it is set at the level of the most sensitive range of conditions. The site-specific numeric criterion is then applied at all times at the site, even when water quality conditions change and are no longer at the more sensitive end of the distribution.

Under this approach, the site-specific numeric criteria would be calculated by DEQ and could be updated periodically as additional monitoring data becomes available. This could be done, for example, in preparation for each biennial Integrated Report assessment cycle. This approach requires adequate sampling of the location where the criteria will apply in order to capture the most sensitive water quality conditions. The fixed numeric criteria would be used for all Clean Water Act purposes, such as conducting the assessments of water quality under sections 303(d) and 305(b) and establishing NPDES permit limits. It differs from the performance-based approach in option 1 because under this approach, although multiple IWQCs are calculated, a single set of acute and chronic values is selected from the range of IWQCs and established as a site-specific acute criterion and a site-specific chronic criterion. These single acute and chronic numeric criteria are then applied to the site at all times.

4.3 Accept promulgation of the copper standard proposed by the Environmental Protection Agency

On April 18, 2016, the EPA published a proposed rule for Aquatic Life Criteria for Copper and Cadmium in Oregon[7]. One option (Option 3) available to the State is to decline to revise the disapproved state standard prior to final promulgation of the federal copper criteria for Oregon. In this case, the state would be subject to the federal criteria and would implement the criteria in Clean Water Act actions.

The proposed EPA rule used the biotic ligand model to calculate site-specific numeric criteria set to the 10^{th} percentile of multiple criterion results for a site. Where measurements of individual input parameters are missing, the 10^{th} percentile of Ecoregional concentration would be used as a default input values so that a conservative criterion value would always be available. The proposed rule includes values for these 10^{th} percentile default input concentrations in tabular form and are proposed to be adopted by reference from EPA's draft technical support document[8]. DEQ does not know what changes EPA will make to its final rule, so its analysis of this option relative to EPA's federal rule is limited to what EPA proposed in April 2016.

The parameter samples would adequately reflect low flow or other sensitive conditions for the site. These site-specific numeric criteria would be used for all Clean Water Act purposes, including performing

[7] Federal Register Vol. 18, No. 74, April 18, 2016 / Proposed Rules. [EPA-HQ-OW-2016-0012]
[8] EPA, 2016. EPA Draft Technical Support Document: Recommended Estimates for Missing Water Quality Parameters for Application in EPA's Biotic Ligand Model. Docket ID Number EPA-HQ-OW-2015-0469.

reasonable-potential analysis, developing NPDES water quality-based effluent limits, and 303(d) integrated report and assessment purposes. This approach differs from option 2 in that it is more conservative because it utilizes default input parameter values at the 10th percentile of concentrations in Ecoregions to calculate IWQCs where measured data is not available.

5. Copper Standard Recommendations

DEQ recommends pursuing Option 1, adoption of the BLM as a performance-based standard, wherein the model results, expressed as instantaneous water quality criteria (IWQCs), define a protective acute and chronic criterion valid for the time and location represented by a given set of the input parameters. Each IWQC represents a discrete measurement of the water quality conditions for a specific location and time that is applicable as long as the water quality conditions persist. These instantaneous criteria determine a protective acute and chronic threshold of dissolved copper concentration.

The inherent benefit of using the Biotic Ligand approach is the level of specificity and accuracy with which it reflects the effect of water chemistry on copper toxicity. The establishment of site-specific numeric criteria at a conservative level of multiple model results for a site does not reflect the 2007 304(a) national criteria guidance, which indicates that IWQCs are protective of aquatic life for each specific water quality condition that is evaluated. Only Option 1 maintains the model as the method to define the criteria.

BLM-based instantaneous water quality criteria will vary with water quality conditions, which means that the criteria will vary over time. Therefore, Clean Water Act actions based on these IWQCs, such as permitting and TMDLs, will need to ensure sources of copper are limited in such a way as to ensure the attainment of the standard through a range of conditions. DEQ's proposed methods to provide assurance of attainment of the standard are described further in Sections 7 and 8 below.

DEQ finds that this application of the BLM is consistent with the EPA 2007 304(a) National Criteria Document for Aquatic Life for Copper[9], and consistent with the application of other equation-based or variable standards, such as toxic metals (hardness-dependent) and ammonia (pH and temperature-dependent). DEQ also finds that this approach will satisfy the requirements of the reasonable and prudent alternatives (RPAs) of the National Marine Fisheries biological opinion[10] and the EPA Disapproval of Oregon's 2003 copper standard.

Oregon DEQ decided not pursue options 2 or 3, described in Sections 4.2 and 4.3, above, for the following reasons:

Scientific defensibility and accuracy of protection against copper toxicity using the model

1. Options 2 and 3 do not take advantage of the power and accuracy of the model. These approaches do not reflect the variability in copper toxicity related to water chemistry conditions, and instead derive overly conservative site-specific numeric criteria. In general, individual copper samples evaluated against the IWQC representing the water quality conditions present at the time the

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[9] EPA 2007, Aquatic Life Ambient Freshwater Quality Criteria – Copper 2007 Revision. United States Environmental Protection Agency. Office of Water 4304T. EPA-822-R-07-001. February 2007.

[10] NMFS, 2012. Destruction or Adverse Modification of Critical Habitat Endangered Species Act Biological Opinion for Environmental Protection Agency's Proposed Approval of Certain Oregon Administrative Rules Related to Revised Water Quality Criteria for Toxic Pollutants, NMFS Consultation Number: 2008/00148. National Marine Fisheries Service. August 14, 2012.

copper concentration was measured is the best determinant of how much of the copper concentration in question was concurrently bioavailable and potentially toxic to aquatic life. Comparing copper concentrations against the most sensitive water chemistry conditions occurring at a different time or location leads to erroneous conclusions regarding toxicity. This approach is counter to the purpose of using a BLM, which is to more accurately characterize the potential for copper toxicity given the prevailing water quality conditions when that copper was measured.

2. By establishing fixed numeric criteria using only a conservative percentile of IWQC, the approaches described in options 2 and 3 (in Section 4, above) identify only the most sensitive condition and then applies it broadly. Defining the criteria as a single conservative numeric value represents only a very conservative portion of the range of protective IWQCs. Options 2 and 3 do not address the fact that frequently occurring water quality conditions have higher IWQCs. That is, those conditions would enable higher concentrations of copper and remain protective of aquatic life with a high margin of safety. The intent of the BLM is to accurately identify where a given copper concentration may or may not be toxic, not to identify the lowest concentration of copper that would be toxic under the most sensitive conditions. Rather than utilize the most sensitive conditions in the state to all locations and times, variability in water chemistry conditions affecting the toxicity of the pollutant should be accurately addressed by criteria expressed as individual IWQCs.

<u>Practical implications for implementation</u>

1. Option 3 does not distinguish the accuracy of IWQCs calculated using measured data from the accuracy of IWQCs calculated using conservative default input parameter values. As a result, the same regulatory weight is given to the conservative, but inaccurate, IWQC values as the accurately measured IWQC values. The quality and accuracy of BLM instantaneous criteria derived using default input parameter data and measured input parameter data are not equivalent. There is a need to explicitly recognize that default values are estimates based on very conservative assumptions. They are appropriately used for Clean Water Act purposes when there is no alternative, but IWQCs based on measured input parameters are more accurate, more directly related to water quality conditions affecting bioavailability of copper, and should supersede default values based on conservative assumptions when data are available.

2. Under Option 2 and Option 3, subsequent regulation based on widespread application of conservative assumptions to IWQC values will lead to indication of toxic conditions, conclusions of impairment, and other regulatory actions where these conditions do not actually exist. This may lead to an inaccurate identification of water bodies as impaired for copper toxicity, masking the identification of locations where copper toxicity is actually impacting aquatic life, and will make it difficult to prioritize the control of sources in those waters. Legally required regulatory actions pursuant to the Clean Water Act, initiated by the application of conservative criteria values derived from very conservative default parameter input values, require significant effort to rescind, update, or revise as accurate data subsequently becomes available. Further, such actions require additional agency time and resources to make adjustments. For example, it takes significant staff time to reopen an NPDES permit to recalculate and justify different effluent limits or the removal of limits.

6. Procedures for Application of the Biotic Ligand Model Copper Standard

This chapter describes how the Biotic Ligand Model copper standard will be used to derive instantaneous water quality criteria for copper for a given set of water chemistry conditions. In addition, Section 6.3 describes how DEQ will establish regional default input parameter values based on the best available data when the site specific data needed to calculate an accurate IWQC are not available.

The general procedure for verifying a set of input parameter samples to calculate an IWQC is as follows:

1. Determine whether data on the humic acid fraction is available. If not specified, use the default input value of 10%.

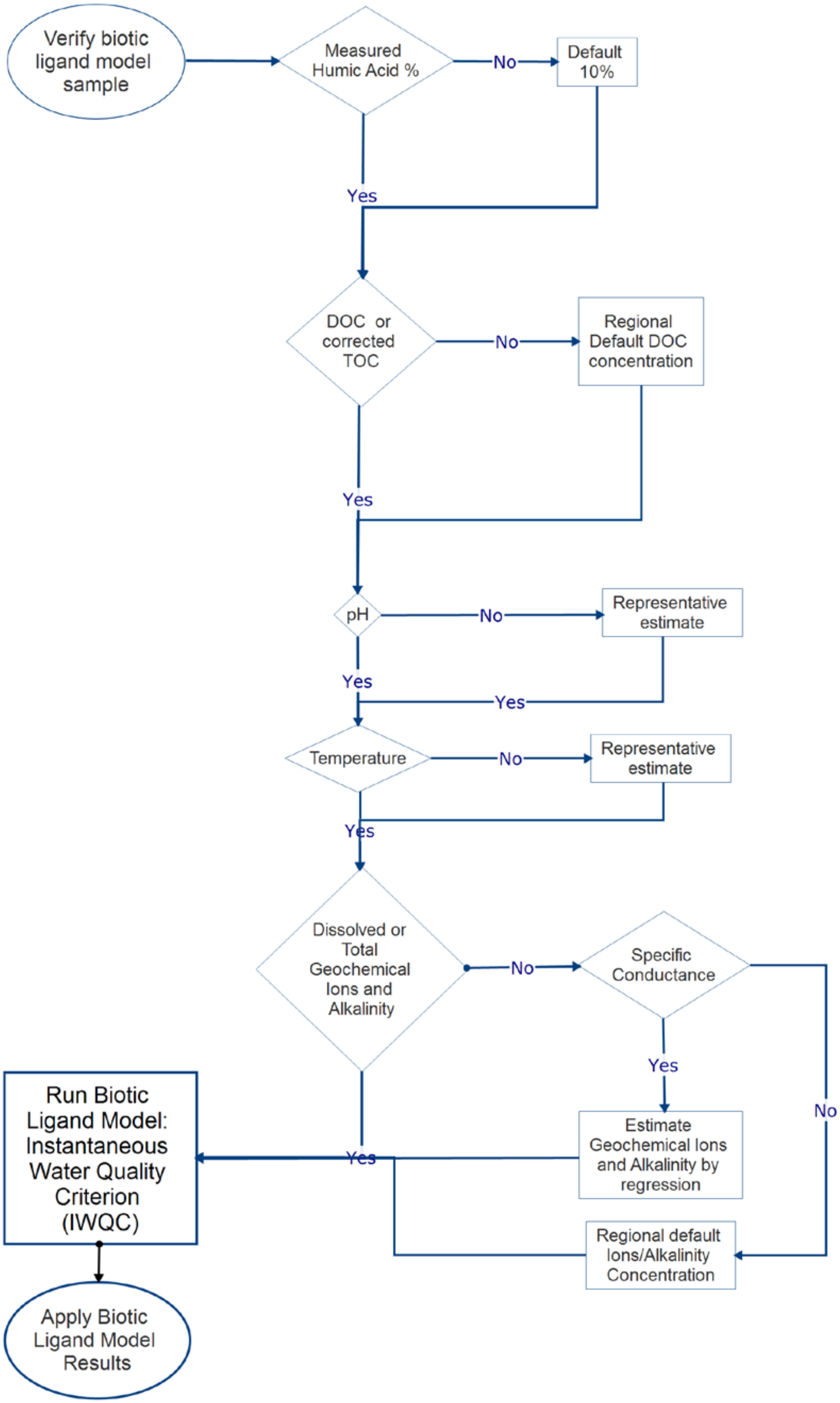
2. Determine if organic carbon data exist and if so, whether it was measured as dissolved organic carbon (DOC) or total organic carbon (TOC).
    a. If DOC, input the value directly
    b. If TOC was measured, apply any correction factors to convert to an estimate of DOC.
    c. If neither DOC nor TOC was measured, apply a regional default value.

3. Determine availability of pH and temperature data.
    a. If available, use values directly
    b. If pH or temperature data are not available, apply a relevant value from a representative monitoring location.

4. Evaluate the availability of measurements of the geochemical ions and alkalinity.
    a. Measures of total concentration may be substituted for dissolved concentration.
    b. If a geochemical ion has not been measured, but specific conductance has been measured, its concentration may be estimated from specific conductance using the equations provided.
    c. If specific conductance data are not available, apply the default regional input value.

5. Run the model using the set of prepared input parameters to obtain acute and chronic instantaneous criterion values (IWQC) values.

Figure 6.1 General procedure to verify biotic ligand model sample data



6.1 Procedure to derive instantaneous water quality criteria (IWQCs)

6.1.1 Data requirements

The Biotic Ligand Model uses 13 water quality parameters, and requires the input of measured values for at least 10 of these parameters to calculate an IWQC. One set of these input parameters, collected at the same location and time, will calculate an acute and chronic IWQC that defines the copper criteria for those conditions. That is, for that location and time. Parameters for a sample used to calculate an IWQC need to be collected coincident in space and time. All input parameters are specified as the dissolved form. Samples passing a 0.45µm filter are considered dissolved for these purposes.

The published calibration range of the model parameters is as follows[11]:

Table 6.1

PARAMETER	LOWER BOUND	UPPER BOUND
Temperature (°C)	10	25
pH (Standard Units)	4.9	9.2
DOC (mg/L)	0.05	29.65
Calcium (mg/L)	0.204	120.24
Magnesium (mg/L)	0.024	51.9
Sodium (mg/L)	0.16	236.9
Potassium (mg/L)	0.039	156
Sulfate (mg/L)	0.096	278.4
Chloride (mg/L)	0.32	279.72
Alkalinity (mg/L)	1.99	360
DIC (mmol/L)	0.056	44.92
Humic Acid Content (%)	10	60
Sulfide (mg/L)	**0**	**0**

Communications with EPA and HydroQual/HDR, Inc. (now at Windward Environmental, LLC), the developers of the biotic ligand model, have indicated that biotic ligand model results remain valid when using parameter concentrations outside of these ranges. The extension of these ranges have been demonstrated in BLM applications and validations conducted since the publication of the 2007 EPA criteria document. Therefore, DEQ expects to use input parameter data that meets quality requirements even if they are outside of this range.

Of these 13 input parameters, ten parameters are commonly monitored. The model requires a value to be input for each of these parameters:

1. temperature
2. pH
3. dissolved organic carbon (DOC)

[11] HydroQual, Inc. (2007). The Biotic Ligand Model Windows Interface, Version 2.2.3: User's Guide and Reference Manual. Mahwah, NJ, HydroQual, Inc.

4. calcium (Ca^{2+})
5. magnesium (Mg^{2+})
6. sodium (Na^{+})
7. potassium (K^{+})
8. sulfate ($SO4^{2-}$)
9. chloride (Cl^{-})
10. alkalinity ($CaCO_3$ equivalent)

Three input parameters are not ordinarily monitored by most water quality monitoring programs. The model uses a standard built-in default value for normal operation:

1. Sulfide
2. Humic acid percent (as a proportion of DOC)
3. Dissolved inorganic carbon (DIC)

For sulfide and humic acid percent, a built-in default value is entered by the user unless replaced by measured values. For DIC, unless a parameter value has been measured and specified, the value is calculated automatically by the model based on other data.

Sulfide: Sulfide concentration values are not currently used in the calculation of IWQC by the Biotic Ligand Model, but are included in the interface as a placeholder. A negligible, non-zero default concentration of $1x10^{-6}$ mg/L may be used as a default. Inputting zero, or a blank, will result in an error.

Humic acid percent: Humic acid is a measure of the characteristics of organic matter, and is not a commonly measured parameter. The percent of humic acid as a proportion of the DOC may be used if data are available for the sample. A default of 10% is recommended by the model developers, and is appropriate for a wide range of conditions. DEQ expects a value of 10% to be adequate for most conditions encountered within the state.

Dissolved inorganic carbon (DIC): The Biotic Ligand Model software will automatically calculate DIC from the alkalinity and pH data provided by the user. DIC may be input directly if those data have been measured for the sample.

Copper concentration for the sample may be input into the model, but it is not required to calculate an IWQC for a set of parameters.

6.1.2 Model settings and versions for generating instantaneous water quality criteria

Use of the following model settings and procedures will generate an acute and chronic criterion consistent with the parameter data compiled in Oregon’s biotic ligand model database:

1. Download and install the latest version of the Biotic Ligand Model that is based on EPA’s 2007 Copper criteria document. These instructions were developed using BLM software version 2.2.3.
2. Set the radio button for “Metal” to “Copper”
3. Set the “Prediction Mode” to “Instantaneous WQC Calculation” (If users are working with version 2.2.1, which is distributed by the US-EPA, then step 3 is not needed).
4. Go to the menu bar, select the “Inputs” drop-down menu
    i. select “Set Units”

   ii. ensure that the model units match the units of the parameter data for input
5. Go to the menu bar, select the "Inputs" drop-down menu
   i. select "Inorganic Carbon"
   ii. if not using measured DIC, select "closed system, input alkalinity"
   iii. if using measured DIC, place these samples in a separate model run and select "closed system, input DIC" for this step
6. Paste or type parameter values for each sample into the spreadsheet interface
7. Go to the toolbar, select the "Run BLM" model icon
8. A report including the final acute value, instantaneous acute criterion, and instantaneous chronic criterion for each set of input parameters will be generated. The reported acute and chronic IWQC for each sample of input parameters are the effective criteria for the location and time represented by the sample.

6.2 Procedures for estimating missing biotic ligand model parameter data

DEQ's best practice is to generate IWQCs from a set of input parameters where data for all the parameters have actually been measured. An IWQC calculated from samples with measured data will take precedence over a criterion generated using estimated data (see also Section 6.3, below). When data for one or more parameters is not available, and an IWQC must be calculated, the missing parameters may be estimated using one of the methods described in this Section. For more information on the development of the following estimation procedures, refer to the Technical Support Document: An Evaluation to Derive Statewide Copper Criteria Using the Biotic Ligand Model.[12]

Based on data available at the time DEQ developed the draft rule, DEQ assessed the number of samples where it has copper data and coincident BLM input parameter data sufficient to calculate an IWQC. Copper samples to be evaluated are most likely to be missing DOC. Samples are rarely missing pH and temperature (**Table 6.2**).

[12] Oregon Department of Environmental Quality 2016, Technical Support Document: An Evaluation to Derive Statewide Copper Criteria Using the Biotic Ligand Model. http://www.oregon.gov/deq/RulesandRegulations/Pages/2015/Rwqcopper.aspx

Table 6.2 Extent of samples missing DOC or pH BLM input parameters

Copper water quality samples to be evaluated (2000-2015)	n=	%
Total copper samples	4,169	–
missing DOC data	2427	58%
missing pH data	354	8%
missing temperature data	318	7%
Samples for IWQC calculation (2000-2015) (having at least DOC & specific conductance)		
Total samples	4,722	–
missing pH data	59	1%
missing temperature data	27	0.05%

6.2.1 Oregon's Statewide Biotic Ligand Model database

DEQ compiled a database of all available input parameter data for Oregon to survey the current availability of BLM input parameter data, calculate IWQCs for complete sets of input parameters, evaluate the sensitivity of model results to variability in each parameter, determine relationships among parameters in Oregon, and evaluate estimation approaches for missing parameters. The database is comprised of samples recorded in the DEQ LASAR database and the USGS-NWIS databases for the years 2000-2015. Details of the database are provided in the Technical Support Document: An Evaluation to Derive Statewide Copper Criteria Using the Biotic Ligand Model.

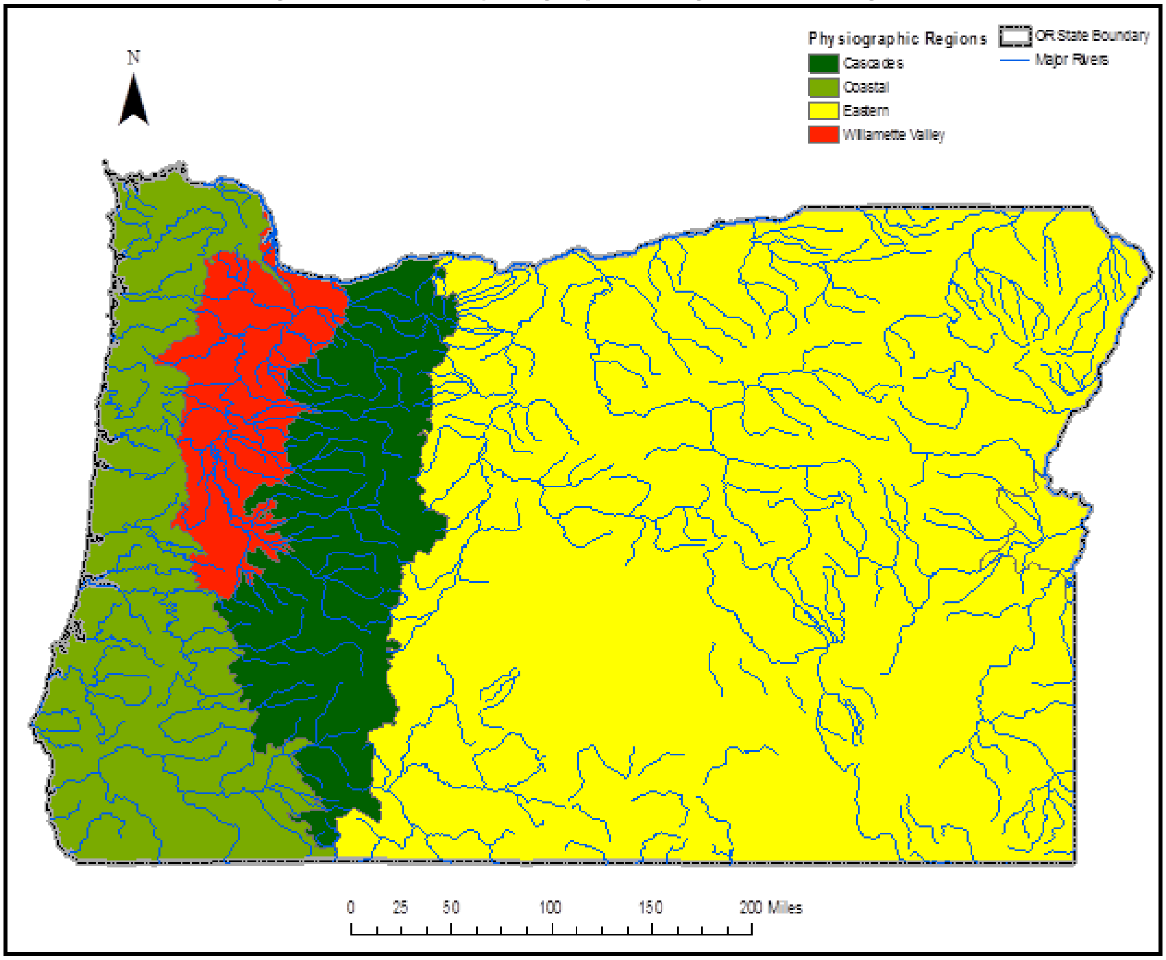
DEQ identified four major physiographic regions of the state based on aggregating EPA Level III Ecoregions. The regions group sampling locations with similar water chemistry, and were determined using statistical differences in the distribution of the most important biotic ligand model input parameters, and the distribution of IWQC values calculated by the model. These regions provide a framework for developing regional estimates of parameter concentrations to be used as default values when measured parameter data is not available. Details of the derivation of the physiographic regions are provided in the Technical Support Document: An Evaluation to Derive Statewide Copper Criteria Using the Biotic Ligand Model.

The physiographic regions are listed 1-4 and shown in the map, **Figure 6.2**, below. Each region contains the EPA Level-III ecoregions indicated:

1. Coastal
    - Coast Range
    - Klamath Mountains
2. Willamette Valley
    - Willamette Valley

3. Cascades
    - Cascades
4. Eastern
    - Eastern Cascades Slopes and Foothills
    - Columbia Plateau
    - Blue Mountains
    - Northern Basin and Range
    - Snake River Plain

Figure 6.2 DEQ Biotic Ligand Model Physiographic Regions of Oregon



6.2.2 Procedure for reconciling total recoverable and dissolved parameter measurements

The Biotic Ligand Model assumes that input parameters are measured as a dissolved concentration. A dissolved measurement is defined here as that portion of a sample that passes through a 0.45 µm pore-size filter. Ion and alkalinity concentrations based on filtered samples are preferred, but concentrations based on unfiltered samples are acceptable. For a parameter sample where the dissolved measurement of concentration is not available, but a total recoverable concentration (for example, measured from an unfiltered sample) is available, the dissolved concentration should be estimated by multiplying the total recoverable concentration by one of the translators in **Table 6.3**:

Table 6.3 Coefficients to translate from total to dissolved BLM input parameter concentration

Parameter	Translator Coefficient
Alkalinity	1
Calcium	1
Sodium	1
Magnesium	1
Potassium	1
Chloride	1
Sulfate	1
DOC	0.83

Detailed information regarding the derivation and evaluation of these translators is discussed in detail in DEQ's Technical Support Document[13]. There DEQ describes its analysis that resulted in a determination that there was a strong 1:1 correlation between the total recoverable and dissolved measurements of alkalinity and the geochemical ions.

DEQ found that the relationship between DOC and TOC statewide was 0.83. DEQ also evaluated whether there was sufficient data to determine regional translators. Sufficient data exists in the Eastern region and the Willamette Valley, resulting in a coefficient of 0.85 and 0.95, respectively. However, there was not sufficient data to determine relationships in the Coastal or Cascade regions. Because there was not a strong relationship between TOC and DOC in the Coastal and Cascade regions, the 0.83 translator based on all DOC/TOC data available for the state, is being used recognizing that the statewide translator is more conservative relative to the regional translators for the Eastern and Willamette Valley regions. In the future, DEQ may consider developing regional translators for the physiographic regions if sufficient on the relationship between total and dissolved parameters becomes available. Such regional translator might be more accurate.

6.2.3 Procedure to estimate missing biotic ligand model geochemical and alkalinity data

Where neither total nor dissolved measurements of the geochemical ions or alkalinity are available, the concentration of these parameters may be estimated. There are two options for estimating the concentration of missing geochemical ions or alkalinity in a sample. In order of accuracy and preference, they are:

1. Estimation of concentration using specific conductance, or
2. A conservative estimate based on the 20th or 15th percentile of the distribution of concentration data in the physiographic regions, as explained further below.

[13] DEQ 2016. Technical Support Document: An Evaluation to Derive Statewide Copper Criteria Using the Biotic Ligand Model. http://www.oregon.gov/deq/RulesandRegulations/Pages/2015/Rwqcopper.aspx

Option 1: Estimate the concentration of the geochemical ions and alkalinity using the relationship of these parameters to specific conductance measurements from the same sample for IWQC analysis.

Specific conductance is an inexpensive, widely-collected water quality parameter that measures the electrical conductivity of water due to the presence of dissolved ions. A strong relationship between specific conductance (µmho/cm), and individual geochemical ions and alkalinity, was found for waters in Oregon. Where specific conductance data are available, the following equations will be used to calculate the expected ion or alkalinity concentration given a value of specific conductance for a sample.

Table 6.4 Regression equations for estimating geochemical ions and alkalinity from specific conductance

Parameter	Regression Equation
Alkalinity	$\text{Alk.} = \exp^{(0.88\cdot[\ln(\text{SpC})] - 0.41)}$
Calcium	$\text{Ca} = \exp^{(0.96\cdot[\ln(\text{SpC})] - 2.29)}$
Sodium	$\text{Na} = \exp^{(0.86\cdot[\ln(\text{SpC})] - 2.22)}$
Magnesium	$\text{Mg} = \exp^{(0.91\cdot[\ln(\text{SpC})] - 3.09)}$
Potassium	$\text{K} = \exp^{(0.84\cdot[\ln(\text{SpC})] - 3.74)}$
Chloride	$\text{Cl} = \exp^{(1.15\cdot[\ln(\text{SpC})] - 3.82)}$
Sulfate	$\text{SO}_4 = \exp^{(1.45\cdot[\ln(\text{SpC})] - 5.59}$

DEQ will provide a calculator or spreadsheet on the DEQ website to automatically calculate these values.

Option 2: Estimate geochemical ions and alkalinity by substituting a conservative default value calculated for the region in which the site is located using the map in Figure 6.2, above. DEQ will calculate these default values using the 20^{th} percentile of the distribution of concentrations for each parameter according to the physiographic regions of the state, and use the 15^{th} percentile for the Eastern Region to be consistent with the DOC default values explained below. DEQ will periodically update the values associated with these percentiles and make them available to the public as ongoing monitoring data are collected.

Derivation and evaluation of both of these estimation techniques is discussed in detail in the Technical Support Document: An Evaluation to Derive Statewide Copper Criteria Using the Biotic Ligand Model.

6.2.4 Procedure to estimate missing dissolved organic carbon data (DOC)

The BLM IWQC values are very sensitive to the concentration of DOC as an input parameter. As approximately 50% of copper samples that could be assessed at this time do not have a concurrently measured value for DOC, the use of a default value will be necessary when these data are missing.

DEQ will estimate DOC by substituting a protective percentile of the DOC concentration measured for the region in which the site is located and will be used as the BLM input parameter when measured DOC data is not available for the site and time for which an IWQC needs to be derived.

Table 6.5 shows the percentiles contained in the final proposed rule and the current estimates of the corresponding DOC default concentration for the Oregon BLM regions. DEQ proposes to use the 20th and 15th percentiles of DOC concentration as the default input value for two reasons. First, our analyses comparing the relative conservatism of the resultant criteria values based on various percentiles of regional DOC concentrations show that the 20th /15th percentile provides a balance between being protective of sensitive conditions and overstating the risk by applying a more conservative (i.e. 10th percentile) assumption to DOC. The IWQC values do not respond linearly to DOC concentration, and thus a criteria value based on the 20th percentile of DOC concentration does not equal the 20th percentile of calculated IWQCs because the value of the resulting IWQC also depends on the value of the other 12 input parameters.

Table 6.5

Region	Percentile	Default DOC (mg/L)
Willamette	20th %	1.0
Coastal	20th %	0.83
Cascades	20th %	0.48
Eastern	15th %	1.33
Columbia River	20th %	1.42

6.2.5 Justification for establishing default percentiles of DOC concentration

6.2.5.1 Percentiles of DOC concentration

Table 6.6 shows the DOC concentrations based on data from the Oregon BLM database at various percentiles between the 10th percentile and 50th percentile (the median). The geometric mean and 99th percentile are shown for reference only.
Table 6.7 shows the EPA 10th percentile of DOC concentration for the Level-III Ecoregions within Oregon. The EPA data is reproduced from the draft 2016 EPA Biotic Ligand Model Missing Parameters Document based on data from the National Organic Carbon Database and the Wadeable Streams Assessment[14].

In addition to the list of DEQ regions described section 6.2.1, DEQ has separately identified the Columbia River main stem, as it borders multiple regions, and the distribution of its input parameters as distinct compared to the data from the other regions.

[14] EPA, 2016. EPA Draft Technical Support Document: Recommended Estimates for Missing Water Quality Parameters for Application in EPA's Biotic Ligand Model. Docket ID Number EPA-HQ-OW-2015-0469

Table 6.6

	Samples	DOC (mg/L)						
Region	**n=**	**10th%**	**15th%**	**20th%**	**25th%**	**median**	**geomean**	**99th%**
Cascades	253	0.08	0.12	0.48	0.58	0.8	0.60	3.87
Coastal	873	0.83	0.83	0.83	0.83	1.33	1.44	9.59
Columbia River	115	1.33	1.40	1.42	1.49	1.69	1.70	2.82
Eastern	1351	1.0	1.33	1.58	1.83	3.1	3.09	23.1
Willamette Valley	2383	0.83	0.83	1.0	1.3	2.3	2.17	12.9

Table 6.7

EPA Level-3 Ecoregion	Samples (n=)	EPA 10th % DOC Estimates (mg/L) [15]
Blue Mountains	91	0.8
Cascades	37	0.3
Coast Range	60	0.7
Columbia Plateau	22	1.0
Eastern Cascades Slopes and Foothills	25	0.5
Klamath Mountains	56	0.6
Northern Basin and Range	49	1.0
Snake River Plain	6	1.2
Willamette Valley	12	0.4

There are a number of conservative assumptions around DOC concentrations inherent in the Oregon database that lead to artificially low IWQC values at the low end of the distribution. Over 25% of DOC values in the Oregon database are below the quantification limit (QL) (0.83 µg/L), also called the reporting limit, for DOC. In order to verify the effect of very low DOC values on IWQC, DEQ used the raw DOC concentration of these samples for evaluation purposes when it was available– even though these values are highly uncertain. The raw concentration scores for DOC samples between the QL (0.83 µg/L) and detection limits (DL) (0.05–0.11 mg/L) result in extreme IWQC values with high uncertainty and introduce a strong bias in the low percentiles of the measured IWQC distribution toward artificially low criteria values. This effect is evident in the highly skewed tail of the measured IWQC distribution below the 10th percentile of measured IWQC (**Figure 6.3**). These IWQC values are 1-2 orders of magnitude below the median IWQC.

An additional conservative assumption is built into the BLM criteria by the model. The BLM IWQC are calibrated to the toxicity data for the most sensitive genera from the more than 600 toxicity studies used.

[15] EPA, 2016. EPA Draft Technical Support Document: Recommended Estimates for Missing Water Quality Parameters for Application in EPA's Biotic Ligand Model. Docket ID Number EPA-HQ-OW-2015-0469, p.79, Table 20.

The acute and chronic IWQC reflect copper toxicity to *Daphnia* and *Ceriodaphnia*[16]. The genus mean acute value (GMAV), or acute toxicity endpoint, for the *Daphnia* species for which lab results were available, is 4.67 µg/L. The GMAV for the threatened and endangered salmonids, *Oncorhynchus* is 31.39 µg/L, or 6.7x less stringent than for *Daphnia*[16]. Therefore, the BLM IWQC being evaluated are many times more stringent than what is required to protect the threatened and endangered salmonid species addressed in the NMFS biological opinion based on the toxicity studies.

6.2.5.2 Distribution of IWQCs based on default DOC concentrations

Table 6.6, below, shows the median chronic IWQC for each region calculated using measured DOC data, and median chronic default action values calculated by substituting the various DOC default input values for the measured DOC values in the Oregon BLM database. All other input parameter values are measured or, for some ions, estimated using specific conductance. The results are based on samples from the Oregon database, where measured data was available for all the input parameters.

The median of the accurate IWQCs, based on measured DOC values ranges from 1.6 – 12.9 µg/L copper. Medians of the default action values, are all more conservative than the accurate IWQCs. For comparison, applying the OR median DOC concentration results in a median of default action IWQC values are higher than the measured IWQC, and are therefore not conservative.

When using the 20th percentile regional DOC as a default input, the substitution results in chronic default action values that are higher than the EPA Ecoregional 10th percentile DOC defaults, but are significantly lower than, and conservative, compared to the accurate IWQC values based on measured DOC data.

Table 6.6 Median chronic IWQC compared to median chronic default criteria values derived from default DOC values

Region	n=	Median chronic IWQC or default action value (µg/L)						
		Measured DOC	EPA 10th% DOC	OR 10th% DOC	OR 15th% DOC	OR 20th% DOC	OR 25th% DOC	OR Median DOC
Cascades	191	1.6	0.78	0.22	0.33	1.2	1.5	2.0
Coastal	853	3.4	1.75	2.08	2.14	2.1	2.1	3.3
Columbia River	113	6.0	2.12	4.64	4.9	5.0	5.3	6.1
Eastern	1133	12.9	4.09	4.85	6.32	7.5	8.8	14.8
Willamette Valley	2316	4.6	0.88	1.79	1.79	2.2	2.8	4.9

Note: The reference to EPA or OR regarding the DOC default input value percentiles refers to the EPA or Oregon database as the source of DOC data, respectively.

16 EPA 2007, Aquatic Life Ambient Freshwater Quality Criteria – Copper 2007 Revision. United States Environmental Protection Agency. Office of Water 4304T. EPA-822-R-07-001. February 2007.

Figure 6.3 Cumulative distribution of chronic IWQC and default action IWQC values resulting from application of measured DOC (black, open circles- at top), the 20th percentile of DOC from the Oregon database (light grey, closed circles- middle), and the 10th percentile EPA Ecoregional estimated DOC (dark grey, closed circles- at bottom). The dashed line references the quantification limit (QL) of copper, 1.5 µg/L.

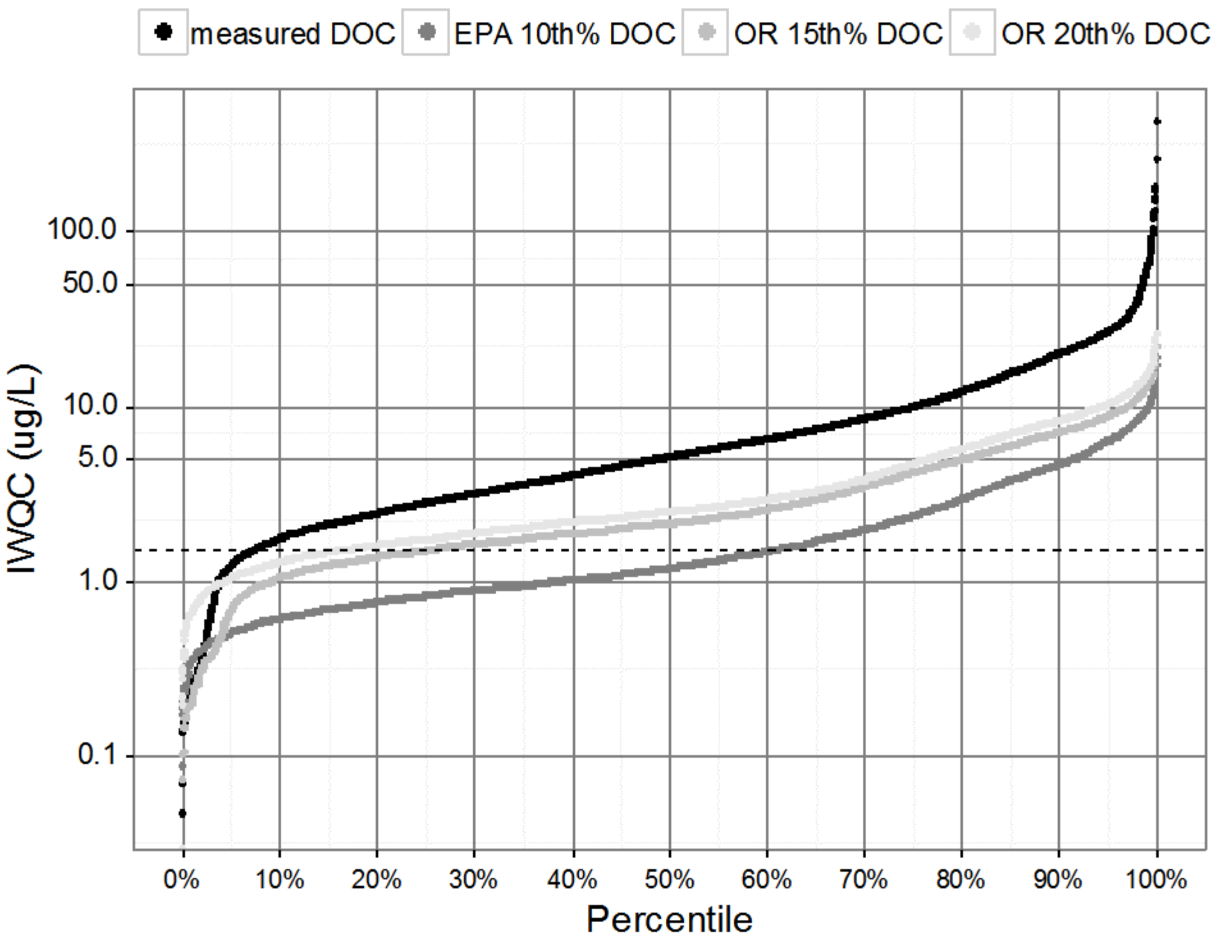


Figure 6.3 shows the cumulative distribution of the chronic IWQC values calculated using: 1) measured DOC, and 2) default action values derived by substituting the measured DOC concentration with EPA's Ecoregional 10th percentile, and 3) default action values derived by substituting the measured DOC concentration with DEQ's OR 20th percentile regional default values for DOC. All other input parameter values are measured or, for some ions, estimated using specific conductance. The points on the curve show the probability (x-axis) that a particular IWQC or default action value (y-axis) will be at or below the shown concentration according to the distribution of the data. Note that the values below the 10th percentile of measured IWQC are highly skewed for all three curves. This is due to bias from application of highly uncertain DOC values that were reported below the quantification limit, as discussed above. These criteria are well below the QL limit for copper. They would be implemented in the same manner, as in either case regulatory programs would focus on ensuring copper stays below quantification levels.

When the distribution curve for the default action values are lower than the measured IWQCs, it indicates the values are more conservative than the actual IWQC values using measured DOC at that percentile of the distribution. Where the curve of the default distributions cross above the black curve for the measured

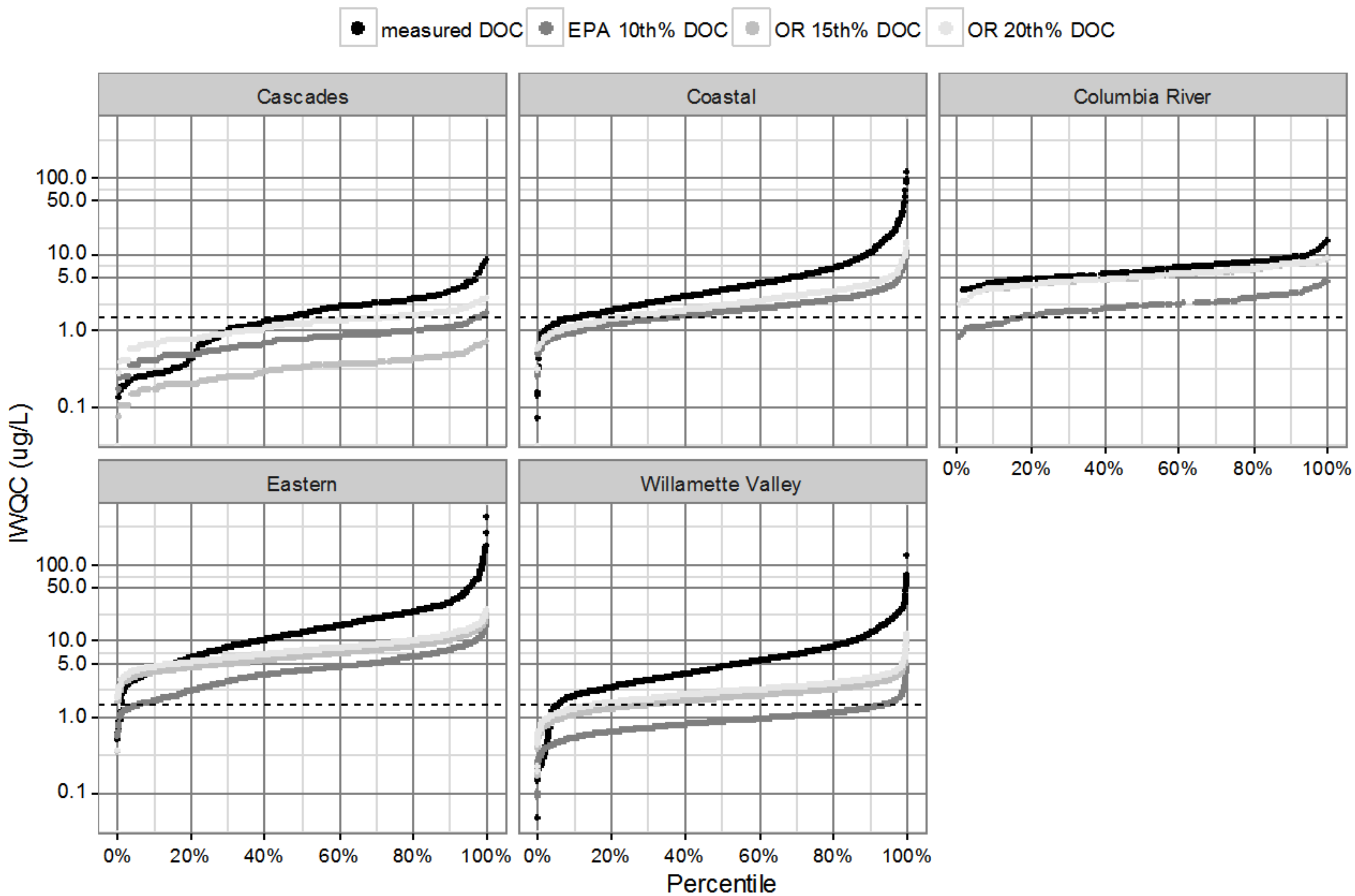
IWQCs, it indicates the percentile of the distribution where the default action values are no longer more conservative than the measured IWQCs. The distribution of default action IWQC value from Oregon 20th percentile of DOC is more conservative than 96% of the measured IWQC, and the OR 15th percentile is more conservative than 97% of the measured IWQCs. The default action values for IWQC from EPA 10th % of DOC are even more conservative, >99% of the measured IWQCs.

Also of note is the magnitude of the difference between the measured IWQC curve and each curve of DOC default action values. While only 6% of accurately measured IWQCs result in chronic criteria values below the QL for copper, 60% of the chronic criteria values using the EPA 10th percentile Ecoregion DOC concentration as a default are below the QL for copper.

Figure 6.4, below, shows the same cumulative distribution function as **Figure 6.3**, above, displayed by OR BLM Regions. Due to differences in the distribution of DOC concentration across regions of the state, we can see that the relative conservativeness of default action IWQC values calculated from the default percentiles of DOC vary according to region.

For the Coastal and Columbia River regions, the distribution of the default regional IWQC using the EPA 10th, OR 15th, or OR 20th percentile was never greater than the measured IWQC. For the Willamette region the OR Regional 20th percentile of DOC resulted in a distribution of IWQCs that were more conservative than 97% of the measured IWQC. In the Cascades, the DOC distribution is low and the range is narrow; therefore a significant portion of DOC values used as the measured inputs to the model are uncertain because they are below the QL for DOC. The result is that the distribution of default action IWQC values are not significantly lower than the measured IWQCs. The default action IWQCs are more stringent than the measured IWQCs only down to the 30th-20th percentile. However, these criteria values are well below the QL for copper and, as stated earlier, are uncertain because of DOC measurements below the QL. For the Eastern region, the distribution of the 20th percentile default DOC was only conservative down to ~15th percentile of measured IWQCs. The range of measured DOC concentrations, and resulting measured IWQC values encountered in the Eastern region is much wider than the other regions. DOC is more likely to be measured at concentrations above the QL for DOC, and the bias at the low end of the distribution of measured DOC is less severe.

Figure 6.4 Cumulative distribution of IWQC resulting from application of measured DOC (black, open circles- at top), the 20th percentile of DOC from the Oregon database (light grey, closed circles- middle), and the 10th percentile EPA Ecoregional estimated DOC (dark grey, closed circles- at bottom) by physiographic region. The dashed line references the QL of 1.5 µg/L Cu.



6.2.5.3 Stringency of alternative percentiles of default DOC concentration

Table 6.8 shows the relative stringency of the various default action IWQC values for different DOC substitution methods compared to their corresponding IWQC values. Unlike the distributions discussed in the previous section, which show the probability of an IWQC value being higher or lower than a certain level, these indicate how individual IWQC samples compare to themselves when a default percentile of DOC concentration is used in place of the measured DOC as an input parameter. Recall that there is great uncertainty in the validity of the chronic criteria approaching the 10th percentile of the measured IWQC values. Therefore, only measured IWQC values that were equal to or above the QL for copper, 1.5 µg/L were considered.

Table 6.8 Number and proportion of default action IWQC values from various default DOC concentrations that are more stringent than their corresponding measured IWQC. Samples shown are for measured IWQC above the quantification limit.

Region	Samples	EPA 10th % DOC		OR 15th % DOC		OR 20th % DOC		OR 25th % DOC	
	(n=)	(n=)	%	(n=)	%	(n=)	%	(n=)	%
Cascades	101	101	100%	101	100%	101	100%	99	98%
Coastal	759	742	98%	715	94%	715	94%	715	94%
Columbia River	113	113	100%	97	86%	94	83%	86	76%
Eastern	1119	1086	97%	928	83%	874	78%	805	72%
Willamette Valley	2178	2178	100%	2023	93%	1856	85%	1721	79%
Total	**4270**	**4220**	**99%**	**3864**	**90%**	**3640**	**85%**	**3426**	**80%**

The proportion of individual default action IWQC values that were more stringent than their corresponding measured IWQC value is somewhat lower than the distributions would indicate. The proportion of samples also varied by region. The OR 20th% was more stringent than 78-100% of measured samples, below 80% only for the Easter region, and overall was more stringent than 85%. The OR 15th % was more stringent than 83-100% of measured samples, below 85% only for the Easter region, and overall stringency was 90%. The EPA 10th % is very stringent, with default action IWQC values more stringent than 97-100%, with overall stringency of 99%.

This comparison does not take into account how the magnitude of the difference between the measured and default values, only whether a default action IWQC was higher or lower than its corresponding measured IWQC value. In many cases, the difference in magnitude between a default action IWQC value that was greater than the corresponding measured value was negligible (see **Table 6.9** and **Figure 6.5**, below). Additionally, these differences aren't predictive of whether the ambient copper concentrations are present in toxic concentrations. The concentration of copper must be evaluated against the measured criteria value to make that determination.

Recall, the BLM IWQC are adjusted based on the sensitivity of the two most sensitive genera included in the toxicity studies used to calibrate the model. *Daphnia* is the most sensitive genus used to calibrate the

BLM. The accuracy of the acute value predicted by the BLM varies from the acute criteria from the toxicity data for *Daphnia,* as cited by EPA, by a factor of +/- 1.3 to +/- 2. [17, 18]

That is, a default action IWQC value that is within at least 1.3 times the value of the corresponding measured IWQC value is at least as protective, given this margin of error in the accuracy of model predictions. **Table 6.9** shows the proportion of samples where the differences between measured IWQC values and corresponding default action IWQC values are within the margin of error.

Table 6.9 Number and proportion of default action IWQC values that are *no more than the 1.3x the margin of error above* corresponding IWQCs from measured DOC. Samples shown are for measured IWQC above the quantification limit.

Region	Samples	EPA 10th % DOC		OR 10th % DOC		OR 15th % DOC		OR 20th % DOC		OR 25th % DOC	
	(n=)	(n=)	%	(n=)	%	(n=)	%	(n=)	%	(n=)	%
Cascades	101	101	100%	101	100%	101	100%	101	100%	101	100%
Coastal	759	755	99%	756	99%	751	100%	751	99%	751	99%
Columbia River	113	113	100%	112	99%	108	99%	108	99%	108	99%
Eastern	1119	1112	99%	1113	100%	998	89%	959	86%	916	82%
Willamette Valley	2178	2178	100%	2173	99%	2162	99%	2124	98%	1843	85%
Total	**4270**	**4259**	**99%**	**4255**	**99%**	**4120**	**96%**	**4043**	**95%**	**3719**	**87%**

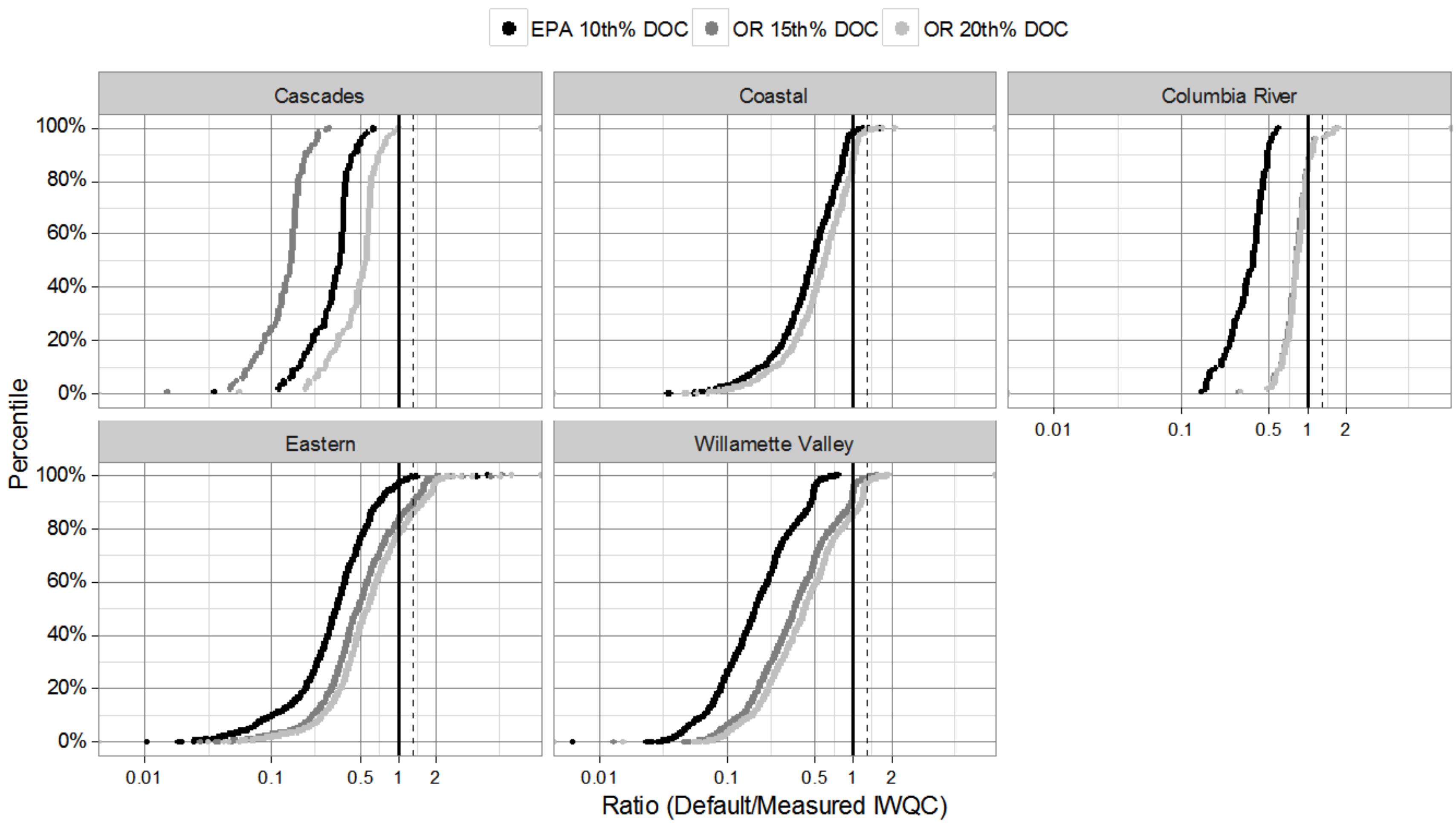
Figure 6.5, below, shows the distribution of the ratio of the various default action IWQC values to their corresponding measured IWQC values. Ratios = 1, (x-axis), indicate that the default action IWQC value was the same as the corresponding IWQC values. The percentile (y-axis) indicates the proportion of samples on each curve that were at or below a given ratio. Ratios of <1 indicate default action IWQC values were *lower*, therefore more stringent, than the corresponding measured IWQC value. Ratios >1 indicate default action IWQC values were *higher*, and therefore less stringent, than their corresponding measured IWQC values. Ratios <1.3 indicate samples that are *at least as stringent* within the margin of error.

Accounting for this margin of error, for the OR 20th percentile of DOC, 95% of default action IWQC values were lower than measured IWQC, or within this margin of error. For the OR 15th percentile of DOC, 96% of IWQC were lower than the measured IWQC, or within this margin of error. This indicates that even when a default action IWQC value was above the corresponding measured IWQC value, the difference was usually within this margin of error. The probability that either the OR 20th percentile or the OR 15th percentile would be at least as stringent as the corresponding measured IWQC value is >95%for all regions.

[17] EPA 2007, Aquatic Life Ambient Freshwater Quality Criteria – Copper 2007 Revision. United States Environmental Protection Agency. Office of Water 4304T. EPA-822-R-07-001. February 2007.

[18] Soumya Niyogi and Chris M. Wood, 2004. Biotic Ligand Model, a Flexible Tool for Developing Site-Specific Water Quality Guidelines for Metals. Environmental Science & Technology, Vol. 38, No. 23, 2004.

Figure 6.5 Ratio of IWQC using default DOC to the corresponding measured IWQC. Ratio < 1 indicates default IWQC < corresponding measured IWQC. Solid vertical line is 1.0, where measured IWQC = default IWQC. Dashed line indicates +1.3 times the measured IWQC, the upper bound of the margin of error. Samples shown are for measured IWQC above the quantification limit.



6.2.5.4 Exceedance frequency of copper resulting from application of IWQC from DOC defaults

The previous sections illustrate how the various default action IWQCs are sufficiently conservative compared to the measured IWQCs. In this section, we provide data for the relative Type-I (false-positive) and type-II (false negative) error rates when comparing copper samples to the various default action IWQCs. Comparing the relative number of copper samples that would exceed default action IWQC values based on each default DOC input provides a general metric for comparing the relative conservativeness and risk of using the different DOC percentiles. We will conclude with a measure of the overall protection rate for existing copper samples provided by each DOC percentile. By design, using a conservative estimate of DOC will identify more copper samples as exceeding than the measured IWQC.

Table 6.10 and **Table 6.11** below show the number of exceedances for a set of samples from the Oregon database where there is both sufficient input parameter data to calculate an accurate IWQC, which is the concentration that by definition is not toxic and protects the use, and a corresponding sample of copper to compare to the criteria. The number of times copper samples exceed their corresponding measured IWQC, or a default action IWQC value, using various percentiles of DOC as a default parameter input, are shown for comparison. When the number of exceedances (n=) for the default action values is greater than the (n=) for the accurate IWQC (measured DOC) it indicates a false-positive result (**Table 6.10**); the default action value detected more copper exceedances than actually exist. When a copper sample exceeded the measured IWQC, but was lower than the corresponding measured IWQC, this indicated a Type-II error, or false-negative, i.e., the default action value fails to identify a copper exceedance when the default action value is actually higher than the measured IWQC. The proportion of samples for each method that were type-I or type-II errors, is shown next to the number of exceedances for each DOC substitution method.

Table 6.10. Number of copper samples exceeding an IWQC, and Type-I (false-positive) error rate, by default action values using various DOC substitution methods. Data for samples with quantifiable copper concentrations.

Region	Samples	Measured DOC	EPA 10th% DOC		OR 10th% DOC		OR 15th% DOC		OR 20th% DOC		OR 25th% DOC	
	(n=)	(n=)	(n=)	%	(n=)	%	(n=)	%	(n=)	%	(n=)	%
Cascades	61	17	19	3%	21	7%	21	7%	18	2%	17	0%
Coastal	272	20	91	33%	55	20%	54	20%	54	20%	55	20%
Columbia River	62	0	6	10%	1	2%	1	2%	1	2%	1	2%
Eastern	448	10	31	7%	17	4%	7	2%	4	1%	0	0%
Willamette Valley	826	111	497	60%	216	26%	225	27%	141	17%	39	5%
Total	**1669**	**158**	**627**	**38%**	**293**	**18%**	**291**	**17%**	**201**	**12%**	**90**	**5%**

Use of the EPA Ecoregional 10th percentile had a high false-positive rate for the Willamette and Coastal regions, and a high overall false-positive rate of 38%. The number of exceedances that occur was overestimated by the 10th percentile by a factor of 4.9. The OR Regional 20th and 15th percentile had similar type-I error rates to each other, except for the Willamette Valley region, and overall error rates were lower than the EPA defaults by at least half. The total number of exceedances was overestimated by a factor of 2.3 to 2.8, respectively.

Table 6.11 Number of missed copper sample exceedances, and Type-II (false-negative) error rate, by default action values using various DOC substitution methods. Data for samples with quantifiable copper concentrations.

Region	Samples	EPA 10th% DOC		OR 10th% DOC		OR 15th% DOC		OR 20th% DOC		OR 25th% DOC	
	(n=)	(n=)	%	(n=)	%	(n=)	%	(n=)	%	(n=)	%
Cascades	61	2	3%	0	0%	0	0%	3	5%	8	13%
Coastal	272	7	3%	8	3%	8	3%	8	3%	8	3%
Columbia River	62	0	0%	0	0%	0	0%	0	0%	0	0%
Eastern	448	3	1%	4	1%	5	1%	6	1%	7	2%
Willamette Valley	826	7	1%	31	4%	30	4%	35	4%	51	6%
Total	**1669**	**19**	**1%**	**43**	**3%**	**43**	**3%**	**52**	**3%**	**74**	**4%**

Use of the EPA Ecoregional 10th percentile had a very low false-negative rate, as nearly all default action IWQC values are much lower than the corresponding measured IWQCs. The DEQ OR Regional 15th and 20th percentile had similarly low false-negative rates. The overall probability for making a Type-II, or false-negative error, was 4% or less for all methods.

Table 6.12 shows the rate of protection of copper samples using measured IWQC and the default action IWQC values for each DOC substitution method. This is the proportion of copper samples where the default action IWQC value matched the determination of the measured IWQC as to whether a copper sample is meeting or exceeding the criteria value.

Table 6.12. Rate of protection of copper samples by default action values using various DOC substitution methods. Data for samples with quantifiable copper concentrations.

Region	Samples	EPA 10th% DOC	OR 10th% DOC	OR 15th% DOC	OR 20th% DOC	OR 25th% DOC
	(n=)	%	%	%	%	%
Cascades	61	97%	100%	100%	96%	87%
Coastal	272	97%	97%	97%	98%	97%
Columbia River	62	100%	100%	100%	100%	100%
Eastern	448	99%	99%	99%	99%	98%
Willamette Valley	826	99%	96%	96%	96%	94%
Total	**1669**	**99%**	**97%**	**97%**	**97%**	**96%**

Conclusions based on both the OR 20th percentile and 15th percentile DOC aligned with conclusions bas on the measured IWQC for 97% of copper samples over all, and with 100% of samples in particularly sensitive Cascades and Coastal regions.

These analyses show that use of the default action IWQC values at any level, but particularly the EPA 10th Ecoregional percentile of DOC, are much more likely to identify a copper sample as exceeding the criteria when according to the actual IWQC value, when no toxic condition due to copper actually occurs. Where a toxic condition actually occurs, any of the default measured IWQC values was not very likely to miss identifying a copper concentration that is of concern. This illustrates that the default action IWQC values proposed by Oregon would be sufficiently protective of a very high proportion of copper samples, while being twice as likely as the EPA 10th percentile defaults, to avoid misidentifying a copper sample as a concern when it is not actually exceeding the standard.

6.2.5.5 Conclusion

DEQ finds that using a combination of the 20th and 15th regional percentiles of DOC as default input values provides a scientifically defensible method to apply the BLM standard when measured DOC data is not available. The default action values will protect aquatic life without greatly overestimating the likelihood of exceeding the IWQC. As shown above, the 20th percentile of DOC as a default input is sufficiently conservative that the resulting default action IWQC values correctly identify the presence of toxic copper conditions in at least 96% of the samples in any given region, and 97% percent of samples statewide, using the available data from Oregon's biotic ligand model database. However, due to the greater range and concentration of DOC in waters of the Eastern region, adjustment of the default to the 15th percentile of DOC concentration is warranted for that region.

Using a more conservative default, such as the 10th percentile of DOC concentration, does not provide a significant increase in protection except for the lowest 10th percentile of measured samples, which are well below the QL for copper. In addition, using the 10th% DOC as the default value significantly increased the number of copper samples incorrectly identified as exceeding, when measured IWQC values indicated they were not, by a factor of two or more. This greatly increases the risk of mischaracterizing conditions in waterbodies.

Using the 20th percentile of DOC concentration as a default input value for the Cascade, Coastal, Columbia River, and Willamette Regions, and the 15th percentile of DOC concentration for the Eastern Region, is scientifically defensible and provides a high degree of protection for aquatic life without greatly overestimating the likelihood of Type-I, false-positive errors. More importantly, DEQ monitoring programs have begun collecting BLM input parameters concurrently with copper samples, and dischargers that are required to monitor for copper will also be required to collect BLM parameters. Therefore, the need to utilize a default action IWQC values in place of accurately measured IWQCs is expected to become less frequent over time.

6.2.6 Procedure to estimate missing pH data

As shown in section 6.2 above, pH is a commonly collected parameter and is expected to be available for nearly all samples. For the rare instances when measured pH data for a sample is unavailable, DEQ will estimate pH for the sample by interpolating data from the same site taken at other times, if available, or by using concurrent data from a representative monitoring location(s) where pH conditions are expected to be similar to the site. At many locations, pH data is collected continuously. The objective of identifying a representative pH value is to identify the sensitive pH conditions from the range of pH values that may be experienced at a site. DEQ expects to use best professional judgment to evaluate available pH data and the characteristics of the site of interest, the applicability of representative data, and the risk to aquatic life associated with using a representative sample of pH data.

The following procedures are shown in order of accuracy:

1. A pH value interpolated from data collected at another time within the site of interest, accounting for sensitive pH conditions that may occur at the site.

2. A concurrent pH value from a nearby monitoring location that is expected to match pH conditions at the site.
3. A pH value from a reference site that is expected to match the conditions at a site of interest, such as type of waterbody, streamflow and geology, accounting for any pH conditions that may indicate increased bioavailability at the site.
4. If there is pH data for multiple sites nearby, all the available data will be used to generate the best practical estimate of pH for the site.

6.2.7 Procedure to estimate missing temperature data

Temperature is a commonly collected parameter and is expected to be available for most samples. Additionally, the Biotic Ligand Model is not sensitive to variability in temperature. The variance in IWQC values between substituting the minimum temperature encountered in the Oregon database, and the maximum temperature encountered in the Oregon database, was negligible.[19] Variability in temperature has very little effect on the resulting IWQC value relative to other input parameters. Therefore, estimation of this parameter will have minimal effect on resulting criteria even if the estimate is very general in nature.

When temperature data for a sample are unavailable, DEQ will substitute the geometric mean monthly temperature for the waterbody based on available data from nearby locations and favoring sites with similar waterbody type and stream flow conditions.

6.3 Accuracy of IWQCs derived using different combinations of missing input parameter estimation techniques

The Biotic Ligand Model IWQC are most accurate in instances where all input parameters have been measured concurrently. The biotic ligand model was developed and calibrated to species toxicity data based on inputs of concurrently measured input parameters. DEQ recognizes that situations will occur where measurements of all required parameters are not available. The methods for estimating missing input parameters vary in their accuracy, and therefore, to varying degrees, influence the accuracy of the resulting IWQC. To ensure that protective IWQC can always be estimated for a sample, highly conservative assumptions can be employed to derive a default action value, which is essentially a conservative IWQC value based on a conservative default input value.

Due to the reduced accuracy and intentionally conservative nature of default values, accurate IWQC derived using measured input parameter data supersede default action values based on conservative input parameter assumptions.

[19] Oregon Department of Environmental Quality 2016, Technical Support Document: An Evaluation to Derive Statewide Copper Criteria Using the Biotic Ligand Model.
http://www.oregon.gov/deq/RulesandRegulations/Pages/2015/Rwqcopper.aspx

Therefore, DEQ established the following order of precedence for IWQCs calculated from sets of parameter samples as most accurate to least accurate:

1. **Method 1**: IWQCs calculated from a set of input parameters where all parameters are measured

2. **Method 2**: IWQCs calculated from a set of input parameters where DOC and pH data are measured, and one or more geochemical ions and alkalinity are measured or estimated using regression by specific conductance

3. **Method 3**: IWQCs calculated from a set of parameters where DOC data are measured, pH is measured on site or at a nearby representative monitoring location; one or more geochemical ions and alkalinity are measured or estimated using regression on specific conductance data

4. **Method 4**: IWQCs calculated from a set of parameters where DOC data are measured, pH is measured on site or at a nearby representative monitoring location; one or more geochemical ions and alkalinity are measured or estimated using either regression on specific conductance data or the regional 20^{th} / 15^{th} percentile of the parameter concentration when conductivity data are not available

5. **Method 5**: Default action values calculated from a set of parameters where DOC is the conservative default value as specified in the rule and published on DEQ's website, pH is measured on site or at a nearby representative monitoring location; one or more geochemical ions and alkalinity are measured or estimated using either regression on specific conductance data or the regional 20^{th} / 15^{th} percentile of the parameter concentration when conductivity data are not available.

Table 6.13

Order of Precedence	DOC	pH	Alkalinity and Geochemical Ions
1	Measured	Measured	Measured
2	Measured	Measured	Measured; Estimated using measured conductivity
3	Measured	Measured or representative data	Measured; Estimated using measured conductivity
4	Measured	Measured or representative data	Conservative default value
5	Estimated	Measured or representative data	Measured; Estimated using measured conductivity, or Conservative default value

DEQ recognizes that it will encounter situations where it will need to evaluate a body of information as part of carrying out its water quality programs. In those instances, DEQ may be able to derive accurate IWQCs based on measured data for some of the available copper samples, but may not have complete model input data for all the copper samples. Depending on the nature of the actions, DEQ will need to specify how it will handle these situations and identify when it can rely solely on the accurate IWQCs and when it is necessary to also use default action values to evaluate the copper data for the purposes of carrying out its programs. As noted throughout this document, DEQ will use IWQCs wherever available, but may need to also use default action values where there are input parameter data gaps and to ensure DEQ is able to take appropriate action to control sources of copper and protect beneficial uses.

The following section describes one of the programs DEQ administers that relies on data collected over time and under varying water quality conditions and describes DEQ's current thinking about how it intends to implement these criteria in doing its required evaluations and establishing requirements.

7. NPDES permits

In this chapter, DEQ describes its intentions for implementing the copper BLM standard in NPDES permits in a manner that will ensure the standard is met throughout the range of conditions that are reasonably expected to occur. This information is provided in order for the public and interested state and federal agencies to more fully understand how the BLM standard will be applied to protect aquatic life, as well as how it may affect regulated parties. This is not an Internal Management Directive and it is not part of the rule. DEQ anticipates it will use this information as a starting point and further develop these procedures in coordination with EPA.

7.1 Affected dischargers

As specified in EPA's federal regulations for NPDES permit applications, DEQ requires all major domestic discharges and specific industrial facilities that are likely to have toxics present in their discharge to monitor for toxic pollutants. In addition, DEQ also requires any facility discharging to a waterbody that is water quality limited for a specific toxic pollutant to monitor for that pollutant. Based on this, DEQ expects the following dischargers to be affected by the adoption of the copper BLM standard:

1. All individual NPDES permitted domestic and industrial facilities that are required to perform toxics monitoring.
2. All individual NPDES facilities discharging to streams that are water quality limited for copper.
3. Some stormwater dischargers whether covered under an individual or general permit.

7.2 Effluent and receiving waterbody data collection

DEQ will require sufficient effluent and ambient samples be collected for all BLM input parameters to represent the range of conditions reasonably expected to occur at the site as well as total and dissolved copper. This data will enable DEQ to conduct a reasonable potential analysis and if needed, to establish permit limits for NPDES discharges protective of sensitive conditions, which includes ensuring protection of IWQC values based on measure inputs. Although DEQ recommends that permit holders collect all BLM data input parameters, DEQ will in some cases allow measuring specific conductance and will use the regression equations in section 6.2.1 to estimate the geochemical ion and alkalinity input parameters in the event that data for those parameters are not available. For example, specific conductance may be collected instead of the individual ions for minor sources, or for major source permit renewal after an initial analysis has been done based on the complete BLM parameter data set that confirms the validity of the relationship at their location. Additional sampling may be necessary if seasonal limits are requested.

To comply with anticipated state and federal requirements, DEQ expects to require the following facilities to collect BLM input parameter data in addition to existing requirements to collect and total and dissolved copper data:

1. All individual major NPDES domestic and industrial facilities.
2. All individual NPDES facilities discharging to streams that are identified as impaired for copper on DEQ's current 303(d) list.
3. Any individual NPDES permit that DEQ determines has significant concentrations in their source water or in their final effluent.

DEQ expects that 2 year of monthly samples that measured upstream ambient and effluent data will be sufficient to represent the variability of conditions reasonably expected to occur at the site and to conduct reasonable potential analysis based on the range of site-specific IWQC that result. DEQ will require affected facilities to perform the BLM monitoring and intends to notify sources of this requirement three to four years in advance of DEQ renewing the permit. This notification could be done as a department order, a permit application requirement, or a condition of a renewed permit. After an initial set of 24 samples are collected, DEQ expects additional periodic monitoring will be required to ensure the necessary data is available for future permit renewals.

If measurements for one or more of the input parameters from the set of 24 samples are missing, estimates or default values will be used to estimate the parameter concentration following the procedures in the rule and described in section 6 above.

7.3 Reasonable potential analysis

To address the variable nature of the copper BLM criteria, DEQ will need to develop clear procedures for conducting reasonable potential analysis for copper so that the criteria are consistently implemented in a manner that protects aquatic life during bioavailable conditions. DEQ's standard practice for conducting a reasonable potential analysis is to use EPA's statistical approach as documented in EPA's Technical Support Document for Water Quality based Toxics Control (TSD)[20]. This methodology was developed well before consideration of multi-parameter dependent criteria, such as the ammonia equation-based criteria or copper BLM. This methodology is more appropriate when applied to a fixed criterion that does not vary on a daily or seasonal basis. However, there are principles in the TDS that are relevant.

One potential method is described below. DEQ designed this analysis to take into account the variability of the BLM input parameters and ambient copper concentrations over a range of water quality conditions at the site to determine whether there is a reasonable potential for the discharge to cause an exceedance of the copper standard under the most sensitive or bioavailable conditions. As DEQ becomes more experienced with implementing the copper BLM standard, other options or variations to the method below may evolve.

7.3.1 Potential Method to perform a reasonable potential analysis given sufficient data:

Under this methodology, DEQ will calculate IWQC for each of the 24 monthly paired effluent and ambient data sets based on the concentration of input parameters at both the edge of the mixing zone and at complete mix. The receiving water copper concentration will also be calculated using a mass balance equation at the edge of the mixing zone and at complete mix for each of the 24 monthly samples.

DEQ's reasonable potential analysis will evaluate whether discharges of copper are likely to cause or contribute to an exceedance of any of the IWQCs calculated for the site. In this manner, DEQ will take into account the variability of all input parameters to determine whether there is reasonable potential to exceed the criteria under critical case conditions. This analysis is likely to vary from DEQ's typical process for performing reasonable potential analyses because the critical case condition may occur at a different time period than what is traditionally assumed (e.g. low stream flow) due to the variability of the copper BLM criteria.   If DEQ concludes the discharge will cause or contribute to an exceedance of

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

IWQCs under sensitive conditions, DEQ will develop effluent limits to ensure copper concentrations are limited to meet IWQCs that are likely to occur over the range of conditions. See section 7.4 below for further discussion about establishing permit limits.

7.3.2 Options for performing reasonable potential analysis with minimal data

DEQ will also need to develop procedures for performing reasonable potential analyses when data is limited or missing. EPA's Permit Writer's Manual provides limited guidance on performing a reasonable potential analysis when there is no effluent pollutant data, and the Manual does not address the situation where there is no ambient data or no model input data to derive a water chemistry-dependent criterion such as copper. The manual suggests that limits for specific pollutants could be required based on facilities with similar operating conditions and effluent characteristics. It also states that if the permit writer does not have the needed data to determine if there is reasonable potential to exceed a criterion, that the permitting authority could delay issuing the permit until the needed data is collected or require monitoring as a condition of the issued permit. The manual further suggests that if the latter is chosen, a reopener clause could be put in the permit that would allow the permitting authority to reopen the permit if needed to incorporate an effluent limit. It also states that the permit writer must provide justification for the decision to require water quality based effluent limits when there is no effluent data.

Analysis based measured data provides the best basis upon which to require and develop effluent limits. However, if the required minimum data set is not available to perform the paired data analysis, DEQ will conduct the reasonable potential analysis based on default action values. The appropriate default action values are defined in the proposed rule and represent a critical case condition because they are based on the low (and therefore most sensitive) end of the range of conditions expected to occur at the site. If the analysis indicates there is no reasonable potential, the permit writer may decide that additional monitoring is warranted as a condition of the permit in order to perform a more robust analysis at the next permit renewal.

When there is no effluent copper data or limited effluent data to perform a reasonable potential analysis DEQ will need to establish procedures addressing circumstances in which it would reprioritize the issuance of the permit and require collection of the needed data or when DEQ will proceed with the available data and the statistical methods to address the uncertainty provided in EPA's TSD.

If the analysis indicates there is reasonable potential based on the default action values, effluent limits would be calculated and incorporated into the proposed permit. The permit would contain a compliance schedule to allow time for treatment installation or upgrades to be made to meet the effluent limits. This would also allow time for the facility to collect the additional 1 – 2 years of data and update the reasonable potential analysis. If the updated analysis demonstrates there is a different effluent limit needed or no reasonable potential to exceed the criteria, and the facility has not performed the upgrades or met the limits, the permit could be reopened and the limits and the compliance schedule either revised or removed, as appropriate.

7.4 Potential methods to calculate effluent limits

If DEQ determines there is reasonable potential to exceed the copper standard, effluent limits will be included in the proposed permit. As stated in Section 7.3.2, the permit will allow for a compliance schedule where immediate compliance is not possible. DEQ typically uses EPA's two value, steady state permit limit methodology, as described in the EPA Technical Support Document for Water Quality-Based

Toxics Control, to establish a daily maximum and monthly average effluent limit. This steady state methodology relies on determining a single, critical case condition as the basis for setting an effluent limit. Typically the critical case is a combination of worst-case effluent flow, stream flow and effluent concentrations. With the copper BLM, there is the added complexity of a variable criterion. In this instance the critical case includes consideration of the range of IWQC values that may occur and ensuring the limits are protective of IWQC representing the most bioavailable condition. The more data that is available, the easier it will be to identify a critical condition and establish limits based on that condition. If there is enough data to identify seasonal or hydrographic patterns, seasonal limits may be warranted. A permittee may wish to have their limits calculated based on the results of dynamic modeling as discussed in EPA's TSD. If so, the permittee would need to perform the modeling and provide the results to DEQ for consideration.

EPA's two value, steady state permit limit methodology relies on the effluent pollutant coefficient of variation, the ambient pollutant concentration, available dilution, and the pollutant criteria. The coefficient of variation would be calculated from the available effluent data. Often times, a 90th percentile from the range of effluent pollutant concentration is used. A worst-case ambient pollutant concentration would be determined based on the available data taking into account seasonal variability. The relationship between ambient concentrations and effluent concentrations may also need to be considered in the event that worst-case effluent concentrations vary inversely to ambient concentrations. Worst-case dilution is typically considered to be during the low flow period. There could be instances where worst-case conditions occur during some other flow period for copper. While worst-case dilution may be associated with the greatest metals concentrations, this time is not always the worst-case scenario for BLM-derived IWQC, as other toxicity-modifying factors, such as DOC, may be enriched when dilution is lowest. This will need to be taken into account when establishing effluent limits. Several options and the conditions under which they could be used for determining an appropriate value to represent the critical case condition for the effluent limit analysis are outlined below. Other methodologies could be used depending on site specific conditions and available data.

Option 1: Use the 10th percentile of IWQCs: This methodology would be used where the necessary BLM input parameters are available but not the concurrent paired effluent and ambient copper concentration values.

DEQ will calculate an instantaneous water quality criterion (IWQC) for each set of input data using a minimum of 24 sample sets collected over 2 years that represent the range of effluent and ambient conditions at the site. A single value would selected by calculating the 10th percentile of the distribution of the IWQCs. This value would then be used to establish the permit effluent limits according to the EPA TSD.

Option 2: Use a default action value: This methodology would be used where data is insufficient to use option 1 or 2 above.

Where there is not sufficient measured data, default action values, as described in the rule and in Chapter 6 of this paper, are used in place of IWQCs derived with measured data. These default action values would then be used as described in Option 2 to identify the applicable value to use in developing effluent limits.

7.5. General Permits

Implementing the proposed water quality standard for copper could affect the development and implementation of general permits because a general permit includes a single set of requirements to regulate similar activities statewide or in limited geographical areas. General permits that could be affected include the proposed 2300A Pesticide general permit, as well as other general permits associated with operations where copper could be part of the discharge, such as the 1700A Wash water general permit. Stormwater general permits (discussed in the next chapter) could also be affected. General permit writers will incorporate the new standard into permits, as appropriate, when they are renewed. This effort could be relatively minimal if regional or a single conservative copper limit was put in place, or much more extensive if site-specific copper limits are developed. In addition, state staff who oversee implementation of general permits will need to ensure copper monitoring done as part of permit requirements complies with appropriate copper limits or benchmarks. To the extent that copper limits may be more stringent than they would be under currently effective hardness-based standards, additional effort or technical assistance may be needed to work with permit registrants to implement Best Management Practices needed to meet standards in receiving waters.

If a site-specific copper limit is needed or desired, some entities may opt to obtain an individual permit. This is more costly than obtaining coverage under a general permit, but may be necessary if the discharge doesn’t qualify for a general permit under the relevant Oregon Administrative Rule.

7.6. Stormwater Permits

The proposed copper standard revision could affect the implementation of stormwater general permits including the 1200Z industrial stormwater permit, 1200COLS stormwater permit for the Columbia Slough and 1200A stormwater permit for gravel mining. The 1200Z and 1200COLS permits have benchmarks for copper as well as monitoring requirements for discharges to waters that are impaired for copper. A facility that discharges to a waterbody that is impaired for copper is given a copper discharge target known as a “reference concentration.” The reference concentration is equal to the acute aquatic life criterion. The 1200A stormwater permit does not have benchmarks for copper, but does have monitoring requirements and reference concentrations for facilities that discharge to waters listed as impaired for copper.

Facilities that exceed a benchmark or reference concentration in a single sample must investigate the cause of the exceedance, report it to DEQ, and attempt to address the cause. Facilities that consistently exceed a benchmark must install filtration, which often comes at a substantial cost. Stormwater permit discharge limits, benchmarks and other action levels are typically based on total concentration. Therefore, it is possible that DEQ would retain the current action levels after the promulgation of the new copper standard. However, it is also possible that DEQ would choose to develop new action levels based on dissolved concentrations.

The copper benchmark in the 1200-Z permit was developed using a technology-based assessment. Therefore, it is unlikely that the 1200-Z copper benchmark would be lowered as a result of the new water quality standard. However, the copper benchmark in the 1200-COLS permit is tied to the previously applicable water quality standard, and could therefore decrease or increase if it were revised to correspond to the new copper standard. A lower water quality standard could trigger requirements for facilities to implement additional Best Management Practices. Similarly, any changes to the impairment status of water bodies would be reflected in revisions of the 1200Z, 1200COLS, and 1200A general permits, and could trigger additional Best Management Practices.

If target levels in the permit are revised, some facilities may choose to use composite sampling to obtain a 24-hour average concentration or storm event average concentration. This is allowed under the current general permits. Also, if a site-specific copper limit is needed or desired, some entities may opt to obtain an individual permit.

8. Assessing Water Quality

The following key principles for assessing water quality apply to copper, as they do to other pollutants:

1. Copper standards are established to protect beneficial uses and accurately identify copper levels that will not harm aquatic life.
2. Copper criteria (IWQC) derived from the BLM will be used to assess a concurrent copper sample to determine whether waters are attaining the water quality standard.
3. The copper criteria will be used to assess where beneficial uses are impaired by copper and to create a list of waters that need total maximum daily loads (TMDLs).
4. Assessing the overall condition of Oregon waters under section 305(b) of the Clean Water Act must reflect the adopted water quality standards.
5. Assessment methods should maximize the use of the available measured BLM input parameter data to obtain the most accurate assessment conclusions; and
6. Methods for 303(d) assessment need to be technically and practically implementable to analyze both extensive and sparse data sets.

Identifying a waterbody as impaired under 303(d) initiates further regulatory requirements and actions. A 303(d) listing:

1. Requires DEQ to develop a TMDL and/or require other pollution controls to meet water quality standards.
2. Requires a priority ranking of listed (impaired) waters taking into account the pollutant, the severity of pollution and the uses of the water, and identifies the waters targeted for TMDL development in the next two years.
3. Additional permittees discharging to a listed waterbody would need to monitor copper and the biotic ligand model input parameters to derive criteria using the BLM, including minor facilities and in some instances, facilities discharging under a general permit.
4. Absent additional or more recent data indicating that there is assimilative capacity in the receiving water, no dilution (i.e. mixing zone) would be available to develop effluent limits. Instead, copper criteria must be met in the effluent prior to discharge.
5. May restrict DEQ's ability to allow new or increased discharges to the waterbody until a TMDL has been developed.

8.1 Options for evaluating water quality data

To evaluate water quality, a criterion value for an acceptable maximum copper level is needed to compare to a given sample of copper in order to determine whether the copper concentration meets or exceeds the water quality standard. Data evaluation may be done to assess water quality at an individual monitoring site, or may be part of a broader assessment of water quality such as DEQ's statewide assessment for Oregon's 303(d)/305(b) Integrated Report. Two general approaches were considered to implement BLM IWQC to evaluate copper data.

Option 1: Evaluate Using IWQC. The criteria are the IWQC reflecting the input parameters measured concurrently for any given copper sample. To evaluate the criteria, calculate the concurrent IWQC for each copper sample to be evaluated and compare the copper concentration to the corresponding IWQC value for the time the copper sample was collected. If measured input parameter data is not available, DEQ will calculate IWQCs using the specific conductance equations, or default values for the missing input parameters where needed, as described in the proposed rule and in Section 6, above. A copper sample that is higher than its corresponding IWQC will be considered to be exceeding the standard. This option is illustrated inFigure 8.1 Evaluation using the corresponding instantaneous water quality criterion (IWQC). In this example, copper is attaining the water quality standard at this site. For **Figure 8.2**, there are at least 2 exceedances of the corresponding IWQC for copper. If the time period represented is a three year period or less, the site is not attaining the water quality standard for copper.

Figure 8.1 Evaluation using the corresponding instantaneous water quality criterion (IWQC). In this example, copper is attaining the water quality standard at this site.

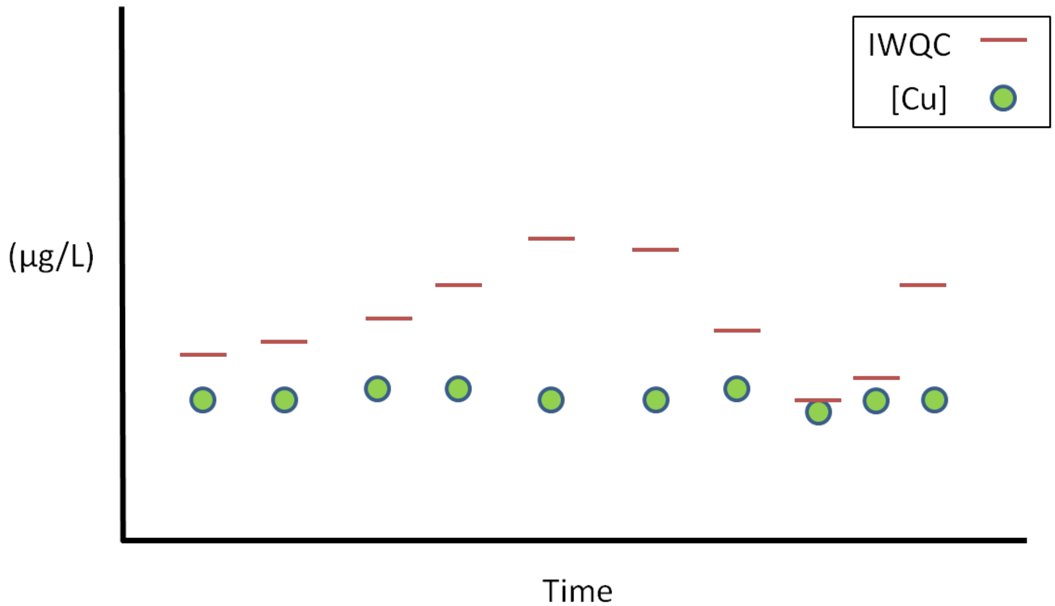
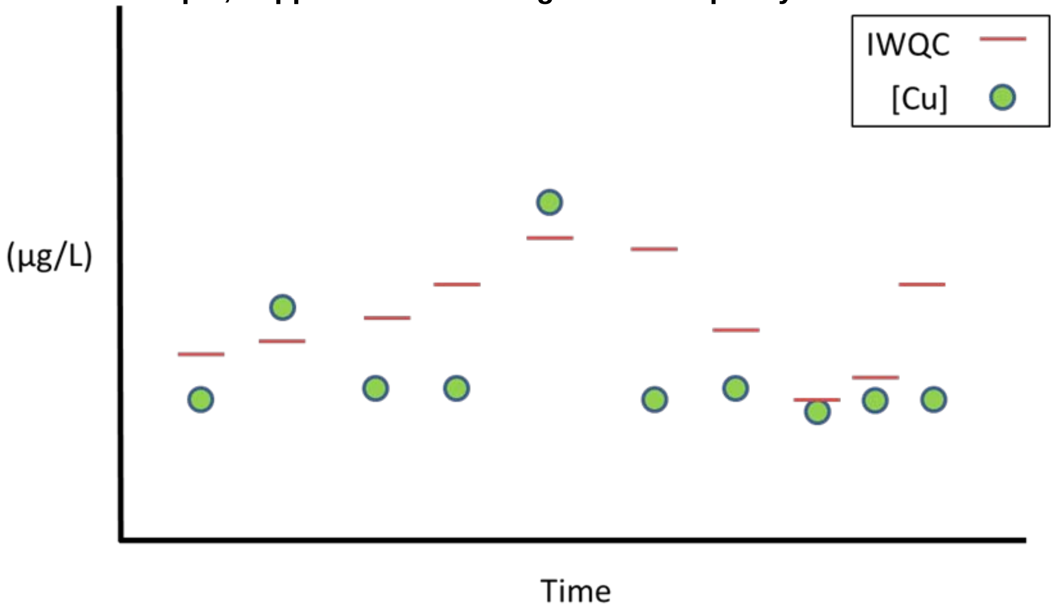
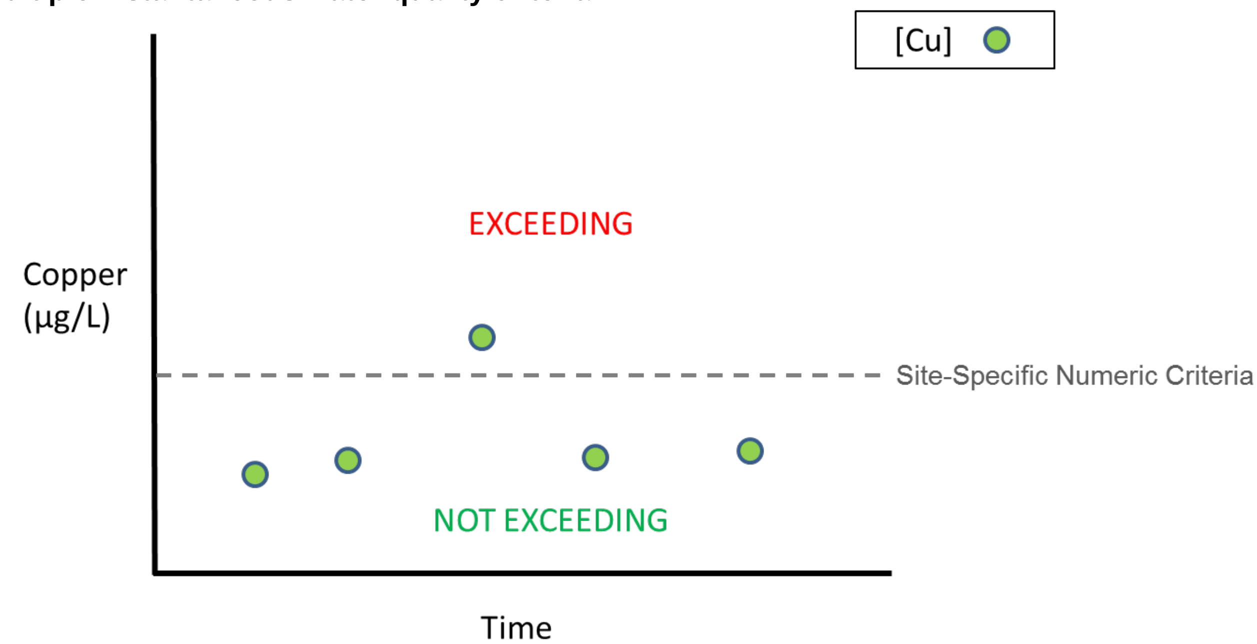


Figure 8.2 Evaluation using the corresponding instantaneous water quality criterion (IWQC). In this example, copper is not attaining the water quality standard at this site.



Option 2: Select a single IWQC value that is a conservative (10th or 20th) percentile of the range of all IWQC available for a site, or use a Monte-Carlo estimation, or another probability based method to identify a site-specific numeric criteria value that is protective of aquatic life such that it will not be exceeded with a frequency greater than once in 3 year period. A copper sample that is higher than this value will be considered to be exceeding the criteria. This is illustrated in **Figure 8.3**. If more than one sample exceeds the criteria over a three year time period, the water body would not be considered to be attaining the standard.

Figure 8.3 Evaluation of copper samples using a site-specific numeric criteria derived from multiple instantaneous water quality criteria



8.2 Potential Integrated Report assessment approaches

Option 1 illustrates an approach the Integrated Report assessment that is consistent with DEQ's final proposed rule. A copper sample that meets its concurrent IWQC is attaining the standard. Option 1 is also consistent with DEQ's assessment methods to evaluate data by calculating criteria for other water-chemistry based standards, such as ammonia (pH and temperature dependent) and metals (hardness dependent). In addition, assessment protocols generally applied to evaluate data sets against the aquatic life toxics criteria would also apply to copper.

Option 2 above, which selects a single site-specific numeric criterion from multiple model results over time (e.g. the 10th percentile value), is not consistent with DEQ's proposed BLM copper standard or its application. If two or more copper samples were exceeding the site-specific numeric criteria within any three-year period, the site would not be attaining the water quality standard. Please see the discussions in Section 4 and Section 5 for DEQ's rationale for not adopting this approach.

8.2.1 Procedures to determine applicable copper water quality criteria for assessment

DEQ's Integrated Report assessment methodology will be published in a separate document for public review prior to use in the next assessment. A general outline of an assessment approach that would be consistent with the proposed copper standard is provided here.

<u>Evaluating copper data using the biotic ligand model criteria:</u>

1. All copper samples within a waterbody segment collected during the relevant assessment period that meet the assessment requirements for data quantity and quality will be evaluated.

2. A copper sample will be evaluated against the corresponding IWQC calculated using measured or accurately estimated input parameter values when that corresponding data is available (Section 6.3, Methods 1-4).
3. A copper sample lower in concentration than the corresponding IWQC or default action value will be considered to be meeting the standard for that sample.
4. A copper sample higher than the associated IWQC will be considered to be exceeding the standard for that sample.
5. DEQ will rely on measured input parameter data and the resulting IWQCs whenever possible as this is the accurate expression of the BLM-based standard and the most accurate representation of the potential toxicity of copper under site-specific conditions.
6. Default action values will be used for assessment when there is not sufficient data to evaluate the waterbody based on accurate IWQCs.