

Part I. Surface Water Standards with General, Statewide Application

9VAC25-260-155. Ammonia surface water quality criteria.

A. The Department of Environmental Quality, after consultation with the Virginia Department of Wildlife Resources and the U.S. Fish and Wildlife Service, has determined that the majority of Virginia freshwaters are likely to contain, or have contained in the past, freshwater mussel species in the family Unionidae and contain early life stages of fish during most times of the year. Therefore, the ammonia criteria presented in subsections B and C of this section are designed to provide protection to these species and life stages. In an instance where it can be adequately demonstrated that either freshwater mussels or early life stages of fish are not present in a specific waterbody, potential options for alternate, site-specific criteria are presented in subsection D of this section. Acute criteria are a one-hour average concentration not to be exceeded more than once every three years¹ on the average, and chronic criteria are 30-day average concentrations not to be exceeded more than once every three years on the average.² In addition, the four-day average concentration of total ammonia nitrogen (in mg N/L) shall not exceed 2.5 times the chronic criterion within a 30-day period more than once every three years on the average.

¹The default design flow for calculating steady state wasteload allocations for the acute ammonia criterion for freshwater is the 1Q10 (see 9VAC25-260-140 B footnote 6) unless statistically valid methods are employed that demonstrate compliance with the duration and return frequency of the water quality criteria.

²The default design flow for calculating steady state wasteload allocations for the chronic ammonia criterion for freshwater is the 30Q10 (see 9VAC25-260-140 B footnote 6) unless statistically valid methods are employed which demonstrate compliance with the duration and return frequency of the water quality criteria.

B. The acute criteria for total ammonia (in mg N/L) for freshwaters with trout absent or present are in the following tables:

Acute Ammonia Freshwater Criteria Total Ammonia Nitrogen (mg N/L) TROUT ABSENT																					
Temperature (°C)																					
pH	0-10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
6.5	51	48	44	41	37	34	32	29	27	25	23	21	19	18	16	15	14	13	12	11	9.9

<div><div>6</div><div>·</div><div>6</div></div>	49	4 6	4 2	3 9	3 6	33	30	28	26	24	22	20	18	17	16	14	13	12	11	10	9. 5
<div><div>6</div><div>·</div><div>7</div></div>	46	4 4	4 0	3 7	3 4	31	29	27	24	22	21	19	18	16	15	14	13	12	11	9. 8	9. 0
<div><div>6</div><div>·</div><div>8</div></div>	44	4 1	3 8	3 5	3 2	30	27	25	23	21	20	18	17	15	14	13	12	11	10	9. 2	8. 5
<div><div>6</div><div>·</div><div>9</div></div>	41	3 8	3 5	3 2	3 0	28	25	23	21	20	18	17	15	14	13	12	11	10	9. 4	8. 6	7. 9
<div><div>7</div><div>·</div><div>0</div></div>	38	3 5	3 3	3 0	2 8	25	23	21	20	18	17	15	14	13	12	11	10	9. 4	8. 6	7. 9	7. 3
<div><div>7</div><div>·</div><div>1</div></div>	34	3 2	3 0	2 7	2 5	23	21	20	18	17	15	14	13	12	11	10	9. 3	8. 5	7. 9	7. 2	6. 7
<div><div>7</div><div>·</div><div>2</div></div>	31	2 9	2 7	2 5	2 3	21	19	18	16	15	14	13	12	11	9. 8	9. 1	8. 3	7. 7	7. 1	6. 5	6. 0
<div><div>7</div><div>·</div><div>3</div></div>	27	2 6	2 4	2 2	2 0	18	17	16	14	13	12	11	10	9. 5	8. 7	8. 0	7. 4	6. 8	6. 3	5. 8	5. 3
<div><div>7</div><div>·</div><div>4</div></div>	24	2 2	2 1	1 9	1 8	16	15	14	13	12	11	9. 8	9. 0	8. 3	7. 7	7. 0	6. 5	6. 0	5. 5	5. 1	4. 7
<div><div>7</div><div>·</div><div>5</div></div>	21	1 9	1 8	1 7	1 5	14	13	12	11	10	9. 2	8. 5	7. 8	7. 2	6. 6	6. 1	5. 6	5. 2	4. 8	4. 4	4. 0
<div><div>7</div><div>·</div><div>6</div></div>	18	1 7	1 5	1 4	1 3	12	11	10	9. 3	8. 6	7. 9	7. 3	6. 7	6. 2	5. 7	5. 2	4. 8	4. 4	4. 1	3. 8	3. 5
<div><div>7</div><div>·</div><div>7</div></div>	15	1 4	1 3	1 2	1 1	10	9. 3	8. 6	7. 9	7. 3	6. 7	6. 2	5. 7	5. 2	4. 8	4. 4	4. 1	3. 8	3. 5	3. 2	2. 9
<div><div>7</div><div>·</div><div>8</div></div>	13	1 2	1 1	1 0	9 · 3	8. 5	7. 9	7. 2	6. 7	6. 1	5. 6	5. 2	4. 8	4. 4	4. 0	3. 7	3. 4	3. 2	2. 9	2. 7	2. 5
<div><div>7</div><div>·</div><div>9</div></div>	11	9 · 9	9 · 1	8 · 4	7 · 7	7. 1	6. 6	3. 0	5. 6	5. 1	4. 7	4. 3	4. 0	3. 7	3. 4	3. 1	2. 9	2. 6	2. 4	2. 2	2. 1
<div><div>8</div><div>·</div><div>0</div></div>	8. 8	8 · 2	7 · 6	7 · 0	6 · 4	5. 9	5. 4	5. 0	4. 6	4. 2	3. 9	3. 6	3. 3	3. 0	2. 8	2. 6	2. 4	2. 2	2. 0	1. 9	1. 7
<div><div>8</div><div>·</div><div>1</div></div>	7.	6	6	5	5	4.	4.	4.	3.	3.	3.	3.	2.	2.	2.	2.	2.	1.	1.	1.	1.

1	2	8	3	8	3	9	5	1	8	5	2	0	7	5	3	1	0	8	7	5	4
8	6.	5	5	4	4	4.	3.	3.	3.	2.	2.	2.	2.	2.	1.	1.	1.	1.	1.	1.	1.
2	0	6	2	8	4	0	7	4	1	9	7	4	3	1	9	8	6	5	4	3	2
8	4.	4	4	3	3	3.	3.	2.	2.	2.	2.	2.	1.	1.	1.	1.	1.	1.	1.	1.	0.
3	9	6	3	9	6	3	1	8	6	4	2	0	9	7	6	4	3	2	1	0	96
8	4.	3	3	3	3	2.	2.	2.	2.	2.	1.	1.	1.	1.	1.	1.	1.	1.	0.	0.	0.
4	1	8	5	2	0	7	5	3	1	0	8	7	5	4	3	2	1	0	93	86	79
8	3.	3	2	2	2	2.	2.	1.	1.	1.	1.	1.	1.	1.	1.	0.	0.	0.	0.	0.	0.
5	3	1	9	7	4	3	1	9	8	6	5	4	3	2	1	98	90	83	77	71	65
8	2.	2	2	2	2	1.	1.	1.	1.	1.	1.	1.	1.	0.	0.	0.	0.	0.	0.	0.	0.
6	8	6	4	2	0	9	7	6	5	3	2	1	0	96	88	81	75	69	63	58	54
8	2.	2	2	1	1	1.	1.	1.	1.	1.	1.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
7	3	2	0	8	7	6	4	3	2	1	0	94	87	80	74	68	62	57	53	49	45
8	1.	1	1	1	1	1.	1.	1.	1.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
8	9	8	7	5	4	3	2	1	0	93	86	79	73	67	62	57	52	48	44	41	37
8	1.	1	1	1	1	1.	1.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
9	6	5	4	3	2	1	0	93	85	79	72	67	61	56	52	48	44	40	37	34	32
9	1.	1	1	1	1	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0	4	3	2	1	0	93	86	79	73	67	62	57	52	48	44	41	37	34	32	29	27

Acute Ammonia Freshwater Criteria Total Ammonia Nitrogen (mg N/L)																				
TROUT PRESENT																				
Temperature (°C)																				
pH	0-14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30			
6.5	33	33	32	29	27	25	23	21	19	18	16	15	14	13	12	11	9.9			
6.6	31	31	30	28	26	24	22	20	18	17	16	14	13	12	11	10	9.5			
6.7	30	30	29	27	24	22	21	19	18	16	15	14	13	12	11	9.8	9.0			
6.8	28	28	27	25	23	21	20	18	17	15	14	13	12	11	10	9.2	8.5			
6.	26	26	25	23	21	20	18	17	15	14	13	12	11	10	9.4	8.6	7.9			

9																	
7.0	24	24	23	21	20	18	17	15	14	13	12	11	10	9.4	8.6	8.0	7.3
7.1	22	22	21	20	18	17	15	14	13	12	11	10	9.3	8.5	7.9	7.2	6.7
7.2	20	20	19	18	16	15	14	13	12	11	9.8	9.1	8.3	7.7	7.1	6.5	6.0
7.3	18	18	17	16	14	13	12	11	10	9.5	8.7	8.0	7.4	6.8	6.3	5.8	5.3
7.4	15	15	15	14	13	12	11	9.8	9.0	8.3	7.7	7.0	6.5	6.0	5.5	5.1	4.7
7.5	13	13	13	12	11	10	9.2	8.5	7.8	7.2	6.6	6.1	5.6	5.2	4.8	4.4	4.0
7.6	11	11	11	10	9.3	8.6	7.9	7.3	6.7	6.2	5.7	5.2	4.8	4.4	4.1	3.8	3.5
7.7	9.6	9.6	9.3	8.6	7.9	7.3	6.7	6.2	5.7	5.2	4.8	4.4	4.1	3.8	3.5	3.2	3.0
7.8	8.1	8.1	7.9	7.2	6.7	6.1	5.6	5.2	4.8	4.4	4.0	3.7	3.4	3.2	2.9	2.7	2.5
7.9	6.8	6.8	6.6	6.0	5.6	5.1	4.7	4.3	4.0	3.7	3.4	3.1	2.9	2.6	2.4	2.2	2.1
8.0	5.6	5.6	5.4	5.0	4.6	4.2	3.9	3.6	3.3	3.0	2.8	2.6	2.4	2.2	2.0	1.9	1.7
8.1	4.6	4.6	4.5	4.1	3.8	3.5	3.2	3.0	2.7	2.5	2.3	2.1	2.0	1.8	1.7	1.5	1.4
8.2	3.8	3.8	3.7	3.5	3.1	2.9	2.7	2.4	2.3	2.1	1.9	1.8	1.6	1.5	1.4	1.3	1.2
8.3	3.1	3.1	3.1	2.8	2.6	2.4	2.2	2.0	1.9	1.7	1.6	1.4	1.3	1.2	1.1	1.0	0.9 6
8.4	2.6	2.6	2.5	2.3	2.1	2.0	1.8	1.7	1.5	1.4	1.3	1.2	1.1	1.0	0.9 3	0.8 6	0.7 9
8.5	2.1	2.1	2.1	1.9	1.8	1.6	1.5	1.4	1.3	1.2	1.1	0.9 8	0.9 0	0.8 3	0.7 7	0.7 1	0.6 5
8.6	1.8	1.8	1.7	1.6	1.5	1.3	1.2	1.1	1.0	0.9 6	0.8 8	0.8 1	0.7 5	0.6 9	0.6 3	0.5 9	0.5 4
8.7	1.5	1.5	1.4	1.3	1.2	1.1	1.0	0.9 4	0.8 7	0.8 0	0.7 4	0.6 8	0.6 2	0.5 7	0.5 3	0.4 9	0.4 5
8.8	1.2	1.2	1.2	1.1	1.0	0.9 3	0.8 6	0.7 9	0.7 3	0.6 7	0.6 2	0.5 7	0.5 2	0.4 8	0.4 4	0.4 1	0.3 7
8.9	1.0	1.0	1.0	0.9 3	0.8 5	0.7 9	0.7 2	0.6 7	0.6 1	0.5 6	0.5 2	0.4 8	0.4 4	0.4 0	0.3 7	0.3 4	0.3 2
9.0	0.8 8	0.8 8	0.8 6	0.7 9	0.7 3	0.6 7	0.6 2	0.5 7	0.5 2	0.4 8	0.4 4	0.4 1	0.3 7	0.3 4	0.3 2	0.2 9	0.2 7

The acute criteria for trout present shall apply to all Class V-Stockable Trout Waters and Class VI-Natural Trout Waters as listed in 9VAC25-260-390 through 9VAC25-260-540. The acute criteria for trout absent apply to all other fresh waters.

To calculate total ammonia nitrogen acute criteria values in freshwater at different pH values than those listed in this subsection, use the following equations and round the result to two significant digits:

Where trout are absent:

Acute Criterion Concentration (mg N/L) =

$$0.7249 \times \left(\frac{0.0114}{1 + 10^{7.204 - \text{pH}}} + \frac{1.6181}{1 + 10^{\text{pH} - 7.204}} \right) \times \text{MIN}$$

Where MIN = 51.93 or $23.12 \times 10^{0.036 \times (20 - T)}$, whichever is less

T = Temperature in °C

Or where trout are present, whichever of the following calculation results is less:

Acute Criterion Concentration (mg N/L) =

$$\left(\frac{0.275}{1 + 10^{7.204 - \text{pH}}} + \frac{39.0}{1 + 10^{\text{pH} - 7.204}} \right)$$

or

$$0.7249 \times \left(\frac{0.0114}{1 + 10^{7.204 - \text{pH}}} + \frac{1.6181}{1 + 10^{\text{pH} - 7.204}} \right) \times (23.12 \times 10^{0.036 \times (20 - T)})$$

T = Temperature in °C

C. The chronic criteria for total ammonia nitrogen (in mg N/L) where freshwater mussels and early life stages of fish are present in freshwater are in the following table:

Chronic Ammonia Freshwater Criteria Mussels and Early Life Stages of Fish Present Total Ammonia Nitrogen (mg N/L)																								
Temperature (°C)																								
pH	0	8	9	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	3	
H	-			0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0
7																								
6	4	4	4	4	3	3	3	3	2	2	2	2	2	2	1	1	1	1	1	1	1	1	1	
5	9	6	3	1	8	6	3	1	9	8	6	4	3	1	0	9	8	6	5	5	4	3	2	1
6	4	4	4	4	3	3	3	3	2	2	2	2	2	2	1	1	1	1	1	1	1	1	1	
6	8	5	3	0	8	5	3	1	9	7	5	4	2	1	0	8	7	6	5	4	3	3	2	1

6	4	4	4	3	3	3	3	3	2	2	2	2	2	2	1	1	1	1	1	1	1	1	1	1
.	8	5	2	9	7	5	2	0	8	7	5	3	2	1	9	8	7	6	5	4	3	2	2	1
6	4	4	4	3	3	3	3	3	2	2	2	2	2	2	1	1	1	1	1	1	1	1	1	1
.	6	4	1	8	6	4	2	0	8	6	4	3	1	0	9	8	7	6	5	4	3	2	1	1
6	4	4	4	3	3	3	3	2	2	2	2	2	2	2	1	1	1	1	1	1	1	1	1	1
.	5	2	0	7	5	3	1	9	7	5	4	2	1	0	8	7	6	5	4	3	2	2	1	0
7	4	4	3	3	3	3	3	2	2	2	2	2	2	1	1	1	1	1	1	1	1	1	1	0
.	4	1	8	6	4	2	0	8	6	4	3	2	0	9	8	7	6	5	4	3	2	1	1	9
7	4	3	3	3	3	3	2	2	2	2	2	2	1	1	1	1	1	1	1	1	1	1	1	0
.	2	9	7	5	2	0	8	7	5	3	2	1	9	8	7	6	5	4	3	2	2	1	0	9
7	4	3	3	3	3	2	2	2	2	2	2	2	1	1	1	1	1	1	1	1	1	1	0	0
.	0	7	5	3	1	9	7	5	4	2	1	0	8	7	6	5	4	3	3	2	1	0	9	9
7	3	3	3	3	2	2	2	2	2	2	2	1	1	1	1	1	1	1	1	1	1	0	0	0
.	8	5	3	1	9	7	6	4	2	1	0	8	7	6	5	4	3	3	2	1	0	9	9	8
7	3	3	3	2	2	2	2	2	2	2	1	1	1	1	1	1	1	1	1	1	0	0	0	0
.	5	3	1	9	7	5	4	2	1	0	8	7	6	5	4	3	3	2	1	0	9	9	8	7
7	3	3	2	2	2	2	2	2	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0
.	9	8	6	4	3	1	0	9	8	6	5	4	4	3	2	1	1	9	9	8	8	7	7	6
7	2	2	2	2	2	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
.	6	4	3	2	0	9	8	7	6	5	4	3	2	1	1	0	9	8	8	7	7	6	6	6
7	2	2	2	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0
.	3	2	1	9	8	7	6	5	4	3	2	2	1	0	9	8	8	7	7	6	6	5	5	5
7	2	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
.	1	9	8	7	6	5	4	3	2	2	1	0	9	8	8	7	7	6	6	5	5	5	5	4

													5	9	4	9	4	9	5	1	7	3	0	7
8	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	8	7	6	5	4	3	2	1	1	0	9	8	8	7	7	6	6	6	5	5	5	4	4	4
											4	8	3	8	3	8	4	0	6	3	0	4	4	1
8	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1	5	5	4	3	2	1	1	9	9	8	8	7	7	6	6	5	5	5	4	4	4	4	3	3
								9	2	7	1	6	1	7	3	9	5	2	9	6	3	0	8	5
8	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	3	2	2	1	0	9	9	8	7	7	7	6	6	5	5	5	4	4	4	3	3	3	3	3
						6	0	4	9	4	0	5	1	7	4	0	7	4	2	9	7	4	2	0
8	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	1	1	9	9	8	8	7	7	6	6	5	5	5	4	4	4	4	3	3	3	3	2	2	2
			9	3	7	2	6	2	7	3	9	5	2	9	6	3	0	8	5	3	1	9	7	6
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	9	8	8	7	7	6	6	6	5	5	5	4	4	4	3	3	3	3	3	2	2	2	2	2
	5	9	4	9	4	9	5	1	7	3	0	7	4	1	9	6	4	2	0	8	6	5	3	2
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	8	7	7	6	6	5	5	5	4	4	4	4	3	3	3	3	2	2	2	2	2	2	2	1
	0	5	1	7	2	8	5	1	8	5	2	0	7	5	3	1	9	7	5	4	2	1	0	8
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	6	6	6	5	5	4	4	4	4	3	3	3	3	2	2	2	2	2	2	2	1	1	1	1
	8	4	0	6	3	9	6	3	1	8	6	3	1	9	8	6	4	3	1	0	9	8	6	5
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	5	5	5	4	4	4	3	3	3	3	3	2	2	2	2	2	2	1	1	1	1	1	1	1
	7	4	1	7	4	2	9	7	4	2	0	8	7	5	3	2	1	9	8	7	6	5	4	3
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	4	4	4	4	3	3	3	3	2	2	2	2	2	2	2	1	1	1	1	1	1	1	1	1
	9	6	3	0	8	5	3	1	9	7	6	4	3	1	0	9	7	6	5	4	3	3	2	1
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	4	3	3	3	3	3	2	2	2	2	2	2	1	1	1	1	1	1	1	1	1	1	1	0
	2	9	7	4	2	0	8	7	5	3	2	1	9	8	7	6	5	4	3	2	2	1	0	9
9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	3	3	3	3	2	2	2	2	2	2	1	1	1	1	1	1	1	1	1	1	1	0	0	0
	6	4	2	0	8	6	4	3	1	0	9	8	7	6	5	4	3	2	1	1	0	9	9	8

To calculate total ammonia nitrogen chronic criteria values in freshwater when freshwater mussels and early life stages of fish are present at different pH and temperature values than

those listed in this subsection, use the following equation and round the result to two significant digits:

Chronic Criteria Concentration =

$$10^{7.6-88-\text{pH}} \times 0.8876 \times \left(\frac{0.0278}{1 + 10^{\text{pH}-7.688}} + \frac{1.1994}{1} \right) \times (2.126 \times 10^{0.028 \times (20 - \text{MAX}(T, 7)))}$$

Where MAX = 7 or temperature in degrees Celsius, whichever is greater

T = temperature in °C

D. Site-specific considerations and alternate criteria. If it can be adequately demonstrated that freshwater mussels or early life stages of fish are not present at a site, then alternate site-specific criteria can be considered using the information provided in this subsection. Recalculated site-specific criteria shall provide for the attainment and maintenance of the water quality standards of downstream waters.

1. Site-specific modifications to the ambient water quality criteria for ammonia to account for the absence of freshwater mussels or early life stages of fish shall be conducted in accordance with the procedures contained in this subdivision. Because the department presumes that most state waterbodies have freshwater mussels and early life stages of fish present during most times of the year, the criteria shall be calculated assuming freshwater mussels and early life stages of fish are present using subsections B and C of this section unless the following demonstration that freshwater mussels or early life stages of fish are absent is successfully completed. Determination of the absence of freshwater mussels requires special field survey methods. This determination must be made after an adequate survey of the waterbody is conducted by an individual certified by the Virginia Department of Wildlife Resources for freshwater mussel identification and surveys. Determination of absence of freshwater mussels will be done in consultation with the Department of Wildlife Resources. Early life stages of fish are defined in subdivision 2 of this subsection. Modifications to the ambient water quality criteria for ammonia based on the presence or absence of early life stages of fish shall only apply at temperatures below 15°C.

a. During the review of any new or existing activity that has a potential to discharge ammonia in amounts that may cause or contribute to a violation of the ammonia criteria contained in subsection B of this section, the department may examine data from the following approved sources in subdivisions 1 a (1) through (5) of this subsection or may require the gathering of data in accordance with subdivisions 1 a (1) through (5) on the presence or absence of early life stages of fish in the affected waterbody.

(1) Species and distribution data contained in the Virginia Department of Wildlife Resources Wildlife Information System database.

(2) Species and distribution data contained in Freshwater Fishes of Virginia, 1994.

(3) Data and fish species distribution maps contained in Handbook for Fishery Biology, Volume 3, 1997.

(4) Field data collected in accordance with U.S. EPA's Rapid Bioassessment Protocols for Use in Streams and Wadeable Rivers, Second Edition, EPA 841-B-99-002. Field data must comply with all quality assurance and quality control criteria.

(5) The American Society for Testing and Materials (ASTM) Standard E-1241-88, Standard Guide for Conducting Early Life-Stage Toxicity Tests with Fishes.

b. If data or information from sources other than subdivisions 1 a (1) through (5) of this subsection are considered, then any resulting site-specific criteria modifications shall be reviewed and adopted in accordance with the site-specific criteria provisions in 9VAC25-260-140 D and submitted to EPA for review and approval.

c. If the department determines that the data and information obtained from subdivisions 1 a (1) through (5) of this subsection demonstrate that there are periods of each year when no early life stages are expected to be present for any species of fish that occur at the site, the department shall issue a notice to the public and make available for public comment the supporting data and analysis along with the department's preliminary decision to authorize the site-specific modification to the ammonia criteria. Such information shall include, at a minimum:

(1) Sources of data and information.

(2) List of fish species that occur at the site as defined in subdivision 3 of this subsection.

(3) Definition of the site. Definition of a "site" can vary in geographic size from a stream segment to a watershed to an entire eco-region.

(4) Duration of early life stage for each species in subdivision 1 c (2) of this subsection.

(5) Dates when early life stages of fish are expected to be present for each species in subdivision 1 c (2) of this subsection.

(6) Based on subdivision 1 c (5) of this subsection, identify the dates (beginning date, ending date), if any, where no early life stages are expected to be present for any of the species identified in subdivision 1 c (2) of this subsection.

d. If, after reviewing the public comments received in subdivision 1 c of this subsection and supporting data and information, the department determines that there are times of the year when no early life stages are expected to be present for any fish species that occur at the site, then the applicable ambient water quality criteria for ammonia for those time periods shall be calculated using the table in this subsection, or the formula for calculating the chronic criterion concentration for ammonia when early life stages of fish are absent.

e. The department shall maintain a comprehensive list of all sites where the department has determined that early life stages of fish are absent. For each site the list will identify the waterbodies affected and the corresponding times of the year that early life stages of fish are absent. This list is available either upon request from the Office of Water Quality

Programs at 1111 East Main Street, Suite 1400 Richmond, VA 23219, or from the department website at <https://www.deq.virginia.gov/our-programs/water/water-quality/standards> .

2. The duration of the "early life stages" extends from the beginning of spawning through the end of the early life stages. The early life stages include the prehatch embryonic period, the post-hatch free embryo or yolk-sac fry, and the larval period, during which the organism feeds. Juvenile fish, which are anatomically similar to adults, are not considered an early life stage. The duration of early life stages can vary according to fish species. The department considers the sources of information in subdivisions 1 a (1) through (5) of this subsection to be the only acceptable sources of information for determining the duration of early life stages of fish under this procedure.
3. "Occur at the site" includes the species, genera, families, orders, classes, and phyla that are usually present at the site; are present at the site only seasonally due to migration; are present intermittently because they periodically return to or extend their ranges into the site; or were present at the site in the past or are present in nearby bodies of water, but are not currently present at the site due to degraded conditions, and are expected to return to the site when conditions improve. "Occur at the site" does not include taxa that were once present at the site but cannot exist at the site now due to permanent physical alteration of the habitat at the site.
4. Any modifications to ambient water quality criteria for ammonia in subdivision 1 of this subsection shall not likely jeopardize the continued existence of any federal or state listed, threatened, or endangered species or result in the destruction or adverse modification of such species' critical habitats.
5. Site-specific modifications to the ambient water quality criteria for ammonia to account for the absence of freshwater mussels shall be conducted in accordance with the procedures contained in this subsection. Because the department presumes that most state waterbodies have freshwater mussel species, the criteria shall be calculated assuming mussels are present using subsections B and C of this section unless the demonstration that freshwater mussels are absent is successfully completed and accepted by DEQ and the Department of Wildlife Resources.
6. Equations for calculating ammonia criteria for four different site-specific scenarios are provided in subdivisions 6 a through d of this subsection as follows: (i) acute criteria when mussels are absent but trout are present, (ii) acute criteria when mussels and trout are absent, (iii) chronic criteria when mussels are absent and early life stages of fish are present, and (iv) chronic criteria when mussels and early life stages of fish are absent. Additional information regarding site-specific criteria can be reviewed in appendix N (pages 225-242) of the EPA Aquatic Life Ambient Water Quality Criteria to Ammonia--Freshwater 2013 (EPA 822-R-13-001).
 - a. Acute criteria: freshwater mussels absent and trout present. To calculate total ammonia nitrogen acute criteria values (in mg N/L) in freshwater with freshwater mussels absent (procedures for making this determination are in subdivisions 1 through 5 of this subsection) and trout present, use the following equations. The acute criterion is the lesser

of the following calculation results. Round the result to two significant digits.

$$\left(\frac{0.275}{1 + 10^{7.204 - \text{pH}}} + \frac{39}{1 + 10^{\text{pH} - 7.204}} \right)$$

or

$$0.7249 \times \left(\frac{0.0114}{1 + 10^{7.204 - \text{pH}}} + \frac{1.6181}{1 + 10^{\text{pH} - 7.204}} \right) \times (62.15 \times 10^{0.036 \times (20 - T)})$$

b. Acute criteria: freshwater mussels absent and trout absent. To calculate total ammonia nitrogen acute criteria values (in mg N/L) in freshwater where freshwater mussels are absent and trout are absent, use the following equation. Round the result to two significant digits.

$$0.7249 \times \left(\frac{0.0114}{1 + 10^{7.204 - \text{pH}}} + \frac{1.6181}{1 + 10^{\text{pH} - 7.204}} \right) \times \text{MIN}$$

Where MIN = 51.93 or $62.15 \times 10^{0.036 \times (20 - T)}$, whichever is less

T = Temperature in °C

c. Chronic criteria: freshwater mussels absent and early life stages of fish present. The chronic criteria for total ammonia nitrogen (in mg N/L) where freshwater mussels are absent (procedures for making this determination are in subdivisions 1 through 5 of this subsection) in freshwater shall not exceed concentration values calculated using the following equation. Round the result to two significant digits.

$$\frac{1}{1 + 10^{7.688 - \text{pH}}} \times 0.9405 \times \left(\frac{0.0278}{1 + 10^{\text{pH} - 7.688}} + \frac{1.1994}{1 + 10^{\text{pH} - 7.688}} \right) \times \text{MIN}$$

Where MIN = 6.920 or $7.547 \times 10^{0.028 \times (20 - T)}$ whichever is less

T = temperature in °C

d. Chronic criteria: freshwater mussels absent and early life stages of fish absent. The chronic criteria for total ammonia nitrogen (in mg N/L) where freshwater mussels are absent and early life stages of fish are absent (procedures for making this determination are in subdivisions 1 through 5 of this subsection) in freshwater shall not exceed concentration values calculated using the following equation. Round the result to two significant digits.

$$\frac{1}{1 + 10^{7.688 - \text{pH}}} \times 0.9405 \times \left(\frac{0.0278}{1 + 10^{\text{pH} - 7.688}} + \frac{1.1994}{1 + 10^{\text{pH} - 7.688}} \right) \times (7.547 \times 10^{0.028 \times (20 - \text{MAX}(T, 7))})$$

Where MAX = 7 or temperature in degrees Celsius, whichever is greater

T = temperature in °C

E. The one-hour average concentration of total ammonia nitrogen (in mg N/L) in saltwater shall not exceed, more than once every three years on the average, the acute criteria in the following

table:

Acute Ammonia Saltwater Criteria Total Ammonia Nitrogen (mg N/L) Salinity = 10 g/kg								
Temperature °C								
pH	0	5	10	15	20	25	30	35
7.0 0	231.9	159.8	110.1	75.88	52.31	36.08	24.91	17.21
7.2 0	146.4	100.9	69.54	47.95	33.08	22.84	15.79	10.93
7.4 0	92.45	63.73	43.94	30.32	20.94	14.48	10.03	6.97
7.6 0	58.40	40.28	27.80	19.20	13.28	9.21	6.40	4.47
7.8 0	36.92	25.48	17.61	12.19	8.45	5.88	4.11	2.89
8.0 0	23.37	16.15	11.18	7.76	5.40	3.78	2.66	1.89
8.2 0	14.81	10.26	7.13	4.97	3.48	2.46	1.75	1.27
8.4 0	9.42	6.54	4.57	3.20	2.27	1.62	1.18	0.87
8.6 0	6.01	4.20	2.95	2.09	1.50	1.09	0.81	0.62
8.8 0	3.86	2.72	1.93	1.39	1.02	0.76	0.58	0.46
9.0 0	2.51	1.79	1.29	0.95	0.71	0.55	0.44	0.36

Salinity = 20 g/kg

Temperature °C								
pH	0	5	10	15	20	25	30	35
7.00	247.6	170.5	117.5	80.98	55.83	38.51	26.58	18.36
7.20	156.3	107.7	74.21	51.17	35.30	24.37	16.84	11.66
7.40	98.67	68.01	46.90	32.35	22.34	15.44	10.70	7.43
7.60	62.33	42.98	29.66	20.48	14.17	9.82	6.82	4.76
7.80	39.40	27.19	18.78	13.00	9.01	6.26	4.37	3.

								07
8.00	24.93	17.23	11.92	8.27	5.76	4.02	2.83	2.01
8.20	15.80	10.94	7.59	5.29	3.70	2.61	1.86	1.34
8.40	10.04	6.97	4.86	3.41	2.41	1.72	1.24	0.91
8.60	6.41	4.47	3.14	2.22	1.59	1.15	0.85	0.65
8.80	4.11	2.89	2.05	1.47	1.07	0.80	0.61	0.48
9.00	2.67	1.90	1.36	1.00	0.75	0.57	0.46	0.37

Salinity = 30 g/kg

Temperature °C

pH	0	5	10	15	20	25	30	35
7.00	264.6	182.3	125.6	86.55	59.66	41.15	28.39	19.61
7.20	167.0	115.1	79.31	54.68	37.71	26.03	17.99	12.45
7.40	105.5	72.68	50.11	34.57	23.87	16.50	11.42	7.92
7.60	66.61	45.93	31.69	21.88	15.13	10.48	7.28	5.07
7.80	42.10	29.05	20.07	13.88	9.62	6.68	4.66	3.27
8.00	26.63	18.40	12.73	8.83	6.14	4.29	3.01	2.13
8.20	16.88	11.68	8.10	5.64	3.94	2.78	1.97	1.42
8.40	10.72	7.44	5.18	3.63	2.56	1.82	1.31	0.96
8.60	6.83	4.77	3.34	2.36	1.69	1.22	0.90	0.68
8.80	4.38	3.08	2.18	1.56	1.13	0.84	0.64	0.50
9.00	2.84	2.01	1.45	1.06	0.79	0.60	0.47	0.39

To calculate total ammonia nitrogen acute criteria values in saltwater at different pH and temperature values than those listed in this subsection, use the following formulas:

I =

19.9273S

$$(1000 - 1.005109S)$$

Where I = molal ionic strength of water

S = Salinity ppt (g/kg)

The regression model used to relate I to pKa (negative log of the ionization constant) is

$$pKa = 9.245 + 0.138(I)$$

pKa as defined by these equations is at 298 degrees Kelvin (25°C).

$$T \text{ }^{\circ}\text{Kelvin} = \text{ }^{\circ}\text{C} + 273$$

To correct for other temperatures:

$$pKa^S_T = pKa^S_{298} + 0.0324(298 - T \text{ }^{\circ}\text{Kelvin})$$

The unionized ammonia fraction (UIA) is given by:

$$UIA = \frac{1}{1 + 10^{(pKa^S_T - pH)}}$$

The acute ammonia criterion in saltwater is given by:

$$Acute = \frac{0.233}{UIA}$$

Multiply the acute value by 0.822 to get the ammonia-N acute criterion.

F. The 30-day average concentration of total ammonia nitrogen (in mg N/L) in saltwater shall not exceed, more than once every three years on the average, the chronic criteria in the following table:

Chronic Ammonia Saltwater Criteria Total Ammonia Nitrogen (mg N/L) Salinity = 10 g/kg								
Temperature °C								
pH	0	5	10	15	20	25	30	35
7.00	34.84	24.00	16.54	11.40	7.86	5.42	3.74	2.59
7.20	21.99	15.15	10.45	7.20	4.97	3.43	2.37	1.64
7.40	13.89	9.57	6.60	4.55	3.15	2.18	1.51	1.05
7.60	8.77	6.05	4.18	2.88	2.00	1.38	0.96	0.67
7.80	5.55	3.83	2.65	1.83	1.27	0.88	0.62	0.43
8.00	3.51	2.43	1.68	1.17	0.81	0.57	0.40	0.28
8.20	2.23	1.54	1.07	0.75	0.52	0.37	0.26	0.19
8.40	1.41	0.98	0.69	0.48	0.34	0.24	0.18	0.13
8.60	0.90	0.63	0.44	0.31	0.23	0.16	0.12	

								0.09
8.80	0.58	0.41	0.29	0.21	0.15	0.11	0.09	0.07
9.00	0.38	0.27	0.19	0.14	0.11	0.08	0.07	0.05

Salinity = 20 g/kg

Temperature °C

pH	0	5	10	15	20	25	30	35
7 . 0 0	37.19	25.62	17.65	12.16	8.39	5.78	3.99	2.76
7 . 2 0	23.47	16.17	11.15	7.69	5.30	3.66	2.53	1.75
7 . 4 0	14.82	10.22	7.04	4.86	3.36	2.32	1.61	1.12
7 . 6 0	9.36	6.46	4.46	3.08	2.13	1.47	1.02	0.71
7 . 8 0	5.92	4.08	2.82	1.95	1.35	0.94	0.66	0.46
8 . 0 0	3.74	2.59	1.79	1.24	0.86	0.60	0.43	0.30
8 . 2 0	2.37	1.64	1.14	0.79	0.56	0.39	0.28	0.20
8 . 4 0	1.51	1.05	0.73	0.51	0.36	0.26	0.19	0.14
8 . 6 0	0.96	0.67	0.47	0.33	0.24	0.17	0.13	0.10
8 . 8	0.62	0.43	0.31	0.22	0.16	0.12	0.09	0.07

0								
9	0.40	0.28	0.20	0.15	0.11	0.09	0.07	0.06
.								
0								
0								

Salinity = 30 g/kg

Temperature °C

p	0	5	10	15	20	25	30	3
H								5
7	39.75	27.38	18.87	13.00	8.96	6.18	4.27	2
.								.
0								9
0								5
7	25.09	17.29	11.91	8.21	5.67	3.91	2.70	1
.								.
2								8
0								7
7	15.84	10.92	7.53	5.19	3.59	2.48	1.72	1
.								.
4								1
0								9
7	10.01	6.90	4.76	3.29	2.27	1.57	1.09	0
.								.
6								7
0								6
7	6.32	4.36	3.01	2.08	1.44	1.00	0.70	0
.								.
8								4
0								9
8	4.00	2.76	1.91	1.33	0.92	0.64	0.45	0
.								.
0								3
0								2
8	2.53	1.75	1.22	0.85	0.59	0.42	0.30	0
.								.
2								2
0								1
8	1.61	1.12	0.78	0.55	0.38	0.27	0.20	0
.								.
4								1
0								4
8	1.03	0.72	0.50	0.35	0.25	0.18	0.14	0
.								.
6								1
0								0

8	0.66	0.46	0.33	0.23	0.17	0.13	0.10	0
.								.
8								0
0								8
9	0.43	0.30	0.22	0.16	0.12	0.09	0.07	0
.								.
0								0
0								6

To calculate total ammonia nitrogen chronic criteria values in saltwater at different pH and temperature values than those listed in this subsection, use the following formulas:

$$I = \frac{19.9273S}{(1000 - 1.005109S)}$$

Where I = molal ionic strength of water

S = Salinity ppt (g/kg)

The regression model used to relate I to pKa (negative log of the ionization constant) is

$$pK_a = 9.245 + 0.138(I)$$

pKa as defined by these equations is at 298 degrees Kelvin (25°C).

$$T^{\circ}\text{Kelvin} = ^{\circ}\text{C} + 273$$

To correct for other temperatures:

$$pK_a^S_T = pK_a^S_{298} + 0.0324(298 - T^{\circ}\text{Kelvin})$$

The unionized ammonia fraction (UIA) is given by:

$$UIA = \frac{1}{1 + 10^{(pK_a^S_T - pH)}}$$

The chronic ammonia criterion in saltwater is given by:

$$\text{Chronic} = \frac{0.035}{UIA}$$

Multiply the chronic value by 0.822 to get the ammonia-N chronic criterion.

G. Implementation of freshwater ammonia water quality criteria in subsections B and C of this section through VPDES permits issued pursuant to Virginia Pollutant Discharge Elimination System (VPDES) Permit Regulation (9VAC25-31).

1. The criteria in subsections B and C of this section shall be implemented in VPDES permits that are being reissued to facilities in accordance with the following schedule:

a. Major municipal facilities with design flows greater than or equal to five million gallons per day and major industrial facilities - 12 months following the Water Quality Standards

effective date.

b. Municipal facilities with design flows greater than or equal to 500,000 gallons per day and less than five million gallons per day and all minor industrial facilities - 24 months following the Water Quality Standards effective date.

c. Minor municipal facilities with design flows that are less than 500,000 gallons per day - 36 months following the Water Quality Standards effective date.

2. VPDES permits shall not be revoked and reissued to avoid or delay being subject to the freshwater ammonia water quality criteria in subsections B and C of this section in accordance with the schedule in subdivision G 1 of this section.

3. The provisions of 9VAC25-31-250 A 3 notwithstanding, a permittee may request and the board may authorize, as appropriate, an extended schedule of compliance, which exceeds the term of the VPDES permit and may include multiple permit cycles to achieve effluent limits based on the freshwater ammonia water quality criteria in subsections B and C of this section.

a. Any extended schedule of compliance necessary for the implementation of the freshwater ammonia water quality criteria shall require compliance as soon as possible in accordance with 9VAC25-31-250 A 1. The board may consider the following factors on a case-by-case basis, relying on information provided by the permittee, in making a determination of the timeframe that meets the standard of "as soon as possible":

(1) The relative priority of freshwater ammonia water quality criteria and other water quality and water infrastructure needs of the local community or permittee;

(2) Availability of grant funding pursuant to § 10.1-2131 of the Code of Virginia and other treatment facility expansion and upgrade plans;

(3) Whether an extended schedule of compliance is appropriate for facilities or classes of facilities; and

(4) Appropriate mechanisms to address affordability limitations and financial hardship situations remaining notwithstanding subdivisions G 1 a, G 1 b, and G 1 c of this section.

b. Any request by the permittee for an extended schedule of compliance shall include at the time of permit application at a minimum the following information:

(1) Documentation of other water quality and water infrastructure projects that are in the planning, design, or construction process and the relative priority of the projects in relation to compliance with the freshwater ammonia water quality criteria.

(2) A preliminary engineering analysis of treatment facility upgrade or source reduction alternatives necessary to meet the freshwater ammonia criteria. The analysis may include any additional upgrade or expansion plans currently under consideration. The analysis shall be prepared by a professional engineer registered in Virginia and shall include an estimation of the capital and operations and maintenance costs.

(3) An assessment of project affordability and identification of all potential sources of

funding for enhanced ammonia treatment. In the case of publicly owned treatment works, include an evaluation of the required sewer use fees versus median household income.

(4) Documentation that demonstrates the minimum estimated time required and schedule to design, fund, and construct the selected treatment or source reduction alternative.

(5) An evaluation prepared by a professional engineer registered in Virginia of the highest achievable condition (HAC) regarding nitrification capabilities of the existing treatment facility under the influent loading conditions expected during the term of the VPDES permit as well as under design loading conditions.

c. Any VPDES permit that authorizes an extended schedule of compliance for meeting the freshwater ammonia water quality criteria that exceeds the permit term shall include interim effluent limitations based on the HAC attainable during the term of the permit, final effluent limitations, and a final compliance date.

d. New dischargers defined in 9VAC25-31 are not eligible for extended schedules of compliance under this section; however, they remain eligible for schedules of compliance consistent with 9VAC25-31-250.

A permittee may seek a site-specific modification or variance to the freshwater ammonia water quality criteria under 9VAC25-260-140 D or E as applicable.

Statutory Authority

§62.1-44.15 the Code of Virginia; Clean Water Act (33 USC §1251 et seq.); 40 CFR 131.

Historical Notes

Derived from Virginia Register Volume 19, Issue 23, eff. August 27, 2003; amended, Virginia Register Volume 20, Issue 9, eff. February 12, 2004; Volume 28, Issue 18, eff. June 6, 2012; Volume 32, Issue 26, eff. July 27, 2017; Volume 36, Issue 22, eff. October 13, 2020; Volume 40, Issue 19, eff. May 6, 2024.