PART I

SURFACE WATER STANDARDS WITH GENERAL, STATEWIDE APPLICATION

9 VAC 25-260-140. Criteria for surface water.

A. Instream water quality conditions shall not be acutely[2] or chronically[3] toxic except as allowed in 9 VAC 25-260-20 B (mixing zones). The following are definitions of acute and chronic toxicity conditions:

"Acute toxicity" means an adverse effect that usually occurs shortly after exposure to a pollutant. Lethality to an organism is the usual measure of acute toxicity. Where death is not easily detected, immobilization is considered equivalent to death.

"Chronic toxicity" means an adverse effect that is irreversible or progressive or occurs because the rate of injury is greater than the rate of repair during prolonged exposure to a pollutant. This includes low level, long-term effects such as reduction in growth or reproduction.

B. The following table is a list of numerical water quality criteria for specific parameters.

1. For those waters with multiple designated beneficial uses, the most stringent criteria in the following table shall apply.

2. When information has become available from the Environmental Protection Agency to calculate additional aquatic life or human health criteria not contained in the table, the board may employ these values in establishing effluent limitations or other limitations pursuant to 9 VAC 25-260-20 A necessary to protect designated uses until the board has completed the regulatory standards adoption process.

Table of Parameters[8,10]

	AQUATIC LIFE				HUMAN HEALTH	
	FRESHWATER		SALTWATER			
	ACUTE[2]	CHRONIC[3]	ACUTE[2]	CHRONIC[3]	PUBLIC WATER SUPPLIES[4]	ALL OTHER SURFACE WATERS[5]
SUBSTANCE[4]	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
Acenaphthene					1,200	2,700
Aldrin [c]	3.0	0.3	1.3	0.13	0.0013	0.0014
Ammonia See 9 VAC 25-260-155	~~See Table 1~~	~~See Table 2~~	~~See Tables 3 and 4~~			
Anthracene					9,600	110,000
Antimony					14	4,300
Arsenic					50	
Arsenic III[1]	360	190	69	36		
Bacteria	See 9 VAC 25-260-160 and 170					
Barium					2,000	
Benzene [c]					12	710
Benzo(a) anthracene [c]					0.044	0.49
Benzo(b) fluoranthene [c]					0.044	0.49
Benzo(k) fluoranthene [c]					0.044	0.49
Benzo(a)pyrene [c]					0.044	0.49
Bromoform [c]					44	3,600
Butyl benzyl phthalate					3,000	5,200
Cadmium[1]	3.9 (See Note 9)	1.1 (See Note 9)	43	9.3		
Carbon Tetrachloride [c]					2.5	45
Chlordane [c]	2.4	0.0043	0.09	0.0040	0.0058	0.0059
Chloride	860,000	230,000			250,000**	
Chlorine Total Residual	19	11				
Chlorine Produced Oxidant			13	7.5		
Chlorodibromomethane					690	57,000
Chloroform [c]					57	4,700

2-Chlorophenol					120	400
Chlorpyrifos	0.083	0.041	0.011	0.0056		
Chromium III[1]	1700 (See Note 9)	210 (See Note 9)				
Chromium VI[1]	16	11	1,100	50		
Chrysene [c]					0.044	0.49
Copper[1]	18 (See Note 9)	12 (See Note 9)	5.9	3.8	1,300	
Cyanide	22	5.2	1.0	1.0	700	215,000
DDD [c]					0.0083	0.0084
DDE [c]					0.0059	0.0059
DDT [c]	1.1	0.0010	0.13	0.0010	0.0059	0.0059
Demeton		0.1		0.1		
Dibenz(a,h) anthracene [c]					0.044	0.49
Dibutyl phthalate					2,700	12,000
Dichloromethane [c]					47	16,000
1,2-Dichlorobenzene					2,700	17,000
1,3-Dichlorobenzene					400	2,600
1,4-Dichlorobenzene					400	2,600
Dichlorobromomethane [c]					5.6	460
1,2-Dichloroethane [c]					3.8	990
1,1-Dichloroethylene					310	17,000
2,4 Dichlorophenol					93	790
2,4-dichlorophenoxy acetic acid (2,4-D)					71	
Dieldrin [c]	2.5	0.0019	0.71	0.0019	0.0014	0.0014
Diethyl phthalate					23,000	120,000
Di-2-Ethylhexyl Phthalate [c]					18	59
2,4 Dimethylphenol					540	2,300
2,4-Dinitrotoluene [c]					1.1	91
Dioxin See 9 VAC 25-260-150						
Dissolved Oxygen See 9 VAC 25-260-50						
Endosulfan	0.22	0.056	0.034	0.0087	110	240
Endrin	0.18	0.0023	0.037	0.0023	0.76	0.81
Ethylbenzene					3,100	29,000
Fecal Coliform See Part II (9 VAC 25-260-160 et seq.) of this chapter						
Fluoranthene					300	370
Fluorene					1,300	14,000

Foaming agents (measured as methylene blue active substances)					500**	
Guthion		0.01		0.01		
Heptachlor [c]	0.52	0.0038	0.053	0.0036	0.0021	0.0021
Hexachlorocyclohexane (Lindane)	2.0	0.080	0.16	0.01	7	25
Hydrogen Sulfide		2.0		2.0		
Indeno(1,2,3-cd)pyrene [c]					0.044	0.49
Iron					300**	
Isophorone					6,900	490,000
Kepone		zero		zero		
Lead[1]	120 (See Note 9)	14 (See Note 9)	240	9.3	15	
Malathion		0.1		0.1		
Manganese					50**	
Mercury[1,6,7]	2.4	0.012	2.1	0.025	0.052	0.053
Methoxyclor		0.03		0.03	40	
Mirex		zero		zero		
Monochlorobenzene					680	21,000
Nickel[1]	180 (See Note 9)	20 (See Note 9)	75	8.3	610	4,600
Nitrate (as N)					10,000	
Nitrobenzene					17	1,900
Parathion	0.065	0.013				
PCB-1242 [c]		0.014		0.030	0.00044	0.00045
PCB-1254 [c]		0.014		0.030	0.00044	0.00045
PCB-1221 [c]		0.014		0.030	0.00044	0.00045
PCB-1232 [c]		0.014		0.030	0.00044	0.00045
PCB-1248 [c]		0.014		0.030	0.00044	0.00045
PCB-1260 [c]		0.014		0.030	0.00044	0.00045
PCB-1016 [c]		0.014		0.030	0.00044	0.00045
Pentachlorophenol [c]	$e^{(1.005(pH) -4.830)}$	$e^{(1.005(pH) -5.290)}$	13	7.9	2.8	82
pH See 9 VAC 25-260-50						
Phenol					21,000	4,600,000
Phosphorus (Elemental)				0.10		
Pyrene					960	11,000
Radionuclides						

Gross Alpha Particle Activity					15 pCi/l	15 pCi/l
Beta Particle and Photon Activity (formerly manmade radionuclides)					4 mrem	4 mrem
Strontium-90					8 pCi/l	8 pCi/l
Tritium					20,000pCi/l	20,000pCi/l
Selenium[1]	20	5.0	300	71	170	11,000
Silver[1]	4.1 (See Note 9)		2.3			
Sulfate					250,000**	
Temperature See 9 VAC 25-260-50						
Tetrachloroethylene					320	3,500
Toluene					6,800	200,000
Total dissolved solids					500,000**	
Toxaphene[6 c]	0.73	0.0002	0.21	0.0002	0.0073	0.0075
1,2,4 Trichlorobenzene					260	950
Trichloroethylene [c]					27	810
2,4,6-Trichlorophenol [c]					21	65
2-(2,4,5-Trichlorophenoxy) propionic acid (Silvex)					50	
Tributyltin	0.46	0.026	0.36	0.001		
Vinyl Chloride [c]					20	5,300
Zinc[1]	120 (See Note 9)	110 (See Note 9)	95	86	5,000**	

NOTES:

*= Hardness as calcium carbonate mg/l CaCO3. The minimum hardness allowed for use in this equation shall not be less than 25 mg/l, as calcium carbonate, even if the actual ambient hardness is less than 25 mg/l as calcium carbonate. The maximum hardness value for use in this equation shall not exceed 400 mg/l as calcium carbonate, even if the actual ambient hardness is greater than 400 mg/l as calcium carbonate.

** = To maintain acceptable taste, odor or aesthetic quality of drinking water.

c = Known or suspected carcinogen, human health standards are for a risk level of 10^{-5}.

1 = All metals shall be measured as dissolved. All aquatic life criteria for metals apply to the biologically available form of the metal. Metals measured as dissolved shall be considered to be biologically available, or, because local receiving water characteristics may otherwise affect the biological availability of the metal, the biologically available equivalent measurement of the metal can be further

defined by determining a Water Effect Ratio (WER) and multiplying the numerical value shown in 9 VAC 25-260-140 B by the WER. Refer to 9 VAC 25-260-140 F.

[2] = One hour average concentration not to be exceeded more than once every three years on the average.

[3] = Four day average concentration not to be exceeded more than once every three years on the average except for ammonia. Ammonia is a 30 day average not to be exceeded more than once every three years on the average.

[4] = Unless otherwise noted, these criteria have been calculated to protect human health from toxic effects through drinking water and fish consumption.

[5] = Unless otherwise noted, these criteria have been calculated to protect human health from toxic effects through fish consumption.

[6] = Chronic aquatic life values have been calculated to protect wildlife from harmful effects through ingestion of contaminated tissue. However, the criteria will also protect aquatic life from toxic effects.

[7] = Chronic aquatic life criteria applies to methyl mercury. This criteria will protect the marketability of natural resources, e.g., fish and shellfish.

[8] = See 9 VAC 25-260-310 for additional standards or effluent limits which are site-specific.

[9] = Freshwater aquatic life criteria for these metals are expressed as a function of total hardness as $CaCO_3$ (mg/l), and as a function of the pollutant's water effect ratio (WER) as defined in 9 VAC 25-260-140 F. The equations are provided in the matrix below. To maintain consistency when using these equations to calculate criteria, intermediate calculations should be rounded to four significant digits and the final criterion's value should be rounded to two significant digits. Values displayed above in the table are examples and correspond to a total hardness of 100 mg/l and a water effect ratio of 1.0.

Acute criterion=WER $\exp\{m_A[\ln(\text{hardness}^*)]+b_A\}$

Chronic criterion=WER $\exp\{m_C[\ln(\text{hardness}^*)]+b_C\}$

	m_A	b_A	m_C	b_C
Cadmium	1.128	-3.828	0.7852	-3.490
Chromium (III)	0.8190	3.688	0.8190	1.561
Copper	0.9422	-1.464	0.8545	-1.465
Lead	1.273	-1.084	1.273	-3.259
Nickel	0.8460	1.312	0.8460	-0.8840
Silver	1.72	-6.52	.....	.....
Zinc	0.8473	0.8604	0.8473	0.7614

Note: The term "exp" represents the base e exponential function.

[10] = The flows listed below are default design flows for calculating steady state waste load allocations unless statistically valid methods are employed which demonstrate compliance with the duration and return frequency of the water quality criteria.

Aquatic Life:

Acute criteria 1Q10

Chronic criteria 7Q10

Chronic criteria (ammonia) 30Q10

Human Health:

Non-carcinogens 30Q5

Carcinogens	Harmonic mean (An exception to this is for the carcinogen dioxin. The applicable stream flow for dioxin is listed in 9 VAC 25-260-150 B.)

The following are defined for this section:

"1Q10" means the lowest flow averaged over a period of one day which on a statistical basis can be expected to occur once every 10 climatic years.

"7Q10" means the lowest flow averaged over a period of seven consecutive days that can be statistically expected to occur once every 10 climatic years.

"30Q5" means the lowest flow averaged over a period of 30 consecutive days that can be statistically expected to occur once every five climatic years.

"30Q10" means the lowest flow averaged over a period of 30 consecutive days that can be statistically expected to occur once every 10 climactic years.

"Averaged" means an arithmetic mean.

"Climatic year" means a year beginning on April 1 and ending on March 31.

~~TABLE 1***~~

~~Acute Ammonia Criteria for Freshwater~~

~~Total Ammonia (mg/liter)****~~

~~Temperature (°C)~~

~~pH~~	~~0 C~~	~~5 C~~	~~10 C~~	~~15 C~~	~~20 C~~	~~25 C~~	~~30 C~~
~~6.50~~	~~35~~	~~33~~	~~31~~	~~30~~	~~29~~	~~29~~	~~29~~
~~6.75~~	~~32~~	~~30~~	~~28~~	~~27~~	~~27~~	~~26~~	~~26~~
~~7.00~~	~~28~~	~~26~~	~~25~~	~~24~~	~~23~~	~~23~~	~~23~~
~~7.25~~	~~23~~	~~22~~	~~20~~	~~19.7~~	~~19.2~~	~~19.0~~	~~19~~
~~7.50~~	~~17.4~~	~~16.3~~	~~15.5~~	~~14.9~~	~~14.6~~	~~14.5~~	~~14.5~~
~~7.75~~	~~12.2~~	~~11.4~~	~~10.9~~	~~10.5~~	~~10.3~~	~~10.2~~	~~10.3~~
~~8.00~~	~~8.0~~	~~7.5~~	~~7.1~~	~~6.9~~	~~6.8~~	~~6.8~~	~~7.0~~
~~8.25~~	~~4.5~~	~~4.2~~	~~4.1~~	~~4.0~~	~~3.9~~	~~4.0~~	~~4.1~~
~~8.50~~	~~2.6~~	~~2.4~~	~~2.3~~	~~2.3~~	~~2.3~~	~~2.4~~	~~2.6~~
~~8.75~~	~~1.47~~	~~1.40~~	~~1.37~~	~~1.38~~	~~1.42~~	~~1.52~~	~~1.66~~
~~9.00~~	~~0.86~~	~~0.83~~	~~0.83~~	~~0.86~~	~~0.91~~	~~1.01~~	~~1.16~~

~~TABLE 2***~~

~~Chronic Ammonia Criteria for Freshwater~~

~~Total Ammonia (mg/liter)****~~

~~Temperature (°C)~~

~~pH~~	~~0 C~~	~~5 C~~	~~10 C~~	~~15 C~~	~~20 C~~	~~25 C~~	~~30 C~~
~~6.50~~	~~3.02~~	~~2.82~~	~~2.66~~	~~2.59~~	~~2.53~~	~~2.5~~	~~2.5~~
~~6.75~~	~~3.02~~	~~2.82~~	~~2.66~~	~~2.59~~	~~2.53~~	~~2.5~~	~~2.5~~
~~7.00~~	~~3.02~~	~~2.82~~	~~2.66~~	~~2.59~~	~~2.53~~	~~2.5~~	~~2.5~~
~~7.25~~	~~3.02~~	~~2.82~~	~~2.66~~	~~2.59~~	~~2.53~~	~~2.5~~	~~2.5~~
~~7.50~~	~~3.02~~	~~2.82~~	~~2.66~~	~~2.59~~	~~2.53~~	~~2.5~~	~~2.5~~
~~7.75~~	~~2.80~~	~~2.60~~	~~2.47~~	~~2.38~~	~~2.35~~	~~2.3~~	~~2.4~~
~~8.00~~	~~1.82~~	~~1.71~~	~~1.62~~	~~1.57~~	~~1.55~~	~~1.56~~	~~1.59~~
~~8.25~~	~~1.03~~	~~0.97~~	~~0.93~~	~~0.91~~	~~0.90~~	~~0.91~~	~~0.95~~
~~8.50~~	~~0.58~~	~~0.55~~	~~0.53~~	~~0.53~~	~~0.53~~	~~0.55~~	~~0.58~~
~~8.75~~	~~0.34~~	~~0.32~~	~~0.31~~	~~0.31~~	~~0.32~~	~~0.35~~	~~0.38~~
~~9.00~~	~~0.20~~	~~0.19~~	~~0.19~~	~~0.20~~	~~0.21~~	~~0.23~~	~~0.27~~

~~TABLE 3~~

~~Acute Ammonia Criteria for Saltwater~~

~~Total Ammonia (mg/liter)****~~

~~Temperature (°C)~~

~~pH~~	~~0 C~~	~~5 C~~	~~10 C~~	~~15 C~~	~~20 C~~	~~25 C~~	~~30 C~~	~~35 C~~
~~Salinity = 10 g/kg~~								
~~7.0~~	~~270~~	~~191~~	~~131~~	~~92~~	~~62~~	~~44~~	~~29~~	~~21~~
~~7.2~~	~~175~~	~~121~~	~~83~~	~~58~~	~~40~~	~~27~~	~~19~~	~~13~~
~~7.4~~	~~110~~	~~77~~	~~52~~	~~35~~	~~25~~	~~17~~	~~12~~	~~8.3~~
~~7.6~~	~~69~~	~~48~~	~~33~~	~~23~~	~~16~~	~~11~~	~~7.7~~	~~5.6~~
~~7.8~~	~~44~~	~~31~~	~~21~~	~~15~~	~~10~~	~~7.1~~	~~5.0~~	~~3.5~~
~~8.0~~	~~27~~	~~19~~	~~13~~	~~9.4~~	~~6.4~~	~~4.6~~	~~3.1~~	~~2.3~~
~~8.2~~	~~18~~	~~12~~	~~8.5~~	~~5.8~~	~~4.2~~	~~2.9~~	~~2.1~~	~~1.5~~
~~8.4~~	~~11~~	~~7.9~~	~~5.4~~	~~3.7~~	~~2.7~~	~~1.9~~	~~1.4~~	~~1.0~~
~~8.6~~	~~7.3~~	~~5.0~~	~~3.5~~	~~2.5~~	~~1.8~~	~~1.3~~	~~0.98~~	~~0.75~~
~~8.8~~	~~4.6~~	~~3.3~~	~~2.3~~	~~1.7~~	~~1.2~~	~~0.92~~	~~0.71~~	~~0.56~~
~~9.0~~	~~2.9~~	~~2.1~~	~~1.5~~	~~1.1~~	~~0.85~~	~~0.67~~	~~0.52~~	~~0.44~~

~~Acute Ammonia Criteria for Saltwater~~

~~Total Ammonia (mg/l)****~~

~~Temperature (°C)~~

~~pH~~	~~0 C~~	~~5 C~~	~~10 C~~	~~15 C~~	~~20 C~~	~~25 C~~	~~30 C~~	~~35 C~~
				~~Salinity = 20 g/kg~~				
~~7.0~~	~~291~~	~~200~~	~~137~~	~~96~~	~~64~~	~~44~~	~~31~~	~~21~~
~~7.2~~	~~183~~	~~125~~	~~87~~	~~60~~	~~42~~	~~29~~	~~20~~	~~14~~
~~7.4~~	~~116~~	~~79~~	~~54~~	~~37~~	~~27~~	~~18~~	~~12~~	~~8.7~~
~~7.6~~	~~73~~	~~50~~	~~35~~	~~23~~	~~17~~	~~11~~	~~7.9~~	~~5.6~~
~~7.8~~	~~46~~	~~31~~	~~23~~	~~15~~	~~11~~	~~7.5~~	~~5.2~~	~~3.5~~
~~8.0~~	~~29~~	~~20~~	~~14~~	~~9.8~~	~~6.7~~	~~4.8~~	~~3.3~~	~~2.3~~
~~8.2~~	~~19~~	~~13~~	~~8.9~~	~~6.2~~	~~4.4~~	~~3.1~~	~~2.1~~	~~1.6~~
~~8.4~~	~~12~~	~~8.1~~	~~5.6~~	~~4.0~~	~~2.9~~	~~2.0~~	~~1.5~~	~~1.1~~
~~8.6~~	~~7.5~~	~~5.2~~	~~3.7~~	~~2.7~~	~~1.9~~	~~1.4~~	~~1.0~~	~~0.77~~
~~8.8~~	~~4.8~~	~~3.3~~	~~2.5~~	~~1.7~~	~~1.3~~	~~0.94~~	~~0.73~~	~~0.56~~
~~9.0~~	~~3.1~~	~~2.3~~	~~1.6~~	~~1.2~~	~~0.87~~	~~0.69~~	~~0.54~~	~~0.44~~

~~Acute Ammonia Criteria for Saltwater~~

~~Total Ammonia (mg/l)****~~

~~Temperature (°C)~~

~~pH~~	~~0 C~~	~~5 C~~	~~10 C~~	~~15 C~~	~~20 C~~	~~25 C~~	~~30 C~~	~~35 C~~
				~~Salinity = 30 g/kg~~				
~~7.0~~	~~312~~	~~208~~	~~148~~	~~102~~	~~71~~	~~48~~	~~33~~	~~23~~
~~7.2~~	~~196~~	~~135~~	~~94~~	~~64~~	~~44~~	~~31~~	~~21~~	~~15~~
~~7.4~~	~~125~~	~~85~~	~~58~~	~~40~~	~~27~~	~~19~~	~~13~~	~~9.4~~
~~7.6~~	~~79~~	~~54~~	~~37~~	~~25~~	~~21~~	~~12~~	~~8.5~~	~~6.0~~
~~7.8~~	~~50~~	~~33~~	~~23~~	~~16~~	~~11~~	~~7.9~~	~~5.4~~	~~3.7~~
~~8.0~~	~~31~~	~~21~~	~~15~~	~~10~~	~~7.3~~	~~5.0~~	~~3.5~~	~~2.5~~
~~8.2~~	~~20~~	~~14~~	~~9.6~~	~~6.7~~	~~4.6~~	~~3.3~~	~~2.3~~	~~1.7~~
~~8.4~~	~~12.7~~	~~8.7~~	~~6.0~~	~~4.2~~	~~2.9~~	~~2.1~~	~~1.6~~	~~1.1~~
~~8.6~~	~~8.1~~	~~5.6~~	~~4.0~~	~~2.7~~	~~2.0~~	~~1.4~~	~~1.1~~	~~0.81~~
~~8.8~~	~~5.2~~	~~3.5~~	~~2.5~~	~~1.8~~	~~1.3~~	~~1.0~~	~~0.75~~	~~0.58~~
~~9.0~~	~~3.3~~	~~2.3~~	~~1.7~~	~~1.2~~	~~0.94~~	~~0.71~~	~~0.56~~	~~0.46~~

~~TABLE 4~~

~~Chronic Ammonia Criteria for Saltwater~~

~~Total Ammonia (mg/l)****~~

~~Temperature (°C)~~

~~pH~~	~~0 C~~	~~5 C~~	~~10 C~~	~~15 C~~	~~20 C~~	~~25 C~~	~~30 C~~	~~35 C~~
				~~Salinity = 10 g/kg~~				
~~7.0~~	~~41~~	~~29~~	~~20~~	~~14~~	~~9.4~~	~~6.6~~	~~4.4~~	~~3.1~~
~~7.2~~	~~26~~	~~18~~	~~12~~	~~8.7~~	~~5.9~~	~~4.1~~	~~2.8~~	~~2.0~~
~~7.4~~	~~17~~	~~12~~	~~7.8~~	~~5.3~~	~~3.7~~	~~2.6~~	~~1.8~~	~~1.2~~
~~7.6~~	~~10~~	~~7.2~~	~~5.0~~	~~3.4~~	~~2.4~~	~~1.7~~	~~1.2~~	~~0.84~~
~~7.8~~	~~6.6~~	~~4.7~~	~~3.1~~	~~2.2~~	~~1.5~~	~~1.1~~	~~0.75~~	~~0.53~~
~~8.0~~	~~4.1~~	~~2.9~~	~~2.0~~	~~1.4~~	~~0.97~~	~~0.69~~	~~0.47~~	~~0.34~~
~~8.2~~	~~2.7~~	~~1.8~~	~~1.3~~	~~0.87~~	~~0.62~~	~~0.44~~	~~0.31~~	~~0.23~~
~~8.4~~	~~1.7~~	~~1.2~~	~~0.81~~	~~0.56~~	~~0.41~~	~~0.29~~	~~0.21~~	~~0.16~~
~~8.6~~	~~1.1~~	~~0.75~~	~~0.53~~	~~0.37~~	~~0.27~~	~~0.20~~	~~0.15~~	~~0.11~~
~~8.8~~	~~0.69~~	~~0.50~~	~~0.34~~	~~0.25~~	~~0.18~~	~~0.14~~	~~0.11~~	~~0.08~~
~~9.0~~	~~0.44~~	~~0.31~~	~~0.23~~	~~0.17~~	~~0.13~~	~~0.10~~	~~0.08~~	~~0.07~~

~~Chronic Ammonia Criteria for Saltwater~~

~~Total Ammonia (mg/l)****~~

~~Temperature (°C)~~

~~pH~~	~~0 C~~	~~5 C~~	~~10 C~~	~~15 C~~	~~20 C~~	~~25 C~~	~~30 C~~	~~35 C~~
				~~Salinity = 20 g/kg~~				
~~7.0~~	~~44~~	~~30~~	~~21~~	~~14~~	~~9.7~~	~~6.6~~	~~4.7~~	~~3.1~~
~~7.2~~	~~27~~	~~19~~	~~13~~	~~9.0~~	~~6.2~~	~~4.4~~	~~3.0~~	~~2.1~~
~~7.4~~	~~18~~	~~12~~	~~8.1~~	~~5.6~~	~~4.1~~	~~2.7~~	~~1.9~~	~~1.3~~
~~7.6~~	~~11~~	~~7.5~~	~~5.3~~	~~3.4~~	~~2.5~~	~~1.7~~	~~1.2~~	~~0.84~~
~~7.8~~	~~6.9~~	~~4.7~~	~~3.4~~	~~2.3~~	~~1.6~~	~~1.1~~	~~0.78~~	~~0.53~~
~~8.0~~	~~4.4~~	~~3.0~~	~~2.1~~	~~1.5~~	~~1.0~~	~~0.72~~	~~0.50~~	~~0.34~~
~~8.2~~	~~2.8~~	~~1.9~~	~~1.3~~	~~0.94~~	~~0.66~~	~~0.47~~	~~0.31~~	~~0.24~~
~~8.4~~	~~1.8~~	~~1.2~~	~~0.84~~	~~0.59~~	~~0.44~~	~~0.30~~	~~0.22~~	~~0.16~~
~~8.6~~	~~1.1~~	~~0.78~~	~~0.56~~	~~0.41~~	~~0.28~~	~~0.20~~	~~0.15~~	~~0.12~~
~~8.8~~	~~0.72~~	~~0.50~~	~~0.37~~	~~0.26~~	~~0.19~~	~~0.14~~	~~0.11~~	~~0.08~~
~~9.0~~	~~0.47~~	~~0.34~~	~~0.24~~	~~0.18~~	~~0.13~~	~~0.10~~	~~0.08~~	~~0.07~~

~~Chronic Ammonia Criteria for Saltwater~~

~~Total Ammonia (mg/l)****~~

~~Temperature (°C)~~

~~pH~~	~~0 C~~	~~5 C~~	~~10 C~~	~~15 C~~	~~20 C~~	~~25 C~~	~~30 C~~	~~35 C~~
				~~Salinity = 30 g/kg~~				
~~7.0~~	~~47~~	~~31~~	~~22~~	~~15~~	~~11~~	~~7.2~~	~~5.0~~	~~3.4~~
~~7.2~~	~~29~~	~~20~~	~~14~~	~~9.7~~	~~6.6~~	~~4.7~~	~~3.1~~	~~2.2~~
~~7.4~~	~~19~~	~~13~~	~~8.7~~	~~5.9~~	~~4.1~~	~~2.9~~	~~2.0~~	~~1.4~~
~~7.6~~	~~12~~	~~8.1~~	~~5.6~~	~~3.7~~	~~3.1~~	~~1.8~~	~~1.3~~	~~0.90~~
~~7.8~~	~~7.5~~	~~5.0~~	~~3.4~~	~~2.4~~	~~1.7~~	~~1.2~~	~~0.81~~	~~0.56~~
~~8.0~~	~~4.7~~	~~3.1~~	~~2.2~~	~~1.6~~	~~1.1~~	~~0.75~~	~~0.53~~	~~0.37~~
~~8.2~~	~~3.0~~	~~2.1~~	~~1.4~~	~~1.0~~	~~0.69~~	~~0.50~~	~~0.34~~	~~0.25~~
~~8.4~~	~~1.9~~	~~1.3~~	~~0.90~~	~~0.62~~	~~0.44~~	~~0.31~~	~~0.23~~	~~0.17~~
~~8.6~~	~~1.2~~	~~0.84~~	~~0.59~~	~~0.41~~	~~0.30~~	~~0.22~~	~~0.16~~	~~0.12~~
~~8.8~~	~~0.78~~	~~0.53~~	~~0.37~~	~~0.27~~	~~0.20~~	~~0.15~~	~~0.11~~	~~0.09~~
~~9.0~~	~~0.50~~	~~0.34~~	~~0.26~~	~~0.19~~	~~0.14~~	~~0.11~~	~~0.08~~	~~0.07~~

~~*** To calculate total ammonia values at different pH's and temperature values than listed in Tables 1 and 2 use the following formulas:~~

~~Formulas Used In The Calculation of Acute Criteria Values for Ammonia In Freshwater~~

~~The one-hour average concentration of ammonia (in mg/l as un-ionized NH_3) can be calculated by using the following formulas.~~

~~0.52/FT/FPH/2 = acute criteria concentration~~

~~where; FT = final temperature~~

~~$= 10^{0.03(20-T)}$~~

~~FPH = final pH~~

~~= 1; 8.0 < pH < 9.0~~

~~$= (1 + 10^{7.4-pH})/1.25; 6.5 < pH < 8.0$~~

~~Conversions from un-ionized to total ammonia should be performed using the following formulas;~~

~~Total ammonia criteria = calculated un-ionized ammonia criteria divided by fraction of un-ionized ammonia~~

~~Where:~~

~~Fraction of un-ionized ammonia = $1/(10^{pKa-pH} + 1)$~~

~~pKa = 0.09018 + (2729.92/(273.2 + temperature °C)).~~

~~Formulas Used In The Calculation of Chronic Criteria Values for Ammonia In Freshwater~~

~~The 30-day average concentration of ammonia (in mg/l as un-ionized NH_3) can be calculated by using the following formulas.~~

~~0.80/FT/FPH/RATIO = chronic criteria concentration~~

~~where;~~

~~FT = final temperature~~

~~$= 10^{0.03(20-T)}$~~

~~FPH = final pH~~

~~$= 1; 8.0 < pH < 9.0$~~

~~$= (1 + 10^{7.4-pH})/1.25; 6.5 < pH < 8.0$~~

~~RATIO = 13.5; 7.7 < pH < 9.0~~

~~$= 20.25 \times (10^{7.7-pH})/(1 + 10^{7.4-pH}); 6.5 < pH < 7.7$~~

~~Conversions from un-ionized to total ammonia should be performed using the following formulas:~~

~~Total ammonia criteria = calculated un-ionized ammonia criteria divided by fraction of un-ionized ammonia~~

~~Where:~~

~~Fraction of un-ionized ammonia = $1/(10^{Ka-pH} + 1)$~~

~~Where pka = 0.09018 + (2729.92/(273.2 + temperature °C)).~~

~~**** To convert these values to mg/liter N, multiply by 0.822.~~

C. Application of freshwater and saltwater numerical criteria. The numerical water quality criteria listed in subsection B of this section (excluding dissolved oxygen, pH, temperature) shall be applied according to the following classes of waters (see 9 VAC 25-260-50) and boundary designations:

CLASS OF WATERS	NUMERICAL CRITERIA
I and II (Estuarine Waters)	Saltwater criteria apply
II (Transition Zone)	More stringent of either the freshwater or saltwater criteria apply
II (Tidal Freshwater), III, IV, V and VI	Freshwater criteria apply

The following describes the boundary designations for Class II, (estuarine, transition zone and tidal freshwater waters) by river basin:

1. Rappahannock Basin.

Tidal freshwater is from the fall line of the Rappahannock River to Buoy 37 near Tappahannock, Virginia, including all tidal tributaries that enter the tidal freshwater Rappahannock River.

Transition zone is from Buoy 37 to Buoy 11 near Morattico, Virginia, including all tidal tributaries that enter the transition zone of the Rappahannock River.

Estuarine waters are from Buoy 11 to the mouth of the Rappahannock River (Buoy 6), including all tidal tributaries that enter the estuarine waters of the Rappahannock River.

2. York Basin.

Tidal freshwater is from the fall line of the Mattaponi River to Clifton, Virginia, and from the fall line of the Pamunkey River to Sweet Hall Landing, Virginia, including all tidal tributaries that enter the tidal freshwaters of the Mattaponi and Pamunkey Rivers.

Transition zone of the Mattaponi River is from Clifton, Virginia to the York River and the transition zone of the Pamunkey River is from Sweet Hall Landing, Virginia, to the York River. The transition zone for the York River is from West Point, Virginia, to Buoy 13 near Poropotank Bay. All tidal tributaries that enter the transition zones of the Mattaponi, Pamunkey, and York Rivers are themselves in the transition zone.

Estuarine waters are from Buoy 13 to the mouth of the York River (Tue Marsh Light) including all tidal tributaries that enter the estuarine waters of the York River.

3. James Basin.

Tidal Freshwater is from the fall line of the James River to the confluence of the Chickahominy River (Buoy 70), including all tidal tributaries that enter the tidal freshwater James River.

Transition zone is from Buoy 70 to Buoy 47 near Jamestown Island including all tidal tributaries that enter the transition zone of the James River.

Estuarine waters are from Buoy 47 to the mouth of the James River (Buoy 25) including all tidal tributaries that enter the estuarine waters of the James River.

4. Potomac Basin.

Tidal Freshwater includes all tidal tributaries that enter the Potomac River from its fall line to Buoy 43 near Quantico, Virginia.

Transition zone includes all tidal tributaries that enter the Potomac River from Buoy 43 to Buoy 33 near Dahlgren, Virginia.

Estuarine waters includes all tidal tributaries that enter the Potomac River from Buoy 33 to the mouth of the Potomac River (Buoy 44B).

5. Chesapeake Bay, Atlantic Ocean, and small coastal basins.

Estuarine waters include the Atlantic Ocean tidal tributaries, and the Chesapeake Bay and its small coastal basins from the Virginia state line to the mouth of the bay (a line from Cape Henry drawn through Buoys 3 and 8 to Fishermans Island), and its tidal tributaries, excluding the Potomac tributaries and those tributaries listed above.

6. Chowan River Basin.

Tidal freshwater includes the Northwest River and its tidal tributaries from the Virginia-North Carolina state line to the free flowing portion, the Blackwater River and its tidal tributaries from the Virginia-North Carolina state line to the end of tidal waters at approximately state route 611 at river mile 20.90, the Nottoway River and its tidal tributaries from the Virginia-North Carolina state line to the end of tidal waters at approximately Route 674, and the North Landing River and its tidal tributaries from the Virginia-North Carolina state line to the Great Bridge Lock.

Transition zone includes Back Bay and its tributaries in the City of Virginia Beach to the Virginia-North Carolina state line.

D. Site-specific modifications to numerical water quality criteria.

1. The board may consider site-specific modifications to numerical water quality criteria in subsection B of this section where the applicant or permittee demonstrates that the alternate numerical water quality criteria are sufficient to protect all designated uses (see 9 VAC 25-260-10) of that particular surface water segment or body.

2. Any demonstration for site-specific human health criteria shall be restricted to a reevaluation of the bioconcentration or bioaccumulation properties of the pollutant. The exceptions to this restriction are for site-specific criteria for taste, odor, and aesthetic compounds noted by double asterisks in subsection B of this section and nitrates.

3. Site-specific temperature requirements are found in 9 VAC 25-260-90.

4. Procedures for promulgation and review of site-specific modifications to numerical water quality criteria resulting from subdivisions 1 and 2 of this subsection.

a. Proposals describing the details of the site-specific study shall be submitted to the board's staff for approval prior to commencing the study.

b. Any site-specific modification shall be promulgated as a regulation in accordance with the Administrative Process Act. All site-specific modifications shall be listed in 9 VAC 25-260-310 (Special standards and requirements).

E. Variances to water quality standards.

1. A variance from numeric criteria may be granted to a discharger if it can be demonstrated that one or more of the conditions in 9 VAC 25-260-10 G limit the attainment of one or more specific water quality criteria.

a. Variances shall apply only to the discharger to whom they are granted and shall be reevaluated and either continued, modified or revoked at the time of permit issuance. At that

time the permittee shall make a showing that the conditions for granting the variance still apply.

b. Variances shall be described in the public notice published for the permit. The decision to approve a variance shall be subject to the public participation requirements of the Virginia Pollutant Discharge Elimination System (VPDES) Permit Regulation, 9 VAC 25-31-10 et seq. (Permit Regulation).

c. Variances shall not prevent the maintenance and protection of existing uses or exempt the discharger or regulated activity from compliance with other appropriate technology or water quality-based limits or best management practices.

d. Variances granted under this section shall not apply to new discharges.

e. Variances shall be submitted by the department's Division of Scientific Research or its successors to the Environmental Protection Agency for review and approval/disapproval.

f. A list of variances granted shall be maintained by the department's Division of Scientific Research or its successors.

2. None of the variances in this subsection shall apply to the halogen ban section (9 VAC 25-260-110) or temperature criteria in 9 VAC 25-260-50 if superseded by § 316(a) of the Clean Water Act requirements. No variances in this subsection shall apply to the criteria that are designed to protect human health from carcinogenic and noncarcinogenic toxic effects (subsection B of this section) with the exception of the metals, and the taste, odor, and aesthetic compounds noted by double asterisks and nitrates, listed in subsection B of this section.

F. Water effect ratio.

1. A water effects ratio (WER) shall be determined by measuring the effect of receiving water (as it is or will be affected by any discharges) on the bioavailability or toxicity of a metal by using standard test organisms and a metal to conduct toxicity tests simultaneously in receiving water and laboratory water. The ratio of toxicities of the metal(s) in the two waters is the WER (toxicity in receiving water divided by toxicity in laboratory water = WER). Once an acceptable WER for a metal is established, the numerical value for the metal in subsection B of this section is multiplied by the WER to produce an instream concentration that will protect designated uses. This instream concentration shall be utilized in permitting decisions.

2. The WER shall be assigned a value of 1.0 unless the applicant or permittee demonstrates to the department's satisfaction in a permit proceeding that another value is appropriate, or unless available data allow the department to compute a WER for the receiving waters. The applicant or permittee is responsible for proposing and conducting the study to develop a WER. The study may require multiple testing over several seasons. The applicant or permittee shall obtain the department's Division of Scientific Research or its successor approval of the study protocol and the final WER.

3. The Permit Regulation at 9 VAC 25-31-230 C requires that permit limits for metals be expressed as total recoverable measurements. To that end, the study used to establish the WER may be based on total recoverable measurements of the metals.

4. The Environmental Protection Agency views the WER in any particular case as a site-specific criterion. Therefore, the department's Division of Scientific Research or its successor shall submit the results of the study to the Environmental Protection Agency for review and approval/disapproval within 30 days of the receipt of certification from the state's Office of the Attorney General. Nonetheless, the WER is established in a permit proceeding, shall be

described in the public notice associated with the permit proceeding, and applies only to the applicant or permittee in that proceeding. The department's action to approve or disapprove a WER is a case decision, not an amendment to the present regulation.

The decision to approve or disapprove a WER shall be subject to the public participation requirements of the Permit Regulation, 9 VAC 25-31-260 et seq. A list of final WERs will be maintained by the department's Division of Scientific Research or its successor.

5. A WER shall not be used for the freshwater and saltwater chronic mercury criteria or the freshwater acute and chronic selenium criteria.

9 VAC 25-260-155. Ammonia surface water quality criteria.

A. The one-hour average concentration of total ammonia nitrogen (in mg N/L) in freshwater shall not exceed, more than once every three years on the average[1], the acute criteria below:

Acute Ammonia Freshwater Criteria

Total Ammonia Nitrogen (mg N/L)

pH	Trout Present	Trout Absent
6.5	32.6	48.8
6.6	31.3	46.8
6.7	29.8	44.6
6.8	28.1	42.0
6.9	26.2	39.1
7.0	24.1	36.1
7.1	22.0	32.8
7.2	19.7	29.5
7.3	17.5	26.2
7.4	15.4	23.0
7.5	13.3	19.9
7.6	11.4	17.0
7.7	9.65	14.4
7.8	8.11	12.1
7.9	6.77	10.1
8.0	5.62	8.40
8.1	4.64	6.95
8.2	3.83	5.72
8.3	3.15	4.71

8.4	2.59	3.88
8.5	2.14	3.20
8.6	1.77	2.65
8.7	1.47	2.20
8.8	1.23	1.84
8.9	1.04	1.56
9.0	0.885	1.32

The acute criteria for trout present shall apply to all Class V -Stockable Trout Waters and Class VI-Natural Trout Waters as listed in 9 VAC 25-260-390 through 9 VAC 25-260-540.

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

Where trout are present:

$$\text{Acute Criterion Concentration (mg N/L)} = \left[\frac{0.275}{(1 + 10^{7.204-pH})} + \frac{39.0}{(1 + 10^{pH-7.204})} \right]$$

Or where trout are absent:

$$\text{Acute Criterion Concentration (mg N/L)} = \left[\frac{0.411}{(1 + 10^{7.204-pH})} + \frac{58.4}{(1 + 10^{pH-7.204})} \right]$$

[1]The default design flow for calculating steady state waste load allocations for the acute ammonia criterion is the 1Q10 (see 9 VAC 25-260-140 B footnote 10) unless statistically valid methods are employed which demonstrate compliance with the duration and return frequency of the water quality criteria.

B. The thirty-day average concentration of total ammonia nitrogen (in mg N/L) where early life stages of fish are present in freshwater shall not exceed, more than once every three years on the average[2], the chronic criteria below:

Chronic Ammonia Freshwater Criteria

Early Life Stages of Fish Present

Total Ammonia Nitrogen (mg N/L)

pH	Temperature (^{o}C)									
	0	14	16	18	20	22	24	26	28	30
6.5	6.67	6.67	6.06	5.33	4.68	4.12	3.62	3.18	2.80	2.46
6.6	6.57	6.57	5.97	5.25	4.61	4.05	3.56	3.13	2.75	2.42
6.7	6.44	6.44	5.86	5.15	4.52	3.98	3.50	3.07	2.70	2.37
6.8	6.29	6.29	5.72	5.03	4.42	3.89	3.42	3.00	2.64	2.32
6.9	6.12	6.12	5.56	4.89	4.30	3.78	3.32	2.92	2.57	2.25
7.0	5.91	5.91	5.37	4.72	4.15	3.65	3.21	2.82	2.48	2.18
7.1	5.67	5.67	5.15	4.53	3.98	3.50	3.08	2.70	2.38	2.09
7.2	5.39	5.39	4.90	4.31	3.78	3.33	2.92	2.57	2.26	1.99
7.3	5.08	5.08	4.61	4.06	3.57	3.13	2.76	2.42	2.13	1.87
7.4	4.73	4.73	4.30	3.78	3.32	2.92	2.57	2.26	1.98	1.74
7.5	4.36	4.36	3.97	3.49	3.06	2.69	2.37	2.08	1.83	1.61
7.6	3.98	3.98	3.61	3.18	2.79	2.45	2.16	1.90	1.67	1.47
7.7	3.58	3.58	3.25	2.86	2.51	2.21	1.94	1.71	1.50	1.32
7.8	3.18	3.18	2.89	2.54	2.23	1.96	1.73	1.52	1.33	1.17
7.9	2.80	2.80	2.54	2.24	1.96	1.73	1.52	1.33	1.17	1.03
8.0	2.43	2.43	2.21	1.94	1.71	1.50	1.32	1.16	1.02	0.897

8.1	2.10	2.10	1.91	1.68	1.47	1.29	1.14	1.00	0.879	0.773
8.2	1.79	1.79	1.63	1.43	1.26	1.11	0.973	0.855	0.752	0.661
8.3	1.52	1.52	1.39	1.22	1.07	0.941	0.827	0.727	0.639	0.562
8.4	1.29	1.29	1.17	1.03	0.906	0.796	0.700	0.615	0.541	0.475
8.5	1.09	1.09	0.990	0.870	0.765	0.672	0.591	0.520	0.457	0.401
8.6	0.920	0.920	0.836	0.735	0.646	0.568	0.499	0.439	0.386	0.339
8.7	0.778	0.778	0.707	0.622	0.547	0.480	0.422	0.371	0.326	0.287
8.8	0.661	0.661	0.601	0.528	0.464	0.408	0.359	0.315	0.277	0.244
8.9	0.565	0.565	0.513	0.451	0.397	0.349	0.306	0.269	0.237	0.208
9.0	0.486	0.486	0.442	0.389	0.342	0.300	0.264	0.232	0.204	0.179

To calculate total ammonia nitrogen chronic criteria values in freshwater when fish early life stages are present at different pH and temperature values than those listed in this subsection, use the following formulas:

Chronic Criteria Concentration = [~~(0.0577/(1 + 10$^{7.688-pH}$) + 2.487/(1 + 10$^{pH-7.688}$))~~ x MIN

$$\left(\frac{0.0577}{1 + 10^{7.688-pH}} + \frac{2.487}{1 + 10^{pH-7.688}} \right) \text{x MIN} \quad]$$

Where MIN = 2.85 or 1.45 x $10^{0.028(25-T)}$, whichever is less.

[T = temperature in °C]

[2] The default design flow for calculating steady state waste load allocations for the chronic ammonia criterion where early life stages of fish are present is the 30Q10 (see 9 VAC 25-260-140 B footnote 10) unless statistically valid methods are employed which demonstrate compliance with the duration and return frequency of the water quality criteria.

C. The thirty-day average concentration of total ammonia nitrogen (in mg N/L) where early life stages of fish are absent (procedures for making this determination are in subdivisions1 through 4 of this subsection), in freshwater shall not exceed, more than once every three years on the average[3], the chronic criteria below:

Chronic Ammonia Freshwater Criteria

Early Life Stages of Fish Absent

Total Ammonia Nitrogen (mg N/L)

	Temperature (C^o)									
pH	0-7	8	9	10	11	12	13	14	15	16
6.5	10.8	10.1	9.51	8.92	8.36	7.84	7.35	6.89	6.46	6.06
6.6	10.7	9.99	9.37	8.79	8.24	7.72	7.24	6.79	6.36	5.97
6.7	10.5	9.81	9.20	8.62	8.08	7.58	7.11	6.66	6.25	5.86
6.8	10.2	9.58	8.98	8.42	7.90	7.40	6.94	6.51	6.10	5.72
6.9	9.93	9.31	8.73	8.19	7.68	7.20	6.75	6.33	5.93	5.56
7.0	9.60	9.00	8.43	7.91	7.41	6.95	6.52	6.11	5.73	5.37
7.1	9.20	8.63	8.09	7.58	7.11	6.67	6.25	5.86	5.49	5.15
7.2	8.75	8.20	7.69	7.21	6.76	6.34	5.94	5.57	5.22	4.90
7.3	8.24	7.73	7.25	6.79	6.37	5.97	5.60	5.25	4.92	4.61
7.4	7.69	7.21	6.76	6.33	5.94	5.57	5.22	4.89	4.59	4.30
7.5	7.09	6.64	6.23	5.84	5.48	5.13	4.81	4.51	4.23	3.97
7.6	6.46	6.05	5.67	5.32	4.99	4.68	4.38	4.11	3.85	3.61
7.7	5.81	5.45	5.11	4.79	4.49	4.21	3.95	3.70	3.47	3.25
7.8	5.17	4.84	4.54	4.26	3.99	3.74	3.51	3.29	3.09	2.89
7.9	4.54	4.26	3.99	3.74	3.51	3.29	3.09	2.89	2.71	2.54
8.0	3.95	3.70	3.47	3.26	3.05	2.86	2.68	2.52	2.36	2.21
8.1	3.41	3.19	2.99	2.81	2.63	2.47	2.31	2.17	2.03	1.91
8.2	2.91	2.73	2.56	2.40	2.25	2.11	1.98	1.85	1.74	1.63
8.3	2.47	2.32	2.18	2.04	1.91	1.79	1.68	1.58	1.48	1.39

8.4	2.09	1.96	1.84	1.73	1.62	1.52	1.42	1.33	1.25	1.17
8.5	1.77	1.66	1.55	1.46	1.37	1.28	1.20	1.13	1.06	0.990
8.6	1.49	1.40	1.31	1.23	1.15	1.08	1.01	0.951	0.892	0.836
8.7	1.26	1.18	1.11	1.04	0.976	0.915	0.858	0.805	0.754	0.707
8.8	1.07	1.01	0.944	0.885	0.829	0.778	0.729	0.684	0.641	0.601
8.9	0.917	0.860	0.806	0.756	0.709	0.664	0.623	0.584	0.548	0.513
9.0	0.790	0.740	0.694	0.651	0.610	0.572	0.536	0.503	0.471	0.442

At 15°C and above, the criterion for fish early life stages absent is the same as the criterion for fish early life stages present.

To calculate total ammonia nitrogen chronic criteria values in freshwater when fish early life stages are absent at different pH and temperature values than those listed in this subsection, use the following formulas:

Chronic Criteria Concentration = $[\left(\frac{0.0577}{1 + 10^{7.688 - pH}} + \frac{2.487}{1 + 10^{pH - 7.688}} \right) \times 1.45(10^{0.028(25 - MAX)})]$

MAX = temperature in ° C or 7, whichever is greater.

[3]The default design flow for calculating steady state waste load allocations for the chronic ammonia criterion where early life stages of fish are absent is the 30Q10 (see 9 VAC 25-260-140 B footnote 10), unless statistically valid methods are employed which demonstrate compliance with the duration and return frequency of the water quality criteria.

1. Site-specific modifications to the ambient water quality criteria for ammonia to account for the absence of 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 early life stages of fish present during most times of the year, the criteria shall be calculated assuming early life stages of fish are present using subsection B of this section unless the following demonstration that early life stages are absent is successfully completed. 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 Game and Inland Fisheries 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/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 9 VAC 25-260-140 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 by 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 where 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 fish early life stages 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 are absent. This list is available either upon request from the Office of Water Quality Programs at 629 E. Main Street, Richmond, VA, 23219 or from the department website http://deq.state.va.us/wqs/ .

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 pre-hatch 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; 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 [~~federally~~ federal or state] listed, threatened or endangered species or result in the destruction or adverse modification of such species' critical habitat.

D. 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 below:

Acute Ammonia Saltwater Criteria

Total Ammonia Nitrogen (mg N/L)

Salinity = 10 g/kg

	Temperature º C							
pH	0	5	10	15	20	25	30	35
7.00	231.9	159.8	110.1	75.88	52.31	36.08	24.91	17.21
7.20	146.4	100.9	69.54	47.95	33.08	22.84	15.79	10.93
7.40	92.45	63.73	43.94	30.32	20.94	14.48	10.03	6.97
7.60	58.40	40.28	27.80	19.20	13.28	9.21	6.40	4.47
7.80	36.92	25.48	17.61	12.19	8.45	5.88	4.11	2.89
8.00	23.37	16.15	11.18	7.76	5.40	3.78	2.66	1.89
8.20	14.81	10.26	7.13	4.97	3.48	2.46	1.75	1.27
8.40	9.42	6.54	4.57	3.20	2.27	1.62	1.18	0.87
8.60	6.01	4.20	2.95	2.09	1.50	1.09	0.81	0.62
8.80	3.86	2.72	1.93	1.39	1.02	0.76	0.58	0.46
9.00	2.51	1.79	1.29	0.95	0.71	0.55	0.44	0.36

Salinity = 20 g/kg

	Temperature º 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

pH	Temperature º C							
	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:

$$I = \left[\frac{19.0273S/(1000-1.005109S)}{19.0273S \over (1000 - 1.005109S)} \right]$$

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 ° Kelvin = ° C + 273]

To correct for other temperatures:

$$pKa^{S}_{T} = pKa^{S}_{298} + .0324(298 - T\ ° Kelvin)$$

[T ° Kelvin = ° C + 273.15]

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:

$$Acute = \frac{.233}{UIA}$$

Multiply the [~~above~~ acute] value by .822 to get the ammonia-N acute criterion.

E. The thirty-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 below:

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

7.00	37.19	25.62	17.65	12.16	8.39	5.78	3.99	2.76
7.20	23.47	16.17	11.15	7.69	5.30	3.66	2.53	1.75
7.40	14.82	10.22	7.04	4.86	3.36	2.32	1.61	1.12
7.60	9.36	6.46	4.46	3.08	2.13	1.47	1.02	0.71
7.80	5.92	4.08	2.82	1.95	1.35	0.94	0.66	0.46
8.00	3.74	2.59	1.79	1.24	0.86	0.60	0.43	0.30
8.20	2.37	1.64	1.14	0.79	0.56	0.39	0.28	0.20
8.40	1.51	1.05	0.73	0.51	0.36	0.26	0.19	0.14
8.60	0.96	0.67	0.47	0.33	0.24	0.17	0.13	0.10
8.80	0.62	0.43	0.31	0.22	0.16	0.12	0.09	0.07
9.00	0.40	0.28	0.20	0.15	0.11	0.09	0.07	0.06

Salinity = 30 g/kg

	Temperature º C							
pH	0	5	10	15	20	25	30	35
7.00	39.75	27.38	18.87	13.00	8.96	6.18	4.27	2.95
7.20	25.09	17.29	11.91	8.21	5.67	3.91	2.70	1.87
7.40	15.84	10.92	7.53	5.19	3.59	2.48	1.72	1.19
7.60	10.01	6.90	4.76	3.29	2.27	1.57	1.09	0.76
7.80	6.32	4.36	3.01	2.08	1.44	1.00	0.70	0.49
8.00	4.00	2.76	1.91	1.33	0.92	0.64	0.45	0.32
8.20	2.53	1.75	1.22	0.85	0.59	0.42	0.30	0.21
8.40	1.61	1.12	0.78	0.55	0.38	0.27	0.20	0.14
8.60	1.03	0.72	0.50	0.35	0.25	0.18	0.14	0.10
8.80	0.66	0.46	0.33	0.23	0.17	0.13	0.10	0.08
9.00	0.43	0.30	0.22	0.16	0.12	0.09	0.07	0.06

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:

$$I = \left[\frac{19.0273S}{(1000-1.005109S)} \right]$$

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 + .138I

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

[T ° Kelvin = ° C + 273]

To correct for other temperatures:

$$pKa^{S}_{T} = pKa^{S}_{298} + .0324(298 - T \text{ ° Kelvin})$$

~~[T ° Kelvin = ° C + 273.15]~~

The unionized ammonia fraction (UIA) is given by:

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

The chronic ammonia criterion is saltwater is given by:

$$Chronic = \frac{.035}{UIA}$$

Multiply the [~~above~~ chronic] value by .822 to get the ammonia-N chronic criterion.

Certified true and accurate: _____

Robert G. Burnley, Director, DEQ

Date: _____