

To: DEQ Water Quality Staff**Date:** Feb. 22, 2023**From:** Water Quality Permitting and Program Development**Updated By:** Aliana Britson, Water Quality Permitting and Program Development (1/4/2022)**Subject:** Implementation Instructions for the Water Quality Criterion Chlorine (CAS #: 7782-50-5)

This memo clarifies how chlorine concentrations in effluent and surface water are measured to determine compliance with water quality criteria.

Criteria Summary

Oregon water quality standards include numeric criteria for chlorine to protect aquatic life (OAR 340-041-0033 and Table 30). Table 1 below reflects the chlorine criteria as published in the rule.

Table 1: Water Quality Criteria

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)
Chlorine	---	---	19	11	13	7.5

Key Issues

There are several forms of chlorine. The chlorine aquatic life criteria do not include any clarifying footnotes as to which form of chlorine is targeted by the criteria. Therefore, DEQ staff referenced a 1984 U.S. Environmental Protection Agency criteria support document (EPA. Ambient Water Quality Criteria for Chlorine - 1984. EPA 440/5-84-030. January 1985) to address this question:

When chlorine is added to fresh water, the solution will usually contain two forms of free chlorine: hypochlorous acid (HOCl) and the hypochlorite ion (OCl⁻). If the water contains ammonia, the solution will probably also contain two forms of combined chlorine: monochloramine and dichloramine. Because all four of these are quite toxic to aquatic organisms, the term "total residual chlorine" is used to refer to the sum of free chlorine and combined chlorine in fresh water. However, because salt water contains bromide, addition of chlorine also produces hypobromous acid (HOBr), hypobromous ion (OBr⁻), and bromamines (Dove, 1970; Johnson, 1977; Macalady, et al. 1977; Sugam and Helz, 1977). The term "chlorine-produced oxidants" is used to refer to the sum of these oxidative products in salt water (Burton, 1977). Consequently, the freshwater and saltwater data herein will be expressed as total residual chlorine (TRC) and chlorine-produced oxidants (CPO), respectively, although both terms are intended to refer to the sum of free and combined chlorine and

bromine as measured by the methods for “total residual chlorine” (U.S. EPA, 1983a).

Because both total residual chlorine and chlorine-produced oxidants are intended to refer to the sum of free and combined chlorine and bromine as measured by the methods for “total residual chlorine” this excerpt indicates that the aquatic life criteria for chlorine are based on total residual chlorine.

Analytical Methods

Methods used must be 40 CFR 136 approved. The holding time for chlorine is 15 minutes (40 CFR 136 Table II-Required Containers, Preservation Techniques, and Holding Times). Samples must be analyzed immediately in the field. In-line continuous analyzers may be used only if they utilize a 40 CFR 136 approved method. Laboratory analysis can be done, but the laboratory must be located near the source of the samples to meet the holding time.

Implementation Instructions for NPDES Permits

For the purposes of effluent and ambient characterization, determining “reasonable potential”, establishing effluent limits and compliance monitoring, the water quality criteria for “chlorine” will be interpreted as “total residual chlorine” for both freshwater and saltwater dischargers. Any data reported as “chlorine-produced oxidants” for saltwater analyses will be interpreted the same as if it was reported as “total residual chlorine” since both terms “refer to the sum of free and combined chlorine and bromine as measured by the methods for ‘total residual chlorine’” (EPA 440/5-84-030). It should be noted that “free available chlorine” data does not measure combined chlorine and should not be used as a substitute for “total residual chlorine”. All permit limits and any data reported by the permittee should be expressed as “total residual chlorine” for both freshwater and saltwater dischargers.

Conclusion

In summary, the aquatic life criteria for chlorine in freshwater are expressed as “total residual chlorine”. The “total residual chlorine” analytical methods apply to both freshwater and saltwater criteria. All permit limits and permittee data should be expressed as “total residual chlorine”.