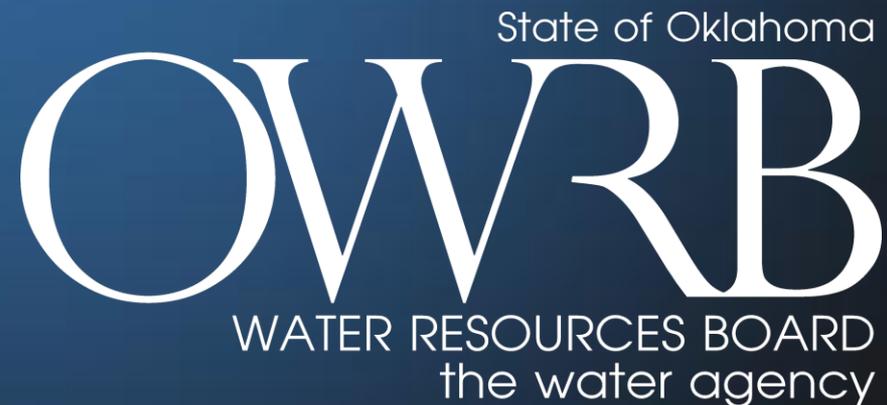


Proposed Revisions to Oklahoma Water Quality Standards

2012-2013 Triennial Revision



Overview of Water Quality Standards

Statutes and Administrative Rules Affecting Water Quality Standards

- Federal Law
 - Clean Water Act (CWA) 303(a)
- Federal Regulation
 - CFR Title 40 Part 131
- State Law
 - Title 82
 - Title 27 (A)
- State Regulation
 - OAC 785:45
 - OAC 785:46

Clean Water Act

- 33 U.S.C. 1251 et seq. (1972)
 - The Clean Water Act (CWA) establishes the basic structure for regulating discharges of pollutants into the waters of the United States and regulating quality standards for surface waters. The basis of the CWA was enacted in 1948 and was called the Federal Water Pollution Control Act, but the Act was significantly reorganized and expanded in 1972. "Clean Water Act" became the Act's common name with amendments in 1977.
 - Navigable waters
 - And 'significant nexus'

What are Water Quality Standards?

- WQS are a set of rules (or laws) adopted by states in accordance with the Clean Water Act and other federal regulations
- 303(a) of the CWA grants states (or federally recognized tribes) the authority to set water quality standards for contaminants in surface waters

How do WQS work?

- WQS have three basic components:
 - Beneficial uses
 - Criteria to protect beneficial uses
 - Anti-degradation policies
- And Implementation

Water Quality Standards (WQS) Triennial Review

- Under the Federal Clean Water Act, 303(c)(1), all States and Tribes are required to periodically conduct a comprehensive review of their surface water quality standards and modify, if appropriate.
 - known as “Triennial Review” because States must conduct a review at least once every three years

Beneficial Uses

Beneficial uses

- Beneficial uses are the kinds of activities a stream or lake can be used for
- Streams and lakes can have many assigned beneficial uses

Types of Beneficial Uses

- Fish and Wildlife Propagation
 - Warm Water Aquatic Community*
 - Cool Water Aquatic Community
 - Habitat Limited Aquatic Community
 - Trout Fishery
- Recreation
 - Primary Body Contact Recreation*
 - Secondary Body Contact Recreation

Types of Beneficial Uses

- Agriculture *
- Aesthetics *
- Public and Private Water Supply *
- Navigation
- Emergency Water Supply

Beneficial Use Assignments

- Appendix A of Chapter 45 of the Oklahoma WQS (OAC 785:45) has a list of waterbodies in Oklahoma and their beneficial use assignments
- If a lake, stream or wetland is not listed in Appendix A, it has default beneficial uses assigned

Use-Attainability Analysis (UAA)

- To “downgrade” a Beneficial Use
 - A use attainability analysis must be conducted for any waterbody with designated uses that do not include the "fishable/swimmable" goal uses identified in the section 101(a)(2) of the Act. Such waterbodies must be reexamined every three years to determine if new information has become available that would warrant a revision of the standard. If new information indicates that "fishable/swimmable" uses can be attained, such uses must be designated.

Use-Attainability Analysis (UAA)

- The factors to be considered in the analysis:
 - Physical
 - Chemical
 - Biological
 - Economics

Use-Attainability Analysis (UAA)

- Six reasons a use can be removed
 - Naturally occurring pollutant
 - Natural, ephemeral, intermittent or low flow conditions
 - Human caused conditions which would cause more environmental damage to correct than to leave in place
 - Dams, diversions or other types of hydrologic modifications
 - Physical conditions related to the natural features of the waterbody, such as the lack of proper substrate, cover, flow, depth, pools, riffles, etc.
 - More stringent controls would result in substantial and widespread economic and social impact.

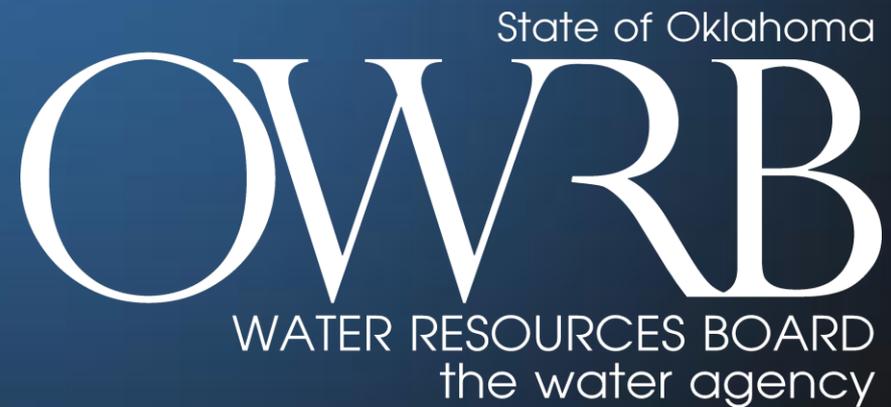
Criteria

To protect the Beneficial Uses

Criteria

- Limit on a particular pollutant or on the condition of a waterbody
- Intended to protect and support a beneficial use
- Numeric Criteria: Specify a precise measurable level of some parameter-two types:
 - Criteria to protect aquatic life; and
 - Criteria to protect human health
- Narrative Criteria: Provide a qualitative benchmark to assess water quality

Human Health Criteria Updates



National Human Health Criteria

- **40 CFR 131.11 Criteria**

(b)(1) “In establishing criteria, States should establish numerical values based on” EPA's 1980 National CWA 304(a) criteria recommendations.

- **CWA 304(a) Criteria Recommendations** – States must establish numerical values based on the following to derive criteria:

(i) 304(a) Guidance; adopt all numerical criteria as developed by EPA; or

(ii) 304(a) Guidance modified to reflect site-specific conditions; adopt only those pollutants whose presence or discharge of which can reasonably be expected to interfere with designated beneficial uses; or

(iii) Use other scientifically defensible methods;

(iv) Develop a narrative criteria where numeric criteria cannot be determined.

➤ **OWRB has chosen to use a combination of these options which allows Oklahoma flexibility to modify criteria and pollutants to meet our specific needs.**

National Human Health Criteria (continued)

- **CWA, under 304(a), requires EPA to develop, publish & from time to time, revise criteria for WQ, accurately reflecting the latest scientific knowledge**
 - criteria based solely on data and scientific judgment, &
 - the relationship between pollutant concentrations and human health
- **EPA's latest revisions use "2000 Human Health Methodology" for deriving HHC both to develop new AWQC for additional pollutants and to periodically revise existing criteria**
- **Provides guidance to the State/Tribes in adopting WQS that provide a basis for controlling discharges or releases of pollutants**

Human Health Criteria Milestones

- 1980 Human Health Methodology
- 1986 Gold Book
- 1991 OWRB HHC Development for Water & Fish Consumption for Inclusion in the 1991OWQS (D. Smithee)
- 1992 National Toxics Rule
- 1994 OWRB WQS Revision-Modification of Numerical Criteria Rationale. Reevaluation and development of additional numerical criteria
- 2000 Human Health Methodology*
- 2002 Human Health Criteria Calculation Matrix
- 2002 Human Health Criteria Recommendations
- 2003 Human Health Criteria Recommendations
- 2009 Human Health Criteria Recommendations for Acrolein & Phenol
- 2010-2011 OWRB WQS Revision - Justification for Creating A Human Health Criteria for Acrolein & Phenol
- Current Nat. CWA 304(a) Criteria Recommendations Table

Website last updated on January 20, 2012

Why Update HHC NOW?

- In 2010, the OWRB updated the HHC for phenol and added acrolein as part of the WQS revision using the updated criteria based on EPA's 2000 Methodology for Deriving Ambient Water Quality Criteria for the Protection of Human Health
- In EPA's June 11, 2010 letter, after their review of the 2010 WQS revisions, OWRB again received recommendations for the WQS section to continue updating additional human health water chemicals using EPA's 2000 Human Health Methodology and the new toxicological information.
- Based on EPA's request and the availability of staff to update the States' HHC, the OWRB reviewed 21 pollutants already listed in Appendix G, Table 2 of the OWQS, and 4 new pollutants, then performed recalculations for these priority pollutants for the 2012 Triennial Revision, as part of the Federal Clean Water Act requirement

OWQS Human Health Criteria

- ▶ Applicable to: Public & Private Water Supply Lakes & Rivers

785:45 Subchapter 5. Surface Water Quality Standards

Part 3. Beneficial Uses And Criteria to Protect Uses

785:45-5-10. Public and Private Water Supplies

(6) Water column criteria to protect for the consumption of fish flesh and water.

(A) Surface waters of the State with the designated beneficial use of Public and Private Water Supply shall be protected to allow for the consumption of fish, shellfish and water.

(B) The water column numerical criteria to protect human health for the consumption of fish flesh and water for the substances identified in Table 2 of Appendix G of this Chapter shall be as prescribed under the “Fish Consumption and Water” column in Table 2 of Appendix G in all surface waters designated with the beneficial use of Public and Private Water Supply. ...

- Not applicable to “finished” or end-of-pipe water criteria, (DEQ’s responsibility)
 - though calculated nearly the same

Human Health Ambient Water Quality Criteria (AWQC)

- Ambient refers to open waters such as rivers, lakes & streams, as opposed to closed water supply systems that distribute treated water or wastewater
- AWQC ~ The highest concentration of a pollutant in water that *is not* expected to pose a significant risk to human health
- EPA publishes two types of human health criteria:
 - Protection from ingesting **water and aquatic organisms (fish & shell fish)**
 - Protection from ingesting **aquatic organisms only**

Data Needs for the AWQC Equations

- AWQC criteria are derived through using risk based assessment formulas:

Toxicity X Exposure

- **Toxicity** -Type of Health Effect: Cancer & Noncancer effects

Noncarcinogens

- Reference dose (RfD) for noncarcinogens
 - An estimate (with uncertainty spanning perhaps an order of magnitude) of a **daily oral exposure** to humans (including sensitive subgroups) that is likely to be without an appreciable risk of adverse effects during a lifetime
- Bioaccumulation factor (BAF), when available, or Bioconcentration factor (BCF)

Carcinogens

- Cancer slope factor (q1*)
- Risk level for carcinogens (**10⁻⁵**) for Oklahoma
 - **This risk level of 1 in 100,000 was a policy decision adopted by the Ok Health Dept. in 1988**
- Risk-specific doses (RSD) for linear carcinogens
- Bioaccumulation factor (BAF), when available, or Bioconcentration factor (BCF)

USEPA Exposure Recommendations

(Default Values)

- **Exposure**

- Relative source contribution factor (RSC); accounts for non-water sources
- **BW = Human Body Weight (kg) 70 kg**
Average adult body weight
(150 pounds)
- **DI = Drinking Water (L/day) 2 liters per day**
90th percentile of the US adult population;
about 8 glasses; 1 liter = about 64 ounces
- **FI = Fish Intake (kg/day) 17.5 grams per day**
90th percentile of US adult population
(consumers & nonconsumers)
4 ounces per week, fresh water & estuarine fish

- There is conservatism built into the criteria, due to uncertainty factors applied to the reference dose calculations, thus criteria are highly protective even at upper percentiles

NonCarcinogen Equation

$$AWQC = RfD \bullet RSC \bullet \frac{(BW)}{[DI + (FCR \bullet BAF)]}$$

where:

AWQC	=	Ambient Water Quality Criterion (milligrams per liter)
RfD	=	Reference dose for noncancer effects (milligrams per kilogram per day)
RSC	=	Relative source contribution factor to account for non-water sources of exposure (unitless)
BW	=	Human body weight (kilograms)
DI	=	Drinking water intake (liters per day)
FCR	=	Fish Consumption Rate (kilograms per day)
BAF	=	Bioaccumulation factor (liters per kilogram)

Noncarcinogenic Human Health Criteria Derivation

$$AWQC = RfD \cdot RSC \cdot \left[\frac{BW}{DI + \sum_{i=2}^4 (FI_i \cdot BAF_i)} \right]$$

Toluene

RfD (mg/kg/day)	RSC	BW (kg)	DW INTAKE (L)	FISH INTAKE (kg/day)	BAF (mg/kg)
0.2	0.2	70	2	0.0175	10.7

CRITERION	CRITERION
Water + Organisms (µ/L)	Organisms Only (µ/L)
1300	15000

Carcinogen Equation

$$AWQC = \frac{(\text{Risk Level} \bullet \text{BW})}{[\text{CSF} \bullet (\text{DI} + (\text{FCR} \bullet \text{BAF}))]}$$

where:

AWQC	=	Ambient Water Quality Criterion (milligrams per liter)
Risk Level	=	Risk level (unitless)
CSF	=	Cancer slope factor (milligrams per kilogram per day)
BW	=	Human body weight (kilograms)
DI	=	Drinking water intake (liters per day)
FCF	=	Fish Consumption Rate (kilograms per day)
BAF	=	Bioaccumulation factor (liters per kilogram)

Updates from 2000 Human Health Methodology

- ▶ FI = Fish Intake 17.5 g/day; (updated from 6.5 g/day used in the 1980 Methodology)
- ▶ Bioaccumulation factor (BAF) replaces the bioconcentration factor (BCF), if available, to reflect uptake of a contaminants from all sources of media exposure (water, food, sediment) by fish, rather than just water column
- ▶ OWRB used toxicity data from EPA's national recommendations from the 2000, 2002 & 2003 to develop draft proposed criteria;
 - EPA Integrated Risk Information System (IRIS)
(<http://www.epa.gov/IRIS>)

Proposed Updates to HHC OWQS ~ Appendix G, Table 2

Priority

Pollutants (25)

Carcinogens (16)

- Acrylonitrile
- Aldrin
- Benzene
- Bis(2-ethylhexyl) Phthalate*
- Carbon Tetrachloride
- Chlordane
- 4,4'-DDD*
- 4,4'-DDT

- Dichlorobromo-methane
- Dieldrin
- Dioxin (TCDD)
- Heptachlor
- Hexachlorobenzene
- PCB (Polychlorinated biphenyls)
- PCE (Tetrachloro-ethylene)
- Pentachlorophenol

Noncarcinogens (9)

- Butylbenzyl Phthalate
- Diethyl Phthalate*
- Dimethyl Phthalate*
- Di-n-butyl Phthalate*
- Endrin
- Ethylbenzene
- gamma BHC (Lindane)
- Thallium
- Toluene

*NEW

Requested Additions to HHC

- Additions*:
 - Bis(2-ethylhexyl) Phthalate &
 - 4,4'-DDD
- Phthalate Esters Category;
subdivided into separate chemicals
 - Bis(2-ethylhexyl) Phthalate
 - Diethyl Phthalate
 - Dimethyl Phthalate
 - Di-n-butyl Phthalate
 - Butylbenzyl Phthalate

*The OK Dept. of Environmental Quality (ODEQ) requested new criteria for these two pollutants as they are being seen in effluent discharged monitoring data by permittees

APPENDIX G. NUMERICAL CRITERIA TO PROTECT BENEFICIAL USES

(a) Introduction. This Appendix prescribes numerical limits for certain criteria which are necessary to protect beneficial uses as and wherever designated. Table 1 is a chart that states the numerical limits to protect the beneficial use and subcategories of Fish and Wildlife Propagation for the single parameter of dissolved oxygen as set forth in OAC 785:45-5-12(f)(1). The latter limits vary depending upon several factors including the pertinent subcategory or fishery class, the time of the year, and the seasonal temperature. Table 2 prescribes the numerical limits ~~that cannot be exceeded~~ for certain substances or parameters in order to protect beneficial uses and subcategories as set forth in OAC 785:45-5-10(1), 785:45-5-10(6), 785:45-5-12(f)(6), and 785:45-5-20. The numerical limits may vary from one beneficial use or subcategory to another according to how the criteria are required by OAC 785:45 or OAC 785:46 to be implemented. Table 3 is a chart that sets forth conversion factors that can be used to determine criteria for dissolved metals in order to protect the beneficial use of Fish and Wildlife Propagation and all its subcategories as set forth in OAC 785:45-5-12(f)(6)(H)

PARAMETER	CAS #	Fish & Wildlife Propagation		Public & Private Water Supply (Raw Water)	Fish Consumption (+ Other Organisms) and Water	Fish Consumption (+ Other Organisms)
		ACUTE	CHRONIC			
		µg/L	µg/L	mg/L(X1000)	µg/L	µg/L
INORGANICS				µg/L		
Arsenic	7440382	360.0	190	40		205.0
Barium	7440393			1000		
Cadmium	7440439	e(1.128[ln(hardness)]-1.6774)	e(0.7852[ln(hardness)]-3.490)	20	14.49	84.13
Cadmium for trout streams		e(1.128[ln(hardness)]-3.828)	e(0.7852[ln(hardness)]-3.490)	20	14.49	84.13
Chromium (total)			50	50	166.3	3365.0
Copper	7440508	e(0.9422[ln(hardness)]-1.3844)	e(0.8545[ln(hardness)]-1.386)	1000		
Cyanide	57125	45.93	10.72	200		
Flouride @ 90° F				4000		
Lead	7439921	e(1.273[ln(hardness)]-1.460)	e(1.273[ln(hardness)]-4.705)	100	5.0	25.0
Mercury	7439976	2.4	1.302	2	0.050	0.051
Nickel	7440020	e(0.8460[ln(hardness)]+3.3612)	e(0.846[ln(hardness)]+1.1645)		607.2	4583.0
Nitrates (as N)	14797558			10,000		
Selenium	7782492	20.0	5	10		
Silver	7440224	e(1.72[ln(hardness)]-6.52)		50	104.8	4620.0
Thallium	7440280	1400.0			1.7	0.24
Zinc	7440666	e(0.8473[ln(hardness)]+0.8604)	e(0.8473[ln(hardness)]+0.7614)	5000		
ORGANICS						
1-1-1 TCE	71556				3094.0	173100.0
2-4-5-TP Silvex	93721		10.0	10		
2-4-6-TNT		450.0				
2-4-D	94757			100		

PARAMETER	CAS #	Fish & Wildlife Propagation		Public & Private Water Supply (Raw Water)	Fish Consumption (+ Other Organisms) and Water	Fish Consumption (+ Other Organisms)
		ACUTE	CHRONIC			
		µg/L	µg/L	mg/L (X1000) µg/L	µg/L	µg/L
Acrolein	107028				6.0	9.0
Acrylonitrile	107131	7550.0			0.59	6.7
Aldrin	309002	3.0			0.001273	0.00049
Benzene	71432		2200.0		11.87	22
Benzidine	92875			1		
Butylbenzyl Phthalate	85687			150		
Carbon Tetrachloride	56235				2.538	2.3
Chlordane	57749	2.4	0.17		0.00575	0.0080
Chloroform	67663				56.69	4708.0
Chlorpyrifos (Dursban)	2921882	0.083	0.041			
4,4'-DDD	72548				0.0031	0.0031
4,4'-DDT	50293	1.1	0.001		0.005876	0.0022
Demeton	8065483		0.1			
Detergents (total)				200		
Diazinon	333415	0.17				
Dichlorobromomethane	75274				1.9	5.5
Dieldrin	60571	2.5	0.0019		0.001352	0.00052
Dioxin (TCDD)	1746016				0.00000013	5.0E-08
Endosulfan		0.22	0.056			
Endrin	72208	0.18	0.0023	0.2	0.7553	0.059
Ethylbenzene	100414				3120.0	530
Guthion	86500		0.01			
gamma BHC (Lindane)	58899	2.0	0.08	4	0.1458	0.98
Heptachlor	76448	0.52	0.0038		0.00208	0.00079
Hexachlorobenzene	118741				0.009026	0.0028
Malathion	121755		0.10			

PARAMETER	CAS #	Fish & Wildlife Propagation		Public & Private Water Supply (Raw Water)	Fish Consumption (+ Other Organisms) and Water	Fish Consumption (+ Other Organisms)
		ACUTE	CHRONIC			
		µg/L	µg/L	mg/L (X1000)	µg/L	µg/L
				µg/L		
Methoxychlor	72435		0.03	100		
Methylene blue active substances			0.001	500		
Mirex	2385855		0.001			
Nonylphenol	25154523	28	6.6			
Parathion	56382	0.065	0.013			
PCB			0.044		0.00079 0.00064	0.00079 0.00064
PCE (Tetrachloroethylene)	127184	5280.0			8.0 6.9	88.5 33
Pentachlorophenol	87865	e[1.005(pH)-4.830]	e[1.005(pH)-5.290]		1014.0 2.7	29370.0 30
Perchlorate	7601-90-3	6600	1800		9	
Phenol	108952				10,000.0	860,000.0
Phthalate esters				3		
Phthalate esters (Bis(2-Ethylhexyl) Phthalate) BEHP	117817				12	22
Butylbenzyl Phthalate	85687			150	1500	1900
Phthalate esters (Diethyl Phthalate)	84662				17000	44000
Phthalate esters (Dimethyl Phthalate)	131113				2.7E+05	1.1E+06
Phthalate esters (Di-n-Butyl Phthalate)	84742				2000	4500
RDX	121824	2591.5				
Toluene	108883		875.0		10150.0 1300	301900.0 15000
Toxaphene	8001352	0.78	0.0002	5		

Summary of HHC Updates

- OWRB is proposing to revise &/or add criteria for 25 pollutants to protect human health
 - All are currently listed by EPA as priority pollutants; 20 are listed on Table 2, Appendix G of the OWQS
 - OWRB is proposing the addition of two pollutants; based on the request of the ODEQ to aid in setting discharge limits in their National Pollutant Discharge Elimination System (NPDES) permits
 - Make a Phthalate Esters Category and subdivide into separate chemicals and move Butylbenzyl Phthalate to this section in Table 2
- New information on exposure necessitates revisions
 - Oklahoma's criteria are based on the old fish consumption rate (6.5 g/day), which is below EPA's national recommendation of 17.5 g/day

Editorial Changes

- Introduction language in the description for Table 2, Appendix G is proposed to be modified to strike the words “that cannot be exceeded”
 - This phrase is erroneous to text in the body of the OWQS and is incorrect for human health parameters that are implemented as averages
- Table 2, “Numerical Criteria to Protect Beneficial Uses and All Subcategories Thereof”, is proposed to be modified to delete mg/L units in the PPWS (Raw Water) column and replace with $\mu\text{g/L}$ for consistency and uniformity with existing units used throughout Table 2
- Updated calculations have been rounded to “two significant figures” (using 5 places as a cutoff point) for consistency with EPA’s 304(a) HH criteria

Editorial Changes (continued)

- Table 2, “Numerical Criteria to Protect Beneficial Uses and All Subcategories Thereof”, is proposed to be modified to add (+ Other Organisms) to both “Fish Consumption and Water” and “Fish Consumption” column headings, for clarity and consistency with the National CWA 304(a) Recommended Water Quality Human Health Criteria Table.
 - The 2000 HH methodology characterizes "organisms" as aquatic organisms that are commonly consumed in the United States including finfish and shellfish. EPA uses the term "organisms" because it is a broader term that includes "shellfish," consistent with CWA 101(a)(2) which includes "fish, shellfish, and wildlife."

Implementation of HH Criteria

785:46-7-1, 2, 3

- HH criteria are based upon long term exposure
- Dilution calculated with average flow
- Effluent concentrations are averaged for permitting
- Assessed using long term averages of ambient data (5 years for streams, 10 years for lakes)

Oklahoma Water Quality Standards online:

www.owrb.ok.gov/standards

