TITLE 327 WATER POLLUTION CONTROL BOARD

SECOND NOTICE OF COMMENT PERIOD
LSA Document #07-185

DEVELOPMENT OF AMENDMENTS TO 327 IAC 2-1-6 CONCERNING SULFATE CRITERION IN WATERS OF THE STATE

PURPOSE OF NOTICE

The Indiana Department of Environmental Management (IDEM) has developed draft rule language concerning amendments to the sulfate criterion contained in 327 IAC 2-1-6. By this notice, IDEM is soliciting public comment on the draft rule language. IDEM seeks comment on the affected citations listed and any other provisions of Title 327 that may be affected by this rulemaking.

HISTORY

First Notice of Comment Period: March 28, 2007, Indiana Register (DIN: 20070328-IR-327070185FNA).

CITATIONS AFFECTED: 327 IAC 2-1-6.

AUTHORITY: IC 13-14-9; IC 13-18-3.

SUBJECT MATTER AND BASIC PURPOSE OF RULEMAKING

Basic Purpose and Background

The Water Pollution Control Board final adopted water quality standards revisions done under the rulemaking of LSA Document #03-129 (28 IR 2046), Fast Track Water Quality Standards Revisions, on October 13, 2004. Under that rulemaking, the sulfate criterion contained in 327 IAC 2-1-6 was revised from 250 mg/l to 1,000 mg/l in waters not used for drinking water supply. IDEM and external parties who were members of the Fast Track rulemaking workgroup understood that the sulfate criterion of 1,000 mg/l that was put into the water quality standards through that rulemaking was an interim standard awaiting the final results of sulfate toxicity studies being conducted by the Illinois Natural History Survey (Illinois studies). IDEM expected to revise the sulfate standard based on the conclusions of the Illinois studies.

In an October 3, 2005, approval letter to IDEM regarding the final adopted water quality standards revisions done under the rulemaking of LSA Document #03-129, Fast Track Water Quality Standards Revisions, U.S. Environmental Protection Agency (U.S. EPA) took no action on the revised sulfate criterion submitted for EPA approval. U.S. EPA has now determined that Indiana's revised sulfate criterion is not protective of aquatic life in waters with an ambient hardness value of less than 109 mg/l based on the final results of the Illinois studies. Therefore, U.S. EPA is requiring IDEM to revise and readopt a sulfate criterion that is protective of aquatic life in all surface waters, including those with an ambient hardness value of less than 109 mg/l.

This rulemaking concerning sulfate criterion in waters of the state (LSA Document #07-185) is the second of two ongoing rulemakings amending 327 IAC 2-1-6. In LSA Document #06-573, amendments are proposed to 327 IAC 2-1-6(d) concerning compliance with the bacteriological criteria and the application of a single sample maximum limitation of 235 most probable number (MPN) or colony forming units (cfu)/100 ml of Escherichia coli (E. coli) bacteria in waters of the state. These proposed E. coli amendments were posted in the Indiana Register on September 12, 2007 (DIN: 20070912-IR-327060573PRA) and are included in this rulemaking. This rulemaking, LSA Document #07-185, amends 327 IAC 2-1-6 by eliminating the sulfate criterion of 1,000 mg/l found in Table 6-1 and adding 327 IAC 2-1-6(a)(5).

IC 13-14-9-4 Identification of Restrictions and Requirements Not Imposed under Federal Law

No element of the draft rule imposes either a restriction or a requirement on persons to whom the draft rule applies that is not imposed under federal law. There is no requirement imposed under this rule because Indiana must submit water quality standards revisions to U.S. EPA for review and approval according to 40 CFR 131.20. Therefore, the alternative of doing a rulemaking to revise the sulfate criterion in 327 IAC 2-1-6 is federally required.

Indiana's NPDES permit issuance program is a delegated program under the federal authority, and to maintain delegation requires federal approval.

Potential Fiscal Impact

Cost associated with a revision to the sulfate criterion contained in 327 IAC 2-1-6 may be limited to the few dischargers with sulfate limits and those possibly to receive sulfate limits in their discharge permits. In most instances, sulfate criteria calculated using the proposed equations will be less stringent than the 1,000 mg/l criterion currently in 327 IAC 2-1-6. There are very few Indiana waters that have ambient hardness values less than 109 mg/l. For those waters, the results of the Illinois studies indicate that a sulfate criterion of 500 mg/l is protective of aquatic life. A criterion of 500 mg/l is less stringent than the sulfate criterion of 250 mg/l that was in

327 IAC 2-1-6 prior to the revision done under the rulemaking of LSA Document #03-129, Fast Track Water Quality Standards Revisions.

Public Participation and Workgroup Information

No workgroup is planned for this rulemaking. If you feel that a workgroup or other informal discussion on the rule is appropriate, please contact MaryAnn Stevens, Rules Section, Office of Water Quality at (317) 232-8635 or (800) 451-6027 (in Indiana). Please provide your name, phone number, and e-mail address, if applicable, where you can be contacted.

SUMMARY/RESPONSE TO COMMENTS FROM THE FIRST COMMENT PERIOD

IDEM requested public comment from March 28, 2007, through April 27, 2007, regarding amendments to the sulfate criterion contained in 327 IAC 2-1-6. IDEM received a comment letter from the following party by the comment period deadline:

Indiana Water Quality Coalition and Indiana Manufacturers Association represented by Fred Andes of Barnes & Thornburg (IWQC-IMA)

Following is a summary of the comments received and IDEM's responses thereto:

Comment: Alternative 1, described in the First Notice, to revise the sulfate criterion through rulemaking and replacing the current criterion with equations developed by Illinois EPA based on Illinois studies, is strongly preferred to the First Notice's Alternative 2, the take no action approach which would result in US EPA replacing the Indiana criterion with its own criterion. (IWQC-IMA)

Response: IDEM agrees that Alternative 1, to revise the sulfate criterion through rulemaking, is the preferred approach. With this second notice, IDEM is putting forth draft rule language incorporating the sulfate equations developed by Illinois EPA based on Illinois studies.

Comment: The rulemaking approach of Alternative 1 should be pursued for the following reasons:

(1) The Illinois EPA criteria equations were developed through an extensive stakeholder process. Members included Illinois EPA personnel, permit holders, representatives from the coal industry, and environmental groups. Thus, development of the Illinois sulfate criterion included a public review and a process that assured a sound basis for decisions.

(2) The two species used by Illinois EPA (*Ceriodaphnia dubia* and *Hyalella azteca*) are two of the most sensitive organisms to sulfate and are commonly included in the development of many other water quality criteria.

(3) The results of the toxicity tests, conducted by Dr. Soucek of the Illinois Natural History Survey, have been published at least twice (by SETAC) and presented as a poster, so have been subjected to peer review. (IWQC-IMA)

Response: IDEM agrees with the rulemaking approach based on the listed reasons.

Comment: The Illinois EPA equations were based on results of toxicity tests designed to be within the typical range of surface water hardness and chloride concentrations for the state of Illinois. In proceeding with Indiana rulemaking, it would be prudent for IDEM to verify that the range of hardness and chloride concentrations in surface waters of Indiana are similar to those reported for Illinois to validate the application of the sulfate equations in Indiana. The possibility is recognized that this issue already may have been evaluated to some extent because the First Notice does state that "there are very few Indiana waters that have ambient hardness values less than 109 mg/l." (IWQC-IMA)

Response: Prior to initiating this rulemaking, IDEM examined data collected by IDEM's Office of Water Quality, Assessment Branch and determined that the ranges of hardness and chloride concentrations of Indiana's surface waters are similar to those of the Illinois waterbodies.

Comment: It also would be prudent for IDEM to verify that the calcium to magnesium ratio in Indiana is similar to that of Illinois since the ranges of hardness and chloride levels in the Illinois studies incorporate a range for the calcium to magnesium ratio that is typical of Illinois waters. (IWQC-IMA)

Response: IDEM has examined data collected by IDEM's Office of Water Quality, Assessment Branch and determined that the calcium:magnesium ratio of Indiana's surface waters is similar to that of the Illinois waterbodies.

Comment: It is important that the sulfate rule revisions allow provisions for site-specific criteria development because there are likely to be some waters, for example, mining districts, that are outside of the typical ranges of hardness and chloride levels. (IWQC-IMA)

Response: The sulfate criteria proposed in this rulemaking are site-specific because they are dependent on hardness and chloride concentration at each site. Additionally, Indiana has provisions for calculating site-specific criteria that are specified in 327 IAC 2-1-8.9.

REQUEST FOR PUBLIC COMMENTS

At this time, IDEM solicits the following:

(1) The submission of alternative ways to achieve the purpose of the rule.

(2) The submission of suggestions for the development of draft rule language.

Mailed comments should be addressed to:
#07-185(WPCB) [Sulfate Revisions]
MaryAnn Stevens Mail Code 65-40
Rules Section
Office of Water Quality
Indiana Department of Environmental Management
100 North Senate Avenue
Indianapolis, Indiana 46204-2251.

Hand delivered comments will be accepted by the receptionist on duty at the twelfth floor reception desk, Office of Water Quality, Indiana Government Center-North, 100 North Senate Avenue, Room N1255, Indianapolis, Indiana. Comments also may be submitted by facsimile to (317) 232-8406, Monday through Friday, between 8:15 a.m. and 4:45 p.m. Please confirm the timely receipt of faxed comments by calling the Office of Water Quality, Rules Section at (317) 233-8903. Please note it is not necessary to follow a faxed comment letter with a copy of the letter submitted through the postal system.

COMMENT PERIOD DEADLINE

Comments must be postmarked, faxed, or hand delivered by December 14, 2007.

Additional information regarding the NPDES program and discharge permit limits for sulfate may be obtained from John Elliott, Permits Branch, Office of Water Quality, (317) 233-0703 or (800) 451-6027. Information regarding the sulfate toxicity studies carried out by the Illinois Natural History Survey may be obtained from Ms. Shivi Selvaratnam, PhD, Water Quality Standards Program Coordinator, Assessment Branch, Office of Water Quality, (317) 308-3088. Additional information regarding this rulemaking action may be obtained from MaryAnn Stevens, Rules Section, Office of Water Quality, (317) 232-8635 or (800) 451-6027 (in Indiana).

DRAFT RULE

SECTION 1. 327 IAC 2-1-6, PROPOSED TO BE AMENDED AT 20070912-IR-327060573PRA, IS AMENDED TO READ AS FOLLOWS:

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

Authority: IC 13-14-8; IC 13-14-9; IC 13-18-3
Affected: 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 mixing zone, shall meet the minimum conditions of being 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 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 a nuisance.

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

(i) create a nuisance;

(ii) be unsightly; or

(iii) otherwise impair the designated uses.

(E) Are in amounts sufficient to be acutely toxic to, or to otherwise severely injure or kill, aquatic life, other animals, plants, or humans. To assure protection of aquatic life, concentrations of toxic substances shall 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:

(i) for certain substances, an AAC is established and set forth in subdivision (3), Table 6-1 and subdivision (3), Table 6-2 (which table incorporates subdivision (4), Table 6-3);

(ii) for substances for which an AAC is not specified in subdivision (3), Table 6-1 or subdivision (3), Table

6-2, an AAC can be calculated by the commissioner using the procedures in section 8.2 of this rule; and (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 clause shall 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 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 are established:

(A) A toxic substance or pollutant shall not be present in such waters 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 in subdivision (3), Table 6-1 and subdivision (3), Table 6-2 (which table incorporates subdivision (4), Table 6-3).

(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 or subdivision (3), Table 6-2, 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.

(D) A CCC determined under clause (B) 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 a mixing zone for a discharge of that substance. Similarly, in 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 the mixing zone for a discharge of that substance. 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 specific substances:

Table 6-1
Surface Water Quality Criteria for Specific Substances

AAC (Maximum)	CCC			
	Outside of Mixing Zone			Point of Water Intake
Substances	Aquatic Life (CAC) (4-Day Average)		Human Health (30-Day Average)	Human Health (30-Day Average)
Metals (µg/l)				
(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	#	#		
Organics (µg/l)				
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)
Hexachlorbenzene$			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			2,600 (T)	400 (T)
Dichlorobenzidine			0.2 (C)	0.1 (C)
1,1-dichloroethylene			18.5 (C)	0.33 (C)
2,4-dichlorophenol				3,090 (T)
Dichloropropenes			14,100 (T)	87 (T)
Dieldrin$	1.3*	0.0019	0.00076 (C)	0.00071 (C)
2,4-dinitrotoluene			91 (C)	1.1 (C)
Dioxin (2,3,7,8-TCDD)$			0.0000001 (C)	0.0000001 (C)
1,2-diphenylhydrazine			5.6 (C)	0.422 (C)
Endosulfan	0.11*	0.056	159 (T)	74 (T)
Endrin$	0.09*	0.0023		1.0 (D)
Ethylbenzene			3,280 (T)	1,400 (T)
Fluoranthene			54 (T)	42 (T)
Halomethanes			157 (C)	1.9 (C)
Heptachlor$	0.26*	0.0038	0.0028 (C)	0.0028 (C)
Hexachlorobutadiene$			500 (C)	4.47 (C)
Hexachlorocyclohexane (HCH)				
alpha HCH$			0.31 (C)	0.09 (C)
beta HCH$			0.55 (C)	0.16 (C)
gamma HCH (Lindane)$	1.0*	0.080	0.63 (C)	0.19 (C)
Technical HCH$			0.41 (C)	0.12 (C)
Hexachlorocyclopentadiene				206 (T)
Isophorone			520,000 (T)	5,200 (T)
Nitrobenzene				19,800 (T)
Nitrophenols				
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	$e^{(1.005\ [pH]-4.830)}$	$e^{(1.005\ [pH]-5.290)}$		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)
Other Substances				
Asbestos (fibers/liter)				300,000 (C)
~~Chlorides~~ **Chloride** (mg/l)	860	230		
Chlorine (Total Residual) (µg/l)	19	11		
Chlorine[a] (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.

~~Sulfates~~ **Sulfate** shall not exceed ~~one thousand (1,000) mg/l~~ **the criteria established in subdivision (5)** 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.

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.

[a]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.

(4) 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 and using a value of one (1) for the WER:

Table 6-3

Metals Concentrations in Micrograms Per Liter; Hardness in Milligrams Per Liter $CaCO_3$[1]

	Arsenic (III)		Cadmium		Chromium (III)		Chromium (VI)		Copper		Lead		Nickel		Silver		Zinc	
Hardness	AAC	CAC	AAC	CAC	AAC	CAC	AAC	CAC	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	30	1.2	790	87	0.52	–	64	58
100	360	190	3.7	1.0	550	180	16	11	17	11	65	2.5	1400	160	1.7	–	110	100
150	360	190	5.7	1.4	760	250	16	11	25	16	100	3.9	2000	220	3.5	–	160	150
200	360	190	7.8	1.7	970	310	16	11	33	21	140	5.3	2500	280	5.7	–	210	190
250	360	190	10	2.0	1200	380	16	11	40	25	170	6.7	3100	340	8.3	–	250	230
300	360	190	12	2.3	1300	440	16	11	48	29	210	8.1	3600	400	11	–	290	270
350	360	190	14	2.6	1500	500	16	11	55	33	240	9.5	4100	450	15	–	330	300
400	360	190	17	2.9	1700	550	16	11	63	37	280	11	4600	510	19	–	370	340
450	360	190	19	3.1	1900	610	16	11	70	41	320	12	5100	560	23	–	410	370
500	360	190	21	3.4	2100	670	16	11	78	45	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. The equations and conversion factors in subdivision (3), Table 6-2 shall be used instead of the criteria in this table when dissolved metals 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 sulfate that shall not be exceeded in all surface waters outside of the mixing zone:

(A) The following provides surface water quality criteria for sulfate in mg/l for the specified ranges of hardness (in mg/l as $CaCO_3$) or chloride (in mg/l), or both:

(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 (hardness) + 54.163 (chloride)] × 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 (hardness) - 1.457 (chloride)] × 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 applies to the surface water quality criteria for sulfate provided in clause (A):

(i) The establishment of surface water quality criteria for sulfate for surface water concentrations of chloride that exceed the CAC for chloride established under subdivision (3), Table 6-1 does not imply that the chloride concentration may exceed the CAC.

(ii) The surface water quality criteria for sulfate calculated from equations in clause (A) shall 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 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:

	Hardness (mg/l)										
Chloride (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**
230	**500**	**970**	**1149**	**1328**	**1507**	**1686**	**1865**	**2044**	**2223**	**2402**	**2402**

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

(1) There shall be no substances that:

(A) impart unpalatable flavor to food fish; or

(B) result in offensive odors in the vicinity of the water.

(2) No pH values below six (6.0) or above nine (9.0), 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:
(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:
(A) There shall be no abnormal temperature changes that may adversely affect aquatic life 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 be maintained.
(C) The maximum temperature rise at any time or place above natural temperatures shall 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 not exceed the maximum limits in the following table 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 by more than three (3) degrees Fahrenheit (one and seven-tenths (1.7) degrees Celsius):

Table 6-4

	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 be used to regulate ammonia:
(A) Except for waters covered in clause (B), at all times, all surface waters outside of mixing zones shall 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;
humans, animals, aquatic life, or plants.
(B) For those waters listed in subsection (c), the following ammonia criteria will apply outside the mixing zone:

Maximum Ammonia Concentrations
(Unionized Ammonia as N)***
(mg/l)

	Temperature (°C)						
pH	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 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

24-Hour Average Ammonia Concentrations
(Unionized Ammonia as N)***
(mg/l)
Temperature (°C)

pH	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 by the value determined by: $1/(10^{pKa-pH} + 1)$.

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

(c) This subsection establishes surface water quality 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 mixing zone:

(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), dissolved oxygen concentrations shall 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), the maximum temperature rise above natural shall 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 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 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 not exceed the following:
(A) One hundred twenty-five (125) 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) per one hundred (100) milliliters in any one (1) sample in a thirty (30) day period.
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 be limited to the lowest whole number result.

(5) Effluent limits to implement the criteria in subdivision (3) during the recreational season shall 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 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 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 supply:

(1) The coliform bacteria group shall not exceed the following:
(A) Five thousand (5,000) per one hundred (100) milliliters as a monthly average value (either MPN or MF count).
(B) Five thousand (5,000) per one hundred (100) milliliters in more than twenty percent (20%) of the samples examined during any month.
(C) Twenty thousand (20,000) 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 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 ~~chlorides~~ **chloride** or ~~sulfates~~ **sulfate** shall not exceed two hundred fifty (250) milligrams per liter unless due to naturally occurring sources.
(4) The concentration of dissolved solids shall 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 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) Chemical constituents in the waters shall not be present in such levels as to 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 not exceed seven hundred fifty (750) milligrams per liter at any time. 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 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 waters classified for limited uses under section 3(a)(5) of this rule shall, at a minimum, meet the following criteria:
(1) The criteria contained in subsection (a).
(2) The criteria contained in subsection (d).
(3) The criteria contained in subsection (f), where applicable.
(4) The waters must be aerobic at all times.
(5) Notwithstanding subdivisions (1) through (4), the quality of a limited use stream at the point where it becomes physically or chemically capable of supporting a higher use or at its interface with a higher use water segment shall meet the criteria that are applicable to the higher use water.

(i) This subsection establishes surface water quality for exceptional uses. Waters classified for exceptional uses warrant extraordinary protection. Unless criteria are otherwise specified on a case-by-case basis, the quality of all waters designated for exceptional use shall be maintained without degradation.

(Water Pollution Control Board; 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)

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