Reasonable Potential Analysis Process for Toxic Pollutants

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1. Introduction

1.1 Purpose of Directive

The purpose of this Internal Management Directive (IMD) is to provide guidance for Department of Environmental Quality (DEQ) staff in determining whether an individual point source discharge (point source) contains toxic pollutants that have a reasonable potential to cause or contribute to an exceedance of a water quality criterion in the receiving water body. Additionally, the IMD guides staff in how to calculate Water Quality Based Effluent Limits (WQBELs), discusses relevant technical and policy issues to reasonable potential analyses (RPA), and how to apply WQBELs for toxic pollutants in a permit. This directive most directly applies to EPA priority pollutants and parameters with State of Oregon Water Quality Criteria. This directive also applies to chlorine and ammonia because the underlying math and processes are the same for these pollutants, though they are considered nonconventional pollutants instead of toxics by EPA.

1.2 Directive Applicability

State and Federal regulation require that NPDES permits include effluent limits for any pollutant discharged under the permit that causes, has the reasonable potential to cause, or contributes to an exceedance of a water quality standard in the receiving water. The determination of whether a discharge has the reasonable potential to cause or contribute to a water quality standard exceedance is called a reasonable potential analysis (RPA). The number and type of pollutants for which the RPA must be conducted will vary with the size, type, and potential hazard of the facility. These processes are repeated at each permit renewal.

1.3 Key Definitions

- **Detection Limit (DL) or Method Detection Limit (MDL)** is defined as the minimum measured concentration of a substance that can be reported with 99% confidence that the measured concentration is distinguishable from method blank results (40 CFR 136). It is the lowest concentration at which a substance can be detected.
- **Estimated value (also known as a qualified value)** is a result that is unable to be accurately quantified due to QA/QC issues or method sensitivity.
- **Pollutant of Concern (POC)** is a pollutant that is required to be tested for by EPA based on a facility's type or process (for example listed in 40 CFR 122 Appendix D or J), identified in the previous permit, or is a pollutant that is otherwise expected to be present above de minimis concentrations in the facility's effluent.
- **Quantitation Limit (QL) or Minimum Level (ML) as mentioned in 40 CFR 122 or Method Reporting Limit (MRL)** is the lowest concentration at which an analytic system gives a quantifiable value. It is equivalent to the concentration of the lowest calibration standard. It is the lowest concentration at which a substance can be accurately measured (or quantified).
- **Reasonable Potential Analysis (RPA)** is the process for determining whether a discharge causes or has reasonable potential (RP) to cause or contribute to an

excursion above Oregon's water quality criteria for pollutants (in the receiving water body).

- **Technology Based Effluent Limit (TBEL)** is the minimum level of effluent quality attainable using demonstrated technologies for reducing discharges of pollutants.
- **Water Quality Based Effluent Limit (WQBEL)** is an effluent limitation included in a permit to help ensure that water quality standards are met in the receiving water.

1.4 Overview of the Reasonable Potential Analysis

NPDES regulations under 40 CFR 122.44(d)(1) specify the minimum requirements and general types of analyses necessary for establishing permit limits. EPA's Technical Support Document for Water Quality-based Toxics Control (TSD)[1] specifies how to determine whether a discharge has the reasonable potential to cause or contribute to an instream excursion above a narrative or numeric criteria within a state water quality standard. This determination is done using the following steps:

Step 1: Develop list of pollutants of concern (POCs) based upon the facility classification, activities, and receiving water classifications.

Step 2: Review the permit files for effluent monitoring data based on the POC list.

Step 3: Use effluent monitoring data, along with receiving water data and dilution values (when applicable), to perform a reasonable potential analysis.

Step 4: For each POC found to have a reasonable potential to exceed the criterion, calculate a Water Quality Based Effluent Limit (WQBEL).[2] Include this limit in the permit unless a more stringent Technology Based Effluent Limit (TBEL) or TMDL waste load allocation (WLA) is applicable.

Step 5: Incorporate the WQBELs and necessary monitoring into the new permit. If the facility is not capable of initially meeting the effluent limit, a Compliance Schedule or Variance may be granted.

For new permit applications or permits where adequate monitoring data are not available to conduct a quantitative RPA, consult with an appropriate subject matter expert (Data SME, RPA SME, and/or Direct Support) to determine how to proceed. This might include a request for additional monitoring, the use of representative data, or the use of an alternative qualitative RPA methodology as described in the TSD Section 3.2 and EPA's NPDES Permit Writer's Manual (Sept 2010), section 6.3.3.

Once the RPA and calculation of WQBELs is complete, include a summary of the analysis and results in the fact sheet.

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

[2] This may include the use of an intake credit analysis as part of the determination. See the Intake Credit IMD

1.5 Sources of Information

The following is the typical information used to characterize the effluent and the receiving waters. Most of the following are typically submitted by the permit applicant; however, in some cases, information will need to be requested from the permittee or collected from additional sources.

Data Sources:

- Permit application forms
- *Discharge Monitoring Reports* (DMRs). DMR summary data is available in EPA's ICIS database. Original DMRs are available through NetDMR.
- *Category 4 or 5* listings for receiving stream segment (Most recently approved Integrated Report)
- *Oregon DEQ AWQMS* ambient data for the applicable waterbody segment and effluent characterization data submitted by the permittee and reviewed by DEQ lab
- Dilution values from a mixing zone memo (if applicable)

2. Identifying Pollutants of Concern

2.1 Overview

The following factors apply to all types of facilities when determining POCs:

- Pollutant parameters with effluent limits in the preceding permit
- Pollutant parameters with monitoring requirements in the preceding permit[3]
- Pollutant parameters that are known to be present in significant concentrations in a facilities' source/intake water[4]
- Pollutant parameters that are known or otherwise expected to be present in significant concentrations in a facility's effluent
- Pollutant parameters identified through the permit application process

The basis for identifying POCs is different for domestic and industrial facilities. POCs are identified for domestic facilities based on the design flow of the facility. There might be additional monitoring requirements for facilities with special conditions such as the discharge of PCB's, pesticides, or mercury.

For industrial facilities, POCs are determined based on the facilities' design flow rates, industrial categories, hazardous production materials, receiving water's status and permitting history.

2.2 Publicly Owned Treatment Works: Identifying Pollutants of Concern

The POCs should mirror EPA's permit application monitoring requirements per 40 CFR 122.21(j)(4). The pollutants vary based upon the Publicly Owned Treatment Work's (POTW) Average Dry Weather Design Flow (ADWDF).

Table 2-1 identifies POCs typical for a POTW. This is based on the permit application monitoring requirements as specified in 40 CFR 122.21(j), and any additional state or federal requirements. While CFR 122 specifies a minimum of 3 analyses, at least 10 samples are recommended to adequately characterize the facility effluent and conduct RPAs.

[3] In some instances, such as a change in water quality criteria, change in treatment method (for example, Cl- to UV) or de-listing of a water body, a permit writer might determine that it is appropriate to not renew a permit monitoring requirement.

[4] For example, intake water is from an impaired water body or contaminated groundwater.

Table 2-1: POTW POC Determination

Average Dry Weather Design Flow in million gallons per day (mgd)	Pollutants of Concern
<0.1 mgd	Biological oxygen demand (BOD), total suspended solids (TSS), fecal coliform, temperature, pH, alkalinity, chlorine (if used)
≥0.1 and <1.0 mgd	All the above AND ammonia, dissolved oxygen (DO), nitrate/nitrite, total Kjeldahl nitrogen (TKN), oil and grease, phosphorus, and total dissolved solids (TDS)
≥1.0 mgd	All the above AND metals/cyanide/total phenols, volatile organic compounds (VOCs), acid extractable compounds, base neutral compounds, and any other pollutants which have state water quality criteria.

2.3 Industrial Facilities: Identifying POCs

The POCs should mirror EPA's permit application monitoring requirements per 40 CFR 122.21(g), (h), and (i) but may include state-specific pollutants. The monitoring requirements at a specific facility are determined based upon industrial category, pre-existing permit limits and monitoring requirements, hazardous material present, effluent limit guidelines, and receiving water impairments. The guidance in Table 2-2 identifies the reporting requirements outlined in 40 CFR 122. These are based on the permit application monitoring requirements included in 40 CFR 122 Appendix D. **More than one industrial category can apply to a permittee.**

Other resources to consider when identifying the POCs include the following:

- Applicable TMDLs
- Most Recent Integrated Report (Category 4 or 5 pollutants)
- Review of hazardous material inventories (SARA Title III, RCRA or State Fire Marshal records) combined with assessment of facility processes to determine if those pollutants have the potential to enter the effluent.
- The "Hazardous Substances Used, Stored, Produced of Transferred at a Facility that Indicate Probability of Toxicity Table" located in 40 CFR 302.4.

Federal application rules require a minimum of one analysis (grab sample or composite sample) for each pollutant parameter. To ensure a robust effluent characterization, DEQ recommends a minimum of ten composite samples for each analyte (or grab samples in the case of cyanide, total phenols, and total residual chlorine).

Table 2-2: Industry Wastewater POC Determination

CFR Citation	Pollutants of Concern	Applicable Industries
122.21(i)	No directly named pollutants. However, nutrient management plans are required for CAFOs.	Concentrated animal feeding operations and aquatic animal production facilities
122.21(h)(4)(i)	BOD_5, TSS, total residual chlorine (if used), COD, TOC, Fecal coliform (if believed present), oil and grease, ammonia, pH, and temperature	Non-process wastewater
122.21(g)(7)(iii)	BOD_5, COD, TOC, TSS, ammonia, temperature, and pH Alkalinity needed for DEQ to complete pH and ammonia RPAs (not mentioned in CFR)	Manufacturing, commercial, mining, and silvicultural process wastewater dischargers
40 CFR 122.21(g)(7)(vi)(B) Appendix D Table I	Organic Toxic Pollutants based on Industrial Category (See Table II for list of analytes included)	Applicable industry with process wastewater discharges based on Industrial Category, or if expected to be present in effluent
40 CFR 122.21(g)(7)(v)(B) Appendix D Table III	Metals, cyanide, and total phenols (see Table III for full list) Note that the table only includes total recoverable metals. For metals that have water quality criteria in dissolved fraction, both total recoverable and dissolved metals will need to be collected (see section 3.3)	Manufacturing, commercial, mining, and silvicultural process wastewater discharger industries outlined in 40 CFR 122 Appendix A, or if expected to be present in effluent
40 CFR 122.21(g)(7)(vi)(A) Appendix D Table IV	See Table IV for list of pollutants	Manufacturing, commercial, mining, and silvicultural process wastewater dischargers, but only if expected to be present in effluent
40 CFR 122.21(g)(7)(vii) D Table V	See Table V for list of pollutants	Manufacturing, commercial, mining, and silvicultural process wastewater dischargers, but only if expected to be present in effluent
40 CFR 122.21(g)(7)(viii)	2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD)	Manufacturing, commercial, mining, and silvicultural process wastewater dischargers that use or manufacture the chemicals listed in 40 CFR 122.21(g)(7)(viii)(A), or knows or has reason to believe that TCDD is or may be present in effluent

2.4 Integrated Report for Impaired Pollutants

If a receiving water body is water quality impaired, it will be listed in the integrated report as category 4 or 5. This designation indicates that a water body is not meeting the state criteria for the listed pollutant(s). A pollutant listed as category 4 or 5 in the integrated

report is only considered to be a POC for a discharge if it is reasonably expected to be in a facility's effluent. To determine whether category a 4 or 5 pollutant in the integrated report is a POC for major and minor domestic facilities, the pollutant should be evaluated to determine if the discharge is, or has the potential to be, a significant contributor to the impairment. When it is determined that a category 4 or 5 pollutant does not have the potential to be a significant contributor to the impairment, it will not be identified as a POC. Rationale must be included in the fact sheet. For example, EPA has considered minor POTWs to not be significant contributors for pollutants listed in Table C of Application Form 2A New and Existing POTWs and therefore these pollutants will not be included as POCs in the permit regardless of a category 4 or 5 listing in the integrated report. This explanation should be included in the fact sheet and is only applicable for minor facilities that are not required to complete Table C of Application Form 2A New and Existing POTWs. Questions on whether an impaired pollutant is a POC should be directed to the appropriate SME (Toxics, Mercury, or Ammonia/Chlorine) depending on the pollutant.

3. Effluent and Ambient Characterizations

The requirement to provide effluent and ambient data for POCs and pollutant fractions stems from the authority under 40 CFR 122.41(3)(h) ("duty to provide information"); 40 CFR 122.21, ("application requirements"); and state monitoring requirements per OAR 340-045-0015(5)(c) and (d). The permit writer also has the legal authority for changing the frequency of monitoring or reporting requirements per minor modification under 40 CFR 122.63 and OAR 340-045-0055(2)(a)(B). If a permittee fails to provide the required monitoring data, it may result in a more conservative RPA analysis.

3.1 Effluent Characterization

Effluent should be analyzed using 40 CFR 136 approved methods. The exception is if there is no method approved under 40 CFR 136 for a particular analyte (40 CFR 122.44(i)(1)(iv)(B)). Conduct the RPA based upon a data set with a minimum of ten effluent sample points. This will allow adequate characterization of the effluent and the ability to calculate a facility-specific coefficient of variation (see section 4.3), resulting in a more representative RPA. For datasets with less than ten data points, it is advisable to request additional monitoring from the permittee so a minimum of ten data points are available for analysis. If time constraints prevent further sample collection, consult with the appropriate SME. While the EPA TSD allows for RPAs to be conducted with as little as one sample point (see section 4.5.1 below), DEQ's recommendation is to prioritize the collection of additional data over the generation of limits for data sets smaller than ten samples. The permit writer might also require additional effluent sampling for any pollutant if the Quantitation Limits were not met, data QA/QC issues, or any other implementation issue.

Note that there is no legal requirement in Oregon for a permittee to use an accredited laboratory for data analyses, though DEQ recommends using an accredited laboratory for data quality purposes.

3.2 Ambient Characterization

First determine the necessity of characterizing the receiving water body for each POC. If a parameter is listed as "water quality limited" (Category 4 or 5) on the integrated report, the assumption is that there is no assimilative capacity and therefore no mixing zone dilution available.[5] If the water body is listed as having a completed TMDL (Category 4), the TMDL would have likely assigned a waste load allocation to the permittee. In these instances, the collection of ambient characterization data for the specific pollutant parameters is generally not required.

For receiving water bodies not listed as category 4 or 5 on the integrated report, it is necessary to characterize the ambient conditions for each POC that has reasonable potential at end of pipe (EOP) during the permitted discharge periods (examples: year-round, winter-only). This data is used in conjunction with the effluent characterization data to conduct the RPA. The ideal is to use a representative (within the last 10 years, within the Assessment Unit the permittee discharges into, and upstream of the permittee discharge) monitoring dataset to characterize the water body. However, when existing monitoring data is unavailable, alternative datasets or conservative surrogates can be used in the RPA (see below), and additional monitoring will be required in the renewed permit.

The permittee may submit alternative ambient monitoring data in lieu of conducting sampling if the submitted data is representative of existing conditions upstream from the facility's discharge and possesses the appropriate analytical limits. Alternative ambient monitoring data must be reviewed by the Data SME prior to use in an RPA. If there are several applicants discharging to the same reach of a receiving water body, chemical monitoring data may be derived from other applicants' studies or may be generated in a group monitoring study performed by multiple applicants discharging in the same reach. Please refer to Table 3-1 for potential data sources. Include a description of the basis of alternative methodologies in the fact sheet.

[5] Site specific data could indicate there is assimilative capacity. However, this would require the collection of nearby ambient data that shows the local ambient conditions meet the water quality criterion in question and requires approval from the Integrated Report group in the Water Quality Assessments Section.

Table 3-1

Water Quality and Stream Flow Databases

Data Source	Data Type
Oregon DEQ AWQMS	Ambient WQ Data
Oregon DEQ Integrated Report[6]	303d List / TMDL List
NOAA, MW River Forecast Center	Stream Flow Data, Forecasting
USACE, Columbia Basin	Temperature, Total Dissolved Gas, and Flow Data
USEPA WQP	Ambient WQ Data
USGS	Ambient WQ Data, Stream Flow Data
Washington DOE	Ambient WQ Data

In some instances, using conservative projections, summary data, or defaults as a surrogate to monitoring data to conduct the RPA is necessary if no monitoring data can be found and collecting monitoring data prior to permit renewal is infeasible. This can include data from similar water bodies, summary data from studies or guidance, or default values found in guidance (for example the 0.6 CV specified in the EPA TSD or the Copper BLM default values). The use of conservative surrogates requires approval by the appropriate SME prior to use. Document their use and their source in the permit fact sheet.

3.3 Characterizing Parameters with Speciated Water Quality Criteria.

Oregon water quality standards include numeric criteria for a variety of toxic metals and cyanide to protect aquatic life and human health (OAR 340-041-0033(3) Tables 30 and 40). Table 3-2 summarizes effective criteria in Oregon that are expressed in terms other than “Total Recoverable”.

[6] Use most recent EPA approved Integrated Report

Table 3-2

Pollutant	Freshwater Aquatic Life Criteria		Saltwater Aquatic Life Criteria		Human Health Criteria	
	Acute	Chronic	Acute	Chronic	Water+Org	Org-Only
Arsenic	Dissolved Inorganic	Dissolved Inorganic	Dissolved Inorganic	Dissolved Inorganic	Total Recoverable Inorganic	
Cadmium	Dissolved	Dissolved	Dissolved	Dissolved	NA	NA
Chromium	Chromium III and VI	Chromium III and VI	Chromium VI	Chromium VI	NA	NA
Copper	Dissolved	Dissolved	Dissolved	Dissolved	Total Recoverable	NA
Cyanide	Free	Free	Free	Free	Total	NA
Lead	Dissolved	Dissolved	Dissolved	Dissolved	NA	NA
Nickel	Dissolved	Dissolved	Dissolved	Dissolved	Total Recoverable	Total Recoverable
Selenium	Dissolved Selenite and Selenate	Dissolved	Dissolved	Dissolved	Total Recoverable	Total Recoverable
Silver	Dissolved	Dissolved	Dissolved	Dissolved	NA	NA
Zinc	Dissolved	Dissolved	Dissolved	Dissolved	Total Recoverable	Total Recoverable

40 CFR 122.45(c) specifies that in cases where a reasonable potential for a metal is indicated, a WQBEL expressed as total recoverable should be calculated and included in the permit. This requirement exists because chemical differences between the effluent discharge and the receiving waterbody can result in changes in the partitioning between the speciated forms of metal. Since partitioning factors for speciated metals and cyanide are not readily available, determination of reasonable potential to exceed a water quality criterion should be done using the speciated fraction when the criterion is specified in the speciated fraction. Total recoverable metals and cyanide may be used as a conservative surrogate to complete an RPA if no speciated concentration data is available at the time of permit renewal. Any determination of reasonable potential or WQBELs calculated using total recoverable data requires review by the RPA SME and/or direct support. If a metal with a speciated concentration criteria is identified as a POC, include monitoring for total recoverable and speciated results in the renewed permit.

According to 40 CFR 122.45(c), WQBELs for metals shall be expressed in terms of "total recoverable" (see section 5.3). Accordingly, compliance monitoring should also be in terms of "total recoverable". The exceptions to this are when all approved analytical methods for the metal only measure the dissolved form (example: hexavalent chromium) and cyanide, which is not a metal.

3.4 Using Qualified Data

In some situations, pollutant concentrations are at or near the ability of laboratories to detect or quantify the data. Two situations can occur:

1. The result is in between the method reporting level and the method detection limit (also known as “J flag” or "trace" data).
2. The result is below the detection limit (also called “non detect” data)

For the first situation, the value used for the RPA is the MDL. For the second situation, a value of “0” is used in the RPA unless calculating a geometric mean. A geometric mean can only be calculated using positive values, and therefore a value of ½ the detection limit will be substituted for non-detect data when calculating a geometric mean.[7]

There can be other issues with the data results. Data that is either estimated or rejected due to quality control issues should not be used in the RPA analyses. The only exception is if there is not sufficient time to collect more data and the only data available is qualified due to quality control issues, it may be used in an RPA provided that the qualification does not affect the analysis in a way that makes it less conservative. For example, if the available data is biased high due to sample contamination but the RPA indicates no reasonable potential to exceed the water quality criteria, it can be used to show no reasonable potential. If such a data set shows there is reasonable potential, it should not be used to conclude reasonable potential. Similarly, if the only available data is biased low then it could be used to demonstrate reasonable potential but should not be used to conclude that there is no reasonable potential, as it would result in a less conservative analysis.

[7] When evaluating reasonable potential using the geometric mean, the results will be evaluated to ensure that a finding of reasonable potential to exceed the criteria is not simply due to the substitution of ½ the detection limit.

4. Reasonable Potential Analysis

4.1 Reasonable Potential Analysis Overview

Once the appropriate effluent and ambient characterization data for each identified POC have been collected, conduct the RPA. DEQ's RPA procedure follows the procedure outlined in section 3.3.2 of the EPA TSD. This procedure fits the data to a lognormal distribution curve to estimate the maximum expected concentration[8] (See EPA TSD Figure 3-1a). If the maximum expected concentration exceeds the state water quality criterion at the EOP[9], then mixing zone dilutions (if any) and ambient concentrations are applied to project the maximum receiving water concentration. Compare the maximum receiving water concentration with the state water quality criteria to determine if reasonable potential to exceed the criteria exists.

4.2 Determining Criteria

4.2.1 Fresh/Marine Water Status

The applicable state toxic water quality criteria depend upon whether the receiving water is freshwater or saltwater. Waters where the 90th percentile of the salinity data is less than 1 ppt are considered freshwater. Waters where the 90th percentile of the salinity data is greater than 10 ppt are considered saltwater. Waters where the 90th percentile of the salinity data is between 1 and 10 ppt use the more conservative of the freshwater or saltwater quality criteria. Request technical assistance from the Data SME or Direct Support when the salinity of the receiving water can not readily be determined.

For human health criteria, both the "Water + Organism" and "Organism Only" apply in freshwater. In saltwater, only the "Organism Only" criteria apply. This is because the "Water + Organism" human health criteria only apply when domestic water supply (public and private) is a designated use. Since saltwater is not used for drinking water, the "Water + Organism" human health criteria do not apply.

4.2.2 Hardness

For cadmium, chromium III, lead, nickel, silver, and zinc, the state aquatic toxicity water quality freshwater criteria are hardness dependent. Therefore, enter effluent and ambient hardness information to calculate the water quality criteria. Data entered should be reflective of the average effluent and ambient concentrations during critical flow conditions. For example, calculate the average ambient hardness from data taken during the dry season, low flow condition, or other appropriate seasonal condition based on the mixing zone study critical time period (Consult Mixing Zone

[8] "The maximum expected concentration is calculated as the upper bound of the expected lognormal distribution of effluent concentrations at a high confidence level" (EPA TSD Section 3.3.2). DEQ defines the upper bound of 95th percentile and the confidence level of 99 %. Essentially it is the maximum concentration of the effluent expected to be seen assuming a lognormal distribution of the data.

[9] Where adequate data is available and the minimum conditions have been met, the permit writer may consider conducting an intake credit analysis. This may change the outcome of the RPA or adjust any calculated WQBELs to reflect intake pollutant concentrations. Guidance is available in the Intake Credit IMD

SME or Direct Support for assistance). In the absence of effluent or ambient hardness data during the critical time period, the average hardness during the non-critical time period can be substituted. Hardness calculated from calcium and magnesium concentrations or from specific conductance can also be used if no measured hardness data is available.

4.3 Statistical Calculation Values

The RPA projects an estimated maximum effluent concentration based on a log-normal distribution curve from the effluent data at a specified Probability Basis and Confidence Level (see EPA TSD Section 3.3.2). The estimated maximum effluent concentration is a function of the number of effluent samples and the coefficient of variation (CV). The lower the number of effluent samples and the higher the CV, the higher the multiplier used to calculate the estimated maximum effluent concentration. If the number of samples of the data set is less than 10, EPA recommends using a default CV of 0.6. If the number of samples is greater than or equal to 10, the permit writer should calculate the CV by dividing the standard deviation of the effluent data set by the mean of the effluent data set.

The Probability Basis reflects the upper boundary of the effluent distribution curve, and the Confidence Level indicates the reliability of the estimated maximum effluent concentration. The statistical values recommended by DEQ are summarized in Table 4-1. For a more detailed discussion of the statistics used in the RPA, please refer to Section 3.3 of the TSD.

Table 4-1 Summary of RPA Variables

Criteria	Effluent Conc	Ambient Conc	CV	%Confidence / %Probability
Aquatic Life: Acute	Max Conc	1-3 Samples: Max Conc. >4 Samples: 90th percentile	<10 Samples: 0.6 ≥10 Samples Calculate	99% / 95%
Aquatic Life: Chronic	Max Conc	1-3 Samples: Max Conc. >4 Samples: 90th percentile	<10 Samples: 0.6 ≥10 Samples Calculate	99% / 95%
Human Health	Carcinogens: Geometric Mean Non-Carcinogen: Max Conc	Geometric Mean	<10 Samples: 0.6 ≥10 Samples Calculate	95% / 95%

4.4 Determining Pollutant Concentration at ZID and RMZ

DEQ's regulations allow for the designation of a Zone of Initial Dilution (ZID) and Regulatory Mixing Zone (RMZ) under certain conditions. The ZID and RMZ are areas around the outfall where suspension of water quality criteria are allowed if lethality is prevented and the integrity of the water body as a whole is protected. When a ZID and RMZ are permitted, the RPA is calculated at the regulatory boundary of the ZID and RMZ using dilutions that correspond to critical flow conditions in the receiving water.

Most facilities conduct a mixing zone study to determine the available dilutions at the edge of the ZID and RMZ. This analysis should be conducted in accordance with DEQ guidance (see Mixing Zone IMD) and will result in the calculation of a series of dilution factors specifically for use in RPAs.

The goal of collecting ambient monitoring (Section 3.2) is to determine the condition of the receiving water body and identify the available assimilative capacity for each POC. Assimilative capacity is the capacity of a natural body of water to receive wastewaters or toxic materials without exceeding water quality criteria. If the ambient pollutant concentrations exceed the corresponding water quality criteria, no assimilative capacity is available and water quality criteria must be met in the final effluent, prior to mixing in the receiving stream. If the ambient pollutant concentrations are below the corresponding water quality criterion, assimilative capacity is available. If the permit includes a RMZ, water quality criteria are required to be met at the edge of the ZID (acute aquatic life criteria) and RMZ (chronic aquatic life criteria and human health criteria). To determine whether water quality criteria are met at the edge of the ZID and RMZ, a reasonably worst-case instream pollutant concentration must be estimated at the ZID and RMZ mixing zone boundaries using dilutions determined from mixing zone studies, ambient pollutant concentrations, and the estimated maximum effluent concentration (EPA TSD Section 4.5).

4.5 Comparison of Maximum Pollutant Concentration to Water Quality Criteria

Once the maximum pollutant concentration is estimated at the ZID and RMZ, compare the result to the applicable water quality criteria (see section 5.2.2). If the maximum pollutant concentration is at or lower than the applicable water quality criterion, there is no reasonable potential, and an effluent limit is not calculated. If the pollutant concentration is higher than the applicable water quality criterion, then there is reasonable potential, and an effluent limit is calculated (see Section 5).

4.5.1 Comparison of Maximum Concentration for Small Datasets

Datasets smaller than 10 values require the use of default CVs (usually 0.6, as recommended in the EPA TSD) and result in a high multiplier used to estimate the maximum effluent concentration. Because of this, DEQ requests additional monitoring if the sample size for a POC is smaller than 10. If the maximum effluent concentration generated from a sample size smaller than 10 exceeds the applicable water quality criteria, then a weight of evidence approach is used to evaluate reasonable potential. In consultation with the RPA SME consider the following factors, as appropriate:

1. Examine the effect of the multiplier on the determination of reasonable potential. If assuming a multiplier based on 10 samples results in reasonable potential at ZID or RMZ, then an effluent limit should be generated for that pollutant.
2. Examine WET tests from the past 5 years. Failure of WET tests may indicate that reasonable potential exists and an effluent limit is warranted for the specific pollutant. Consult with the RPA and WET SMEs.
3. Approaches outlined in Section 3.2 of the TSD may also be considered with the consultation of the RPA SME.

4.6 Situations that Use Other Methods to Determine Reasonable Potential

4.6.1 Copper BLM

The Oregon aquatic life water quality standard for copper states that the copper criteria are to be based on the Biotic Ligand Model (BLM), which is a metal bioavailability model that uses water characteristics to develop site-specific instantaneous water quality criteria (IWQC). Ideally, complete sets of input parameter data measured from the effluent and ambient environment upstream of the discharge are available to calculate the applicable IWQC.

Required BLM input parameters:

1. Temperature (°C)
2. pH (Standard Units)
3. Dissolved Organic Carbon (DOC) (mg/L)
4. Calcium, Dissolved (mg/L)
5. Magnesium, Dissolved (mg/L)
6. Sodium, Dissolved (mg/L)
7. Potassium, Dissolved (mg/L)
8. Sulfate, Dissolved (mg/L)
9. Chloride, Dissolved (mg/L)

10. Alkalinity, Dissolved (mg/L CaCO3 equivalent)

For the purposes of an RPA using the BLM, these data sets would be collected over a long enough period to characterize the range of both upstream ambient receiving waterbody and effluent copper water chemistry conditions and include the most bioavailable conditions. While it is the intention of DEQ to evaluate a full set of model input values for the effluent and receiving water, data sets may be limited for a variety of reasons. DEQ substitutes conservative estimates or default values for input parameters that are not available to determine protective instantaneous copper criteria and to complete the copper reasonable potential analysis. See the "Reasonable Potential Process for Copper Using the Biotic Ligand Model" for details on how to complete the RPA.

4.6.2 Aluminum

The U.S. EPA published Aluminum criteria for Oregon on March 19th, 2021. The freshwater aluminum criterion is similar to the copper criterion in that the aluminum criterion is a calculated criterion that changes based on pH, dissolved organic carbon, and total hardness. The aluminum criteria values must be applied in order to protect the water body over the full range of water chemistry conditions, including during conditions when aluminum is most toxic. The federal rule also addresses Oregon's ability to use emerging analytical methods to measure bioavailable aluminum for characterizing aluminum toxicity in ambient waters, where scientifically appropriate and allowable by state and federal regulations. However, an ASTM standard method to measure bioavailable aluminum is currently under development. Until the bioavailable aluminum standard method is available, major domestic and some industrial permittees will be required to measure total recoverable aluminum for ambient waters. When ambient bioavailable data is available, it will be used preferentially over total recoverable aluminum.

Aluminum RPAs are conducted in a similar manner to Copper BLM RPAs (See the "Reasonable Potential Process for Copper Using the Biotic Ligand Model") and utilize total recoverable aluminum as an initial screen. When the bioavailable aluminum standard method becomes broadly available, permittees will be allowed to monitor ambient aluminum using the bioavailable method. At that time, site specific translators may be developed and used between bioavailable and total recoverable aluminum (see section 5.3). Any necessary effluent limits will be established based on the total recoverable aluminum criteria. Aluminum limits in permits and associated compliance monitoring will be in the total recoverable fraction as required by 40 CFR 122.45(c).

4.6.3 Methylmercury

The human health methylmercury criterion is a fish tissue-based criterion. Instructions on monitoring, reasonable potential analysis, and WQBELs for methylmercury can be found in the "Implementation of Methylmercury Criterion in NPDES Permits" IMD.

4.6.4 Determining Reasonable Potential for Pollutants with Existing Limits

Pollutants with limits in the existing permit will be re-evaluated using updated dilutions to ensure that they remain protective of Oregon WQ criteria. If the existing limit is not found to have reasonable potential to exceed the WQ criteria, then the limits remain the same in the new permit pending any applicable anti-backsliding exceptions (see DEQ's most recent guidance related to anti-backsliding). If the existing limit is found to have reasonable potential, then develop more restrictive limits in accordance with section 5 below.

4.6.5 Determining Reasonable Potential for Water Quality with Criteria Below Available Analytics Limits.

Though 40 CFR 122.21(e)(3) and 122.44(i)(1)(iv) require data submitted for NPDES purposes to be sufficiently sensitive, some water quality criteria fall far below analytic limits for 40 CFR 136 approved methods, resulting in datasets where most or all values are non-detect. These datasets cannot be evaluated using the statistical basis established in the TSD as they cannot be fit to a lognormal distribution curve. Procedures are outlined for the following situations when the water quality criteria are below analytic limits (note that a minimum dataset of 10 is assumed, for datasets with fewer than 10 datapoints consult the RPA SME for guidance):

- **All data points are non-detect**: If all values are non-detect for a pollutant and the data meets DEQ's list of recommended quantitation limits (QLs) (see "Revised Quantitation Limit List for Individual NPDES Permittees" memo), then the permittee is considered to not have reasonable potential for that pollutant. No additional monitoring beyond the monitoring matrix requirements is needed.
- **Less than ¼ of data points have detected values, and 1 or fewer of all detections are above the QL**: Data reported below the QL but above the MDL is considered estimated, and therefore is unable to be accurately quantified. This makes the data difficult to use in an RPA. It is also not recommended to base reasonable potential on only one quantifiable sample. Therefore, if fewer than a quarter of the data points reported by a permittee are detectable and 1 or fewer data points are above QL, the permittee is considered to not have reasonable potential for that pollutant. The permittee will be required to monitor the analyte in question monthly for 3 years (for a total of 36 monitoring points)[10] and complete a source identification study to determine potential sources of the pollutant.
- **More than ¼ of data points have detected values**: The permittee is considered to have reasonable potential if the maximum pollutant concentrations at ZID or RMZ are greater than the water quality criteria.

[10] If there is at least one quantifiable value, assuming that water quality violations are happening at least once per month, the probability of being able to determine reasonable potential using a dataset size of 36 is 70%. A larger sample size than 36 results in diminishing increases in probability (e.g. a sample size of 48 (4 years of sampling) results in a probability of 80%, only a 10% increase from 36 samples. A sample size of 24 (2 years of sampling) results in a probability of 54%, a 16% decrease from 36 samples).

- **2 or more data points are above the QL**: The permittee is considered to have reasonable potential if the maximum pollutant concentrations at ZID or RMZ are greater than the water quality criteria.

4.6.6 Pollutant Parameters without Numeric Water Quality Criteria

There are a few POCs that do not have corresponding numeric state water quality criteria.[11] These POCs are not evaluated as part of a typical toxics RPA. However, due to 40 CFR 122 requirements, monitoring for these pollutants may not be waived for a permittee.

4.7 Narrative Toxics Criteria

The WET analysis is the primary mechanism to protect water quality using the state's Narrative Toxic Criteria (OAR 340-041-033(1)). Permit writers may need to conduct RPAs or establish whole effluent toxicity limits for permittees based on the outcomes of WET testing (TSD section 3.3.3 and 5.7.4). For additional information regarding WET procedures, review the WET guidance or contact the WET SME.

Additionally, if a permittee discharges a POC that does not have an established aquatic life water quality criterion, an RPA may be done (with the approval of Direct Support) using the aquatic life water quality guidance values found in OAR 340-041-8033 Table 31. Because WET analysis only evaluates toxicity to aquatic organisms, DEQ may also use public health advisories or published scientific literature to perform an RPA and establish permit limits for specific pollutants (OAR 340-041-033(4)). Decisions using public health advisories or published scientific literature must clearly be explained in the permit fact sheet and include the site-specific values used as a substitute for promulgated state aquatic life or human health criteria specified in statute for the pollutant in question. Consultation with the appropriate SME(s) is required in these cases.

5. Effluent Limit Calculation and Determination

5.1 Effluent Limit Determination Process Overview

Once the permit writer has conducted the RPA and determines that a facility has reasonable potential to exceed the in-stream water quality criteria, the next step is to calculate the Waste Load Allocations (WLA) and derive Water Quality Based Effluent Limits (WQBELs).

WLAs define the effluent quality necessary to comply with the water quality criterion. However, WLAs cannot be applied directly as an effluent limit because they do not specifically consider the effluent variability or the assumed probability basis (see Table 5-1). Therefore, it is necessary to translate the WLAs into WQBELs to ensure proper implementation and enforcement. In category 4A stream segments where a formal TMDL has been completed and WLA's assigned, the permit writer must ensure the permit limits

[11] Examples include Beryllium, Total Kjeldahl Nitrogen, Total Chromium, etc.

are consistent with the assumptions and requirements of the TMDL. All toxic pollutant permit limits should be expressed as average monthly limit (AML) and maximum daily limit (MDL) values (40 CFR122.45(d) and TSD Section 5.2.3).

Once calculated, the permit writer compares the derived limits (WQBEL) with existing limits or applicable Technology Based Effluent Limits (TBELs) and selects the most stringent value.

5.2 WLA and WQBEL Calculation

DEQ developed methodology to calculate WLAs and WQBELs that are protective of water quality criteria in the receiving water (based on EPA TSD Section 5.4 and 5.5). This methodology accounts for the allowable dilution, background concentration, effluent variability, and sampling frequency when calculating a WQBEL. Table 5-1 summarizes the critical conditions used in effluent limit calculation that are protective of aquatic life and human health. Note that the general procedure for determining limits is the same for all toxic pollutants, regardless of differences in the methodology, for determining reasonable potential (See section 4.6).

Table 5.1 Summary of Waste Load Allocation and Effluent Limit Calculation Variables

Criteria Type	Ambient Flow Statistic	Ambient Conc	CV	%Probability
Aquatic Life	Acute: 1Q10 Chronic: 7Q10	1-3 samples: Max Conc >4 samples: 90th percentile	<10 samples: 0.6 ≥10 samples: calculate	99% (MDL) and 95% (AML)
Human Health	Carcinogens: Harmonic Mean Non-Carcinogen: 30Q5 flow	Geometric Mean	<10 sample: 0.6 ≥10 samples: calculate	99% (MDL) and 95% (AML)

A summary and list of formulas used in the calculations can be found in the EPA TSD Sections 5.4 and 5.5[12]. Monitoring frequency will affect the final AML. Consult the Monitoring Matrix to determine monitoring frequency for pollutants with limits. When available, an intake credit may be used in determining compliance with the WQBEL. Please refer to the Intake Credit IMD for guidance in the use of intake credits and permit language.

5.3 Converting Dissolved Metal Criteria into Total Recoverable Limits

40 CFR 122.45(c) requires that all permit effluent limits for metals be expressed in terms of "total recoverable". Therefore, any effluent limits derived from water quality criteria for

[12] EPA TSD assumes a 4-day averaging period for chronic criteria. For chronic criteria that utilize a 30-day average please see 64 FR 71976.

metals in the dissolved form must be converted into the total recoverable fraction. DEQ follows the EPA guidance "The Metals Translator: Guidance for Calculating a Total Recoverable Permit Limit from a Dissolved Criterion"[13] when converting between dissolved criteria and total recoverable limits. If there is not adequate downstream data present to develop a site-specific translator as outlined in the EPA metals translator guidance, use the EPA Conversion Factors (OAR 340-041-8033 Endnote F) to convert between dissolved and total fractions. If no site-specific conversion factor exists, then apply a conservative conversion factor of one ("1").

5.4 Effluent Limitations Below Analytic Limits

Some water quality criteria are below current analytic limits; thus effluent limits cannot be evaluated with available methodology. In these situations, a compliance limit is established equal to the recommended QL (see DEQ Recommended QL list) to evaluate compliance with the effluent limit. The effluent limit is listed in the permit and the compliance limit is established as a note to the effluent limit.

5.5 Final RPA and Effluent Limit Evaluations

After calculating and confirming the effluent limits, ensure relevant raw data, spreadsheets, mixing zone models and notes detailing all decision rationale are preserved in the permit file.

If there is an effluent limit in the existing permit, then Anti-Backsliding requirements normally prevent any changes resulting in a less-conservative limit. However, pursuant to the conditions in 40 CFR 122.44 (l) and CWA 402(0), a less stringent limit may be allowed. Please contact the Anti-Backsliding SME for technical assistance on this topic.

A permittee may have additional TBELs or ELGs that apply to the facility. In these situations, compare the WQBELs to the applicable TBELs (including ELGs) and apply the more stringent limit in the permit. Please contact the TBEL SME for technical assistance.

If the permittee is not able to comply with a newly applicable WQBEL immediately upon permit issuance, a Compliance Schedule allowing for the use of interim effluent limits may be allowed. Please refer to the DEQ's guidance, "Compliance Schedules in NPDES Permits" for more information and consult with the Compliance Schedule SME. Alternatively, a permittee may request a variance from water quality criteria. Consult with the Variance SME.

[13] U.S. EPA Office of Water (4305) EPA 823-B-96-007 June 1996

6. Revision History

Revision	Date	Changes	Editor
1.0	9/2005	Initial Publication	MF
2.0	12/2006	Updated revision	MF & JN
3.0	8/2011	Extensive revisions to reflect changes in environmental regulation, new DEQ policies regarding timing of the permit process, inclusion of new RPA and WQBEL spreadsheets and revision of Quantitation Limit values.	SRB
3.1	2/2012	Addition of Intake Credit guidance in App. F, removal of App. C Quantitation Limits to a stand-alone IMD, discussion of recently adopted water quality criteria and implementation options, and numerous minor corrections and clarifications	SRB
4.0	11/15/2023	Complete overhaul of RPA IMD to comply with current practices. Removal of appendix E and F to be stand-alone guidance	Aliana Britson
4.1	4/19/2024	Refinement of POC section. Updates to Aluminum section. Minor clarifications.	Aliana Britson
4.2	5/7/2024	Formatting issues fixed. Minor clarifications and grammar edits.	Aliana Britson
4.3	10/17/2024	Fixed typo in Table 4-1. Reverted analysis of human health carcinogen to use geometric mean instead of arithmetic mean. Minor clarifications to Aluminum section.	Aliana Britson