



pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION



Office of Water Management

Triennial Review of Water Quality Standards TR17 Updates to Chloride Criteria

Water Resources Advisory Committee
November 18, 2015

Tom Wolf, Governor

John Quigley, Secretary

Current Chloride Criterion

- Pennsylvania's existing chloride criterion was developed primarily for the protection of potable water supplies (PWS)
- It is not applied in all waters of this Commonwealth. It is applied only at the point of water supply intake.
- A maximum level of 250 milligrams of chloride per liter of water

▶ Need for Aquatic Life Use Protection

- Numerous toxicity tests show aquatic organisms found in Commonwealth waters are negatively impacted by chloride concentrations that could occur.
- Aquatic life protection must extend statewide to all waters, not just waters at PWS intakes, in order to protect sensitive organisms

History of PA's – Chloride Criterion

- During the **2009 Triennial Review** of Water Quality Standards, the proposed chloride criteria was withdrawn because additional science was under development.
- During the **2013 Triennial Review** of Water Quality Standards, the proposed chloride criteria was withdrawn so DEP could conduct further studies.

2017 Triennial Review

- Initiated and completed chloride toxicity studies on sensitive endemic mayflies. Tests were conducted by Stroud Water Research Center.
- Conducted special surveys and evaluated existing data on the ionic composition of the state's waters.
- EPA approved toxicity tests are now complete for over 60 organisms.

U.S. EPA Toxicological Chloride Dataset

	Species	Genus		Species	Genus		Species	Genus
1	<i>Acipenser oxyrinchus</i>	<i>Acipenser</i>	28	<i>Fundulus kansae</i>	<i>Fundulus</i>	55	<i>Planorbella campanulata</i>	<i>Planorbella</i>
2	<i>Agria sp.</i>	<i>Agria</i>	29	<i>Gambusia affinis</i>	<i>Gambusia</i>	56	<i>Poecilia reticulata</i>	<i>Poecilia</i>
3	<i>Ambystoma maculatum</i>	<i>Ambystoma</i>	30	<i>Gammarus pseudolimnaeus</i>	<i>Gammarus</i>	57	<i>Pseudacris crucifer</i>	<i>Pseudacris</i>
4	<i>Ameiurus melas</i>	<i>Ameiurus</i>	31	<i>Gasterosteus aculeatus</i>	<i>Gasterosteus</i>	58	<i>Pseudacris triseriata</i>	
5	<i>Anguilla rostrata</i>	<i>Anguilla</i>	32	<i>Gyraulus circumstriatus</i>	<i>Gyraulus</i>	59	<i>Salmo trutta</i>	<i>Salmo</i>
6	<i>Brachionus calyciflorus</i>	<i>Brachionus</i>	33	<i>Gyraulus parvus</i>		60	<i>Rana clamitans</i>	<i>Rana</i>
7	<i>Bufo americanus</i>	<i>Bufo</i>	34	<i>Isonychia bicolor</i>	<i>Isonychia</i>	61	<i>Rana sylvatica</i>	
8	<i>Caecidotea communis</i>	<i>Caecidotea</i>	35	<i>Lampsilis fasciola</i>	<i>Lampsilis</i>	62	<i>Sphaerium nitidum</i>	<i>Sphaerium</i>
9	<i>Cambarus sp.</i>	<i>Cambarus</i>	36	<i>Lampsilis siliquoidea</i>		63	<i>Sphaerium simile</i>	
10	<i>Carassius auratus</i>	<i>Carassius</i>	37	<i>Lasmigona complanata</i>	<i>Lasmigona</i>	64	<i>Tubifex tubifex</i>	<i>Tubifex</i>
11	<i>Centroptilum triangulifer</i>	<i>Centroptilum</i>	38	<i>Lepidostoma sp.</i>	<i>Lepidostoma</i>	65	<i>Villosa constricta</i>	<i>Villosa</i>
12	<i>Ceriodaphnia dubia</i>	<i>Ceriodaphnia</i>	39	<i>Lepomis cyanellus</i>	<i>Lepomis</i>	66	<i>Villosa delumbis</i>	
13	<i>Chironomus attenuatus</i>	<i>Chironomus</i>	40	<i>Lepomis macrochirus</i>		67	<i>Villosa iris</i>	
14	<i>Chironomus dilutus</i>		41	<i>Libellulidae</i>	<i>Libellulidae</i>			
15	<i>Crangonyx sp.</i>	<i>Crangonyx</i>	42	<i>Limnodrilus hoffmeisteri</i>	<i>Limnodrilus</i>			
16	<i>Cyprinella leedsii</i>	<i>Cyprinella</i>	43	<i>Lirceus fontinalis</i>	<i>Lirceus</i>			
17	<i>Cyprinella lutrensis</i>		44	<i>Lithobates catesbeianus</i>	<i>Lithobates</i>			
18	<i>Daphnia ambigua</i>	<i>Daphnia</i>	45	<i>Lumbriculus variegatus</i>	<i>Lumbriculus</i>			
19	<i>Daphnia magna</i>		46	<i>Margaritifera falcata</i>	<i>Margaritifera</i>			
20	<i>Daphnia pulex</i>		47	<i>Megalonaisas nervosa</i>	<i>Megalonaisas</i>			
21	<i>Diaptomus clavipes</i>	<i>Diaptomus</i>	48	<i>Musculium transversum</i>	<i>Musculium</i>			
22	<i>Elliptio complanata</i>	<i>Elliptio</i>	49	<i>Nemoura trispinosa</i>	<i>Nemoura</i>			
23	<i>Elliptio lanceolata</i>		50	<i>Nephelopsis obscura</i>	<i>Nephelopsis</i>			
24	<i>Epioblasma brevidens</i>	<i>Epioblasma</i>	51	<i>Oncorhynchus mykiss</i>	<i>Oncorhynchus</i>			
25	<i>Epioblasma capsaeformis</i>		52	<i>Physa gyrina</i>	<i>Physa</i>			
26	<i>E. torulosa rangiana</i>		53	<i>Physa heterostropha</i>				
27	<i>Erpobdella punctata</i>	<i>Erpobdella</i>	54	<i>Pimephales promelas</i>	<i>Pimephales</i>			

Note:

Centroptilum triangulifer (#11)
now known as
Neocloeon triangulifer

Toxicological Study - Chloride

- EPA and Chapter 93 criteria development methodologies were used to derive acute and chronic chloride criteria.
- Data used was from:
 - approved U.S. EPA chloride toxicity dataset
 - results of the Stroud mayfly toxicity tests
- Chloride toxicity is dependent on hardness and sulfate concentrations, making the criteria equation-based

Recommended Aquatic Life Criteria

The recommended, proposed chloride criteria will be calculated using the following equations*:

- Acute Chloride Criterion:
 - One hour average concentration should not exceed, more than once in three years
 - Acute Criterion (mg/L) = $349(\text{Hardness})^{0.205797}(\text{Sulfate})^{-0.07452}$
- Chronic Chloride Criterion:
 - Four day average concentration should not exceed, more than once in three years
 - Chronic Criterion (mg/L) = $112.7(\text{Hardness})^{0.205797}(\text{Sulfate})^{-0.07452}$

**Hardness and sulfate coefficients based on studies done by the Great Lakes Environmental Center*

Example Calculations

Hardness mg/l	SO4 mg/l	Chronic Criteria mg/l	Acute Criteria mg/l
25	10	184	570
50	10	212	658
100	10	245	758
150	10	266	824
25	20	175	541
50	20	202	624
100	20	233	720
150	20	253	783



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Questions?

Rodney Kime
Bureau of Point and Non-Point Source
Management
rkime@pa.gov
(717) 787-9637