Introduction to permit limits, what do they mean and how are they calculated?

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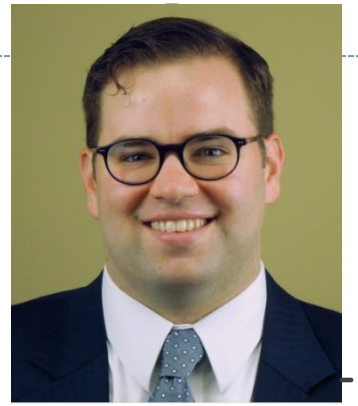
AQUATIC ECOLOGIST COORDINATOR
FIELD AND RESEARCH PROGRAM
OFFICE OF WATER QUALITY

Office of Water Quality



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Water Quality Planning Branch
Sarah Clem, Branch Manager

- Monitoring
- Assessments {305(b) and 303(d)}
- TMDLs
- Whole Effluent Toxicity
- Short Term Activity Authorizations (STAAs)
- Water Quality Standards (Regulation 2)

"Water Quality Standards and Your Permit"

Permitting Branch
Bryan Leamons, P.E., Senior Operations Manager

Three Permit Sections:

- NPDES Individual Permits / ARR (IGP)/ MS4
  - Vacant., Engineer Supervisor
- NPDES Individual Permits / ARG
  - Carrie McWilliams, P.E., Engineer Supervisor
- No Discharge Permits / ARR15
  - Jamal Solaimanian, P.E., Engineer Supervisor

ADEQ Mission

"To protect, enhance and restore the natural environment for the well-being for all Arkansans."

NPDES Program Goal:

No source will be allowed to discharge any wastewater which:

- Causes a violation of an applicable narrative and/or numerical state water quality standard;
- Results in instream toxicity; or
- Results in the endangerment of a drinking water supply

NPDES Program

"*National Pollutant Discharge Elimination System*"

- Established in 1972 Federal Clean Water Act.
- Unlawful to discharge pollutants to surface water. without NPDES permit.
- Arkansas has the NPDES program since 1986.

"Discharge is a privilege, not a right"

Who Needs a Permit?

40 CFR 122.21 :

Duty to apply.	Any person who discharges or proposes to discharge pollutants from a point source to waters of the State shall submit a complete application.
Who applies?	When a facility or activity is owned by one person but is operated by another person, it is the operator's duty to obtain a permit.

Introduction to Permit Limits
Individual Permits

- Specific Pollutant effluent limits
  - Technology-based (40 CFR); and/or
  - Water quality based (Reg. 2)
  - Most stringent limits placed in permit

PART I
PERMIT REQUIREMENTS

SECTION A. EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS: OUTFALL 001 - treated municipal wastewater.

During the period beginning on the effective date and lasting until the date of expiration, the permittee is authorized to discharge from Outfall 001. Such discharges shall be limited and monitored by the permittee as specified below as well as Parts II and III. See Part IV for all definitions and calculations.

Effluent Characteristics	**Discharge Limitations**			**Monitoring Requirements**	
	Mass (lbs/day, unless otherwise specified)	Concentration (mg/l, unless otherwise specified)		Frequency	Sample Type
	Monthly Avg.	Monthly Avg.	7-Day Avg.		
Flow	N/A	Report, MGD	Report, MGD (Daily Maximum)	Daily	instantaneous
Overflows	Monthly Total SSOs (occurrences/month)			See Comments[1]	
Overflow Volume	Monthly Total Volume of SSOs (gallons/month)			See Comments[1]	
Biochemical Oxygen Demand (BOD5) (Nov-Apr)	20.0	30.0	45.0	twice/month	grab
Total Suspended Solids (TSS) (Nov-Apr)	60.0	90.0	135.0	twice/month	grab
Dissolved Oxygen (DO) (Nov-Apr)	N/A	2.0 (Inst. Min.)		twice/month	grab
Fecal Coliform Bacteria (FCB)		(colonies/100ml)			
(Apr)	N/A	200	400	twice/month	grab
(Nov-Mar)	N/A	1000	2000	twice/month	grab
pH (Nov-Apr)	N/A	Minimum 6.0 s.u.	Maximum 9.0 s.u.	twice/month	grab

No Discharge is allowed during the months of May through October.

1 See Condition No. 5 of Part II (SSO Condition). If there are no overflows during the entire month, report "zero" (0).

There shall be no discharge of distinctly visible solids, scum, or foam of a persistent nature, nor shall there be any formation of slime, bottom deposits, or sludge banks. There shall be no visible sheen as defined in Part IV of this permit.

Samples and measurements taken as required herein shall be representative of the volume and nature of the monitored discharge during the entire monitoring period. Samples shall be taken after chlorine contact, prior to the receiving stream.

Introduction to Permit Limits
Individual Permits

- Specific Pollutant effluent limits
  - Technology-based (40 CFR); and/or
  - Water quality based (Reg. 2)
  - Most stringent limits placed in permit

- Permit Procedures in Continuing Planning Process
  - (Appendix D)

Introduction to Permit Limits
Individual Permits

- Dischargers of ≤0.65MGD, shall include as minimum
  - BOD5
  - TSS
  - NH4
  - Dissolved Oxygen
- Dischargers of ≤0.05MGD
  - Best Conventional Treatment 10/15 BOD5/TSS
- New oxygen demanding effluents shall be modeled to ensure protection of water quality and designated uses

Introduction to Permit Limits
Individual Permits

- Outstanding National or State Resource Waters
  (Extraordinary Resource Waters, Ecological Sensitive, Natural or Scenic Waters)

- In no case shall BOD5/TSS be greater than 10/15

Introduction to Permit Limits
Individual Permits

- New permits, expansion of permits and renewals
  - Review of priority pollutant scan
    - Method Quantification Levels (MQLs)

Instream Waste Concentration (IWC)

$IWC = (C_d * Q_d + C_b * Q_b)/(Q_d + Q_b)$

C_d=effluent pollutant concentration (mg/L)
Q_d=effluent flow (mgd)
C_b=pollutant concentration upstream (mg/L)
Q_b=upstream flow (mgd)

Introduction to Permit Limits
Individual Permits

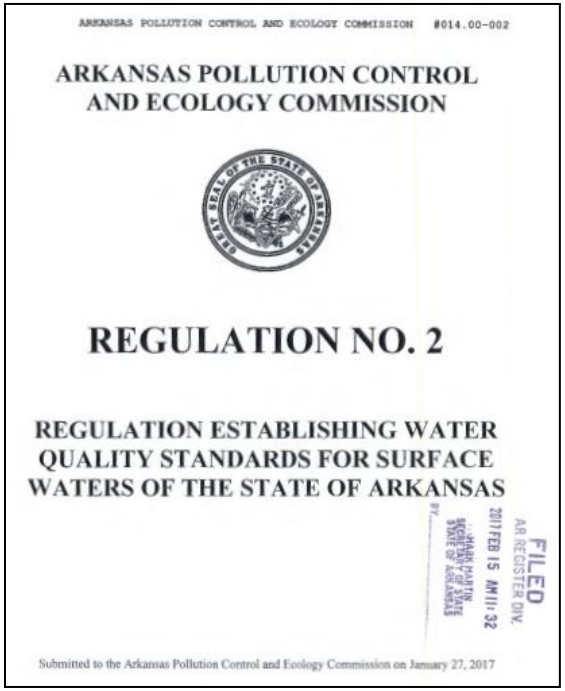
Instream Waste Concentration (IWC) example

$$IWC = (C_d * Q_d + C_b * Q_b)/(Q_d + Q_b)$$

C_d=effluent pollutant concentration (mg/L)
Q_d=effluent flow (mgd)
C_b=pollutant concentration upstream (mg/L)
Q_b=upstream flow (mgd)

Introduction to Permit Limits
Individual Permits

- Compare results of IWC to water quality criteria (WQC)
- WQC are identified in Regulation 2
  - Chapter 4 General Standards
  - Chapter 5 Specific Standards


ARKANSAS POLLUTION CONTROL AND ECOLOGY COMMISSION #014.00-002

ARKANSAS POLLUTION CONTROL AND ECOLOGY COMMISSION

REGULATION NO. 2

REGULATION ESTABLISHING WATER QUALITY STANDARDS FOR SURFACE WATERS OF THE STATE OF ARKANSAS

FILED
AR REGISTER DIV.
2017 FEB 15 AM 11:32
SECRETARY OF STATE
STATE OF ARKANSAS

Submitted to the Arkansas Pollution Control and Ecology Commission on January 27, 2017

Regulation 2

Reg. 2.502 Temperature

Heat shall not be added to any waterbody in excess of the amount that will elevate the natural temperature, outside the mixing zone, by more than 5°F (2.8°C) based upon the monthly average of the maximum daily temperatures measured at mid-depth or three feet (whichever is less) in streams, lakes or reservoirs. The following standards are applicable:

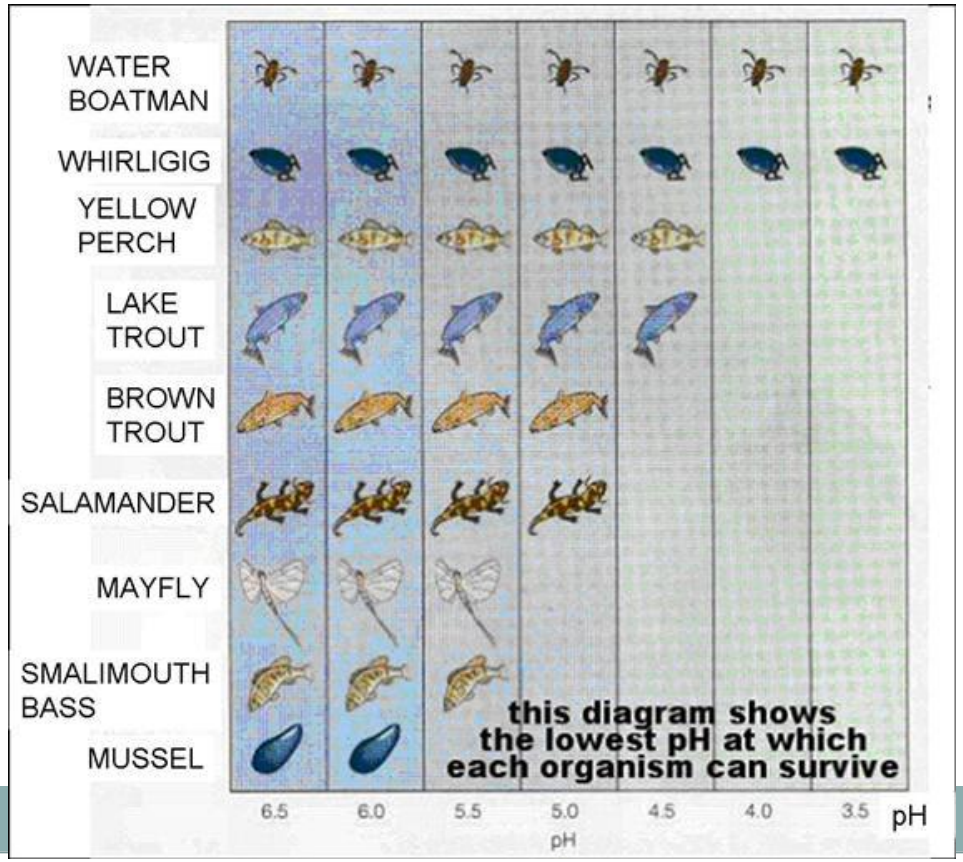
Waterbodies	Limit °C (°F)
Streams	
Ozark Highlands	29 (84.2)
Boston Mountains	31 (87.8)
Arkansas River Valley	31 (87.8)
Ouachita Mountains	30 (86.0)
Springwater-influenced Gulf Coastal	30 (86.0)
Typical Gulf Coastal	30 (86.0)
Least-Altered Delta	30 (86.0)
Channel-Altered Delta	32 (89.6)
White River (Dam #1 to mouth)	32 (89.6)
St. Francis River	32 (89.6)
Mississippi River	32 (89.6)
Arkansas River	32 (89.6)
Ouachita River (L. Missouri R.to Louisiana state line)	32 (89.6)
Red River	32 (89.6)
Lakes and Reservoirs (applicable at 1.0 meter depth)	32 (89.6)
Trout waters	20 (68.0)

Temperature requirements shall not apply to off-stream privately-owned reservoirs constructed primarily for industrial cooling purposes and financed in whole or in part by the entity or successor entity using the lake for cooling purposes.

Regulation 2

Reg. 2.504 pH

pH between 6.0 and 9.0 standard units are the applicable standards for streams. For lakes, the standards are applicable at 1.0 meter depth. As a result of waste discharges, the pH of water in streams or lakes must not fluctuate in excess of 1.0 standard unit over a period of 24 hours.



Regulation 2

For purposes of determining effluent discharge limits, the following conditions shall apply:

(A) The primary season dissolved oxygen standard is to be met at a water temperature of 22°C (71.5°F) and at the minimum stream flow for that season. At water temperatures of 10°C (50°F), the dissolved oxygen standard is 6.5 mg/L.

(B) During March, April and May, when background stream flows are 15 cfs or higher, the dissolved oxygen standard is 6.5 mg/L in all areas except the Delta Ecoregion, where the primary season dissolved oxygen standard will remain at 5 mg/L.

(C) The critical season dissolved oxygen standard is to be met at maximum allowable water temperatures and at Q7-10 flows. However, when water temperatures exceed 22°C (71.6°F), a 1 mg/L diurnal depression will be allowed below the applicable critical standard for no more than 8 hours during any 24-hour period.

Reg. 2.505 Dissolved Oxygen

Rivers and Streams

The following dissolved oxygen standards are applicable:

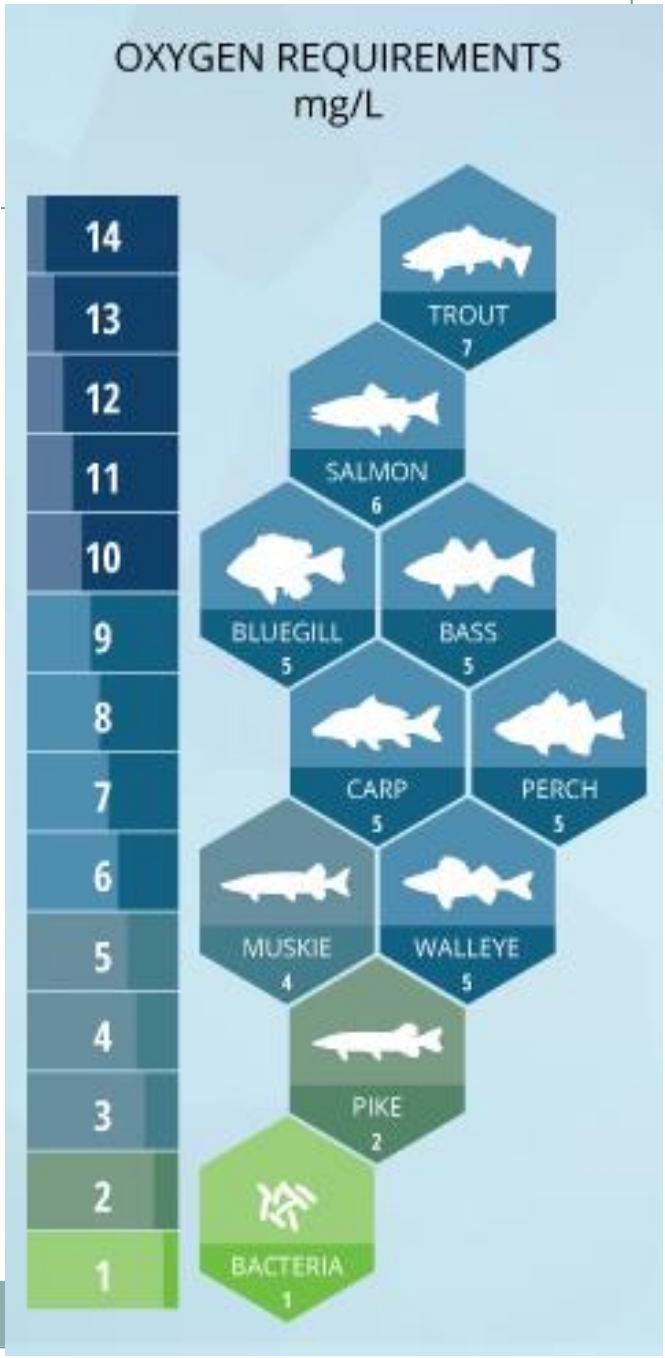
Waterbodies	Criteria (mg/L)	
Streams	Primary	Critical
Ozark Highlands		
<10 mi² watershed	6	2
10 to 100 mi²	6	5
>100 mi² watershed	6	6

5-2

Waterbodies	Criteria (mg/L)	
Boston Mountains		
<10 mi² watershed	6	2
>10 mi² watershed	6	6
Arkansas River Valley		
<10 mi² watershed	5	2
10 mi² to 150 mi²	5	3
151 mi² to 400 mi²	5	4
>400 mi² watershed	5	5
Ouachita Mountains		
<10 mi² watershed	6	2
>10 mi² watershed	6	6
Typical Gulf Coastal		
<10 mi² watershed	5	2
10 mi² to 500 mi²	5	3
>500 mi² watershed	5	5
Springwater-influenced Gulf Coastal		
All size watersheds	6	5
Delta (least-altered and channel altered)		
<10 mi² watershed	5	2
10 mi² to 100 mi²	5	3
>100 mi² watershed	5	5
Trout Waters		
All size watersheds	6	6

Regulation 2

Oxygen Demanding Model Results
BOD/CBOD
TSS
NH_4



Regulation 2

Reg. 2.507 Bacteria

For the purposes of this regulation, all streams with watersheds less than 10 mi^2 shall not be designated for primary contact unless and until site verification indicates that such use is attainable. No mixing zones are allowed for discharges of bacteria.

For assessment of ambient waters as impaired by bacteria, the below listed applicable values for *E. coli* shall not be exceeded in more than 25% of samples in no less than eight (8) samples taken during the primary contact season or during the secondary contact season.

The following standards are applicable:

Contact Recreation Seasons	Limit (col/100mL)			
	E. coli		Fecal Coliform	
Primary Contact[1]	IS[3]	GM[4]	IS[3]	GM[4]
ERW, ESW, NSW, Reservoirs, Lakes[2]	298	126	400	200
All Other Waters	410	-	400	200
Secondary Contact[5]				
ERW, ESW, NSW, Reservoirs, Lakes[2]	1490	630	2000	1000
All Other Waters	2050	-	2000	1000

[1] May 1 to September 30
[2] Applicable at 1.0 meter depth in Reservoirs and Lakes
[3] For assessment of Individual Sample Criteria– at least eight (8) data points
[4] For calculation and assessment of Geometric Mean – calculated on a minimum of five (5) samples spaced evenly and within a thirty (30)-day period.
[5] October 1 to April 30

The Arkansas Department of Health has the responsibility of approving or disapproving surface waters for public water supply and of approving or disapproving the suitability of specifically delineated outdoor bathing places for body contact recreation, and it has issued rules and regulations pertaining to such uses.

Regulation 2

Reg. 2.508 Toxic Substances

Toxic substances shall not be present in receiving waters, after mixing, in such quantities as to be toxic to human, animal, plant or aquatic life or to interfere with the normal propagation, growth and survival of the indigenous aquatic biota. Acute toxicity standards apply outside the zone of initial dilution. Within the zone of initial dilution acute toxicity standards may be exceeded but acute toxicity may not occur. Chronic toxicity and chronic numeric toxicity standards apply at, or beyond, the edge of the mixing zone. Permitting of all toxic substances shall be in accordance with the toxic implementation strategy found in the State of Arkansas Continuing Planning Process. For non-permit issues and as a guideline for evaluating toxic substances not listed in the following tables, the Department may consider No Observed Effect Concentrations or other literature values as appropriate. For the substances listed below, the following standards shall apply:

ALL WATERBODIES - AQUATIC LIFE CRITERIA

Substance	Acute Values (µg/L)	Chronic Values (µg/L) (24-hr Average)
PCBs		0.0140
Aldrin	3.0	
Dieldrin	2.5	0.0019
DDT (& metabolites)	1.1	0.0010
Endrin*	0.18	0.0023
Toxaphene	0.73	0.0002
Chlordane	2.4	0.0043
Endosulfan*	0.22	0.056
Heptachlor	0.52	0.0038
Hexachlorocyclohexane*	2.0	0.080
Pentachlorophenol	$e^{[1.005(pH)-4.869]}$	$e^{[1.005(pH)-5.134]}$
Chlorpyrifos	0.083	0.041

* Total of all isomers

DISSOLVED METALS *

	Acute Criteria (CMC) - µg/L(ppb)		Chronic Criteria (CCC) - ug/L(ppb)	
Substance	Formula X Conversion		Formula X Conversion	
Cadmium	$e^{[1.128(\ln hardness)]-3.828}$	(a)	$e^{[0.7852(\ln hardness)]-3.490}$	(c)
Chromium(III)	$e^{[0.819(\ln hardness)]+3.688}$	0.316	$e^{[0.8190(\ln hardness)]+1.561}$	0.860
Chromium (VI)	16	0.982	11	0.962
Copper	$e^{[0..9422(\ln hardness)]-1.464}$	0.960	$e^{[0.8545(\ln hardness)]-1.465}$	0.960
Lead	$e^{[1.273(\ln hardness)]-1.460}$	(b)	$e^{[1.273(\ln hardness)]-4.705}$	(b)
Mercury‡	2.4	0.85	0.012**	NONE
Nickel	$e^{[0.8460(\ln hardness)]+3.3612}$	0.998	$e^{[0.8460(\ln hardness)]+1.1645}$	0.997
Selenium**	20	NONE	5	NONE
Silver	$e^{[1.72(\ln hardness)]-6.52}$	0.85	----------	NONE
Zinc	$e^{[0.8473(\ln hardness)]+0.8604}$	0.978	$e^{[0.8473(\ln hardness)]+0.7614}$	0.986
Cyanide**	22.36	NONE	5.2	NONE

The permittee shall have the option to develop site-specific numerical standards for toxic substances using United States Environmental Protection Agency approved bioassay methodology and guidance. Such guidance may include but may not be limited to *Water Quality Standards Handbook*; *Guidelines for Deriving Numerical National Water Quality Criteria for the Protection of Aquatic Organisms and Their Uses* (August, 1994); *Methods for Measuring the Acute Toxicity of Effluents to Freshwater and Marine Organisms* (EPA 600/4-90/027F. 5th ed. December 2002); *Short Term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Freshwater Organisms* (EPA/600/4-91/002. 4th ed. October 2002) or most recent update thereof.

Only ambient water quality data for dissolved metals generated or approved by the Department after March 1, 1993 will be considered in the documentation of background concentrations for the purpose of developing permit limitations.

Regulation 2

Reg. 2.509 Nutrients

All point source discharges into the watershed of waters officially listed on Arkansas' impaired waterbody list (303d) with phosphorus as the major cause shall have monthly average discharge permit limits no greater than those listed below. Additionally, waters in nutrient surplus watersheds as determined by Act 1061 of 2003 Regular Session of the Arkansas 84th General Assembly and subsequently designated nutrient surplus watersheds may be included under this Reg. if point source discharges are shown to provide a significant phosphorus contribution to waters within the listed nutrient surplus watersheds.

Facility Design Flow – mgd	Total Phosphorus discharge limit – mg/L
= or > 15	Case by case
3 to <15	1.0
1 to <3	2.0
0.5 to <1.0	5.0
<0.5	Case by Case

For discharges from point sources which are greater than 15 mgd, reduction of phosphorus below 1 mg/L may be required based on the magnitude of the phosphorus load (mass) and the type of downstream waterbodies (e.g., reservoirs, Extraordinary Resource Waters). Additionally, any discharge limits listed above may be further reduced if it is determined that these values are causing impairments to special waters such as domestic water supplies, lakes or reservoirs or Extraordinary Resource Waters.

Regulation 2

Reg. 2.510 Oil and Grease

Oil and grease shall be an average of no more than 10 mg/L or a maximum of no more than 15 mg/L. No mixing zones are allowed for discharges of oil and grease.

Regulation 2

Reg. 2.511 Minerals

- Based on 7Q10 background critical flows and ecoregion standards (ER)
  - If there is reasonable potential exists to exceed ER, limits will be developed.
  - Permit issued without limits if below ER and discharge to watershed <10mi^2
- Not to exceed 250/250/500 or remove DWS

Regulation 2

Reg. 2.511 Minerals

For discharges into streams with watersheds >10mi^2, one of the following will apply:

a) **IF** IWC at 7Q10 is ≤ 100/100/500 permit is issued w/o limits

b) **IF** IWC at 7Q10 is > 100/100/500, but <230/250/500 issue permit with calculated limits

c) IF IWC at 7Q10 exceeds 230/250/500 actions must be taken to remove DWS, plus WET testing requirements added.

Regulation 2

Reg. 2.512 Ammonia

(A) Acute Criteria Table

(B) Chronic Criteria Table

(C) The highest four-day average within a 30-day period should not exceed 2.5 times the chronic values shown above.

Regulation 2

Reg. 2.512 Ammonia

(D) For permitted discharges, the daily maximum of seven-day average permit limit shall be calculated using the four-day average value described above as an instream value, after mixing and based on a season when fish early life stages are present and a season when fish early life stages are absent. Temperature values used will be 14C when fish early life stages are absent and the ecoregion temperature standard for the season when fish early life stages are present. The pH will be the ecoregion mean value from least-disturbed stream data.

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ARKANSAS

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