

To: DEQ Water Quality Staff

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Subject: Implementation Instructions for Water Quality Criteria Chromium III (CAS #: 16065-83-1) and Chromium VI (CAS #: 18540-29-9)

This memo clarifies how chromium III (trivalent form) and chromium VI (hexavalent form) concentrations in effluent and surface water are measured to determine compliance with water quality criteria.

Criterion Summary

Oregon water quality standards include numeric criteria for chromium III and VI (Table 30) to protect aquatic life (See table below). There are no associated human health criteria¹.

Chemical	Human Health Criteria		Aquatic Life Criteria (Freshwater)		Aquatic Life Criteria (Saltwater)	
	Water + Org (µg/L)	Org Only (µg/L)	Acute (µg/L)	Chronic (µg/L)	Acute (µg/L)	Chronic (µg/L)
Chromium VI	---	---	16 ^C	11 ^C	1100 ^C	50 ^C
Chromium III	---	---	Calculate ^{C,F}	Calculate ^{C,F}	---	---
^C Criterion is expressed in terms of "dissolved" concentrations in the water column. ^F The freshwater criteria 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 .						

Key Issues

Laboratories (including the DEQ laboratory) typically report chromium as total chromium, unless analysis for chromium VI is requested. Total chromium consists primarily of trivalent and hexavalent forms. Hexavalent forms which are generally produced by industrial sources are considered to be more toxic than trivalent forms which typically come from natural sources².

¹ EPA approved DEQ's withdrawal of the human health criteria for chromium III and chromium VI in June 2010. DEQ withdrew these criteria to be consistent with EPA's National Toxics Rule and 2002 nationally recommended CWA 304(a) criteria which determined that these criteria were no longer scientifically defensible.

² ATSDR. Toxicological Profile for Chromium. See: <http://www.atsdr.cdc.gov/toxprofiles/tp.asp?id=62&tid=17>

In the situation where only total chromium data are available, results are compared to the most stringent applicable criterion for either chromium III or chromium VI. In this particular case, chromium VI will be the most stringent criteria in either freshwater or saltwater environments. This is conservative and represents toxicity based on chromium VI criteria when the water sample may be primarily comprised of chromium III.

Recommended Analytical Method

The recommended analytical method for total chromium is **EPA Method 200.8**. The recommended analytical method for chromium VI is **EPA Method 218.6**. There is no recognized analytical method for chromium III; therefore, chromium III should be determined from the calculated difference of chromium VI from total chromium. To determine the applicable quantitation limits for individual permit holders, please refer to Schedule B of the applicable permit. For older permits without quantitation limits in their Schedule B, please refer to Revision 3.0 of the [Reasonable Potential Analysis for Toxic Pollutants IMD](#) to determine applicable quantitation limits.

Implementation Instructions

Chromium III and VI are not currently listed in *Appendices D or J of 40 CFR 122* and are not required as part of the federally mandated priority pollutant scan.

Since chromium III and VI have state water quality criteria, current policy as described in **Sections 2.2.2 and 2.2.4** of the **RPA IMD rev. 3.1**, is to require monitoring and subsequent evaluation for each pollutant when one of the conditions³ described in the RPA IMD occurs.

In the event where monitoring for chromium III is indicated, staff have the following two options:

1. Require quantification of chromium III. This will require the determination of the concentrations for total chromium and chromium VI. The difference between these two values will be assumed as the concentration of chromium III and will then be used for determining reasonable potential and calculation of water quality based effluent limits (WQBEL).
2. Require monitoring and analysis of total chromium in lieu of chromium III. This would occur as part of the Tier 1 monitoring and in the event that a concentration of total chromium is detected in excess of the water quality criterion (when statistically projected to account for sample variance), the permittee may:
 - a. opt to base the reasonable potential analysis and water quality based effluent limit (WQBEL) calculation on the total chromium data or
 - b. using the method described in Option 1, quantify the concentration of chromium III in the effluent and ambient waters during the Tier 2 monitoring. The collected data would then be used to complete the RPA and WQBEL calculation.

In the event where monitoring for chromium VI is indicated, staff have the following options:

1. Require monitoring and analysis for chromium VI
2. Require monitoring and analysis of total chromium in lieu of chromium VI. This would occur as part of the Tier 1 monitoring and in the event that a concentration of total

³ Generally, a pollutant is “known” to be present in the effluent due to factors such as source water contamination, industrial sources within the collection area, listing status of the receiving water body, or inclusion in a pretreatment program.

chromium is detected in excess of the water quality criterion (when statistically projected to account for sample variance), the permittee may:

- a. opt to base the reasonable potential analysis and water quality based effluent limit (WQBEL) calculation on the total chromium data or
- b. collect additional chromium VI effluent and ambient data during the Tier 2 monitoring. The collected data would then be used to complete the RPA and WQBEL calculation.

The RPA Workbook has been set up with notations to this effect and will automatically use total chromium data in lieu of data for chromium III and VI. The permit writer may later have to make modifications to the workbook, depending upon the option selected.

Conclusion

As a cost savings measure, total chromium data results may be used as a conservative surrogate in cases where there are no analytical results based on chromium III or VI. If either pollutant is identified as a Pollutant of Concern⁴, DEQ recommends that permit holders determine the concentration of chromium III and VI during the Tier 2 monitoring and analysis. Otherwise, total chromium data should be used to complete the RPA and calculate the WQBELs.

⁴ For having exceeded the water quality criterion at the end of pipe using statistical projection to estimate a maximum effluent concentration.