



Memorandum on Chromium

To: Integrated Report Work Group
Date: Feb. 27, 2018
From: Integrated Report Improvement Team
Subject: Chromium assessment methodology recommendations

Chromium background

Aquatic life surface water quality criteria are in effect for chromium III (trivalent form) and chromium VI (hexavalent form) as identified in OAR 340-041-0033 Table 30. Total chromium, which is measured by most laboratories (including DEQ’s laboratory) consists primarily of trivalent and hexavalent forms. Total chromium is present in both the soil and natural geology of the region. However, based on microbial and biological activity, it tends not to be present as chromium VI in surface waters. Hexavalent forms are generally produced by industrial sources and are considered to be more toxic than trivalent forms which typically come from natural sources.

In the situation where only total chromium data are available, the 2012 Integrated Report took the approach of comparing results to the most stringent applicable criterion for either chromium III or chromium VI. In this particular case, chromium VI has the most stringent criteria in either freshwater or saltwater environments (Table 1). This approach is conservative and effectively presumes the samples represent toxicity based on chromium VI criteria when the water sample may be primarily comprised of chromium III.

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. 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 .						

Table 1. Numeric water quality criteria for chromium III and VI (Table 30)

Oregon’s human health criteria for chromium III and chromium VI were withdrawn in 2004 and the withdrawal was approved by EPA in June 2011. The aquatic life criteria in OAR 340-041-0033 Table 30 include criteria for two oxidation states of chromium - chromium III (trivalent) and chromium VI (hexavalent). The criteria for chromium III are hardness dependent.

Most sample analyses are done for total chromium and do not report concentrations for the separate oxidation states. DEQ reviewed 79 aqueous total chromium samples submitted by EPA for the time period September 2004 through June 2007 extracted from the Water Quality Portal in July 2017. Seventy-four of the seventy-nine samples (94%) were reported as either estimated or non-detect. Five of the 79 samples (6%) reported measured total chromium data, with four of the five samples reported as estimated values between method detection and method reporting limits. One measured value of 24.5 µg/L exceeded the chronic aquatic life chromium VI criteria of 11 µg/L and chromium III criteria of 24 µg/L¹(Table 1).

Hardness, mg/L	Chromium III (chronic), µg/L	Chromium VI (chronic), µg/L
25	24	11
50	42	11
75	59	11
100	74	11
125	89	11
150	103	11
175	117	11
200	131	11

Table 1. Chromium III criteria values under common hardness levels.

DEQ is recommending for the 2018 Integrated Report that when chromium data are available as total chromium, and the chromium III (trivalent) criteria are exceeded, waterbodies will be identified as Category 5. When chromium data are available as total chromium, and the chromium VI (hexavalent) criteria are exceeded, waterbodies will be identified as Category 3B: Insufficient Data - Potential Concern until follow up monitoring can occur for confirmation laboratory analysis of chromium VI, specifically. In general, DEQ does not expect to have more Chromium VI data than it has had in previous Integrated Reports; therefore, it is preferable to identify these waters for follow-up monitoring and avoid a potentially flawed listing.

¹ A default hardness value of 25 mg/L was used to calculate chromium III criteria.