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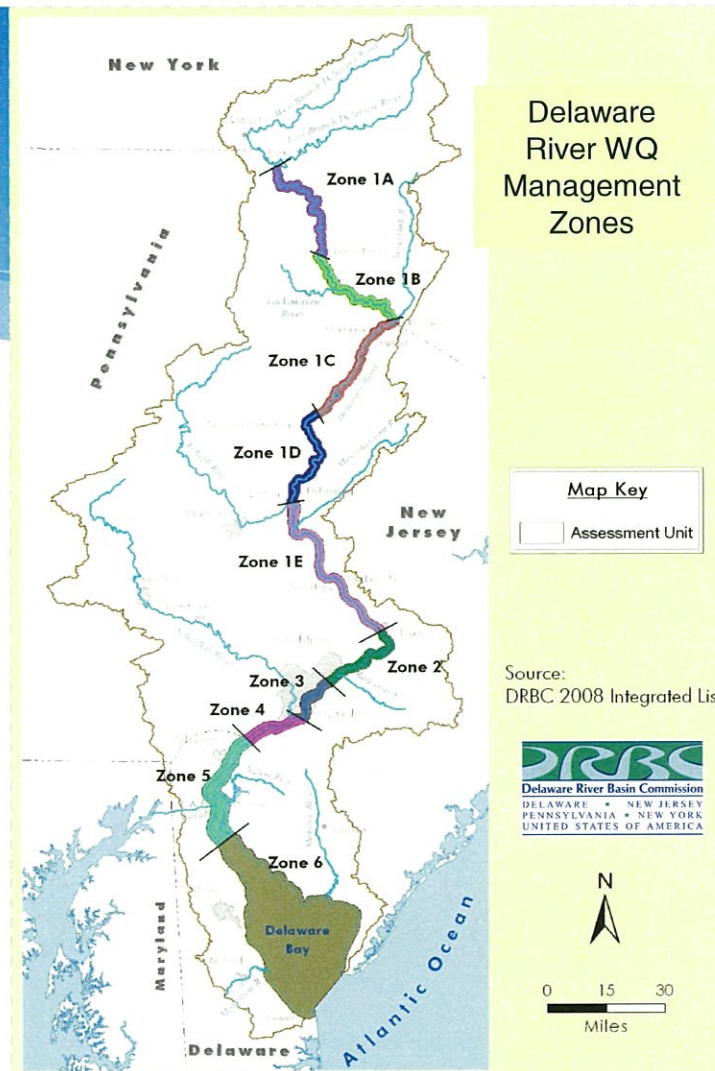
Delaware River Basin Commission

Ammonia Criteria for the Interstate Waters of the Delaware River

Toxics Advisory
Committee

June 23, 2016

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Outline

- ② Brief Review of Technical Background
- ② 2013 National Criteria
- ③ Ammonia Criteria Issues
- ④ Recommendations



Technical Background

pH Dependence

- Considerable evidence indicates that the effects of pH on ammonia toxicity is due to the joint toxicity of un-ionized ammonia and the ammonium ion.
- At very high and low pHs, pH can affect membrane function and other physiological processes that could alter ammonia toxicity.

Temperature Dependence

- Invertebrate criteria are dependent on temperature, being more sensitive at higher temperatures.

Technical Background

☐ Temperature Dependence – Acute Toxicity

- Since the most sensitive genera for acute toxicity are invertebrate species, the criteria are both pH and temperature dependent.
- Fish acute criteria are not dependent on temperature; but below a temperature of 15.7°C, fish are more sensitive than invertebrates. At temperatures below 15.7°C, the CMC is therefore capped at 24.1 mg TAN/L.

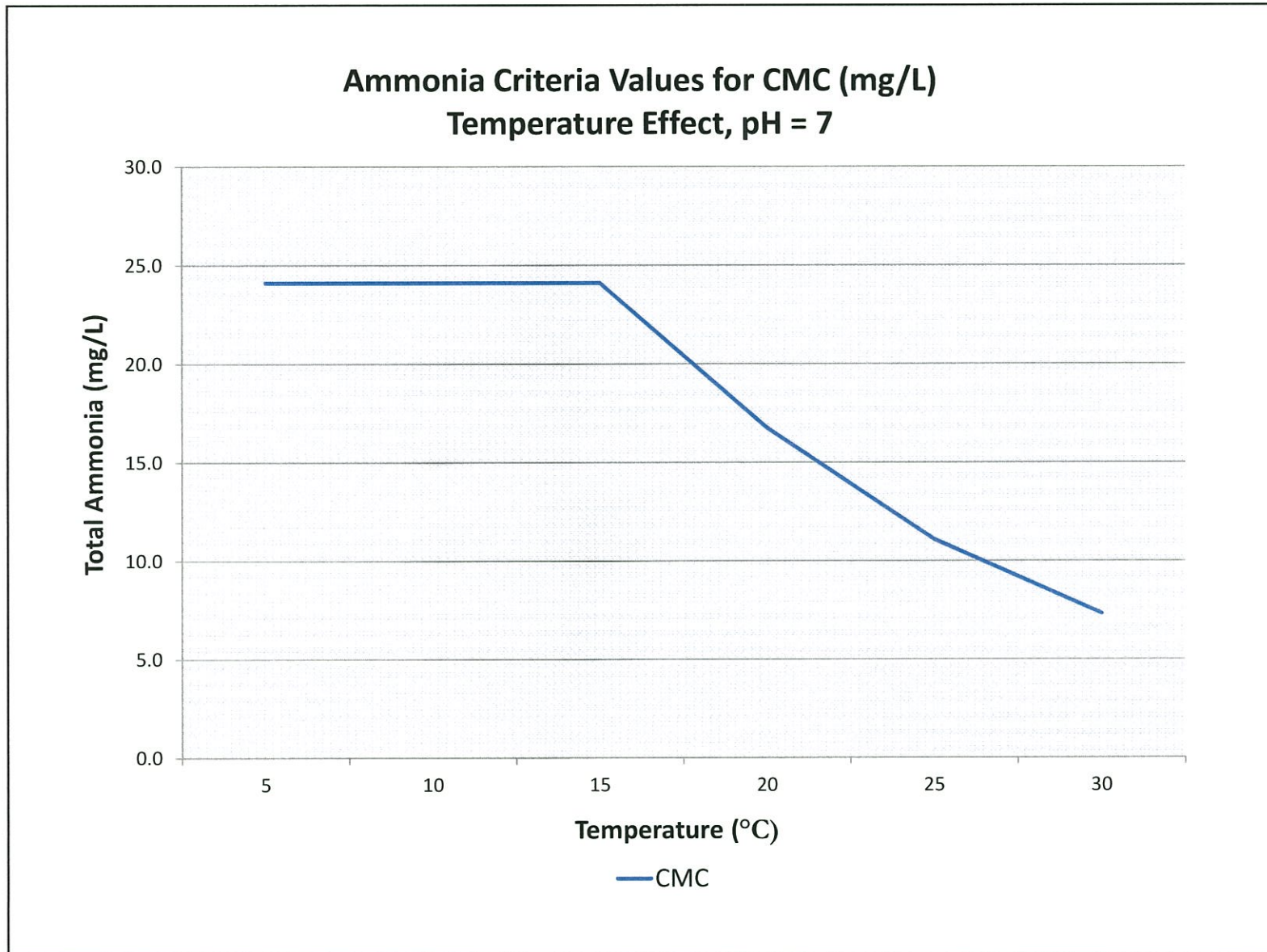


Updated Acute Criteria

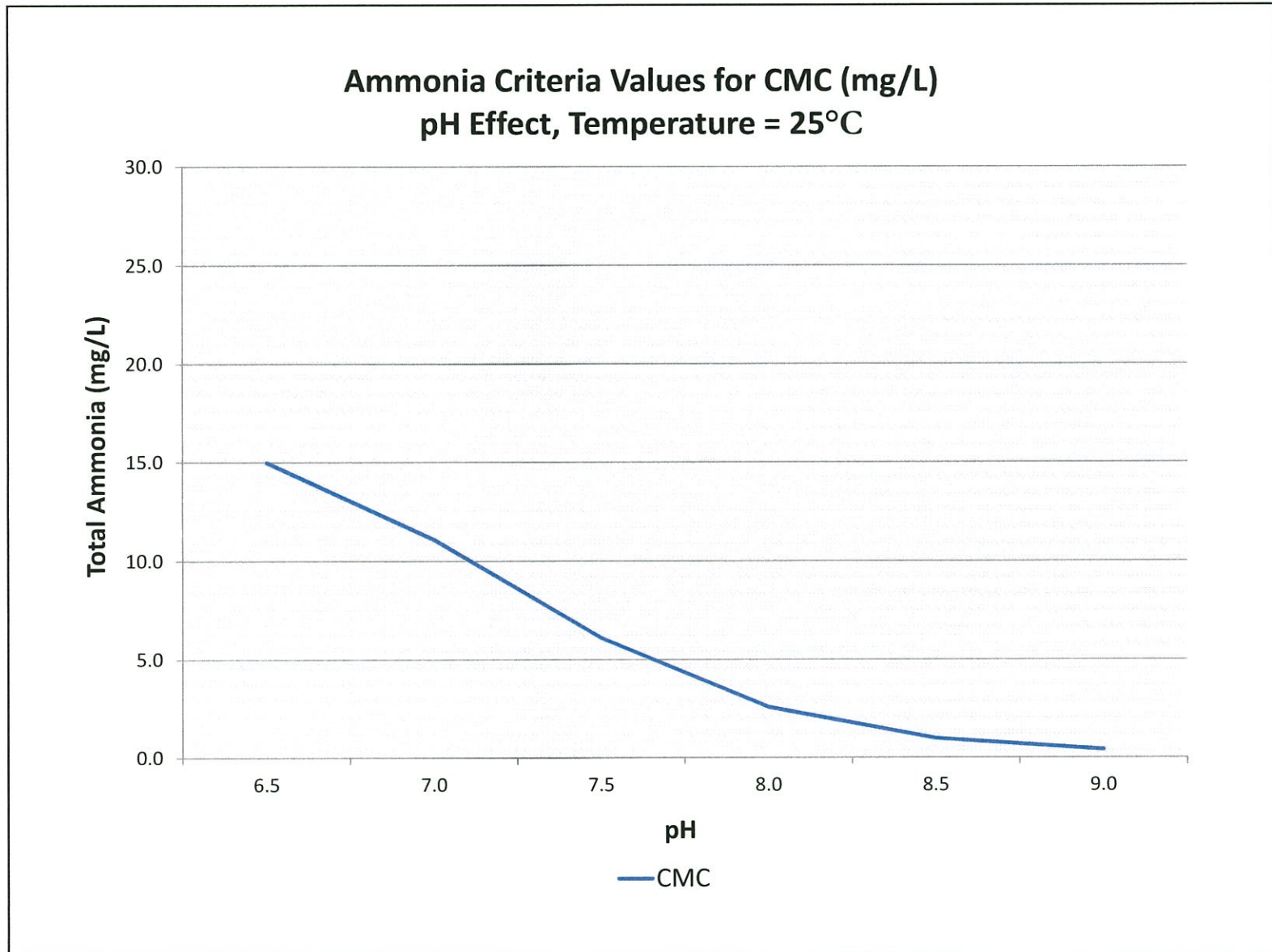
Class	Criteria (mg/L – Total Ammonia)	Value at pH=7 and T=20°C
Full Equation	$\text{CMC} = \text{MIN} \left[\left(\frac{0.275}{1 + 10^{7.204 - \text{pH}}} \right) + \left(\frac{39.0}{1 + 10^{\text{pH} - 7.204}} \right), \left(0.7249 * \left(\frac{0.0114}{1 + 10^{7.204 - \text{pH}}} \right) + \frac{1.6181}{1 + 10^{\text{pH} - 7.204}} \right) * \left(23.12 * 10^{0.036 * (20 - T)} \right) \right]$	17.0

Note: At low temperatures, invertebrates are less sensitive than fish so CMC is capped at 24.1 mg TAN/L at a temperature of 15.7°C and a pH of 7.0.

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Presented to the Toxics Advisory Committee on June 23, 2016

Technical Background

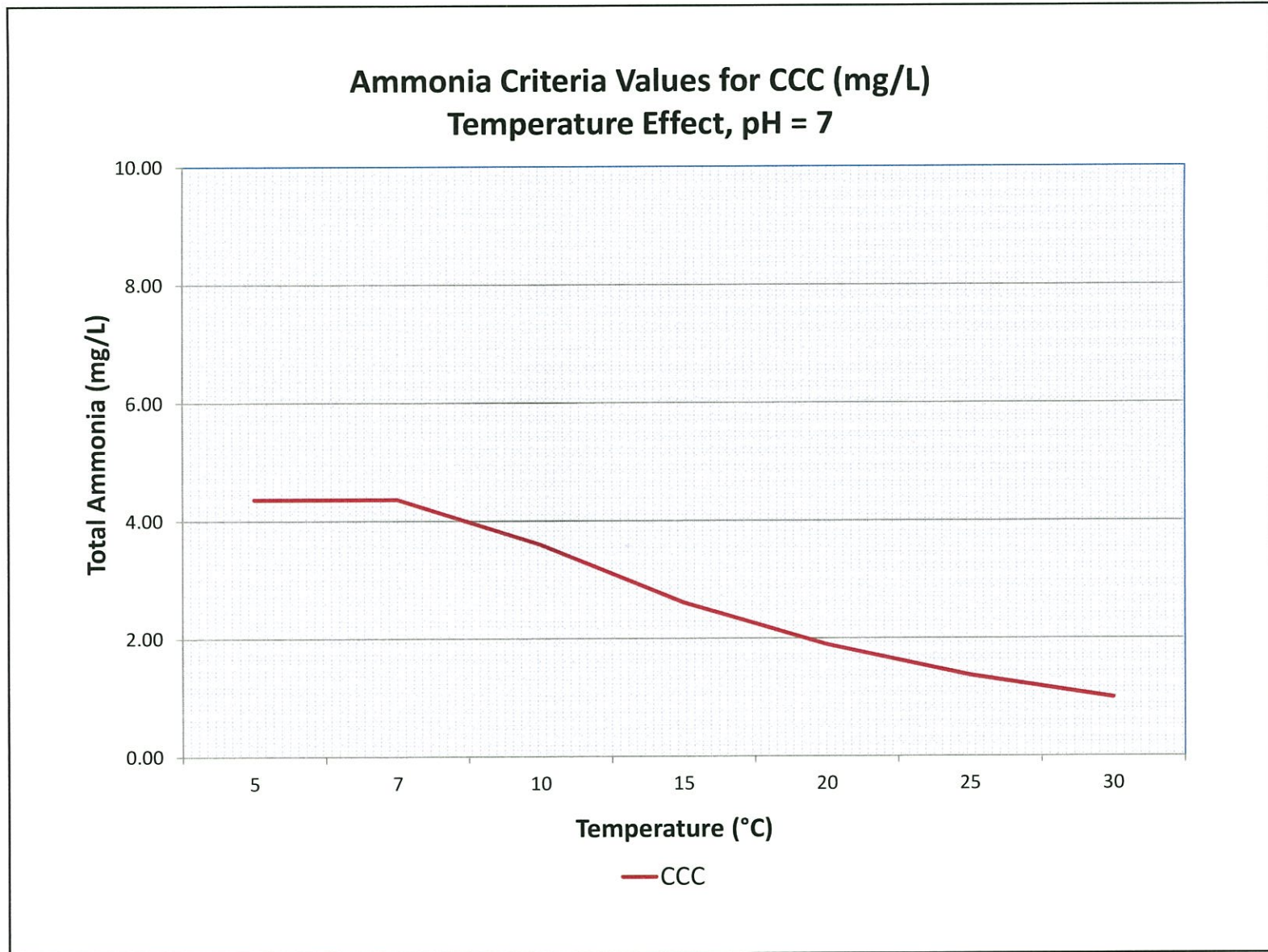
- Temperature Dependence – Chronic Toxicity
 - Since the most sensitive genera for chronic criteria are invertebrate species, the criteria are both pH and temperature dependent.
 - Below a temperature of 7°C, fish are more sensitive than invertebrates. Therefore, at temperatures below 7°C, the CMC is capped at 4.6 mg TAN/L.



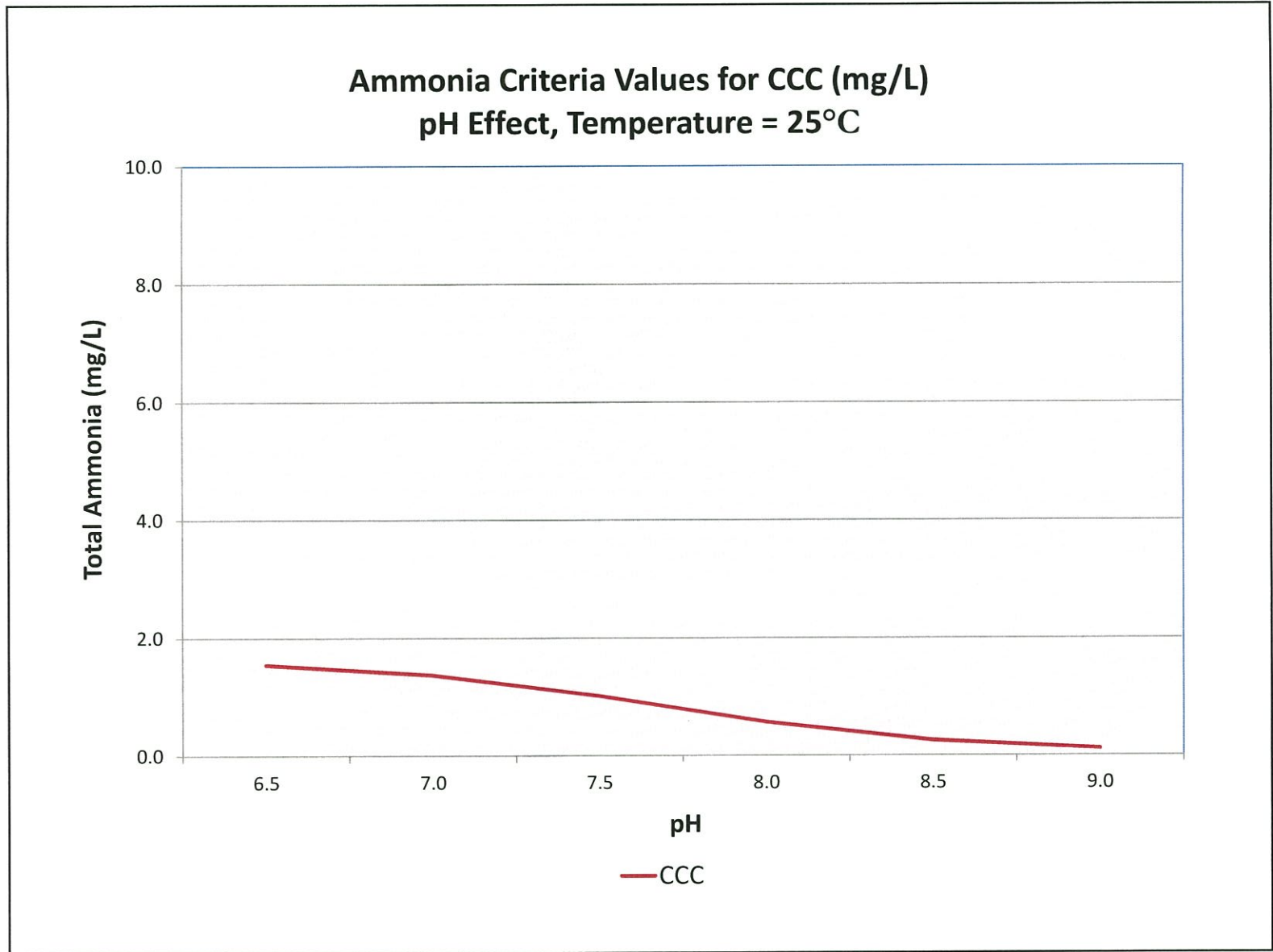
Updated Chronic Criteria

Class	Criteria (mg/L – Total Ammonia)	Value at pH=7 and T=20°C
Full Equation	$CCC = 0.8876 * (0.0278 / (1 + 10^{(7.688 - pH)})) + 1.1994 / (1 + 10^{(pH - 7.688)}) * (2.126 * 10^{(0.028 * (25 - \text{MAX}(T, 7)))})$	1.9
Additional Requirement	Not to exceed 2.5 times the CCC as a 4 day average within the 30 day duration more than once every 3 years.	4.8

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Ammonia Criteria Issues

- ❑ Need uniform criteria for shared waters.
 - States are considering options for state-wide adoption of the new criteria.
 - Implementation policies utilized by states could result in differing criteria.
 - Differing criteria hampers cumulative assessment of multiple discharges.



Ammonia Criteria Issues

Application of criteria:

- pH data or value to be used.
- Temperature data or value to be used.
- Design flows



Preliminary Staff Recommendations

☐ Acute Criteria:

- Adopt 2013 EPA recommended freshwater acute criteria formulas for **total ammonia** for Zones 1 through Zone 5 (above RM 68.75).
- Criteria are related to pH and temperature.
- Assume mussels are present in Zones 1 through 5 given the DRBC biosurvey data in Zone 1 and the PDE data in Zones 2 – 5.
- Duration of criteria – 1 hour



Preliminary Staff Recommendations

Chronic Criteria:

- Adopt EPA recommended chronic criteria formulas for **total ammonia**.
- Criteria are related to both pH and temperature.
- Duration – adopt both 30 day average criteria formula and the 4 day average criterion value.



Preliminary Staff Recommendations

□ Application of Standards:

- Duration – Follow EPA recommendations.
- pH and temperature values – options are:
 1. Utilize site-specific data typically from automatic monitors (for all or specified Zones).
 2. Specify a median pH value of 7.1 (Section 4.20.5A3.) and background temperature specified in Section 4.30.6C.1. for Zones 2, 3 and 4.
 3. Specify a percentile from a frequency distribution of data.

Preliminary Staff Recommendations

□ Application of Standards:

- pH and temperature values – options are:
 4. Specify median pH values for Existing Water Quality (EWQ) at Interstate Control Points (ICPs) in Special Protection Waters in Zones 1A-1E [Section 3.10.3A.2.g.3)].
- Design Flows: per Section 4.30.7B.2.c.b)
 - Acute Criteria – 2500 cfs at Trenton and 7Q10 for other tributaries.
 - Chronic Criteria – 30Q5 flow at both Trenton and for other tributaries.

State Progress

- PA – Triennial Review 2017
 - Adopt national ammonia criteria
 - pH and Temperature – use “instream measurement or best estimates, representative of the median pH and temperature of the receiving stream for the applicable time period and design conditions.” (Dec. 30, 2015 draft)

Staff Recommendations

- Task Toxics Criteria Subcommittee to develop recommendations for pH and temperature values to be used in implementing new criteria.