NPDES Implementation of Instream Dissolved Metals Standards – Saltwater Standards

The NC 2007-2015 Water Quality Standard (WQS) Triennial Review was approved by the NC Environmental Management Commission (EMC) on November 13, 2014. The US EPA subsequently approved the WQS revisions on April 6, 2016, with some exceptions. Therefore, metals limits in draft permits out to public notice after April 6, 2016 must be calculated to protect the new standards - as approved.

Table 1. NC Dissolved Metals Water Quality Standards/Aquatic Life Protection

Parameter	Acute FW, µg/l (Dissolved)	Chronic FW, µg/l (Dissolved)	Acute SW, µg/l (Dissolved)	Chronic SW, µg/l (Dissolved)
Arsenic	340	150	69	36
Beryllium	65	6.5	---	---
Cadmium	Calculation	Calculation	40	8.8
Chromium III	Calculation	Calculation	---	---
Chromium VI	16	11	1100	50
Copper	Calculation	Calculation	4.8	3.1
Lead	Calculation	Calculation	210	8.1
Nickel	Calculation	Calculation	74	8.2
Silver	Calculation	0.06	1.9	0.1
Zinc	Calculation	Calculation	90	81

Table 1 Notes:

1. FW= Freshwater, SW= Saltwater
2. Calculation = Hardness dependent standard
3. Only the aquatic life standards listed above are expressed in dissolved form. Aquatic life standards for Mercury and selenium are still expressed as Total Recoverable Metals due to bioaccumulative concerns (as are all human health standards for all metals). It is still necessary to evaluate total recoverable aquatic life and human health standards listed in 15A NCAC 2B.0200 (e.g., arsenic at 10 µg/l for human health protection; cyanide at 5 µg/L and fluoride at 1.8 mg/L for aquatic life protection).

General Information on the Reasonable Potential Analysis (RPA)

The RPA process itself did not change as the result of the new metals standards. However, application of the dissolved metal standards requires additional consideration in order to establish the numeric standard for each metal of concern of each individual discharge. Note that none of the saltwater standards are hardness-dependent.

Metals limits must be expressed as 'total recoverable' metals in accordance with 40 CFR 122.45(c). The discharge-specific standards must be converted to the equivalent total values for use in the RPA calculations. We will generally rely on conversion factors determined by EPA (more on that below), but it is also possible to consider case-specific translators developed in accordance with established methodology.

RPA Permitting Guidance – Discharges to Saltwater (Tidal waters)

The RPA is designed to predict the maximum likely effluent concentrations for each metal of concern, based on recent effluent data, and calculate the allowable effluent concentrations, based on applicable standards and the stream dilution. For discharges to saltwater, no allowance for dilution is given unless a dilution study, such as a CORMIX model, is performed.

If the maximum predicted value is greater than the maximum allowed value (chronic or acute), the discharge has reasonable potential to exceed the standard, which warrants a permit limit in most cases. If monitoring for a particular pollutant indicates that the pollutant is not present (i.e. consistently below detection level), then the Division may remove the monitoring requirement in the reissued permit.

1. To perform a RPA using the saltwater dissolved metal standards, the Permit Writer compiles the following information:
   - Permitted flow
   - Receiving stream classification
   - Instream Wastewater Concentration, if a dilution model has been performed

2. The RPA spreadsheet converts the dissolved numeric standard (SW standards listed in Table 1.) for each metal of concern to a total recoverable metal, using the EPA conversion factors published in the June, 1996 EPA Translator Guidance Document. This method presumes that the metal is dissolved to the same extent as it was during EPA's criteria development for metals.

Conversion Factors for Dissolved Metals

Metal	Saltwater CMC (Acute)	Saltwater CCC (chronic)
Arsenic	1.000	1.000
Cadmium	0.994	0.994
Chromium VI	0.993	0.993
Copper	0.83	0.83
Lead	0.951	0.951
Mercury	0.85	0.85
Nickel	0.990	0.990
Selenium	0.998	0.998
Silver	0.85	—
Zinc	0.946	0.946

From: US EPA website, National Recommended Water Quality Criteria - Aquatic Life Criteria Table
https://www.epa.gov/wqc/national-recommended-water-quality-criteria-aquatic-life-criteria-table#a

3. The dissolved numeric standard for each metal of concern is divided by the EPA conversion factor (or site-specific translator) to obtain a Total Recoverable Metal at ambient conditions.

4. If a dilution study was performed on the receiving stream and an Instream Wastewater Concentration (IWC) determined the RPA spreadsheet uses a mass balance equation to determine the total allowable concentration (permit limits) for each pollutant using the following equation:

$$Ca = \frac{(s7Q10 + Qw)(Cwqs) - (s7Q10)(Cb)}{Qw}$$

Where: Ca = allowable effluent concentration (µg/L or mg/L)
Cwqs = NC Water Quality Standard or federal criteria (µg/L or mg/L)
Cb = background concentration: assume zero for all toxicants except NH_3* (µg/L or mg/L)
Qw = permitted effluent flow (cfs, match 7Q10 units)
s7Q10 = summer, critical low flow (cfs)
* Discussions are on-going with EPA on how best to address background concentrations

Assuming no background concentration, this equation can be reduced to:

$$Ca = \frac{(s7Q10 + Qw)(Cwqs)}{Qw} \quad \text{or} \quad Ca = \frac{Cwqs}{IWC}$$

Where: IWC = $\frac{Qw}{Qw + s7Q10}$ or $\frac{1}{D}$

and D = modelled dilution factor (unitless)

If no dilution study has been performed Ca, the allowable effluent concentration, is equal to the Total Recoverable Metal determined at ambient conditions (ie. the dissolved numeric standard divided by the EPA conversion factor (or site-specific translator) for the metal of concern). See item # 3 above.

5. The permit writer enters the most recent 2-3 years of effluent data for each pollutant of concern. Data entered must have been taken within four and one-half years prior to the date of the permit application (40 CFR 122.21). The RPA spreadsheet estimates the 95th percentile upper concentration of each pollutant. The Predicted Max concentrations are compared to the Total allowable concentrations to determine if a permit limit is necessary. If the predicted max exceeds the acute or chronic Total allowable concentrations, the discharge is considered to show reasonable potential to violate the water quality standard, and a permit limit (Total allowable concentration) is included in the permit in accordance with the U.S. EPA Technical Support Document for Water Quality-Based Toxics Control published in 1991.

6. When appropriate, permit writers develop facility specific compliance schedules in accordance with the EPA Headquarters Memo dated May 10, 2007 from James Hanlon to Alexis Strauss on 40 CFR 122.47 Compliance Schedule Requirements.

7. The Total Chromium NC WQS was removed and replaced with a hexavalent chromium standard. 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 VI. In these cases, the projected maximum concentration (95th %) for total chromium will be compared against the water quality standard chromium VI.