

Bold = new language

~~Strikeout~~ = existing language deleted in this rulemaking

TITLE 327 WATER POLLUTION CONTROL DIVISION

DRAFT RULE

LSA Document #14-58

DIGEST

Amends 327 IAC 2-1-6 and 327 IAC 2-1.5-8 concerning revisions to Indiana's aquatic life and human health surface water quality criteria (WQC) for select metals to reflect updates based on current science and National Recommended Water Quality Criteria (NRWQC) at Section 304(a) of the Clean Water Act (CWA). Effective 30 days after filing with the Publisher.

HISTORY

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327 IAC 2-1-6; 327 IAC 2-1.5-8.

DRAFT RULE

SECTION 1. 327 IAC 2-1-6 IS AMENDED TO READ AS FOLLOWS:

327 IAC 2-1-6 Minimum surface water quality criteria

Authority: IC 13-14-8-2; IC 13-14-8-3; IC 13-18-4-3

Affected: IC 13-11-2-258; IC 13-18-4; IC 13-30-2-1; IC 14-22-9

Sec. 6. (a) The following are minimum surface water quality conditions:

(1) All surface waters, ~~at all times and at all places,~~ including waters within ~~the~~ a mixing zone, ~~shall meet the minimum conditions of being~~ **must be** free from substances, materials, floating debris, oil, or scum attributable to municipal, industrial, agricultural, and other land use practices, or other discharges that do any of the following:

(A) ~~Will~~ Settle to form putrescent or otherwise objectionable deposits.

(B) ~~Are~~ **Occur** in amounts sufficient to be unsightly or deleterious.

(C) Produce:

(i) color;

- (ii) visible oil sheen;
- (iii) odor; or
- (iv) other conditions;

~~in such degree as to create~~ **an extent that creates** a nuisance.

(D) ~~Are~~ **Occur** in concentrations or combinations that will cause or contribute to the growth of aquatic plants or algae to ~~such a degree as to:~~

- (i) create a nuisance;
- (ii) be unsightly; or
- (iii) otherwise impair the designated uses **of the surface waters.**

(E) ~~Are~~ **Occur** in amounts sufficient to be acutely toxic to, or to otherwise severely injure or kill, aquatic life, other animals, plants, or humans. To ~~assure~~ **ensure** protection of aquatic life, concentrations of toxic substances ~~shall~~ **must** not exceed the final acute value (FAV = 2 (AAC)) in the undiluted discharge or the acute aquatic criterion (AAC) outside the zone of initial dilution or, if applicable, the zone of discharge-induced mixing. **The following apply where applicable:**

(i) For certain substances, an AAC is ~~established and set forth~~ **specified** in:

- (AA)** subdivision (3), Table 6-1, **which incorporates** subdivision ~~(3), (5),~~ Table 6-2; ~~which table incorporates~~ subdivision ~~(4), Table 6-3;~~ and
- (BB)** subdivision ~~(5); (6).~~

(ii) ~~for substances for which an AAC is not specified in subdivision (3), Table 6-1, subdivision (3), Table 6-2, or subdivision (5),~~ An AAC ~~can~~ **may** be calculated by the commissioner using the procedures in section 8.2 of this rule ~~and~~ **for substances for which an AAC is not specified in:**

- (AA)** subdivision (3), Table 6-1, **which incorporates** subdivision (5), Table 6-2; or
- (BB)** subdivision (6).

(iii) The AAC determined under item (i) or (ii) may be modified on a site-specific basis to reflect local conditions in accordance with section 8.9 of this rule. ~~This~~

(F) Clause ~~shall~~ **(E) does** not apply to the chemical control of plants and animals when that control is performed in compliance with approval conditions specified by the Indiana department of natural resources as provided by IC 14-22-9.

(2) ~~At All times,~~ all surface waters outside of mixing zones ~~shall~~ **must** be free of substances in concentrations that, on the basis of available scientific data, are believed to be sufficient to injure, be chronically toxic to, or be carcinogenic, mutagenic, or teratogenic to humans, animals, aquatic life, or plants. ~~To assure protection against the adverse effects identified in this subdivision,~~ **The following requirements to ensure protection against the adverse effects identified in this subdivision are established:** ~~as follows:~~

- (A) A toxic substance or pollutant ~~shall~~ **must** not be present in ~~such~~ **surface** waters **outside of mixing zones** in concentrations that exceed the most stringent of the following continuous criterion concentrations (CCCs):
 - (i) A chronic aquatic criterion (CAC) to protect aquatic life from chronic toxic effects.
 - (ii) A terrestrial life cycle safe concentration (TLSC) to protect terrestrial

organisms from toxic effects that may result from the consumption of aquatic organisms or water from the waterbody.

(iii) A human life cycle safe concentration (HLSC) to protect human health from toxic effects that may result from the consumption of aquatic organisms or drinking water from the waterbody.

(iv) For carcinogenic substances, a criterion to protect human health from unacceptable cancer risk of greater than one (1) additional occurrence of cancer per one hundred thousand (100,000) population.

(B) For certain substances, one (1) or more of the CCCs identified in clause (A) are ~~established and set forth~~ **specified** in:

(i) subdivision (3), Table 6-1, **which incorporates subdivision (5), Table 6-2;**

(ii) ~~subdivision (3), Table 6-2 (which table incorporates subdivision (4), (4)(A), Table 6-3), and subdivision (5).~~ **6-1a;**

(iii) **subdivision (4)(B), Table 6-1b;**

(iv) **subdivision (6); and**

(v) **subdivision (7), Table 6-4.**

(C) ~~For substances for which one (1) or more of the CCCs identified in clause (A) are not specified in subdivision (3), Table 6-1, subdivision (3), Table 6-2, or subdivision (5), such~~ Criterion or criteria may be calculated by the commissioner using the corresponding procedures prescribed by sections 8.3 through 8.6 of this rule **for substances for which a CCC identified in clause (A) is not specified in:**

(i) **subdivision (3), Table 6-1, which incorporates subdivision (5), Table 6-2;**

(ii) **subdivision (4)(A), Table 6-1a;**

(iii) **subdivision (4)(B), Table 6-1b;**

(iv) **subdivision (6); or**

(v) **subdivision (7), Table 6-4.**

(D) A CCC determined under clause ~~(B)~~ **(B)(i), (B)(iv), (B)(v)**, or (C) may be modified on a site-specific basis to reflect local conditions in accordance with section 8.9 of this rule.

(E) The CAC and TLSC for a substance apply in all surface waters outside of a mixing zone for a discharge of that substance. ~~Similarly,~~

(F) In surface waters where a public water system intake is not present or is unaffected by the discharge of a substance, the HLSC and the carcinogenic criterion for that substance based on consumption of organisms from the waterbody and only incidental ingestion of water ~~shall~~ apply to all surface waters outside **of** the mixing zone for a discharge of that substance.

(G) In surface waters where a public water system intake is present, the HLSC and the carcinogenic criterion for a substance based on consumption of organisms and potable water from the waterbody ~~shall~~ apply at the point of the public water system intake.

(3) ~~The following establishes~~ Surface water quality criteria **for the protection of aquatic life** for specific substances **are as follows:**

~~Table 6-1~~

~~Surface Water Quality Criteria for Specific Substances~~

AAC (Maximum)		CCC		
Substances		Outside of Mixing Zone		Point of Water Intake
		Aquatic Life (CAC) (4-Day Average)	Human Health (30-Day Average)	Human Health (30-Day Average)
<u>Metals (µg/l)</u>				
(Total recoverable)				
Antimony			45,000 (T)	146 (T)
Arsenic (III)	#	#	0.175 (C)	0.022 (C)
Barium				1,000 (D)
Beryllium			1.17 (C)	0.068 (C)
Cadmium	#	#		10 (D)
Chromium (III)	#	#	3,433,000 (T)	170,000 (T)
Chromium (VI)	#	#		50 (D)
Copper	#	#		
Lead	#	#		50 (D)
Mercury\$	2.4	0.012	0.15 (T)	0.14 (T)
Nickel	#	#	100 (T)	13.4 (T)
Selenium	130*	35 ##		10 (D)
Silver	#			50 (D)
Thallium			48 (T)	13 (T)
Zinc	#	#		
<u>Organics (µg/l)</u>				
Acrolein			780 (T)	320 (T)
Acrylonitrile			6.5 (C)	0.58 (C)
Aldrin\$	1.5*		0.00079 (C)	0.00074 (C)
Benzene			400 (C)	6.6 (C)
Benzidine			0.0053 (C)	0.0012 (C)
Carbon Tetrachloride			69.4 (C)	4.0 (C)
Chlordane\$	1.2*	0.0043	0.0048 (C)	0.0046 (C)
Chlorinated Benzenes				
Monochlorobenzene				488 (T)
1,2,4,5-Tetrachlorobenzene\$			48 (T)	38 (T)
Pentachlorobenzene\$			85 (T)	74 (T)
Hexachlorobenzene\$			0.0074 (C)	0.0072 (C)
Chlorinated Ethanes				
1,2-dichloroethane			2,430 (C)	9.4 (C)
1,1,1-trichloroethane			1,030,000 (T)	18,400 (T)
1,1,2-trichloroethane			418 (C)	6.0 (C)
1,1,2,2-tetrachloroethane			107 (C)	1.7 (C)
Hexachloroethane			87.4 (C)	19 (C)

Chlorinated Phenols				
2,4,5-trichlorophenol				2,600 (T)
2,4,6-trichlorophenol			36 (C)	12 (C)
Chloroalkyl Ethers				
bis(2-chloroisopropyl) ether			4,360 (T)	34.7 (T)
bis(chloromethyl)-ether			0.018 (C)	0.000038 (C)
bis(2-chloroethyl)-ether			13.6 (C)	0.3 (C)
Chloroform			157 (C)	1.9 (C)
Chlorpyrifos	0.083	0.041		
DDT\$	0.55*	0.0010	0.00024 (C)	0.00024 (C)
Dichlorobenzenes				
Dichlorobenzidine			2,600 (T)	400 (T)
1,1-dichloroethylene			0.2 (C)	0.1 (C)
2,4-dichlorophenol			18.5 (C)	0.33 (C)
Dichloropropenes				3,090 (T)
Dieldrin\$	1.3*	0.0019	14,100 (T)	87 (T)
2,4-dinitrotoluene			0.00076 (C)	0.00071 (C)
Dioxin (2,3,7,8-TCDD)\$			91 (C)	1.1 (C)
1,2-diphenylhydrazine			0.0000001 (C)	0.0000001 (C)
Endosulfan	0.11*	0.056	5.6 (C)	0.422 (C)
Endrin\$	0.09*	0.0023	159 (T)	74 (T)
Ethylbenzene				1.0 (D)
Fluoranthene			3,280 (T)	1,400 (T)
Halomethanes			54 (T)	42 (T)
Heptachlor\$	0.26*	0.0038	157 (C)	1.9 (C)
Hexachlorobutadiene\$			0.0028 (C)	0.0028 (C)
Hexachlorocyclohexane (HCH)			500 (C)	4.47 (C)
alpha-HCH\$				
beta-HCH\$			0.31 (C)	0.09 (C)
gamma-HCH (Lindane)\$	1.0*	0.080	0.55 (C)	0.16 (C)
Technical HCH\$			0.63 (C)	0.19 (C)
Hexachlorocyclopentadiene			0.41 (C)	0.12 (C)
Isophorone				206 (T)
Nitrobenzene			520,000 (T)	5,200 (T)
Nitrophenols				19,800 (T)
4,6-dinitro-o-cresol			765 (T)	13.4 (T)
Dinitrophenol			14,300 (T)	70 (T)
Nitrosamines				
N-nitrosodiethylamine			12.4 (C)	0.008 (C)
N-nitrosodimethylamine			160 (C)	0.014 (C)

N-nitrosodibutylamine			5.9 (C)	0.064 (C)
N-nitrosodiphenylamine			161 (C)	49 (C)
N-nitrosopyrrolidine			919 (C)	0.16 (C)
Parathion	0.065	0.013		
Pentachlorophenol	$e^{(4.005 \cdot [\text{pH}] - 4.830)}$	$e^{(4.005 \cdot [\text{pH}] - 5.290)}$		1,000 (T)
Phenol				3,500 (T)
Phthalate Esters				
Dimethyl phthalate			2,900,000 (T)	313,000 (T)
Diethyl phthalate			1,800,000 (T)	350,000 (T)
Dibutyl phthalate			154,000 (T)	34,000 (T)
Di-2-ethylhexyl phthalate			50,000 (T)	15,000 (T)
Polychlorinated Biphenyls (PCBs)\$		0.014	0.00079 (C)	0.00079 (C)
Carcinogenic Polynuclear Aromatic Hydrocarbons (PAHs)			0.31 (C)	0.028 (C)
Tetrachloroethylene			88.5 (C)	8 (C)
Toluene			424,000 (T)	14,300 (T)
Toxaphene\$	0.73	0.0002	0.0073 (C)	0.0071 (C)
Trichloroethylene			807 (C)	27 (C)
Vinyl Chloride			5,246 (C)	20 (C)
<u>Other Substances</u>				
Asbestos (fibers/liter)				300,000 (C)
Chloride (mg/l)	**	**		
Chlorine (Total Residual) (µg/l)	19	11		
Chlorine* (mg/l) (intermittent, total residual)		0.2		
Cyanide (Free) (µg/l)	22	5.2		
Cyanide (Total) (µg/l)				200 (D)
Nitrate-N + Nitrite-N (mg/l)				10 (D)
Nitrite-N (mg/l)				1.0 (D)

Fluoride shall not exceed two (2.0) mg/l in all surface waters outside of the mixing zone except the Ohio River and Interstate Wabash River where it shall not exceed one (1.0) mg/l outside of the mixing zone.

Sulfate shall not exceed the criteria established in subdivision (6) in all surface waters outside of the mixing zone.

#The AAC and CAC for this substance are established in Table 6-2.

*One-half (½) of the final acute value (FAV) as calculated by procedures developed by U.S. EPA in 1980. This value would correspond to acute aquatic values calculated using IDEM procedures or U.S. EPA procedures developed in 1985 in which the calculated

FAV is divided by two (2) to reduce acute toxicity.

**The AAC and CAC for this substance are established in subdivision (5).

T derived from threshold toxicity.

C derived from nonthreshold cancer risk.

D derived from drinking water standards, equal to or less than threshold toxicity.

\$This substance is a bioaccumulative chemical of concern.

*To be considered an intermittent discharge, total residual chlorine shall not be detected in the discharge for a period of more than forty (40) minutes in duration, and such periods shall be separated by at least five (5) hours.

Table 6-2
Surface Water Quality Criteria for Specific Substances

Substances	AAC (Maximum) (µg/l)	AAC Conversion Factors	CAC (4-Day Average) (µg/l)	CAC Conversion Factors
Metals (dissolved) ^[1]				
Arsenic (III)	WER ^[2] (360)	1.000	WER ^[2] (190)	1.000
Cadmium	WER ^[2] (e ^{(-1.128 [ln(hardness)]-3.828)})	1.136672-[ln hardness) (0.041838)]	WER ^[2] (e ^{(-0.7852 [ln(hardness)]-3.490)})	1.101672-[ln hardness) (0.041838)]
Chromium (III)	WER ^[2] (e ^{(-0.819 [ln(hardness)]+3.688)})	0.316	WER ^[2] (e ^{(-0.8190 [ln(hardness)]+1.561)})	0.860
Chromium (VI)	WER ^[2] (16)	0.982	WER ^[2] (11)	0.962
Copper	WER ^[2] (e ^{(-0.9422 [ln(hardness)]-1.464)})	0.960	WER ^[2] (e ^{(-0.8545 [ln(hardness)]-1.465)})	0.960
Lead	WER ^[2] (e ^{(-1.273 [ln(hardness)]-1.460)})	1.46203-[ln hardness) (0.145712)]	WER ^[2] (e ^{(-1.273 [ln(hardness)]-4.705)})	1.46203-[ln hardness) (0.145712)]
Nickel	WER ^[2] (e ^{(-0.8460 [ln(hardness)]+3.3612)})	0.998	WER ^[2] (e ^{(-0.8460 [ln(hardness)]+1.1645)})	0.997
Silver	WER ^[2] (e ^{(-1.72 [ln(hardness)]- 6.52)/2^[3])}	0.85		
Zinc	WER ^[2] (e ^{(-0.8473 [ln(hardness)]+0.8604)})	0.978	WER ^[2] (e ^{(-0.8473 [ln(hardness)]+0.7614)})	0.986

^[1]The AAC and CAC columns of this table contain total recoverable metals criteria (numeric and hardness based). The criterion for the dissolved metal is calculated by multiplying the appropriate conversion factor by the AAC or CAC. This dissolved AAC or CAC shall be rounded to two (2) significant digits, except when the criteria are used as intermediate values in a calculation, such as in the calculation of water quality based effluent limitations (WQBELs).

^[2]A value of one (1) shall be used for the water effect ratio (WER) unless an alternate value is established under section 8.9 of this rule.

^[3]One half (½) of the FAV as calculated by procedures developed by U.S. EPA in 1980. This value would correspond to acute aquatic values calculated using IDEM procedures or U.S. EPA procedures developed in 1985 in which the calculated FAV is divided by two (2) to reduce acute toxicity.

**Table 6-1
Surface Water Quality Criteria for the Protection of Aquatic Life**

CAS Number	Substances	Acute Aquatic Criteria (AAC) (Maximum) (µg/l)	AAC Conversion Factors (CF)	Chronic Aquatic Criteria (CAC) (4-Day Average) (µg/l)	CAC Conversion Factors (CF)
Metals					
7440382	Arsenic ^[1]	WER(340)(CF)	1.000	WER(150)(CF)	1.000
7440439	Cadmium ^{[1][2]}	$WER(e^{(0.9789[\ln H]-3.866)})(CF)$	1.136672- [lnH]0.041838	$WER(e^{(0.7977[\ln H]-3.909)})(CF)$	1.101672- [lnH]0.041838
16065831	Chromium (III) ^{[1][2]}	$WER(e^{(0.819[\ln H]+3.7256)})(CF)$	0.316	$WER(e^{(0.819[\ln H]+0.6848)})(CF)$	0.860
18540299	Chromium (VI) ^[1]	WER(16)(CF)	0.982	WER(11)(CF)	0.962
7440508	Copper ^{[1][2]}	$WER(e^{(0.9422[\ln H]-1.464)})(CF)$	0.960	$WER(e^{(0.8545[\ln H]-1.465)})(CF)$	0.960
7439921	Lead ^{[1][2]}	$WER(e^{(1.273[\ln H]-1.460)})(CF)$	1.46203- [lnH]0.145712	$WER(e^{(1.273[\ln H]-4.705)})(CF)$	1.46203- [lnH]0.145712
7439976	Mercury ^{[3][4]}	2.4	NA	0.012	NA
7440020	Nickel ^{[1][2]}	$WER(e^{(0.846[\ln H]+2.255)})(CF)$	0.998	$WER(e^{(0.846[\ln H]+0.0584)})(CF)$	0.997
7440224	Silver ^{[1][2][5]}	$WER(e^{(1.72[\ln H]-6.59)})/2)(CF)$	0.85		
7440666	Zinc ^{[1][2]}	$WER(e^{(0.8473[\ln H]+0.884)})(CF)$	0.978	$WER(e^{(0.8473[\ln H]+0.884)})(CF)$	0.986
Organics					
309002	Aldrin ^{[4][5]}	1.5	NA		NA
57749	Chlordane ^{[4][5]}	1.2	NA	0.0043	NA
2921882	Chlorpyrifos	0.083	NA	0.041	NA
50293	DDT ^{[4][5]}	0.55	NA	0.0010	NA
60571	Dieldrin ^{[4][5]}	1.3	NA	0.0019	NA
	Endosulfan ^[5]	0.11	NA	0.056	NA
72208	Endrin ^{[4][5]}	0.09	NA	0.0023	NA
76448	Heptachlor ^{[4][5]}	0.26	NA	0.0038	NA
58899	Gamma HCH (Lindane) ^{[4][5]}	1.0	NA	0.080	NA
56382	Parathion	0.065	NA	0.013	NA
87865	Pentachlorophenol	$e^{(1.005[\text{pH}]-4.830)}$	NA	$e^{(1.005[\text{pH}]-5.290)}$	NA
	Polychlorinated Biphenyls (PCBs) ^[4]		NA	0.014	NA
8001352	Toxaphene ^[4]	0.73	NA	0.0002	NA
Other Substances					
7782505	Chlorine (Total Residual)	19	NA	11	NA

7782505	Chlorine (intermittent, total residual) ^[6]			200	NA
57125	Cyanide (free)	22	NA	5.2	NA
Selenium CAC are specified in subdivision (4).					
Chloride AAC and CAC are specified in subdivision (6).					

^[1]Aquatic life criteria for these metals are expressed as a dissolved concentration and are calculated using the water-effect ratio (WER) and the specified conversion factor (CF). The AAC and CAC for a dissolved metal are calculated by multiplying the WER by the criterion value or formula and then by the appropriate CF. A value of one (1) must be used for the WER unless an alternate value is established under section 8.9 of this rule. The dissolved AAC and CAC must be rounded to two (2) significant digits, except when the criteria are used as intermediate values in a calculation, such as in the calculation of water quality-based effluent limitations (WQBELs).

^[2]The hardness values used in the equations for these criteria must not be greater than 400 mg/l as calcium carbonate (CaCO₃), and the criteria at a hardness of 400 mg/l as CaCO₃ are used for a water hardness above 400 mg/l as CaCO₃. The term “lnH” is the natural log of hardness.

^[3]Aquatic life criteria for this metal are expressed as a total recoverable concentration.

^[4]These substances are bioaccumulative chemicals of concern.

^[5]The AAC for these substances is one-half (½) of the FAV as calculated by procedures developed by U.S. EPA in 1980. This value would correspond to acute aquatic values calculated using procedures of the department or U.S. EPA procedures developed in 1985 in which the calculated FAV is divided by two (2) to reduce acute toxicity.

^[6]To be considered an intermittent discharge, total residual chlorine must not be detected in the discharge for a period of more than forty (40) minutes in duration, and these time periods must be separated by at least five (5) hours.

(4) Surface water quality criterion for selenium must meet the following:

(A) The surface water quality criterion for selenium, except for waters where the department has made, and U.S. EPA has approved, a site-specific determination that the criterion in Table 6-1b are applicable, is as follows:

Table 6-1a
Surface Water Quality Aquatic Life Criterion for Selenium (CAS # 7782492)

Chronic Aquatic Criterion (CAC)				
Media Type	Fish Tissue ^[1]		Water Column ^{[5][7]}	
Criterion Element	Egg/Ovary ^[2]	Fish Whole Body or Muscle ^[3]	Monthly Average Exposure	Intermittent Exposure ^[6]
Magnitude	15.1 mg/kg dw	8.5 mg/kg dw whole body or 11.3 mg/kg dw muscle (skinless, boneless filet)	1.5 µg/l in lentic aquatic systems 3.1 µg/l in lotic aquatic systems	$WQC_{int} = \frac{WQC_{30\text{-day}} - C_{bkg\text{r}nd}(1 - f_{int})}{f_{int}}$
Duration	Instantaneous	Instantaneous	30 days	Number of days per month

	measurement ^[4]	measurement ^[4]		with an elevated concentration
Frequency	Not to be exceeded	Not to be exceeded	Not more than once in three (3) years on average	Not more than once in three (3) years on average

^[1]Fish tissue elements are expressed as steady-state; the aquatic system should not be experiencing new or increasing inputs of selenium.

^[2]Egg or ovary supersedes any whole-body, muscle, or water column element when fish egg or ovary concentrations are measured. Any proposal to sample egg or ovary fish tissue must be submitted to the department for review and approval prior to initiation of sampling, and the department will evaluate all representative egg or ovary fish tissue data to determine compliance with this criterion element.

^[3]Fish whole-body or muscle tissue supersedes the water column element when both fish tissue and water concentrations are measured. Any proposal to sample fish whole-body or muscle tissue must be submitted to the department for review and approval prior to initiation of sampling, and the department will evaluate all representative fish whole-body or muscle tissue data to determine compliance with this criterion element.

^[4]Fish tissue data provide instantaneous point measurements that reflect integrative accumulation of selenium over time and space in fish populations at a given site.

^[5]Water column values are the applicable criterion element in the absence of steady-state condition fish tissue data and for fishless waters. Water column values are based on dissolved total selenium in water and are derived from fish tissue values via bioaccumulation modeling. Instead of the requirements in 327 IAC 5-2-11.1(b)(2), the allowable mixing zone dilution will be determined by applying the guideline in 327 IAC 2-1-4 to the thirty (30) day, ten (10) year ($Q_{30,10}$) low flow of the receiving stream for the chronic aquatic criterion (CAC) water column criterion element applicable to lotic aquatic systems, in the absence of site-specific mixing zone data.

^[6]Intermittent Exposure Equation variables mean the following:

WQC_{int} is the water column intermittent element.

$WQC_{30\text{-day}}$ is the water column monthly element for either lentic or lotic waters.

C_{bkgrnd} is the average background selenium concentration.

f_{int} is the fraction of any 30-day period during which elevated selenium concentrations occur, with f_{int} assigned a value ≥ 0.033 (corresponding to one (1) day).

^[7]The water column criterion element may be modified on a site-specific basis in accordance with clause (C).

(B) The surface water quality criterion for selenium, where the department has made, and U.S. EPA has approved, a site-specific determination that fishes in the Order Acipenseriformes (Order includes sturgeon and paddlefish) do not occur at the site, is as follows:

Table 6-1b

Site-specific Surface Water Quality Aquatic Life Criterion for Selenium (CAS # 7782492) in Non-Acipenseriformes (No Sturgeon or Paddlefish) Waters ^[1]

Chronic Aquatic Criterion (CAC)

Media Type	Fish Tissue ^[2]		Water Column ^{[6][8]}	
Criterion Element	Egg/Ovary ^[3]	Fish Whole Body or Muscle ^[4]	Monthly Average Exposure	Intermittent Exposure ^[7]
Magnitude	19.0 mg/kg dw	9.5 mg/kg dw whole body or 13.1 mg/kg dw muscle (skinless, boneless filet)	2.7 µg/l in lentic aquatic systems 5.5 µg/l in lotic aquatic systems	$WQC_{int} = \frac{WQC_{30\text{-day}} - C_{bkgrnd}(1-f_{int})}{f_{int}}$
Duration	Instantaneous measurement ^[5]	Instantaneous measurement ^[5]	30 days	Number of days per month with an elevated concentration
Frequency	Not to be exceeded	Not to be exceeded	Not more than once in three (3) years on average	Not more than once in three (3) years on average

^[1]This criterion is applicable to surface waters for which the department has made, and U.S EPA has approved, a site-specific determination that fishes in the Order Acipenseriformes do not occur at the site. In making this determination, the department must comply with the procedures in clause (D).

^[2]Fish tissue elements are expressed as steady-state; the aquatic system should not be experiencing new or increasing inputs of selenium.

^[3]Egg or ovary supersedes any whole-body, muscle, or water column element when fish egg or ovary concentrations are measured. Any proposal to sample egg or ovary fish tissue must be submitted to the department for review and approval prior to initiation of sampling, and the department will evaluate all representative egg or ovary fish tissue data to determine compliance with this criterion element.

^[4]Fish whole-body or muscle tissue supersedes the water column element when both fish tissue and water concentrations are measured. Any proposal to sample fish whole-body or muscle tissue must be submitted to the department for review and approval prior to initiation of sampling, and the department will evaluate all representative fish whole-body or muscle tissue data to determine compliance with this criterion element.

^[5]Fish tissue data provide instantaneous point measurements that reflect integrative accumulation of selenium over time and space in fish populations at a given site.

^[6]Water column values are the applicable criterion element in the absence of steady-state condition fish tissue data and for fishless waters. Water column values are based on dissolved total selenium in water and are derived from fish tissue values via bioaccumulation modeling. Instead of the requirements in 327 IAC 5-2-11.1(b)(2), the allowable mixing zone dilution will be determined by applying the guideline in 327 IAC 2-1-4 to the thirty (30) day, ten (10) year (Q_{30,10}) low flow of the receiving stream for the

chronic aquatic criterion (CAC) water column criterion element applicable to lotic aquatic systems, in the absence of site-specific mixing zone data.

^{17]}Intermittent Exposure Equation variables mean the following:

WQC_{int} is the water column intermittent element.

$WQC_{30\text{-day}}$ is the water column monthly element for either lentic or lotic waters.

C_{bkgrnd} is the average background selenium concentration.

f_{int} is the fraction of any 30-day period during which elevated selenium concentrations occur, with f_{int} assigned a value ≥ 0.033 (corresponding to one (1) day).

^{18]}The water column criterion element may be modified on a site-specific basis in accordance with clause (C).

(C) Modification of the selenium water column criterion element must be achieved according to the following:

(i) Site-specific water column criterion elements must be derived using either the empirical bioaccumulation factor (BAF) or mechanistic modeling method provided in Aquatic Life Ambient Water Quality Criterion for Selenium – Freshwater, EPA-822-R-16-006, Appendix K: Translation of a Selenium Fish Tissue Criterion Element to a Site-Specific Water Column Value (June 2016)*.

(ii) Any proposal to derive a site-specific water column criterion element must be submitted to the department for review and approval of the methodology and sampling plan prior to initiation of sampling. The department shall evaluate and approve the applicability of and use of all representative data used to derive a site-specific water column criterion element.

(iii) Any proposal to derive a site-specific water column criterion element must be protective of downstream designated uses for aquatic life and human health.

(iv) Upon receipt of an application for a site-specific water column criterion element, the department shall do the following:

(AA) Publish on the department's website all pertinent information about the proposed site-specific modification.

(BB) Provide notice and request comment on the application.

(v) Upon approval of a site-specific water column criterion element, the department shall do the following:

(AA) Publish a notice in the Indiana Register.

(BB) Place on the department's website all pertinent information about the approved site-specific modification.

(CC) Submit the site-specific modification to U.S. EPA for approval.

(DD) If approved by U.S. EPA, incorporate the site-specific modification into the water quality standards during the next revision of the water quality standards.

(vi) Site-specific modifications of this criterion must not be incorporated into a final NPDES permit or used for other Clean Water Act purposes until approved by U.S. EPA.

(D) Upon receipt of an application for a site-specific determination that fishes in the Order Acipenseriformes (Order includes sturgeon and paddlefish) do not occur at the site, the department shall do the following:

(i) Review available species occurrence and distribution information and do one (1) of the following:

(AA) Make a tentative determination that fishes in the Order Acipenseriformes do not occur at the site.

(BB) Make a determination that fishes in the Order Acipenseriformes occur at the site and deny the application.

(ii) Upon a tentative determination that fishes in the Order Acipenseriformes do not occur at the site, the department shall do the following:

(AA) Publish on the department's website all pertinent information about the proposed site-specific determination.

(BB) Provide notice and request comment on the tentative decision.

(iii) Upon a final determination that fishes in the Order Acipenseriformes do not occur at the site, the department shall do the following:

(AA) Publish a notice in the Indiana Register.

(BB) Place on the department's website all pertinent information about the approved site-specific modification.

(CC) Submit the site-specific modification to U.S. EPA for approval.

(DD) If approved by U.S. EPA, incorporate the site-specific modification into the water quality standards during the next revision of the water quality standards.

(iv) Site-specific modifications of this criterion must not be incorporated into a final NPDES permit or used for other Clean Water Act purposes until approved by U.S. EPA.

(4) (5) The following establishes dissolved AAC and CAC for certain metals at selected hardness values calculated from the equations and conversion factors in subdivision (3), Table 6-2, 6-1, with a value of one (1) used for the WER are as follows:

Table 6-3 6-2

Metals Concentrations in Micrograms Per Liter; Hardness in Milligrams Per Liter CaCO₃¹

Hardness	Arsenic (III)		Cadmium		Chromium (III)		Chromium (VI)		Copper	
	AAC	CAC	AAC	CAC	AAC	CAC	AAC	CAC	AAC	CAC
50	360	190	1.7	0.62	310	100	16	11	8.9	6.3
	340	150	0.94	0.43	320	42				
100	360	190	3.7	1.0	550	180	16	11	17	11
	340	150	1.8	0.72	570	74				
150	360	190	5.7	1.4	760	250	16	11	25	16
	340	150	2.6	0.97	790	100				
200	360	190	7.8	1.7	970	310	16	11	33	21
	340	150	3.4	1.2	1,000	130				

250	360	190	10	2.0	1200	380	16	11	40	25
	340	150	4.2	1.4		160				
300	360	190	12	2.3	1300	440	16	11	48	29
	340	150	5.0	1.6	1,400	180				
350	360	190	14	2.6	1500	500	16	11	55	33
	340	150	5.8	1.8	1,600	210				
400	360	190	17	2.9	1700	550	16	11	63	37
	340	150	6.5	2.0	1,800	230				
450	360	190	19	3.1	1900	610	16	11	70	41
500	360	190	21	3.4	2100	670	16	11	78	45

Hardness	Lead		Nickel		Silver		Zinc	
	AAC	CAC	AAC	CAC	AAC	CAC	AAC	CAC
50	30	1.2	790	87	0.52	--	64	58
			260	29	0.49		65	66
100	65	2.5	1400	160	1.7	--	110	100
			470	52	1.6		120	120
150	100	3.9	2000	220	3.5	--	160	150
			660	73	3.2		170	170
200	140	5.3	2500	280	5.7	--	210	190
			840	93	5.3			210
250	170	6.7	3100	340	8.3	--	250	230
			1,000	110	7.8			260
300	210	8.1	3600	400	11	--	290	270
			1,200	130			300	300
350	240	9.5	4100	450	15	--	330	300
			1,400	150	14		340	340
400	280	11	4600	510	19	--	370	340
			1,500	170	17		380	380
450	320	12	5100	560	23	--	410	370
500	350	14	5500	610	27	--	450	410

^[1] The dissolved metals criteria in this table have been rounded to two (2) significant digits in accordance with subdivision (3), ~~Table 6-2~~ **Table 6-1**. The equations and conversion factors in subdivision (3), ~~Table 6-2~~ **Table 6-1** must be used instead of the criteria in this table when dissolved metals these criteria are used as intermediate values in a calculation, such as in the calculation of WQBELs.

~~(5)~~ **(6)** The following establishes Surface water quality criteria for chloride for protection of aquatic life are as follows:

(A) The following provides the AAC for chloride as a function of hardness (in mg/l as CaCO₃) and sulfate (in mg/l) in surface waters **is calculated using the following formula:**

$$C = 287.8 (\text{hardness})^{0.205797} (\text{sulfate})^{-0.07452}$$

Where: C = chloride AAC (maximum) in mg/l.

(B) The following provides the CAC for chloride as a function of hardness (in mg/l as CaCO₃) and sulfate (in mg/l) in surface waters **is calculated using the following formula:**

$$C = 177.87 (\text{hardness})^{0.205797} (\text{sulfate})^{-0.07452}$$

Where: C = chloride CAC (4-day average) in mg/l.

~~(C)~~ **This clause** applies to the AAC and CAC for chloride provided in this subdivision, **as follows:**

(i) Chloride criteria may only be established based on a sulfate concentration greater than the water quality criterion for sulfate, as

established under subdivision ~~(6)~~, **(8)**, where the water quality criterion for sulfate has been modified on a site-specific basis in accordance with either the:

(AA) variance provisions under section 8.8 of this rule; or ~~the~~

(BB) site-specific criteria provisions under section 8.9 of this rule.

(ii) The AAC and CAC for chloride calculated from the equations in this subdivision ~~shall~~ **must** be rounded to the nearest whole numbers, except when the criteria are used as intermediate values in a calculation, such as in the calculation of WQBELs.

~~(D) The following establishes the AAC for chloride in mg/l at selected concentrations of hardness (in mg/l as CaCO₃) and sulfate with the understanding that the equation in clause (A) shall be used instead of the criteria in this clause when chloride criteria are used as intermediate values in a calculation, such as in the calculation of WQBELs:~~ **is as follows:**

Table 6-3a^[1]

Sulfate (mg/l)	Hardness (mg/l)									
	50	100	150	200	250	300	350	400	450	500
15	526	607	660	700	733	761	785	807	827	845
20	515	594	646	685	717	745	769	790	809	827
25	506	584	635	674	705	732	756	777	796	813
50	481	555	603	640	670	695	718	738	756	773
100	457	527	573	608	636	660	682	701	718	734
150	443	511	556	589	617	641	661	680	697	712
200	434	500	544	577	604	627	647	665	682	697
250	427	492	535	567	594	617	637	654	671	685
300	421	485	528	560	586	609	628	646	661	676
350	416	480	522	553	579	602	621	638	654	668
400	412	475	516	548	574	596	615	632	647	662
450	408	471	512	543	569	590	609	626	642	656
500	405	467	508	539	564	586	605	622	637	651

^[1] **The equation in clause (A) must be used instead of the criteria in this table when chloride criteria are used as intermediate values in a calculation, such as in the calculation of WQBELs.**

~~(E) The following establishes the CAC for chloride in mg/l at selected concentrations of hardness (in mg/l as CaCO₃) and sulfate with the understanding that the equation in clause (B) shall be used instead of the criteria in this clause when chloride criteria are used as intermediate values in a calculation, such as in the calculation of WQBELs:~~ **is as follows:**

Table 6-3b^[1]

Sulfate (mg/l)	Hardness (mg/l)									
	50	100	150	200	250	300	350	400	450	500
15	325	375	408	433	453	470	485	499	511	522
20	318	367	399	423	443	460	475	488	500	511
25	313	361	392	416	436	453	467	480	492	503
50	297	343	373	395	414	430	444	456	467	477
100	282	326	354	375	393	408	421	433	444	453

150	274	316	343	364	381	396	409	420	430	440
200	268	309	336	357	373	388	400	411	421	431
250	264	304	331	351	367	381	394	404	414	423
300	260	300	326	346	362	376	388	399	409	418
350	257	297	322	342	358	372	384	394	404	413
400	255	294	319	339	355	368	380	391	400	409
450	252	291	316	336	351	365	377	387	397	405
500	250	289	314	333	349	362	374	384	394	402

^[1] The equation in clause (B) must be used instead of the criteria in this table when chloride criteria are used as intermediate values in a calculation, such as in the calculation of WQBELs.

(7) Surface water quality criteria for protection of human health for specific substances are as follows:

**Table 6-4
Surface Water Quality Criteria for Protection of Human Health^[1]**

CAS Number	Substances	Continuous Criterion Concentrations	
		Outside of Mixing Zone (µg/l)	Point of Water Intake (µg/l)
	Metals (total recoverable)		
7440360	Antimony	640 (T)	5.6 (T)
	Arsenic III	0.175 (C)	0.022 (C)
7440393	Barium		1,000 (D)
7440508	Copper		1,300 (D)
7439976	Mercury ^[2]	0.15 (T)	0.14 (T)
7440020	Nickel	4,600 (T)	610 (T)
7782492	Selenium	4,200 (T)	170 (T)
7440280	Thallium	48 (T)	13 (T)
7440666	Zinc	26,000 (T)	7,400 (T)
	Organics		
107028	Acrolein	780 (T)	320 (T)
107131	Acrylonitrile	6.5 (C)	0.58 (C)
309002	Aldrin ^[2]	0.00079 (C)	0.00074 (C)
71432	Benzene	400 (C)	6.6 (C)
92875	Benzidine	0.0053 (C)	0.0012 (C)
56235	Carbon Tetrachloride	69.4 (C)	4.0 (C)
57749	Chlordane ^[2]	0.0048 (C)	0.0046 (C)
	Chlorinated Benzenes		
108907	Monochlorobenzene		488 (T)
95943	1,2,4,5-Tetrachlorobenzene ^[2]	48 (T)	38 (T)
608935	Pentachlorobenzene ^[2]	85 (T)	74 (T)
118741	Hexachlorobenzene ^[2]	0.0074 (C)	0.0072 (C)

	Chlorinated Ethanes		
107062	1,2-dichloroethane	2,430 (C)	9.4 (C)
71556	1,1,1-trichloroethane	1,030,000 (T)	18,400 (T)
79005	1,1,2-trichloroethane	418 (C)	6.0 (C)
79345	1,1,2,2-tetrachloroethane	107 (C)	1.7 (C)
67721	Hexachloroethane	87.4 (C)	19 (C)
	Chlorinated Phenols		
95954	2,4,5-trichlorophenol		2,600 (T)
88062	2,4,6-trichlorophenol	36 (C)	12 (C)
	Chloroalkyl Ethers		
	bis(2-chloroisopropyl) ether	4,360 (T)	34.7 (T)
542881	bis(chloromethyl) ether	0.018 (C)	0.000038 (C)
111444	bis(2-chloroethyl) ether	13.6 (C)	0.3 (C)
67663	Chloroform	157 (C)	1.9 (C)
50293	DDT ^[2]	0.00024 (C)	0.00024 (C)
	Dichlorobenzenes	2,600 (T)	400 (T)
	Dichlorobenzidine	0.2 (C)	0.1 (C)
75354	1,1-dichloroethylene	18.5 (C)	0.33 (C)
120832	2,4-dichlorophenol		3,090 (T)
	Dichloropropenes	14,100 (T)	87 (T)
60571	Dieldrin ^[2]	0.00076 (C)	0.00071 (C)
121142	2,4-dinitrotoluene	91 (C)	1.1 (C)
1746016	Dioxin (2,3,7,8-TCDD) ^[2]	0.0000001 (C)	0.0000001 (C)
122667	1,2-diphenylhydrazine	5.6 (C)	0.422 (C)
	Endosulfan	159 (T)	74 (T)
72208	Endrin ^[2]		1.0 (D)
100414	Ethylbenzene	3,280 (T)	1,400 (T)
206440	Fluoranthene	54 (T)	42 (T)
	Halomethanes	157 (C)	1.9 (C)
76448	Heptachlor ^[2]	0.0028 (C)	0.0028 (C)
87683	Hexachlorobutadiene ^[2]	500 (C)	4.47 (C)
	Hexachlorocyclohexane (HCH)		
319846	alpha HCH ^[2]	0.31 (C)	0.09 (C)
319857	beta HCH ^[2]	0.55 (C)	0.16 (C)
58899	gamma HCH (Lindane) ^[2]	0.63 (C)	0.19 (C)
608731	Technical HCH ^[2]	0.41 (C)	0.12 (C)
77474	Hexachlorocyclopentadiene		206 (T)
78591	Isophorone	520,000 (T)	5,200 (T)
98953	Nitrobenzene		19,800 (T)
	Nitrophenols		
534521	4,6-dinitro-o-cresol	765 (T)	13.4 (T)
25550587	Dinitrophenol	14,300 (T)	70 (T)
	Nitrosamines		
55185	N-nitrosodiethylamine	12.4 (C)	0.008 (C)

62759	N-nitrosodimethylamine	160 (C)	0.014 (C)
924163	N-nitrosodibutylamine	5.9 (C)	0.064 (C)
86306	N-nitrosodiphenylamine	161 (C)	49 (C)
930552	N-nitrosopyrrolidine	919 (C)	0.16 (C)
87865	Pentachlorophenol		1,000 (T)
108952	Phenol		3,500 (T)
	Phthalate Esters		
131113	Dimethyl phthalate	2,900,000 (T)	313,000 (T)
84662	Diethyl phthalate	1,800,000 (T)	350,000 (T)
84742	Dibutyl phthalate	154,000 (T)	34,000 (T)
117817	Di-2-ethylhexyl phthalate	50,000 (T)	15,000 (T)
	Polychlorinated Biphenyls (PCBs) ^[2]	0.00079 (C)	0.00079 (C)
	Carcinogenic Polynuclear Aromatic Hydrocarbons (PAHs)	0.31 (C)	0.028 (C)
127184	Tetrachloroethylene	88.5 (C)	8 (C)
108883	Toluene	424,000 (T)	14,300 (T)
8001352	Toxaphene ^[2]	0.0073 (C)	0.0071 (C)
79016	Trichloroethylene	807 (C)	27 (C)
75014	Vinyl Chloride	5,246 (C)	20 (C)
	Other Substances		
1332214	Asbestos (fibers/liter)		300,000 (C)
57125	Cyanide (Total)		200 (D)
^[1] The human health criteria are thirty (30) day average criteria. T-derived from threshold toxicity C-derived from non-threshold cancer risk D-derived from drinking water standards, equal to or less than threshold toxicity ^[2] This substance is a bioaccumulative chemical of concern.			

(6) ~~The following establishes~~ (8) Surface water quality criteria for sulfate that ~~shall~~ **must** not be exceeded in all surface waters outside of ~~the~~ a mixing zone **are as follows:**

(A) ~~The following provides~~ surface water quality criteria for sulfate in mg/l for the specified ranges of hardness (in mg/l as CaCO₃) or chloride (in mg/l), or both, **are as follows:**

(i) If the hardness concentration of surface waters is greater than or equal to one hundred (100) mg/l but less than or equal to five hundred (500) mg/l, and if the chloride concentration of surface waters is greater than or equal to five (5) mg/l but less than twenty-five (25) mg/l, then:

$$C = [-57.478 + 5.79 (\text{hardness}) + 54.163 (\text{chloride})] \times 0.65$$

Where: C = sulfate criterion in mg/l.

(ii) If the hardness concentration of surface waters is greater than or equal to one hundred (100) mg/l but less than or equal to five hundred (500) mg/l, and if the chloride concentration of surface waters is greater than or equal to twenty-five (25) mg/l but less than or equal to five hundred (500) mg/l, then:

$$C = [1276.7 + 5.508 (\text{hardness}) - 1.457 (\text{chloride})] \times 0.65$$

Where: C = sulfate criterion in mg/l.

(iii) If the hardness concentration of surface waters is less than one hundred (100) mg/l and the chloride concentration of surface waters is less than or equal to five hundred (500) mg/l, the sulfate criterion is five hundred (500) mg/l.

(iv) If the hardness concentration of surface waters is greater than five hundred (500) mg/l and the chloride concentration of surface waters is greater than or equal to five (5) mg/l, but less than or equal to five hundred (500) mg/l, the sulfate criterion shall be calculated using a hardness concentration of five hundred (500) mg/l and the equation in item (i) or (ii) that applies to the chloride concentration.

(v) If the chloride concentration of surface waters is less than five (5) mg/l, the sulfate criterion is five hundred (500) mg/l.

(B) ~~The following~~ **This clause** applies to the surface water quality criteria for sulfate provided in clause (A), **as follows:**

(i) Sulfate criteria may only be established based on a chloride concentration greater than the CAC for chloride established under subdivision ~~(5)~~ **(6)** where the CAC for chloride has been modified on a site-specific basis in accordance with either the:

(AA) variance provisions under section 8.8 of this rule; or ~~the~~

(BB) site-specific criteria provisions under section 8.9 of this rule.

(ii) The surface water quality criteria for sulfate calculated from equations in clause (A) shall **must** be rounded to the nearest whole numbers, except when the criteria are used as intermediate values in a calculation, such as in the calculation of WQBELs.

(C) ~~The following establishes~~ surface water quality criteria for sulfate in mg/l at selected concentrations of hardness (**in mg/l as CaCO₃**) and chloride ~~with the understanding that the equations in clause (A) shall be used instead of the criteria in this clause when sulfate criteria are used as intermediate values in a calculation, such as in the calculation of WQBELs;~~ **as follows:**

Table 6-5^[1]

Chloride (mg/l)	Hardness (mg/l)										
	<100	100	150	200	250	300	350	400	450	500	>500
<5	500	500	500	500	500	500	500	500	500	500	500
5	500	515	703	891	1080	1268	1456	1644	1832	2020	2020
10	500	691	879	1067	1256	1444	1632	1820	2008	2196	2196
15	500	867	1055	1243	1432	1620	1808	1996	2184	2372	2372
20	500	1043	1231	1419	1608	1796	1984	2172	2360	2549	2549
25	500	1164	1343	1522	1701	1880	2059	2238	2417	2596	2596
50	500	1141	1320	1499	1678	1857	2036	2215	2394	2573	2573
100	500	1093	1272	1451	1630	1809	1988	2167	2346	2525	2525
150	500	1046	1225	1404	1583	1762	1941	2120	2299	2478	2478
200	500	998	1177	1356	1535	1715	1894	2073	2252	2431	2431
250	500	951	1130	1309	1488	1667	1846	2025	2204	2383	2383

^[1]The equations in clause (A) must be used instead of the criteria in this table when sulfate criteria are used as intermediate values in a calculation, such as in the calculation of WQBELs.

(9) Fluoride must not exceed two (2.0) mg/l in surface waters outside of a mixing zone except in the Ohio River and Interstate Wabash River where it must not exceed one (1.0) mg/l outside of a mixing zone.

(b) ~~This subsection establishes minimum surface water quality for aquatic life. In addition to subsection (a), subdivisions (1) through (5) are established to ensure the following minimum conditions necessary for the maintenance of a well-balanced aquatic community. The following are applicable at any point in the surface waters outside of the a mixing zone to ensure conditions necessary for the maintenance of a well-balanced aquatic community:~~

- (1) There ~~shall~~ **must** be no ~~substances~~ **substance** that:
 - (A) ~~impart~~ **imparts** unpalatable flavor to food fish; or
 - (B) ~~result~~ **results** in offensive odors in the vicinity of the water.
- (2) No pH values below six (6.0) or above nine (9.0) **are permitted**, except daily fluctuations that:
 - (A) exceed pH nine (9.0); and
 - (B) are correlated with photosynthetic activity.~~shall be permitted.~~
- (3) Concentrations of dissolved oxygen ~~shall~~ **must**:
 - (A) average at least five (5.0) milligrams per liter per calendar day; and
 - (B) not be less than four (4.0) milligrams per liter at any time.
- (4) ~~The following are~~ Conditions for temperature **are as follows**:
 - (A) ~~There shall be no~~ Abnormal temperature changes that may adversely affect aquatic life **are prohibited** unless caused by natural conditions.
 - (B) The normal daily and seasonal temperature fluctuations that existed before the addition of heat due to other than natural causes ~~shall~~ **must** be maintained.
 - (C) The maximum temperature rise at any time or place above natural temperatures ~~shall~~ **must** not exceed:
 - (i) five (5) degrees Fahrenheit (two and eight-tenths (2.8) degrees Celsius) in streams; and
 - (ii) three (3) degrees Fahrenheit (one and seven-tenths (1.7) degrees Celsius) in lakes and reservoirs.
 - (D) Water temperatures ~~shall~~ **must** not exceed the maximum limits in the following table:
 - (i) during more than one percent (1%) of the hours in the twelve (12) month period ending with any month; ~~At no time shall the water temperature at such locations exceed the maximum limits in the following table and~~
 - (ii) by more than three (3) degrees Fahrenheit (one and seven-tenths (1.7) degrees Celsius):

Table 6-4 6-6

	Ohio River Main Stem F(°C)	Other Indiana Streams F(°C)
January	50 (10.0)	50 (10.0)
February	50 (10.0)	50 (10.0)
March	60 (15.6)	60 (15.6)
April	70 (21.1)	70 (21.1)
May	80 (26.7)	80 (26.7)

June	87 (30.6)	90 (32.2)
July	89 (31.7)	90 (32.2)
August	89 (31.7)	90 (32.2)
September	87 (30.7)	90 (32.2)
October	78 (25.6)	78 (25.5)
November	70 (21.1)	70 (21.1)
December	57 (14.0)	57 (14.0)

(5) The following criteria ~~will~~ **must** be used to regulate ammonia:

(A) Except for waters covered in clause (B), ~~at all times, all~~ surface waters outside of mixing zones ~~shall~~ **must** be free of substances in concentrations that, on the basis of available scientific data, are believed to be sufficient to ~~(i)~~ injure, ~~(ii)~~ be chronically toxic to, or ~~(iii)~~ be carcinogenic, mutagenic, or teratogenic to:

- (i) humans;
- (ii) animals;
- (iii) aquatic life; or
- (iv) plants.

(B) For ~~these~~ waters listed in subsection (c), the following ammonia criteria ~~will~~ apply outside ~~the~~ of a mixing zone:

Table 6-7
Maximum Ammonia Concentrations
(Unionized Ammonia as N)^{***}
(mg/l)

pH	Temperature (°C)						
	0	5	10	15	20	25	30
6.5	0.0075	0.0106	0.0150	0.0211	0.0299	0.0299	0.0299
6.6	0.0092	0.0130	0.0183	0.0259	0.0365	0.0365	0.0365
6.7	0.0112	0.0158	0.0223	0.0315	0.0444	0.0444	0.0444
6.8	0.0135	0.0190	0.0269	0.0380	0.0536	0.0536	0.0536
6.9	0.0161	0.0228	0.0322	0.0454	0.0642	0.0642	0.0642
7.0	0.0191	0.0270	0.0381	0.0539	0.0761	0.0761	0.0761
7.1	0.0244	0.0316	0.0447	0.0631	0.0892	0.0892	0.0892
7.2	0.0260	0.0367	0.0518	0.0732	0.1034	0.1034	0.1034
7.3	0.0297	0.0420	0.0593	0.0837	0.1183	0.1183	0.1183
7.4	0.0336	0.0474	0.0669	0.0946	0.1336	0.1336	0.1336
7.5	0.0374	0.0528	0.0746	0.1054	0.1489	0.1489	0.1489
7.6	0.0411	0.0581	0.0821	0.1160	0.1638	0.1638	0.1638
7.7	0.0447	0.0631	0.0892	0.1260	0.1780	0.1780	0.1780
7.8	0.0480	0.0678	0.0958	0.1353	0.1911	0.1911	0.1911
7.9	0.0510	0.0720	0.1017	0.1437	0.2030	0.2030	0.2030
8.0	0.0536	0.0758	0.1070	0.1512	0.2135	0.2135	0.2135
8.1	0.0537	0.0758	0.1071	0.1513	0.2137	0.2137	0.2137
8.2	0.0537	0.0758	0.1071	0.1513	0.2137	0.2137	0.2137
8.3	0.0537	0.0758	0.1071	0.1513	0.2137	0.2137	0.2137
8.4	0.0537	0.0758	0.1071	0.1513	0.2137	0.2137	0.2137

8.5	0.0537	0.0758	0.1071	0.1513	0.2137	0.2137	0.2137
8.6	0.0537	0.0758	0.1071	0.1513	0.2137	0.2137	0.2137
8.7	0.0537	0.0758	0.1071	0.1513	0.2137	0.2137	0.2137
8.8	0.0537	0.0758	0.1071	0.1513	0.2137	0.2137	0.2137
8.9	0.0537	0.0758	0.1071	0.1513	0.2137	0.2137	0.2137
9.0	0.0537	0.0758	0.1071	0.1513	0.2137	0.2137	0.2137

***To calculate total ammonia, divide the number in the Table 6-7 by the value determined by:
 $1/(10^{pK_a - pH} + 1)$.

Where: $pK_a = 0.09018 + (2729.92/(T + 273.2))$
 $pH =$ pH of water
 $T =$ °C

Table 6-8
 24-Hour Average Ammonia Concentrations
 (Unionized Ammonia as N)***
 (mg/l)

pH	Temperature (°C)						
	0	5	10	15	20	25	30
6.5	0.0005	0.0008	0.0011	0.0015	0.0015	0.0015	0.0015
6.6	0.0007	0.0010	0.0014	0.0019	0.0019	0.0019	0.0019
6.7	0.0009	0.0012	0.0017	0.0024	0.0024	0.0024	0.0024
6.8	0.0011	0.0015	0.0022	0.0031	0.0031	0.0031	0.0031
6.9	0.0014	0.0019	0.0027	0.0038	0.0038	0.0038	0.0038
7.0	0.0017	0.0024	0.0034	0.0048	0.0048	0.0048	0.0048
7.1	0.0022	0.0031	0.0043	0.0061	0.0061	0.0061	0.0061
7.2	0.0027	0.0038	0.0054	0.0077	0.0077	0.0077	0.0077
7.3	0.0034	0.0048	0.0068	0.0097	0.0097	0.0097	0.0097
7.4	0.0043	0.0061	0.0086	0.0122	0.0122	0.0122	0.0122
7.5	0.0054	0.0077	0.0108	0.0153	0.0153	0.0153	0.0153
7.6	0.0068	0.0097	0.0136	0.0193	0.0193	0.0193	0.0193
7.7	0.0086	0.0122	0.0172	0.0242	0.0242	0.0242	0.0242
7.8	0.0092	0.0130	0.0184	0.0260	0.0260	0.0260	0.0260
7.9	0.0098	0.0138	0.0196	0.0276	0.0276	0.0276	0.0276
8.0	0.0103	0.0146	0.0206	0.0294	0.0294	0.0294	0.0294
8.1	0.0103	0.0146	0.0206	0.0294	0.0294	0.0294	0.0294
8.2	0.0103	0.0146	0.0206	0.0294	0.0294	0.0294	0.0294
8.3	0.0103	0.0146	0.0206	0.0294	0.0294	0.0294	0.0294
8.4	0.0103	0.0146	0.0206	0.0294	0.0294	0.0294	0.0294
8.5	0.0103	0.0146	0.0206	0.0294	0.0294	0.0294	0.0294
8.6	0.0103	0.0146	0.0206	0.0294	0.0294	0.0294	0.0294
8.7	0.0103	0.0146	0.0206	0.0294	0.0294	0.0294	0.0294
8.8	0.0103	0.0146	0.0206	0.0294	0.0294	0.0294	0.0294
8.9	0.0103	0.0146	0.0206	0.0294	0.0294	0.0294	0.0294
9.0	0.0103	0.0146	0.0206	0.0294	0.0294	0.0294	0.0294

***To calculate total ammonia, divide the number in the Table 6-8 by the value determined by: $1/(10^{pK_a - pH} + 1)$.

Where: $pK_a = 0.09018 + (2729.92/(T + 273.2))$
 $pH = \text{pH of water}$
 $T = \text{°C}$

~~(c) This subsection establishes surface water quality~~ **Waters designated by the Indiana department of natural resources for put-and-take trout fishing are designated as salmonid waters and must be protected** for cold-water fish. In addition to subsections (a) and (b), the following criteria are ~~established to ensure conditions necessary for the maintenance of a well-balanced, cold-water fish community and are applicable at any point in the waters outside of the a mixing zone in the surface waters designated as salmonid waters to ensure conditions necessary for the maintenance of a well-balanced, cold-water fish community:~~

~~(1) Waters:~~

~~(A) designated as salmonid waters; and~~

~~(B) that shall be protected for cold-water fish;~~

~~are those waters designated by the Indiana department of natural resources for put and take trout fishing.~~

~~(2) In the waters listed in subdivision (1),~~

(1) Dissolved oxygen concentrations shall must not be less than:

(A) six (6.0) milligrams per liter at any time; and

(B) seven (7.0) milligrams per liter in areas where spawning occurs during the spawning season and in areas used for imprinting during the time salmonids are being imprinted.

~~(3) In those waters listed in subdivision (1),~~ **(2) The maximum temperature rise above natural shall must not exceed two (2) degrees Fahrenheit (one and one-tenth (1.1) degrees Celsius) at any time or place and, unless due to natural causes, the temperature shall must not exceed the following:**

(A) Seventy (70) degrees Fahrenheit (twenty-one and one-tenth (21.1) degrees Celsius) at any time.

(B) Sixty-five (65) degrees Fahrenheit (eighteen and three-tenths (18.3) degrees Celsius) during spawning and imprinting periods.

~~(d) This subsection establishes Bacteriological quality for recreational uses during the recreational season is as follows:~~

(1) The recreational season is defined as the months of April through October, inclusive.

(2) In addition to subsection (a), the criteria in this subsection are to be used to do the following:

(A) Evaluate waters for full body contact recreational uses.

(B) Establish wastewater treatment requirements.

(C) Establish effluent limits during the recreational season.

(3) For full body contact recreational uses, E. coli bacteria shall must not exceed the following:

(A) One hundred twenty-five (125) colony forming units (cfu) or most probable number (MPN) per one hundred (100) milliliters as a geometric mean based on not less than five (5) samples equally spaced over a thirty (30) day period.

(B) Two hundred thirty-five (235) cfu or MPN per one hundred (100) milliliters in any one (1) sample in a thirty (30) day period, except that, in cases where there

are at least ten (10) samples at a given site, up to ten percent (10%) of the samples may exceed two hundred thirty-five (235) cfu or MPN per one hundred (100) milliliters where the:

- (i) E. coli exceedances are incidental and attributable solely to E. coli resulting from the discharge of treated wastewater from a wastewater treatment plant as defined at IC 13-11-2-258; and
- (ii) criterion in clause (A) is met.

However, a single sample ~~shall be~~ **is** used for making beach notification and closure decisions.

If a geometric mean cannot be calculated because five (5) equally spaced samples are not available, then the criterion stated in clause (B) must be met.

(4) For demonstrating compliance with wastewater treatment requirements, sanitary wastewater dischargers shall ensure the following:

(A) The concentration of E. coli in the undiluted discharge does not exceed one hundred twenty-five (125) cfu or MPN per one hundred (100) milliliters as a geometric mean of the effluent samples taken in a calendar month.

(B) Not more than ten percent (10%) of all samples when not less than ten (10) samples are taken and analyzed for E. coli in a calendar month exceed two hundred thirty-five (235) cfu or MPN per one hundred (100) milliliters as a daily maximum. Under this clause, the calculation of ten percent (10%) of the samples taken ~~shall~~ **must** be limited to the lowest whole number result.

(5) Effluent limits to implement the criteria in subdivision (3) during the recreational season ~~shall~~ **must** be established in NPDES permits by incorporating the following that are to be applied to the undiluted discharge:

(A) The concentration of E. coli in the undiluted discharge ~~shall~~ **must** not exceed one hundred twenty-five (125) cfu or MPN per one hundred (100) milliliters as a geometric mean of the effluent samples taken in a calendar month.

(B) Not more than ten percent (10%) of all samples in a calendar month exceed two hundred thirty-five (235) cfu or MPN per one hundred (100) milliliters as a daily maximum. Under this clause, the calculation of ten percent (10%) of the samples taken ~~shall~~ **must** be limited to the lowest whole number result.

(e) ~~This subsection establishes surface water quality for public water supply.~~ In addition to subsections (a) and (d), the ~~following~~ criteria ~~are established~~ to protect the surface water quality at the point at which water is withdrawn for treatment for public **water supply are as follows:**

(1) The coliform bacteria group ~~shall~~ **must** not exceed the following:

(A) Five thousand (5,000) **cfu or MPN** per one hundred (100) milliliters as a monthly average value (either MPN or **membrane filter** (MF) count).

(B) Five thousand (5,000) **cfu or MPN** per one hundred (100) milliliters in more than twenty percent (20%) of the samples examined during any month.

(C) Twenty thousand (20,000) **cfu or MPN** per one hundred (100) milliliters in more than five percent (5%) of the samples examined during any month.

(2) Taste and odor producing substances, other than naturally occurring, ~~shall~~ **must** not interfere with the production of a finished water by conventional treatment consisting of the following:

(A) Coagulation.

(B) Sedimentation.

(C) Filtration.

(D) Disinfection.

(3) The concentrations of either chloride or sulfate ~~shall~~ **must** not exceed two hundred fifty (250) milligrams per liter unless due to naturally occurring sources.

(4) The concentration of dissolved solids ~~shall~~ **must** not exceed seven hundred fifty (750) milligrams per liter unless due to naturally occurring sources. A specific conductance of one thousand two hundred (1,200) micromhos per centimeter (at twenty-five (25) degrees Celsius) may be considered equivalent to a dissolved solids concentration of seven hundred fifty (750) milligrams per liter.

(5) Surface waters ~~shall be considered~~ **are** acceptable for public water supply if radium-226 and strontium-90 are present in amounts not exceeding three (3) and ten (10) picocuries per liter, respectively. In the known absence of strontium-90 and alpha emitters, the water supply is acceptable when the gross beta concentrations do not exceed one thousand (1,000) picocuries per liter.

(6) The:

(A) combined concentration of nitrate-N and nitrite-N must not exceed ten (10) milligrams per liter as a thirty (30) day average value; and

(B) concentration of nitrite-N must not exceed one (1) milligram per liter as a thirty (30) day average value.

~~(6)~~ (7) Chemical constituents in the waters ~~shall~~ **must** not be present ~~in such~~ **at** levels as ~~to~~ **that** prevent, after conventional treatment, meeting the drinking water standards contained in 327 IAC 8-2, due to other than natural causes.

~~(f) This subsection establishes surface water quality for industrial water supply. In addition to subsection (a), the criterion to ensure protection of water quality at the point at which water is withdrawn for use (either with or without treatment) for industrial cooling and processing is that, other than from naturally occurring sources, the dissolved solids shall~~ **must** not exceed seven hundred fifty (750) milligrams per liter at any time **other than from naturally occurring sources to ensure protection of water quality at the point at which surface water is withdrawn for use, either with or without treatment, for industrial cooling and processing.** A specific conductance of one thousand two hundred (1,200) micromhos per centimeter (at twenty-five (25) degrees Celsius) may be considered equivalent to a dissolved solids concentration of seven hundred fifty (750) milligrams per liter.

~~(g) This subsection establishes surface water quality for agricultural uses. The criteria to ensure~~ **surface** water quality conditions necessary for agricultural use are the same as those in subsection (a).

~~(h) This subsection establishes surface water quality for limited uses. The quality of~~ **surface** waters ~~classified~~ **designated** for limited uses under section 3(a)(5) **11(a)** of this rule ~~shall,~~ **must**, at a minimum, meet the following criteria ~~(1) The criteria contained in subsection~~ **subsections (a), (2) The criteria contained in subsection (d), (3) The criteria contained in subsection (f), and** where applicable, ~~(4) The waters must~~ **subsection (f), and** be aerobic at all times. ~~(5) Notwithstanding subdivisions (1) through (4), the quality of a limited use stream~~ **However, the water must meet the criteria that are applicable to the higher use water** at the point where ~~it~~ **a limited use water:**

(1) becomes physically or chemically capable of supporting a higher use; or at its interface

(2) interfaces with a higher use water segment. ~~shall meet the criteria that are applicable to the higher use water.~~

***This document is incorporated by reference. Copies may be obtained from the Government Publishing Office, www.gpo.gov, U.S. EPA National Service Center for Environmental Publications (www.epa.gov/nscep), or are available for review at the Indiana Department of Environmental Management, Office of Legal Counsel, Indiana Government Center North, Thirteenth Floor, 100 North Senate Avenue, Indianapolis, Indiana 46204.** (*Water Pollution Control Division; 327 IAC 2-1-6; filed Sep 24, 1987, 3:00 p.m.: 11 IR 581; filed Feb 1, 1990, 4:30 p.m.: 13 IR 1020; errata, 13 IR 1861; errata filed Jul 6, 1990, 5:00 p.m.: 13 IR 2003; filed Feb 26, 1993, 5:00 p.m.: 16 IR 1725; errata filed May 7, 1993, 4:00 p.m.: 16 IR 2189; filed Jan 14, 1997, 12:00 p.m.: 20 IR 1348; errata filed Aug 11, 1997, 4:15 p.m.: 20 IR 3376; filed Feb 14, 2005, 10:05 a.m.: 28 IR 2047; errata filed Apr 6, 2006, 2:48 p.m.: 29 IR 2546; errata, 29 IR 3027; filed Mar 18, 2008, 2:26 p.m.: 20080416-IR-327060573FRA; filed May 22, 2008, 10:40 a.m.: 20080618-IR-327070185FRA; filed Jul 9, 2012, 2:54 p.m.: 20120808-IR-327110320FRA; filed Nov 10, 2014, 1:51 p.m.: 20141210-IR-327130290FRA*)

SECTION 2. 327 IAC 2-1.5-8 IS AMENDED TO READ AS FOLLOWS:

327 IAC 2-1.5-8 Minimum surface water quality criteria

Authority: IC 13-14-8-2; IC 13-14-8-3; IC 13-18-4-3

Affected: IC 13-11-2-258; IC 13-18-4; IC 13-30-2-1; IC 14-22-9

Sec. 8. (a) All surface water quality criteria in this section, except those provided in subsection (b)(1), ~~will cease to be~~ **are not** applicable when the stream flows are less than the applicable stream design flow for the particular criterion as determined under 327 IAC 5-2-11.4.

(b) The following are minimum surface water quality conditions:

(1) All surface waters within the Great Lakes system, ~~at all times, and at all places,~~ including waters within ~~the~~ a mixing zone, ~~shall meet the minimum conditions of being~~ **must be** free from substances, materials, floating debris, oil, or scum attributable to municipal, industrial, agricultural, and other land use practices, or other discharges that do any of the following:

(A) ~~Will~~ Settle to form putrescent or otherwise objectionable deposits.

(B) ~~Are~~ **Occur** in amounts sufficient to be unsightly or deleterious.

(C) Produce:

- (i) color;
- (ii) visible oil sheen;
- (iii) odor; or
- (iv) other conditions;

~~in such degree as to create~~ **an extent that creates** a nuisance.

(D) ~~Are~~ **Occur** in concentrations or combinations that will cause or contribute to the growth of aquatic plants or algae to ~~such a degree as to:~~

- (i) create a nuisance;
- (ii) be unsightly; or
- (iii) otherwise impair the designated uses **of the surface waters.**

(E) ~~Are~~ **Occur** in amounts sufficient to be acutely toxic to, or to otherwise severely injure or kill, aquatic life, other animals, plants, or humans. To ~~assure~~ **ensure** protection of aquatic life, the **surface** waters ~~shall~~ **must** meet the following requirements:

- (i) Concentrations of toxic substances ~~shall~~ **must** not exceed the CMC or

SMC outside the zone of initial dilution or the final acute value (FAV = 2 (CMC) or 2 (SMC)) in the undiluted discharge unless, for a discharge to a receiving stream or Lake Michigan, an alternate mixing zone demonstration is conducted and approved in accordance with 327 IAC 5-2-11.4(b)(4), in which case, the CMC or SMC ~~shall~~ **must** be met outside the applicable alternate mixing zone. **The following apply where applicable:**

(AA) For certain substances, a CMC is ~~established and set forth~~ **specified** in:

(aa) subdivision (3), Table 8-1, which ~~table~~ incorporates subdivision (4), Table 8-2; and

(bb) subdivision (5).

(BB) For substances for which a CMC is not specified in subdivision (3), Table 8-1, **subdivision (4), Table 8-2,** or subdivision (5):

(aa) a CMC ~~shall~~ **must** be calculated by the commissioner using the procedures in section 11 of this rule; or

(bb) if the minimum data requirements to calculate a CMC are not met, an SMC ~~shall~~ **must** be calculated using the procedures in section 12 of this rule. ~~and~~

(CC) The CMC or SMC determined under subitem (AA) or (BB) may be modified on a site-specific basis to reflect local conditions in accordance with section 16 of this rule.

(ii) A discharge ~~shall~~ **must** not cause acute toxicity, as measured by whole effluent toxicity tests, at any point in the waterbody. Compliance with this criterion ~~shall be~~ **is** demonstrated if a discharge does not exceed one and zero-tenths (1.0) TU_a in the undiluted discharge. For a discharge into a receiving stream or Lake Michigan, for which an alternate mixing zone demonstration is conducted and approved in accordance with 327 IAC 5-2-11.4(b)(4), compliance with this criterion ~~shall be~~ **is** demonstrated if three-tenths (0.3) TU_a is not exceeded outside the applicable alternate mixing zone.

(F) ~~This Clause shall~~ **(E) does** not apply to the chemical control of plants and animals when that control is performed in compliance with approval conditions specified by the Indiana department of natural resources as provided by IC 14-22-9.

(2) ~~At All times, all~~ surface waters outside of the applicable mixing zones determined in accordance with section 7 of this rule ~~shall~~ **must** be free of substances in concentrations that, on the basis of available scientific data, are believed to be sufficient to injure, be chronically toxic to, or be carcinogenic, mutagenic, or teratogenic to humans, animals, aquatic life, or plants. To ~~assure~~ **ensure** protection against the adverse effects identified in this subdivision, a toxic substance or pollutant ~~shall~~ **must** not be present in ~~such~~ **surface waters outside of the applicable mixing zones determined in accordance with section 7 of this rule** in concentrations that exceed the most stringent of the following:

(A) A CCC or ~~an~~ SCC to protect aquatic life from chronic toxic effects, **which is determined** as follows:

(i) For certain substances, a CCC is ~~established and set forth~~ **specified** in:

(AA) subdivision (3), Table 8-1, which ~~table~~ incorporates

subdivision (4), Table 8-2;
(BB) subdivision (3), Table 8-1a; and
(CC) subdivision (5).

(ii) For substances for which a CCC is not specified in subdivision (3), Table 8-1, **subdivision (3), Table 8-1a, subdivision (4), Table 8-2,** or subdivision (5):

(AA) a CCC ~~shall~~ **must** be calculated by the commissioner using the procedures in section 11 of this rule; or

(BB) if the minimum data requirements to calculate a CCC are not met, an SCC ~~shall~~ **must** be calculated using the procedures in section 12 of this rule.

(iii) The CCC or SCC determined under item ~~(i)~~ **(i)(AA), (i)(CC),** or (ii) may be modified on a site-specific basis to reflect local conditions in accordance with section 16 of this rule.

(iv) To ~~assure~~ **ensure** protection of aquatic life, a discharge ~~shall~~ **must** not cause chronic toxicity, as measured by whole effluent toxicity tests, outside of the applicable mixing zone. Compliance with this criterion ~~shall be is~~ demonstrated if the waterbody does not exceed one and zero-tenths (1.0) TU_c at the edge of the mixing zone.

(B) An HNC or HNV to protect human health from adverse noncancer effects that may result from the consumption of aquatic organisms or drinking water from the waterbody, **which is** determined as follows:

(i) For certain substances, an HNC is ~~established and set forth~~ **specified** in subdivision (6), Table 8-3.

(ii) For substances for which an HNC is not specified in subdivision (6), Table 8-3:

(AA) an HNC ~~shall~~ **must** be calculated by the commissioner using the procedures in section 14 of this rule; or

(BB) if the minimum data requirements to calculate an HNC are not met, an HNV ~~shall~~ **must** be calculated using the procedures in section 14 of this rule.

(iii) The HNC or HNV determined under item (i) or (ii) may be modified on a site-specific basis to reflect local conditions in accordance with section 16 of this rule.

(iv) The HNC **for nondrinking water** or HNV **for nondrinking water** for a substance ~~shall apply~~ **applies** to all surface waters outside the applicable mixing zone for a discharge of that substance. The HNC **for drinking water** or HNV **for drinking** ~~shall apply~~ **water for a substance applies** at the point of the public water system intake.

(C) For carcinogenic substances, an HCC or HCV to protect human health from unacceptable cancer risk of greater than one (1) additional occurrence of cancer per one hundred thousand (100,000) population, **which is determined** as follows:

(i) For certain substances, an HCC is ~~established and set forth~~ **specified** in subdivision (6), Table 8-3.

(ii) For substances for which an HCC is not specified in subdivision (6), Table 8-3:

(AA) an HCC ~~shall~~ **must** be calculated by the commissioner using the procedures in section 14 of this rule; or

(BB) if the minimum data requirements to calculate an HCC are not met, an HCV shall **must** be calculated using the procedures in section 14 of this rule.

(iii) The HCC or HCV determined under item (i) or (ii) may be modified on a site-specific basis to reflect local conditions in accordance with section 16 of this rule.

(iv) The HCC **for** nondrinking **water** or HCV **for** nondrinking **water** for a substance shall ~~apply~~ **applies** to all surface waters outside the applicable mixing zone for a discharge of that substance. The HCC **for** drinking **water** or HCV **for** drinking ~~shall apply~~ **water applies** at the point of the public water system intake.

(D) A WC to protect avian and mammalian wildlife populations from adverse effects that may result from the consumption of aquatic organisms or water from the waterbody, **which is determined** as follows:

(i) For certain substances, a WC is ~~established and set forth~~ **specified** in subdivision (7), Table 8-4.

(ii) For substances for which a WC is not specified in subdivision (7), Table 8-4:

(AA) a WC shall **must** be calculated by the commissioner using the procedures in section 15 of this rule; or

(BB) if the minimum data requirements to calculate a WC are not met, a WV may be calculated using the procedures in section 15 of this rule.

(iii) The WC or WV determined under item (i) or (ii) may be modified on a site-specific basis to reflect local conditions in accordance with section 16 of this rule.

(3) ~~The following establishes~~ Surface water quality criteria for protection of aquatic life **are as follows:**

~~Table 8-1~~
Surface Water Quality Criteria for Protection of Aquatic Life^[1]

CAS Number	Substances	CMC (Maximum) (µg/l)	CMC Conversion Factors	CCC (4-Day Average) (µg/l)	CCC Conversion Factors
Metals (dissolved) ^[2]					
7440382	Arsenic (III)	$WER^{[3]}(339.8)$	1.000	$WER^{[3]}(147.9)$	1.000
7440439	Cadmium	$WER^{[3]}(e^{(4.128 - [\ln(\text{hardness})] - 3.6867)})$	$1.136672 - [(\ln(\text{hardness}) - 0.041838)]$	$WER^{[3]}(e^{(0.7852 - [\ln(\text{hardness})] - 2.715)})$	$1.101672 - [(\ln(\text{hardness}) - 0.041838)]$
7440473	Chromium (III)	$WER^{[3]}(e^{(0.819 - [\ln(\text{hardness})] + 3.7256)})$	0.316	$WER^{[3]}(e^{(0.819 - [\ln(\text{hardness})] + 0.6848)})$	0.860
7440473	Chromium (VI)	$WER^{[3]}(16.02)$	0.982	$WER^{[3]}(10.98)$	0.962
7440508	Copper	$WER^{[3]}(e^{(0.9422 - [\ln(\text{hardness})] - 1.700)})$	0.960	$WER^{[3]}(e^{(0.8545 - [\ln(\text{hardness})] - 1.702)})$	0.960
7439976	Merecury	$WER^{[3]}(1.694)$	0.85	$WER^{[3]}(0.9081)$	0.85

7440020	Nickel	$WER^{[3]}(e^{(0.846[\ln(\text{hardness})]+2.255)})$	0.998	$WER^{[3]}(e^{(0.846[\ln(\text{hardness})]+0.0584)})$	0.997
7782492	Selenium			5	0.922
7440666	Zinc	$WER^{[3]}(e^{(0.8473[\ln(\text{hardness})]+0.884)})$	0.978	$WER^{[3]}(e^{(0.8473[\ln(\text{hardness})]+0.884)})$	0.986
	Organics (total)				
60571	Dieldrin	0.24	NA	0.056	NA
72208	Endrin	0.086	NA	0.036	NA
56382	Parathion	0.065	NA	0.013	NA
87865	Pentachlorophenol [4][6]	$e^{(-1.005[\text{pH}]-4.869)}$	NA	$e^{(-1.005[\text{pH}]-5.134)}$	NA
	Other Substances				
	Chloride	[6]	NA	[6]	NA
	Chlorine (total residual)	19	NA	11	NA
	Chlorine (intermittent, total residual) ^[5]	200	NA		NA
57125	Cyanide (free)	22	NA	5.2	NA

^[1]Aquatic organisms should not be affected unacceptably if the four (4) day average concentration of any substance in this table, does not exceed the CCC more than once every three (3) years on the average and if the one (1) hour average concentration does not exceed the CMC more than once every three (3) years on the average, except possibly where a commercially or recreationally important species is very sensitive.

^[2]The CMC and CCC columns of this table contain total recoverable metals criteria (numeric and hardness-based). The criterion for the dissolved metal is calculated by multiplying the appropriate conversion factor by the CMC or CCC. This dissolved CMC or CCC shall **must** be rounded to two (2) significant digits, except when the criteria are used as intermediate values in a calculation, such as in the calculation of water quality based effluent limitations (WQBELs).

^[3]A value of one (1) shall be used for the WER unless an alternate value is established under section 16 of this rule.

^[4]A CMC and CCC calculated for pentachlorophenol using the equation in this table shall be rounded to two (2) significant digits, except when the criteria are used as intermediate values in a calculation, such as in the calculation of WQBELs.

^[5]To be considered an intermittent discharge, total residual chlorine shall not be detected in the discharge for a period of more than forty (40) minutes in duration, and such periods shall be separated by at least five (5) hours.

^[6]The CMC and CCC for this substance are established in subdivision (5).

(A) The surface water quality criteria for the protection of aquatic life for specific substances are as follows:

**Table 8-1
Surface Water Quality Criteria for Protection of Aquatic Life^[1]**

		Criterion		Criterion	
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CAS Number	Substances	Maximum Concentration (CMC) (Maximum) ($\mu\text{g/L}$)	CMC Conversion Factors (CF)	Continuous Concentration (CCC) (4-Day Average) ($\mu\text{g/L}$)	CCC Conversion Factors (CF)
Metals (dissolved) ^{[2][3]}					
7440382	Arsenic	WER(340)(CF)	1.000	WER(150)(CF)	1.000
7440439	Cadmium	WER($e^{(0.9789[\ln\text{H}] - 3.866)}$)(CF)	1.136672- [lnH] 0.041838	WER($e^{(0.7977[\ln\text{H}] - 3.909)}$)(CF)	1.101672-[lnH] 0.041838
7440473	Chromium (III)	WER($e^{(0.819[\ln\text{H}] + 3.7256)}$)(CF)	0.316	WER($e^{(0.819[\ln\text{H}] + 0.6848)}$)(CF)	0.860
7440473	Chromium (VI)	WER(16)(CF)	0.982	WER(11)(CF)	0.962
7440508	Copper	WER($e^{(0.9422[\ln\text{H}] - 1.700)}$)(CF)	0.960	WER($e^{(0.8545[\ln\text{H}] - 1.702)}$)(CF)	0.960
7439921	Lead	WER($e^{(1.273[\ln\text{H}] - 1.460)}$)(CF)	1.46203- [lnH]0.145712	WER($e^{(1.273[\ln\text{H}] - 4.705)}$)(CF)	1.46203- [lnH]0.145712
7439976	Mercury	WER(1.694)(CF)	0.85	WER(0.9081)(CF)	0.85
7440020	Nickel	WER($e^{(0.846[\ln\text{H}] + 2.255)}$)(CF)	0.998	WER($e^{(0.846[\ln\text{H}] + 0.0584)}$)(CF)	0.997
7440666	Zinc	WER($e^{(0.8473[\ln\text{H}] + 0.884)}$)(CF)	0.978	WER($e^{(0.8473[\ln\text{H}] + 0.884)}$)(CF)	0.986
Organics (Total)					
60571	Dieldrin	0.24	NA	0.056	NA
72208	Endrin	0.086	NA	0.036	NA
56382	Parathion	0.065	NA	0.013	NA
87865	Pentachlorophenol ^[4]	$e^{(1.005[\text{pH}] - 4.869)}$	NA	$e^{(1.005[\text{pH}] - 5.134)}$	NA
Other Substances					
	Chlorine (total residual)	19	NA	11	NA
	Chlorine (intermittent, total residual) ^[5]	200	NA		NA
57125	Cyanide (free)	22	NA	5.2	NA
Selenium CCC are specified in clause B					
Chloride CMC and CCC are specified in subdivision (5)					

^[1]Aquatic organisms should not be affected unacceptably if the four (4) day average concentration specified in this table for a substance does not exceed the CCC more than once every three (3) years on the average and if the one (1) hour average concentration does not exceed the CMC more than once every three (3) years on the average, except possibly where a commercially or recreationally important species is very sensitive.

^[2]Aquatic life criteria for these metals are expressed as a dissolved concentration and are calculated using the water-effect ratio (WER) and the specified conversion factor (CF). The CMC and CCC for a dissolved metal are calculated by multiplying the WER by the criterion value or formula and then by the appropriate conversion factor. A value of one (1) must be used for the WER unless an alternate value is established under section 16 of this rule. The dissolved CMC and CCC must be rounded to two (2) significant digits, except when the criteria are used as intermediate values in a calculation, such as in the calculation of water quality-based effluent limitations (WQBELs).

^[3]The hardness values used in the equations for these criteria must not be greater than 400 mg/l as calcium carbonate (CaCO₃), and the criteria at a hardness of 400 mg/l as CaCO₃ are used for a water hardness above 400 mg/l as CaCO₃. The term “lnH” is the natural log of hardness.

^[4]A CMC and CCC calculated for pentachlorophenol using the equation in this table must be rounded to two (2) significant digits, except when the criteria are used as intermediate values in a calculation, such as in the calculation of WQBELs.

^[5] To be considered an intermittent discharge, total residual chlorine must not be detected in the discharge for a period of more than forty (40) minutes in duration, and these time periods must be separated by at least five (5) hours.

(B) The surface water quality criterion for the protection of aquatic life for selenium is as follows:

Table 8-1a
Surface Water Quality Aquatic Life Criterion for Selenium (CAS # 7782492)

Criterion Continuous Concentration (CCC)				
Media Type	Fish Tissue ^[1]		Water Column ^{[5][7]}	
Criterion Element	Egg/Ovary ^[2]	Fish Whole Body or Muscle ^[3]	Monthly Average Exposure	Intermittent Exposure ^[6]
Magnitude	15.1 mg/kg dw	8.5 mg/kg dw whole body or 11.3 mg/kg dw muscle (skinless, boneless filet)	1.5 µg/l in lentic aquatic systems 3.1 µg/l in lotic aquatic systems	$WQC_{int} = \frac{WQC_{30\text{-day}} - C_{bkg\text{rnd}}(1 - f_{int})}{f_{int}}$
Duration	Instantaneous measurement ^[4]	Instantaneous measurement ^[4]	30 days	Number of days per month with an elevated concentration
Frequency	Not to be exceeded	Not to be exceeded	Not more than once in three (3) years on average	Not more than once in three (3) years on average

^[1]Fish tissue elements are expressed as steady-state; the aquatic system should not be experiencing new or increasing inputs of selenium.

^[2]Egg or ovary supersedes any whole-body, muscle, or water column element when fish egg or ovary concentrations are measured. Any proposal to sample egg or ovary fish tissue must be submitted to the department for review and approval prior to initiation of sampling, and the department will evaluate all representative egg or ovary fish tissue data to determine compliance with this criterion element.

^[3]Fish whole-body or muscle tissue supersedes the water column element when both fish tissue and water concentrations are measured. Any proposal to sample fish whole-body or muscle tissue must be submitted to the department for review and approval prior to initiation of sampling, and the department will evaluate all representative fish whole-body or muscle tissue data to determine compliance with this criterion element.

^[4]Fish tissue data provide instantaneous point measurements that reflect integrative accumulation of selenium over time and space in fish populations at a given site.

^[5]Water column values are the applicable criterion element in the absence of steady-state condition fish tissue data and for fishless waters. Water column values are based on dissolved total selenium in water and are derived from fish tissue values via bioaccumulation modeling. Instead of the requirement in 327 IAC 5-2-11.4(b)(3)(A)(i)(CC), the thirty (30) day, ten (10) year stream design flow ($Q_{30,10}$) must be used for deriving TMDLs, WLAs in the absence of TMDLs, and preliminary WLAs for tributaries of the Great Lakes system that exhibit appreciable flows relative to their volumes for the criterion continuous concentration (CCC) water column criterion element applicable to lotic aquatic systems unless data exist to demonstrate that an alternate stream design flow is appropriate for stream-specific and pollutant-specific conditions.

^[6]Intermittent Exposure Equation variables mean the following:

WQC_{int} is the water column intermittent element.

$WQC_{30\text{-day}}$ is the water column monthly element for either lentic or lotic waters.

C_{bkgrnd} is the average background selenium concentration.

f_{int} is the fraction of any 30-day period during which elevated selenium concentrations occur, with f_{int} assigned a value ≥ 0.033 (corresponding to one (1) day).

^[7]The water column criterion element may be modified on a site-specific basis in accordance with clause (C).

(C) Modification of the selenium water column criterion element must be achieved according to the following:

(i) Site-specific water column criterion elements must be derived using either the empirical bioaccumulation factor (BAF) or mechanistic modeling method provided in Aquatic Life Ambient Water Quality Criterion for Selenium – Freshwater, EPA-822-R-16-006, Appendix K: Translation of a Selenium Fish Tissue Criterion Element to a Site-Specific Water Column Value (June 2016)*.

(ii) Any proposal to derive a site-specific water column criterion element must be submitted to the department for review and approval of the methodology and sampling plan prior to initiation of sampling. The department shall evaluate and approve the applicability of and use of all representative data used to derive a site-specific water column criterion element.

(iii) Any proposal to derive a site-specific water column criterion element must be protective of downstream designated uses for aquatic life and human health.

(iv) Upon receipt of an application for a site-specific water column criterion element, the department shall do the following:

(AA) Publish on the department’s website all pertinent information about the proposed site-specific modification.

(BB) Provide notice and request comment on the application.

(v) Upon approval of a site-specific water column criterion element, the department shall do the following:

(AA) Publish a notice in the Indiana Register.

(BB) Place on the department’s website all pertinent information about the approved site-specific modification.

(CC) Submit the site-specific modification to U.S. EPA for approval.

(DD) If approved by U.S. EPA, incorporate the site-specific modification into the water quality standards during the next revision of the water quality standards.

(vi) Site-specific modifications of this criterion must not be incorporated into a final NPDES permit or used for other Clean Water Act purposes until approved by U.S. EPA.

(4) The following establishes dissolved CMCs CMC and CCCs CCC for certain metals at selected hardness values calculated from the equations and conversion factors in subdivision (3), Table 8-1 and using with a value of one (1) used for the WER where applicable, are as follows:

Table 8-2
Metals Concentrations in Micrograms Per Liter; Hardness in Milligrams Per Liter CaCO₃^[1]

Hardness	Arsenic (III)		Cadmium		Chromium (III)		Chromium (VI)		Copper	
	CMC	CCC	CMC	CCC	CMC	CCC	CMC	CCC	CMC	CCC
50	340	150	2.0 0.94	1.3 0.43	320	42	16	11	7.0	5.0
100	340	150	4.3 1.8	2.2 0.72	570	74	16	11	13	9.0
150	340	150	6.6 2.6	3.0 0.97	790	100	16	11	20	13
200	340	150	9.0 3.4	3.7 1.2	1,000	130	16	11	26	16
250	340	150	12 4.2	4.4 1.4	1,200	160	16	11	32	20
300	340	150	14 5.0	5.0 1.6	1,400	180	16	11	38	23
350	340	150	17 5.8	5.6 1.8	1,600	210	16	11	44	26
400	340	150	19 6.5	6.2 2.0	1,800	230	16	11	50	29
450	340	150	22	6.8	2,000	250	16	11	55	32
500	340	150	24	7.3	2,100	280	16	11	61	35

Hardness	Lead		Mercury		Nickel		Selenium		Zinc	
	CMC	CCC	CMC	CCC	CMC	CCC	CMC	CCC	CMC	CCC
50	30	1.2	1.4	0.77	260	29	—	4.6	65	66

100	65	2.5	1.4	0.77	470	52	—	4.6	120	120
150	100	3.9	1.4	0.77	660	73	—	4.6	170	170
200	140	5.3	1.4	0.77	840	93	—	4.6	210	210
250	170	6.7	1.4	0.77	1,000	110	—	4.6	250	260
300	210	8.1	1.4	0.77	1,200	130	—	4.6	300	300
350	240	9.5	1.4	0.77	1,400	150	—	4.6	340	340
400	280	11	1.4	0.77	1,500	170	—	4.6	380	380
450			1.4	0.77	1,700	190	—	4.6	420	420
500			1.4	0.77	1,800	200	—	4.6	460	460

[1] The dissolved metals criteria in this table have been rounded to two (2) significant digits in accordance with subdivision (3), Table 8-1. The equations and conversion factors in subdivision (3), Table 8-1 shall **must** be used instead of the criteria in this table when dissolved metals these criteria are used as intermediate values in a calculation, such as in the calculation of WQBELs.

(5) ~~The following establishes~~ Surface water quality criteria for chloride for protection of aquatic life **are as follows:**

(A) ~~The following provides the~~ CMC for chloride as a function of hardness (in mg/l as CaCO₃) and sulfate (in mg/l) in surface waters **is calculated using the following formula:**

$$C = 287.8 (\text{hardness})^{0.205797} (\text{sulfate})^{-0.07452}$$

Where: C = chloride CMC (maximum) in mg/l.

(B) ~~The following provides the~~ CCC for chloride as a function of hardness (in mg/l as CaCO₃) and sulfate (in mg/l) in surface waters **is calculated using the following formula:**

$$C = 177.87 (\text{hardness})^{0.205797} (\text{sulfate})^{-0.07452}$$

Where: C = chloride CCC (4-Day Average) in mg/l.

(C) The CMC and CCC for chloride calculated from the equations in this subdivision shall **must** be rounded to the nearest whole numbers, except when the criteria are used as intermediate values in a calculation, such as in the calculation of WQBELs.

(D) ~~The following establishes the~~ CMC for chloride in mg/l at selected concentrations of hardness (**in mg/l as CaCO₃**) and sulfate ~~with the understanding that the equation in clause (A) shall be used instead of the criteria in this clause when chloride criteria are used as intermediate values in a calculation, such as in the calculation of WQBELs:~~ **is as follows:**

Table 8-2a^[1]

Sulfate (mg/l)	Hardness (mg/l)									
	50	100	150	200	250	300	350	400	450	500
15	526	607	660	700	733	761	785	807	827	845
20	515	594	646	685	717	745	769	790	809	827
25	506	584	635	674	705	732	756	777	796	813

50	481	555	603	640	670	695	718	738	756	773
100	457	527	573	608	636	660	682	701	718	734
150	443	511	556	589	617	641	661	680	697	712
200	434	500	544	577	604	627	647	665	682	697
250	427	492	535	567	594	617	637	654	671	685
300	421	485	528	560	586	609	628	646	661	676
350	416	480	522	553	579	602	621	638	654	668
400	412	475	516	548	574	596	615	632	647	662
450	408	471	512	543	569	590	609	626	642	656
500	405	467	508	539	564	586	605	622	637	651

^[1] The equation in clause (A) must be used instead of the criteria in this table when chloride criteria are used as intermediate values in a calculation, such as in the calculation of QBELs.

(E) ~~The following establishes the CCC for chloride in mg/l at selected concentrations of hardness (in mg/l as CaCO₃) and sulfate with the understanding that the equation in clause (B) shall be used instead of the criteria in this clause when chloride criteria are used as intermediate values in a calculation, such as in the calculation of QBELs:~~ **is as follows:**

Table 8-2b^[1]

Sulfate (mg/l)	Hardness (mg/l)									
	50	100	150	200	250	300	350	400	450	500
15	325	375	408	433	453	470	485	499	511	522
20	318	367	399	423	443	460	475	488	500	511
25	313	361	392	416	436	453	467	480	492	503
50	297	343	373	395	414	430	444	456	467	477
100	282	326	354	375	393	408	421	433	444	453
150	274	316	343	364	381	396	409	420	430	440
200	268	309	336	357	373	388	400	411	421	431
250	264	304	331	351	367	381	394	404	414	423
300	260	300	326	346	362	376	388	399	409	418
350	257	297	322	342	358	372	384	394	404	413
400	255	294	319	339	355	368	380	391	400	409
450	252	291	316	336	351	365	377	387	397	405
500	250	289	314	333	349	362	374	384	394	402

^[1] The equation in clause (B) must be used instead of the criteria in this table when chloride criteria are used as intermediate values in a calculation, such as in the calculation of QBELs.

(6) ~~The following establishes~~ Surface water quality criteria for protection of human health **are as follows:**

Table 8-3

Surface Water Quality Criteria for Protection of Human Health^[1]

Human Noncancer Criteria (HNC)

Human Cancer Criteria (HCC)

CAS Number	Substances	Drinking Water (µg/l)	Nondrinking Water (µg/l)	Drinking Water (µg/l)	Nondrinking Water (µg/l)
	Metals (total recoverable)				
7439976	Mercury (including methylmercury)	0.0018	0.0018		
	Organics (total)				
71432	Benzene	19	510	12	310
57749	Chlordane	0.0014	0.0014	0.00025	0.00025
108907	Chlorobenzene	470	3,200		
50293	DDT	0.002	0.002	0.00015	0.00015
60571	Dieldrin	0.00041	0.00041	6.5×10^{-6}	6.5×10^{-6}
105679	2,4-dimethylphenol	450	8,700		
51285	2,4-dinitrophenol	55	2,800		
118741	Hexachlorobenzene	0.046	0.046	0.00045	0.00045
67721	Hexachloroethane	6	7.6	5.3	6.7
58899	Lindane	0.47	0.5		
75092	Methylene chloride	1,600	90,000	47	2600
1336363	PCBs (class)			6.8×10^{-6}	6.8×10^{-6}
1746016	2,3,7,8-TCDD (dioxin)	6.7×10^{-8}	6.7×10^{-8}	8.6×10^{-9}	8.6×10^{-9}
108883	Toluene	5,600	51,000		
8001352	Toxaphene			6.8×10^{-5}	6.8×10^{-5}
79016	Trichloroethylene			29	370
	Other Substances				
57125	Cyanide (total)	600	48,000		

^[1]The HNC and HCC are thirty (30) day average criteria.

(7) ~~The following establishes~~ Surface water quality criteria for protection of wildlife **are as follows:**

Table 8-4
Surface Water Quality Criteria for Protection of Wildlife^[1]

CAS Number	Substances	Wildlife Criteria (µg/l)
	Metals (total recoverable)	
7439976	Mercury (including methylmercury)	0.0013
	Organics (total)	
50293	DDT and metabolites	1.1×10^{-5}
1336363	PCBs (class)	1.2×10^{-4}
1746016	2, 3, 7, 8-TCDD (dioxin)	3.1×10^{-9}

^[1]The WC are thirty (30) day average criteria.

(c) ~~This subsection establishes minimum surface water quality criteria for aquatic life.~~ In addition to the criteria in subsection (b), ~~this subsection ensures~~ **the following minimum conditions necessary for the maintenance of a well-balanced aquatic community. The following conditions** are applicable at any point in the **surface** waters outside of the applicable mixing zone, as determined in accordance with section 7 of this rule, **to ensure conditions necessary**

for the maintenance of a well-balanced aquatic community:

- (1) There ~~shall~~ **must** be no ~~substances~~ **substance** that:
 - (A) ~~impart~~ **imparts** unpalatable flavor to food fish; or
 - (B) ~~result~~ **results** in offensive odors in the vicinity of the water.
- (2) No pH values below six (6.0) or above nine (9.0) **are permitted** except daily fluctuations that:
 - (A) exceed pH nine (9.0); and
 - (B) are correlated with photosynthetic activity.~~shall be permitted.~~
- (3) Concentrations of dissolved oxygen ~~shall~~ **must**:
 - (A) average at least five (5.0) milligrams per liter per calendar day; and
 - (B) not be less than four (4.0) milligrams per liter at any time.
- (4) ~~The following are~~ Conditions for temperature **are as follows**:
 - (A) ~~There shall be no~~ Abnormal temperature changes that may adversely affect aquatic life **are prohibited** unless caused by natural conditions.
 - (B) The normal daily and seasonal temperature fluctuations that existed before the addition of heat due to other than natural causes ~~shall~~ **must** be maintained.
 - (C) Water temperatures ~~shall~~ **must** not exceed the maximum limits in the following table:
 - (i) during more than one percent (1%) of the hours in the twelve (12) month period ending with any month; ~~At no time shall the water temperature at such locations exceed the maximum limits in the following table and~~
 - (ii) by more than three (3) degrees Fahrenheit (one and seven-tenths (1.7) degrees Celsius):

Table 8-5

Maximum Instream Water Temperatures

Month	St. Joseph River Tributary to Lake Michigan Upstream of the Twin Branch Dam F(°C)	All Other Indiana Streams in the Great Lakes System F(°C)
January	50 (10)	50 (10)
February	50 (10)	50 (10)
March	55 (12.8)	60 (15.6)
April	65 (18.3)	70 (21.1)
May	75 (23.9)	80 (26.7)
June	85 (29.4)	90 (32.2)
July	85 (29.4)	90 (32.2)
August	85 (29.4)	90 (32.2)
September	84 (29.4)	90 (32.2)
October	70 (21.1)	78 (25.5)
November	60 (15.6)	70 (21.1)
December	50 (10)	57 (14.0)

- (D) The following temperature criteria ~~shall~~ apply to Lake Michigan:
 - (i) In all receiving waters, the points of measurement normally ~~shall~~ **must** be in the first meter below the surface at ~~such~~ depths necessary to avoid thin layer surface warming due to extreme ambient air temperatures, but, where required to determine the true distribution of heated wastes and

natural variations in water temperatures, measurements ~~shall~~ **must** be at a greater depth and at several depths as a thermal profile.

(ii) ~~There shall be no~~ Abnormal temperature changes ~~so as to be~~ injurious to fish, wildlife, or other aquatic life, or the growth or propagation thereof **are prohibited**. In addition, plume interaction with the bottom ~~shall~~ **must**:

(AA) be minimized; and

(BB) not injuriously affect fish, shellfish, and wildlife spawning or nursery areas.

(iii) The normal daily and seasonal temperature fluctuations that existed before the addition of heat ~~shall~~ **must** be maintained.

(iv) At any time and at a maximum distance of a one thousand (1,000) foot arc inscribed from a fixed point adjacent to the discharge or as agreed upon by the commissioner and federal regulatory agencies, the following ~~shall~~ apply:

(AA) The receiving water temperature ~~shall~~ **must** not be more than three (3) degrees Fahrenheit (one and seven-tenths (1.7) degrees Celsius) above the existing natural water temperature.

(BB) Thermal discharges to Lake Michigan ~~shall~~ **must** comply with the following maximum temperature requirements:

(aa) Thermal discharges to Lake Michigan ~~shall~~ **must** not raise the maximum temperature in the receiving water above those listed in the following table, except to the extent the permittee adequately demonstrates that the exceedance is caused by the water temperature of the intake water:

Table 8-6

Maximum Water Temperatures

Month	F(°C)
January	45 (7)
February	45 (7)
March	45 (7)
April	55 (13)
May	60 (16)
June	70 (21)
July	80 (27)
August	80 (27)
September	80 (27)
October	65 (18)
November	60 (16)
December	50 (10)

(bb) If the permittee demonstrates that the intake water temperature is within three (3) degrees Fahrenheit below an applicable maximum temperature under subitem (aa), Table 8-6, then not more than a three (3) degree Fahrenheit exceedance of the maximum water temperature ~~shall be~~ **is**

permitted.

(v) The **following** facilities ~~described as follows~~ that discharge into the open waters of Lake Michigan ~~shall be~~ **are** limited to the amount essential for blowdown in the operation of a closed cycle cooling facility:

(AA) All facilities that have new waste heat discharges exceeding a daily average of five-tenths (0.5) billion British thermal units per hour. As used in this item, "new waste heat discharge" means a **any** discharge that had not begun operations as of February 11, 1972.

(BB) All facilities with existing waste heat discharges that increase the quantity of waste heat discharged by more than a daily average of five-tenths (0.5) billion British thermal units per hour.

(vi) Water intakes ~~shall~~ **must** be designed and located to minimize entrainment and damage to desirable organisms. Requirements may vary depending upon local conditions, but, in general, intakes ~~shall:~~ **must:**

(AA) have minimum water velocity; and

(BB) not be located in spawning or nursery areas of important fishes.

Water velocity at screens and other exclusion devices ~~shall also~~ **must** be at a minimum.

(vii) Discharges other than those ~~now~~ in existence ~~shall be such that the on or before February 11, 1972,~~ **must not have** thermal plumes ~~do not~~ that overlap or intersect.

(viii) Facilities discharging more than a daily average of five-tenths (0.5) billion British thermal units of waste heat ~~shall:~~ **must:**

(AA) continuously record intake and discharge temperature and flow; and

(BB) make those records available to the public or regulatory agencies upon request.

(5) The following criteria ~~shall~~ **must** be used to regulate ammonia:

(A) Concentrations of total ammonia (as N) ~~shall~~ **must** not exceed the CMC outside the zone of initial dilution or the final acute value (FAV = 2 (CMC)) in the undiluted discharge unless, for a discharge to a receiving stream or Lake Michigan, an alternate mixing zone demonstration is conducted and approved in accordance with 327 IAC 5-2-11.4(b)(4), in which case, the CMC ~~shall~~ **must** be met outside the applicable alternate mixing zone. The CMC of total ammonia (as N) is determined using the following equation:

$$\text{CMC} = \frac{(0.822)(0.52)(10^{(\text{pk}_a - \text{pH})} + 1)}{(\text{FT})(\text{FPH})(2)}$$

Where: FT = $10^{0.03(20-T)}$

FPH = 1; when: $8 \leq \text{pH} \leq 9$; or

$$\frac{1 + 10^{(7.4 - \text{pH})}}{1.25}$$

; when: $6.5 \leq \text{pH} \leq 8$

$$pK_a = 0.09018 + \frac{2729}{T + 273.2}$$

T = Temperature in °C

(B) The CCC of total ammonia (as N) is determined using the following equation:

$$CCC = \frac{(0.822)(0.80)(10^{(pK_a - pH)} + 1)}{(FT)(FPH)(RATIO)}$$

Where: FT = $10^{0.03(20-T)}$

FPH = 1; when: $8 \leq pH \leq 9$; or

$$\frac{1 + 10^{(7.4 - pH)}}{1.25}$$

; when: $6.5 \leq pH \leq 8$

RATIO = 13.5; when: $7.7 \leq pH \leq 9$; or

$$\frac{(20)(10^{(7.7 - pH)})}{1 + 10^{(7.4 - pH)}}$$

; when: $6.5 \leq pH \leq 7.7$

$$pK_a = 0.09018 + \frac{2729}{T + 273.2}$$

T = Temperature in °C

(C) The use of the equations in clause (A) results in the following CMCs for total ammonia (as N) at different temperatures and pHs:

Table 8-7

Criterion Maximum Concentrations for Total Ammonia (as N) Temperature (°C)

pH	0	5	10	15	20	25	30
6.5	28.48	26.61	25.23	24.26	23.64	23.32	23.29
6.6	27.68	25.87	24.53	23.59	22.98	22.68	22.65
6.7	26.74	24.99	23.69	22.78	22.20	21.92	21.90
6.8	25.64	23.96	22.72	21.85	21.30	21.03	21.01
6.9	24.37	22.78	21.60	20.78	20.26	20.01	20.00
7.0	22.95	21.45	20.35	19.58	19.09	18.86	18.86
7.1	21.38	19.98	18.96	18.24	17.80	17.59	17.60
7.2	19.68	18.40	17.46	16.81	16.40	16.22	16.24
7.3	17.90	16.73	15.88	15.29	14.93	14.78	14.81
7.4	16.06	15.02	14.26	13.74	13.42	13.30	13.35
7.5	14.23	13.31	12.64	12.19	11.92	11.81	11.88
7.6	12.44	11.65	11.07	10.67	10.45	10.37	10.45
7.7	10.75	10.06	9.569	9.238	9.052	9.003	9.088
7.8	9.177	8.597	8.181	7.907	7.760	7.734	7.830
7.9	7.753	7.268	6.924	6.701	6.589	6.584	6.689
8.0	6.496	6.095	5.813	5.636	5.555	5.569	5.683
8.1	5.171	4.857	4.639	4.508	4.457	4.486	4.602
8.2	4.119	3.873	3.707	3.612	3.584	3.625	3.743

8.3	3.283	3.092	2.967	2.900	2.891	2.942	3.061
8.4	2.618	2.472	2.379	2.335	2.340	2.399	2.519
8.5	2.091	1.979	1.911	1.886	1.903	1.968	2.089
8.6	1.672	1.588	1.540	1.529	1.555	1.625	1.747
8.7	1.339	1.277	1.246	1.246	1.279	1.353	1.475
8.8	1.075	1.030	1.011	1.021	1.060	1.137	1.260
8.9	0.8647	0.8336	0.8254	0.8418	0.8862	0.9650	1.088
9.0	0.6979	0.6777	0.6777	0.6998	0.7479	0.8286	0.9521

(D) The use of the equations in clause (B) results in the following CCCs for total ammonia (as N) at different temperatures and pHs:

Table 8-8

pH	Criterion Continuous Concentrations for Total Ammonia (as N) Temperature (°C)						
	0	5	10	15	20	25	30
6.5	2.473	2.310	2.191	2.106	2.052	2.025	2.022
6.6	2.473	2.311	2.191	2.107	2.053	2.026	2.023
6.7	2.473	2.311	2.191	2.107	2.054	2.027	2.025
6.8	2.473	2.311	2.192	2.108	2.055	2.028	2.027
6.9	2.474	2.312	2.193	2.109	2.056	2.030	2.030
7.0	2.474	2.312	2.193	2.110	2.058	2.033	2.033
7.1	2.475	2.313	2.195	2.112	2.060	2.036	2.037
7.2	2.475	2.314	2.196	2.114	2.063	2.040	2.043
7.3	2.476	2.315	2.198	2.116	2.066	2.044	2.050
7.4	2.477	2.317	2.200	2.119	2.070	2.050	2.058
7.5	2.478	2.319	2.202	2.123	2.075	2.058	2.069
7.6	2.480	2.321	2.206	2.128	2.082	2.067	2.082
7.7	2.450	2.294	2.181	2.106	2.063	2.052	2.071
7.8	2.092	1.959	1.865	1.802	1.769	1.763	1.785
7.9	1.767	1.657	1.578	1.527	1.502	1.501	1.525
8.0	1.481	1.389	1.325	1.285	1.266	1.269	1.295
8.1	1.179	1.107	1.057	1.027	1.016	1.022	1.049
8.2	0.9387	0.8828	0.8450	0.8232	0.8169	0.8263	0.8531
8.3	0.7481	0.7048	0.6762	0.6610	0.6589	0.6705	0.6976
8.4	0.5968	0.5634	0.5421	0.5321	0.5334	0.5468	0.5741
8.5	0.4766	0.4511	0.4357	0.4298	0.4337	0.4485	0.4760
8.6	0.3811	0.3619	0.3511	0.3485	0.3545	0.3704	0.3981
8.7	0.3052	0.2910	0.2839	0.2839	0.2916	0.3083	0.3362
8.8	0.2450	0.2347	0.2305	0.2326	0.2417	0.2591	0.2871
8.9	0.1971	0.1900	0.1881	0.1919	0.2020	0.2199	0.2480
9.0	0.1591	0.1545	0.1545	0.1595	0.1705	0.1889	0.2170

(d) ~~This subsection establishes surface water quality for cold-water fish. The Waters designated by the Indiana department of natural resources for put-and-take trout fishing and listed in section 5(a)(3) of this rule are designated as salmonid waters and shall~~ **must** be protected for cold-water fish. In addition to subsections (b) and (c), the following criteria are established to ~~ensure conditions necessary for the maintenance of a well-balanced, cold-water~~

fish community and are applicable at any point in the waters outside of the applicable a mixing zone, as determined in accordance with section 7 of this rule, in the surface waters designated as salmonid waters to ensure conditions necessary for the maintenance of a well-balanced, cold-water fish community:

- (1) Dissolved oxygen concentrations ~~shall~~ **must** not be less than:
 - (A) six (6.0) milligrams per liter at any time; and
 - (B) seven (7.0) milligrams per liter in areas where spawning occurs during the spawning season and in areas used for imprinting during the time salmonids are being imprinted.

Dissolved oxygen concentrations in the open waters of Lake Michigan ~~shall~~ **must** not be less than seven (7.0) milligrams per liter at any time.

- (2) The maximum temperature rise above natural ~~shall~~ **must** not exceed two (2) degrees Fahrenheit (one and one-tenth (1.1) degrees Celsius) at any time or place and, unless due to natural causes, the temperature ~~shall~~ **must** not exceed the following:

- (A) Seventy (70) degrees Fahrenheit (twenty-one and one-tenth (21.1) degrees Celsius) at any time.
- (B) Sixty-five (65) degrees Fahrenheit (eighteen and three-tenths (18.3) degrees Celsius) during spawning or imprinting periods.

(e) ~~This subsection establishes~~ Bacteriological quality for recreational uses during the recreational season **is** as follows:

- (1) The recreational season is defined as the months of April through October, inclusive.

(2) In addition to subsection (b), the criteria in this subsection ~~shall~~ **are to** be used to do the following:

- (A) Evaluate waters for full body contact recreational uses.
- (B) Establish wastewater treatment requirements.
- (C) Establish effluent limits during the recreational season.

(3) For full body contact recreational uses, E. coli bacteria ~~shall~~ **must** not exceed the following:

- (A) One hundred twenty-five (125) **colony forming units (cfu) or most probable number (MPN)** per one hundred (100) milliliters as a geometric mean based on not less than five (5) samples equally spaced over a thirty (30) day period.
- (B) Two hundred thirty-five (235) **cfu or MPN** per one hundred (100) milliliters in any one (1) sample in a thirty (30) day period, except that, in cases where there are at least ten (10) samples at a given site, up to ten percent (10%) of the samples may exceed two hundred thirty-five (235) cfu or MPN per one hundred (100) milliliters where **the**:
 - (i) ~~the~~ E. coli exceedances are incidental and attributable solely to E. coli resulting from the discharge of treated wastewater from a wastewater treatment plant as defined at IC 13-11-2-258; and
 - (ii) ~~the~~ criterion in clause (A) is met.

However, a single sample ~~shall be~~ **is** used for making beach notification and closure decisions.

If a geometric mean cannot be calculated because five (5) equally spaced samples are not available, then the criterion stated in clause (B) must be met.

(4) For demonstrating compliance with wastewater treatment requirements, sanitary wastewater dischargers shall ensure the following:

- (A) The concentration of E. coli in the undiluted discharge does not exceed one

hundred twenty-five (125) cfu or MPN per one hundred (100) milliliters as a geometric mean of the effluent samples taken in a calendar month.

(B) Not more than ten percent (10%) of all samples when not less than ten (10) samples are taken and analyzed for E. coli in a calendar month exceed two hundred thirty-five (235) cfu or MPN per one hundred (100) milliliters as a daily maximum. Under this clause, the calculation of ten percent (10%) of the samples taken ~~shall~~ **must** be limited to the lowest whole number result.

(5) Effluent limits to implement the criteria in subdivision (3) during the recreational season ~~shall~~ **must** be established in NPDES permits by incorporating the following that are to be applied to the undiluted discharge:

(A) The concentration of E. coli in the undiluted discharge ~~shall~~ **must** not exceed one hundred twenty-five (125) cfu or MPN per one hundred (100) milliliters as a geometric mean of the effluent samples taken in a calendar month.

(B) Not more than ten percent (10%) of all samples in a calendar month exceed two hundred thirty-five (235) cfu or MPN per one hundred (100) milliliters as a daily maximum. Under this clause, the calculation of ten percent (10%) of the samples taken ~~shall~~ **must** be limited to the lowest whole number result.

(f) ~~This subsection establishes surface water quality for public water supply.~~ In addition to subsection (b), the following criteria ~~are established~~ to protect the surface water quality at the point at which water is withdrawn for treatment for public **water** supply **are as follows**:

(1) The coliform bacteria group ~~shall~~ **must** not exceed the following:

(A) Five thousand (5,000) **cfu or MPN** per one hundred (100) milliliters as a monthly average value (either MPN or **membrane filter** (MF) count).

(B) Five thousand (5,000) **cfu or MPN** per one hundred (100) milliliters in more than twenty percent (20%) of the samples examined during any month.

(C) Twenty thousand (20,000) **cfu or MPN** per one hundred (100) milliliters in more than five percent (5%) of the samples examined during any month.

(2) Taste and odor producing substances, other than those naturally occurring, ~~shall~~ **must** not interfere with the production of a finished water by conventional treatment consisting of the following:

(A) Coagulation.

(B) Sedimentation.

(C) Filtration.

(D) Disinfection.

(3) The concentrations of either chloride or sulfate ~~shall~~ **must** not exceed two hundred fifty (250) milligrams per liter unless due to naturally occurring sources.

(4) The concentration of dissolved solids ~~shall~~ **must** not exceed seven hundred fifty (750) milligrams per liter unless due to naturally occurring sources. A specific conductance of one thousand two hundred (1,200) micromhos per centimeter (at twenty-five (25) degrees Celsius) may be considered equivalent to a dissolved solids concentration of seven hundred fifty (750) milligrams per liter.

(5) Surface waters ~~shall be considered~~ **are** acceptable for public water supply if radium-226 and strontium-90 are present in amounts not exceeding three (3) and ten (10) picocuries per liter, respectively. In the known absence of strontium-90 and alpha emitters, the water supply is acceptable when the gross beta concentrations do not exceed one thousand (1,000) picocuries per liter.

(6) The:

(A) combined concentration of nitrate-N and nitrite-N ~~shall~~ **must** not exceed ten

(10) milligrams per liter; and

(B) concentration of nitrite-N ~~shall~~ **must** not exceed one (1) milligram per liter.

(7) Chemical constituents in the waters ~~shall~~ **must** not be present ~~in such~~ **at** levels ~~as to~~ **that** prevent, after conventional treatment, meeting the drinking water standards contained in 327 IAC 8-2, due to other than natural causes.

~~(g) This subsection establishes surface water quality for industrial water supply. In addition to subsection (b), the criterion to ensure protection of water quality at the point at which water is withdrawn for use (either with or without treatment) for industrial cooling and processing is that, other than from naturally occurring sources, the dissolved solids shall~~ **must** not exceed seven hundred fifty (750) milligrams per liter at any time **other than from naturally occurring sources to ensure protection of water quality at the point at which surface water is withdrawn for use, either with or without treatment, for industrial cooling and processing.** A specific conductance of one thousand two hundred (1,200) micromhos per centimeter (at twenty-five (25) degrees Celsius) may be considered equivalent to a dissolved solids concentration of seven hundred fifty (750) milligrams per liter.

~~(h) This subsection establishes surface water quality for agricultural uses. The criteria to ensure~~ **surface** water quality conditions necessary for agricultural use are the same as those in subsection (b).

~~(i) This subsection establishes surface water quality for limited uses. The quality of~~ **surface** waters designated for limited uses under section 19(a) of this rule ~~shall,~~ **must**, at a minimum, meet the following criteria ~~(1) The criteria contained in subsection~~ **subsections (b), (2) The criteria contained in subsection (c), (3) The criteria contained in subsection and (g), (4) The waters must and** be aerobic at all times. ~~(5) Notwithstanding subdivisions (1) through (4), the quality of a limited use stream~~ **However, the water must meet the criteria that are applicable to the higher use water** at the point where ~~it~~ **is a limited use water:**

~~(1) becomes physically or chemically capable of supporting a higher use; or at its interface~~

~~(2) interfaces with a higher use water segment. shall meet the criteria that are applicable to the higher use water.~~

(j) Additional requirements for the open waters of Lake Michigan are as follows:

(1) In addition to complying with all other applicable subsections, open waters in Lake Michigan ~~shall~~ **must** meet the following criteria:

Table 8-9

Additional Criteria for Lake Michigan

Parameters	Criteria
Dissolved oxygen	Dissolved oxygen concentrations shall must not be less than seven (7.0) milligrams per liter at any time at all places outside the applicable mixing zone.
pH	No pH values below six (6.0) or above nine (9.0) are permitted except daily fluctuations that exceed pH 9.0 and are correlated with photosynthetic activity. shall be permitted.
Chloride	250 mg/l ^[1]
Phenols	See The criteria in subsection (c)(1)
Sulfate	250 mg/l ^[1]
Total phosphorus	See The requirements in 327 IAC 5-10-2
Total dissolved solids	750 mg/l ^[1]
Fluoride	1.0 mg/l ^[1]

Dissolved iron 300 µg/l^[1]

^[1] This criterion is established to minimize or prevent ~~minimizes or prevents~~ increased levels of this substance in Lake Michigan. For the purposes of establishing water quality-based effluent limitations based on this criterion, it ~~shall~~ **must** be treated as a four (4) day average criterion.

(2) During each triennial review of the water quality standards, prior to preliminary adoption of revised rules, the **following must occur:**

(A) ~~The~~ department shall prepare a report for the ~~water pollution control~~ board on the monitoring data for the ~~constituents~~ **parameters** in the following ~~table~~ Table 8-10, as measured at the drinking water intakes in Lake Michigan.

(B) If ~~these~~ **the monitoring data in clause (A)** indicate that the levels of the ~~constituents~~ **parameters** are either increasing or exceed the levels in ~~the~~ **Table 8-10**, the report ~~shall~~ **for the board must** provide available information on the known and potential causes of the increased levels of these parameters, the known and potential impacts on aquatic life, wildlife, and human health, and any recommended revisions of the criteria.

Table 8-10

Parameters	Levels
pH	7.5-8.5 s.u.
Chloride	
Monthly average	15 mg/l
Daily maximum	20 mg/l
Sulfate	
Monthly average	26 mg/l
Daily maximum	50 mg/l
Total phosphorus	
Monthly average	0.03 mg/l
Daily maximum	0.04 mg/l
Total dissolved solids	
Monthly average	172 mg/l
Daily maximum	200 mg/l

***This document is incorporated by reference. Copies may be obtained from the Government Publishing Office, www.gpo.gov, U.S. EPA National Service Center for Environmental Publications (www.epa.gov/nscep), or are available for review at the Indiana Department of Environmental Management, Office of Legal Counsel, Indiana Government Center North, Thirteenth Floor, 100 North Senate Avenue, Indianapolis, Indiana 46204. (Water Pollution Control Division; 327 IAC 2-1.5-8; filed Jan 14, 1997, 12:00 p.m.: 20 IR 1370; errata filed Aug 11, 1997, 4:15 p.m.: 20 IR 3376; filed Feb 14, 2005, 10:05 a.m.: 28 IR 2074; errata filed Apr 6, 2006, 2:48 p.m.: 29 IR 2546; filed Mar 18, 2008, 2:26 p.m.: 20080416-IR-327060573FRA; filed Jul 9, 2012, 2:54 p.m.: 20120808-IR-327110320FRA)**