Appendix G. Calculating Hardness in Freshwater Receiving Waters for Hardness Dependent Metals

1 Overview

For any sectors required to conduct benchmark samples for a hardness-dependent metal, DEQ includes "hardness ranges" from which benchmark values are determined. To determine which hardness range to use, you must collect data on the hardness of your receiving water(s). Once the site-specific hardness data have been collected, the corresponding benchmark value for each metal is determined by comparing where the hardness data fall within hardness ranges, as shown in Table 1. You only need to determine hardness for your discharges into freshwater as the benchmark values for metals do not vary for discharges to saline waters.

Table 1. Hardness Ranges to Be Used to Determine Benchmark Values for Cadmium, Chromium (III), Lead, Nickel, Silver, and Zinc.

All Units (mg/L)	Benchmark Values (µg/L, total)					
	Cadmium[1]	Chromium (III)[1]	Lead	Nickel	Silver	Zinc
0-24.99	0.20	183	14	145	0.37	37
25-49.99	0.42	183	24	203	0.80	52
50-74.99	0.75	323	45	314	1.9	80
75-99.99	1.05	450	69	418	3.3	107
100-124.99	1.34	570	95	518	5.0	132
125-149.99	1.62	684	123	614	7.1	157
150-174.99	1.88	794	152	707	9.4	181
175-199.99	2.14	901	182	798	12	204
200-224.99	2.39	1005	213	888	15	227
225-249.99	2.64	1107	246	975	18	249
250+	2.89	1207	262	1019	20	260

1. To comply with Idaho water quality standards, DEQ will require benchmarks for all sectors subject to cadmium and chromium (III) benchmarks be based on Idaho's hardness-based acute criterion.

2 How to Determine Hardness for Hardness-Dependent Parameters in Freshwater

You may select one of three methods to determine hardness:(1) individual grab sampling, (2) grab sampling by a group of operators that discharge to the same receiving water, or (3) using third-party data. Regardless of the method used, you are responsible for documenting the procedures used for determining hardness values. The hardness value is required to be

submitted to DEQ with the Notice of Intent (NOI) so that the electronic Discharge Monitoring Report (DMR), submitted through NetDMR, will include the appropriate limits. You must retain all report and monitoring data in accordance with Part 7.G of the permit. The three method options for determining hardness are detailed in the following sections.

2.1 Permittee Samples for Receiving Stream Hardness

This method involves collecting samples in the receiving water and submitting these to a laboratory for analysis. If you elect to sample your receiving water(s) and submit samples for analysis, hardness must be determined from the closest intermittent or perennial stream downstream of your point of discharge. The sample can be collected during either dry or wet weather. Collection of the sample during wet weather is more representative of conditions during stormwater discharges; however, collection of in-stream samples during wet weather events may be impracticable or present safety issues.

Hardness must be sampled and analyzed using approved methods as described in 40 CFR 136 (Guidelines Establishing Test Procedures for the Analysis of Pollutants).

2.2 Group Monitoring for Receiving Stream Hardness

You can be part of a group of permittees discharging to the same receiving waters and collect samples that are representative of the hardness values for all members of the group. In this scenario, hardness of the receiving water must be determined using 40 CFR 136 procedures and the results shared by group members. To use the same results, hardness measurements must be taken on a stream reach within a reasonable distance of the discharge points of each of the group members.

2.3 Collection of Third-Party Hardness Data

You can submit receiving stream hardness data collected by a third party provided the results are collected consistent with the approved 40 CFR 136 methods. These data may come from a local water utility, previously conducted stream reports, TMDLs, peer-reviewed literature, other government publications, or data previously collected by the permittee. Data should be less than 10 years old.

Water quality data for many of the nation's surface waters are available online or by contacting DEQ or EPA. EPA's data system STORET, short for STOrage and RETrieval, is a repository for receiving water quality, biological, and physical data and is used by state environmental agencies, EPA, and other federal agencies, universities, and private citizens. Similarly, DEQ and the US Geological Service (USGS) also have water quality data available that can be accessed online. "Legacy STORET" codes for hardness include: 259 hardness, carbonate; 260 hardness, noncarbonated; and 261 calcium + magnesium, while more recent, "Modern STORET" data codes include: 00900 hardness, 00901 carbonate hardness, and 00902 noncarbonate hardness; or the discrete measurements of calcium (00915) and magnesium (00925) can be used to

calculate hardness. Hardness data historically has been reported as “carbonate,” “noncarbonate,” or “Ca + Mg.” If these are unavailable, then individual results for calcium (Ca) and magnesium (Mg) may be used to calculate hardness using the following equation:

$$\text{mg/L } CaCO_3 = 2.497 \text{ (Ca mg/L)} + 4.118 \text{ (Mg mg/L)}$$

When interpreting the data for carbonate and noncarbonate hardness, note that total hardness is equivalent to the sum of carbonate and noncarbonate hardness if both forms are reported. If only carbonate hardness is reported, it is more than likely that noncarbonate hardness is absent and the total hardness is equivalent to the available carbonate hardness.