

Key Factors for the 2014 Revision of the State of Delaware Surface Water Quality Standards Regulation (the “Standards”)

Introduction

The Delaware Department of Natural Resources and Environmental Control (the “Department”) is providing proposed water quality standards that update the most recent set of Standards that were promulgated in 2011. Some of these proposed Standards and numeric criteria have changed from the 2011 Standards based on a review of the most up-to-date recommendations from the United States Environmental Protection Agency (EPA) and Department staff review of documents from an extensive site-specific criteria project for the tidal Murderkill River. The Department hopes to promulgate final Standards in early 2014. All proposed amendments to the Standards can be found online at the following URL:

<http://www.dnrec.delaware.gov/swc/wa/Documents/Surface%20Water%20Quality%20Standards/mark%20up%207401%20Surface%20Water%20Quality%20Standards.pdf>

The Department has relied heavily on EPA recommendations across the board for these proposed standards and criteria. Proposed aquatic life criteria have been adopted directly from the latest EPA recommendations found online at this URL:

<http://water.epa.gov/scitech/swguidance/standards/criteria/current/index.cfm>.

EPA recommendations for certain factors in the Human Health Criteria were retrieved, when available, from the EPA Integrated Risk Information System (IRIS) at this URL: <http://www.epa.gov/iris/>. If those key factors were not published in IRIS, they were gleaned from EPA guidance documents. The Department used EPA Document EPA_822-R-02-012, titled “National Recommended Water Quality Criteria: 2002 Human Health Criteria Calculation Matrix” extensively to compare Delaware and EPA recommendations.

Site-specific criteria for the tidal portion of the Murderkill River were developed after an extensive data collection and modelling effort in the watershed. The project involved Department staff, representatives from Kent County, academia, and other State and Federal agencies. Reports of those efforts and data are online at: <http://whiteclay.wra.udel.edu/murderkill/> . A draft technical report for the Murderkill criteria is available online here:

<http://www.dnrec.delaware.gov/swc/wa/Pages/Watershed%20Assessment%20Surface%20Water%20Quality%20Management.aspx> . When the report is final, it will be posted at the same URL.

Human Health Criteria Calculations

Fish & Shellfish Consumption Rates

The Department has calculated the draft numeric human health criteria in the same way as in the past for most of the chemicals in Table Two of the Standards.

The Department commissioned an extensive survey of Delaware fishermen to estimate the actual consumption rates for fish from Delaware waters. That survey showed that fishermen consumed, on average, approximately 17.5 grams of fish per day from Delaware's fresh and marine waters. This consumption rate was further supported by an EPA nationwide study and recommendation that 17.5 grams per day be used as the basis for water quality criteria calculations. Thus, there is good scientific evidence that 17.5 grams per day is the appropriate fish consumption rate for Delaware and there is no need to distinguish between fresh and marine waters for numeric criteria in which fish consumption is the primary route of exposure for humans.

The oral reference dose (RfD) and or oral cancer potency slope (q1*) are key factors in the formula used to derive human health criteria. Several RfDs and q1*s have changed and those changes are now reflected in revised human health criteria.

Reference Risk Level for Carcinogens:

A primary risk management decision that must be made as a part of developing and adopting water quality standards for the protection of human health is the selection of a reference risk level for carcinogens. It is important to point out that this selection includes social policy considerations as well as substantial scientific evaluation. The Department has retained the use of a reference risk level of 1×10^{-6} (one in one million) from earlier standards reviews for purposes of developing human health criteria for known or suspected human carcinogens.

Equations used for the Development of Proposed Human Health Criteria

The following formulas are unchanged from prior iterations of the Standards. The fish & shellfish consumption rate used for this review has changed as noted in the discussion above. The drinking water consumption rate and body weights assumed in the calculations remain unchanged at 2 liters/day and 70 kilograms respectively. Reference doses and cancer potency slopes are the latest EPA recommended values.

Equations for Systemic Toxicants

The general equation used to calculate a water quality criterion for a systemic toxicant is as follows:

$$Criterion (mg / l) = \frac{(RfD) * (Body Weight)}{(drinking water consumption rate) + [fish \& shellfish consumption rate * (BCF)]}$$

where:

RfD	= reference dose (mg/kg/day)
Body Weight	= 70 kilograms
drinking water consumption rate	= 2 liter/day
fish & shellfish consumption rate	= 17.5 grams/day = 0.0175 kg/day
BCF	= bioconcentration factor (liters/kilogram)

In instances where the above equation yielded a criterion less stringent than the corresponding Primary Maximum Contaminant Level (MCL), the MCL has been proposed for adoption. Such an approach was only taken for surface waters designated as Public Water Supplies. This approach is consistent with recommendations made by the Delaware Division of Public Health and the EPA.

Note that In the case of waters that are not drinking water supplies, the first term in the denominator of the equation presented above is eliminated, leaving the following:

$$Criterion (mg / l) = \frac{(RfD) * (Body Weight)}{fish \& shellfish consumption rate * (BCF)}$$

Equations for Known or Suspected Carcinogens

The general equation used to calculate a water quality criterion for a known or suspected human carcinogen is as follows:

$$Criterion (mg / l) = \frac{(Risk level) * (Body Weight)}{q_1 * [(drinking water consumption rate) + [fish \& shellfish consumption rate * (BCF)]]}$$

where:

Risk_level	= 1x10 ⁻⁶
Body Weight	= 70 kilograms
q ₁ *	= cancer potency slope (mg/kg/day)
drinking water consumption rate	= 2 liter/day
fish & shellfish consumption rate	= 17.5 grams/day = 0.0175 kg/day
BCF	= bioconcentration factor (liters/kilogram)

As before, in instances where the above equation yielded a criterion less stringent than MCL, the MCL has been proposed for adoption.

As before, in the case of waters that are not drinking water supplies, the term involving drinking water in the denominator is eliminated, leaving the following:

$$Criterion (mg/l) = \frac{(Risk\ level) * (Body\ Weight)}{q1 * [fish\ \&\ shellfish\ consumption\ rate * (BCF)]}$$

Calculations were performed as appropriate for toxicants for which sufficient toxicological and bioaccumulation data was available. The results of those calculations are available for review at the Watershed Assessment and Management Section office at 820 Silver Lake Blvd, Suite 220, Dover, DE. Criterion values were incorporated into the proposed Standards.

Summary of Proposed Changes to the 2011 Human Health Criteria.

Pollutant	Systemic Toxicant Values				Human Carcinogens			
	2011 Fish Ingestion	2014 Proposed Fish Ingestion	2011 Fish and Water Ingestion	2014 Proposed Fish and Water Ingestion	2011 Fish Ingestion	Proposed Fish Ingestion	2011 Fish and Water Ingestion	2014 Proposed Fish and Water Ingestion
1,1,2,2-Tetrachloroethane	-	16000	-	670	4	nc	0.17	nc
2,3,7,8-TCDD (Dioxin)(asTEQ)	-	0.0000006	.00003 (MCL)	0.0000005	5.1 E-09	nc	5.0 E-09	nc
Carbon Tetrachloride	150	850	5 (MCL)	nc	1.6	3.0	0.23	0.43
Cyanide	80000	2400	200	21	-	nc	-	nc
Dichloromethane	260000	27000	5 (MCL)	nc	590	2200	4.6	17
Hexachloroethane	46	32	20	14	3.3	1.1	1.4	0.5
Nitrobenzene	690	2800	17	68	--	nc	--	nc
Tetrachloroethylene	1300	780	5 (MCL)	nc	3.3	62	0.69	13
Trichloroethylene	-	190	5 (MCL)	nc	30	8.2	2.5	0.7
Pentachlorophenol	11000	1800	1 (MCL)	nc	3	0.9	0.27	0.08

nc = No Change

Proposed Changes to Aquatic Life Criteria

The Department is proposing changes to Aquatic Life Criteria based on the latest EPA recommendations found online at this URL:

<http://water.epa.gov/scitech/swguidance/standards/criteria/current/index.cfm>

Acrolien : Proposed new criteria for Fresh Waters

Carbaryl : Proposed new criteria for Fresh and Marine Waters

Copper: Proposed amended criteria for Fresh Waters
Diazinon: Proposed new criteria for Fresh and Marine Waters
Tributyltin: Proposed new criteria for Fresh and Marine Waters

Site-Specific Criteria for the Tidal Murderkill River from the Route 1 Bridge to the Confluence with Delaware Bay

The Department is proposing site-specific dissolved oxygen (DO) for the tidal Murderkill River from the Route 1 Bridge to the confluence with Delaware Bay based on a multi-year monitoring and modelling study conducted within the Murderkill River Watershed. Links to the data, reports, and proposed criteria are online at <http://whiteclay.wra.udel.edu/murderkill/>.

Proposed DO criteria changes for the summer months in the tidal Murderkill River are at Section 4.5.2.5. If adopted as proposed, the language formerly in Section 4.5.2.5 will be found in Section 4.5.2.6.

Contact Information

For questions about the proposed Standards, or to request additional information, please contact David Wolanski at david.wolanski@state.de.us or (302) 739-9939.