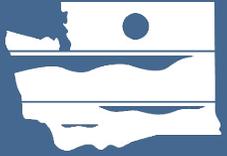




Aquatic Life Toxics Rulemaking

Water Quality Program

November 30, 2023



Overview of Strategy

Deriving Aquatic Life Toxics Criteria

- Methods developed by EPA in 1985
 - Some current EPA recommendations are based on pre-1985 methods
- Toxicity data for a minimum of 8 taxonomic families
 - When 8 family requirement cannot be met then apply acute to chronic ratio that extrapolates chronic criteria from acute criteria
 - Acute toxicity value: median lethal concentration (LC50)
 - Chronic toxicity value: maximum acceptable toxicant concentration (MATC)
- Criteria must be based on high quality studies

MINIMUM DATA REQUIREMENTS (MDRS) FRESHWATER

freshwater

SALMONID



SECOND
FISH
FAMILY



CHORDATA



PLANKTONIC
CRUSTACEAN



BENTHIC
CRUSTACEAN



INSECT



ROTIFERA,
ANNELIDA,
MOLLUSCA



OTHER
INSECT OR
MOLLUSC

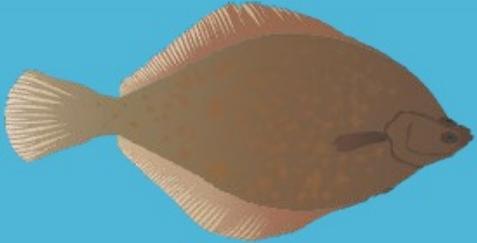


Toxicity values
from 8 different
families

MINIMUM DATA REQUIREMENTS (MDRS) SALTWATER

twater

Family in
Chordata



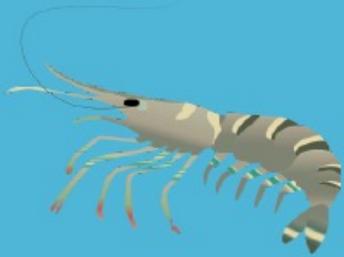
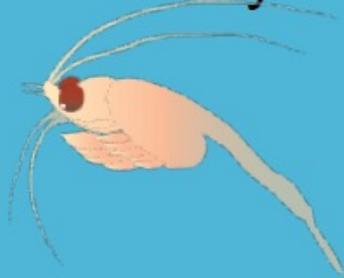
Family in
Chordata



Family other
than Arthropoda
or Chordata



Either Mysidae or Penaeidae



Toxicity values
from 8 different
families

3 other families not in the phylum Chordata

Any other SW family

Bivalves



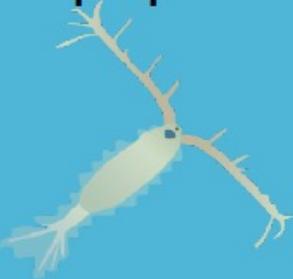
Barnacles



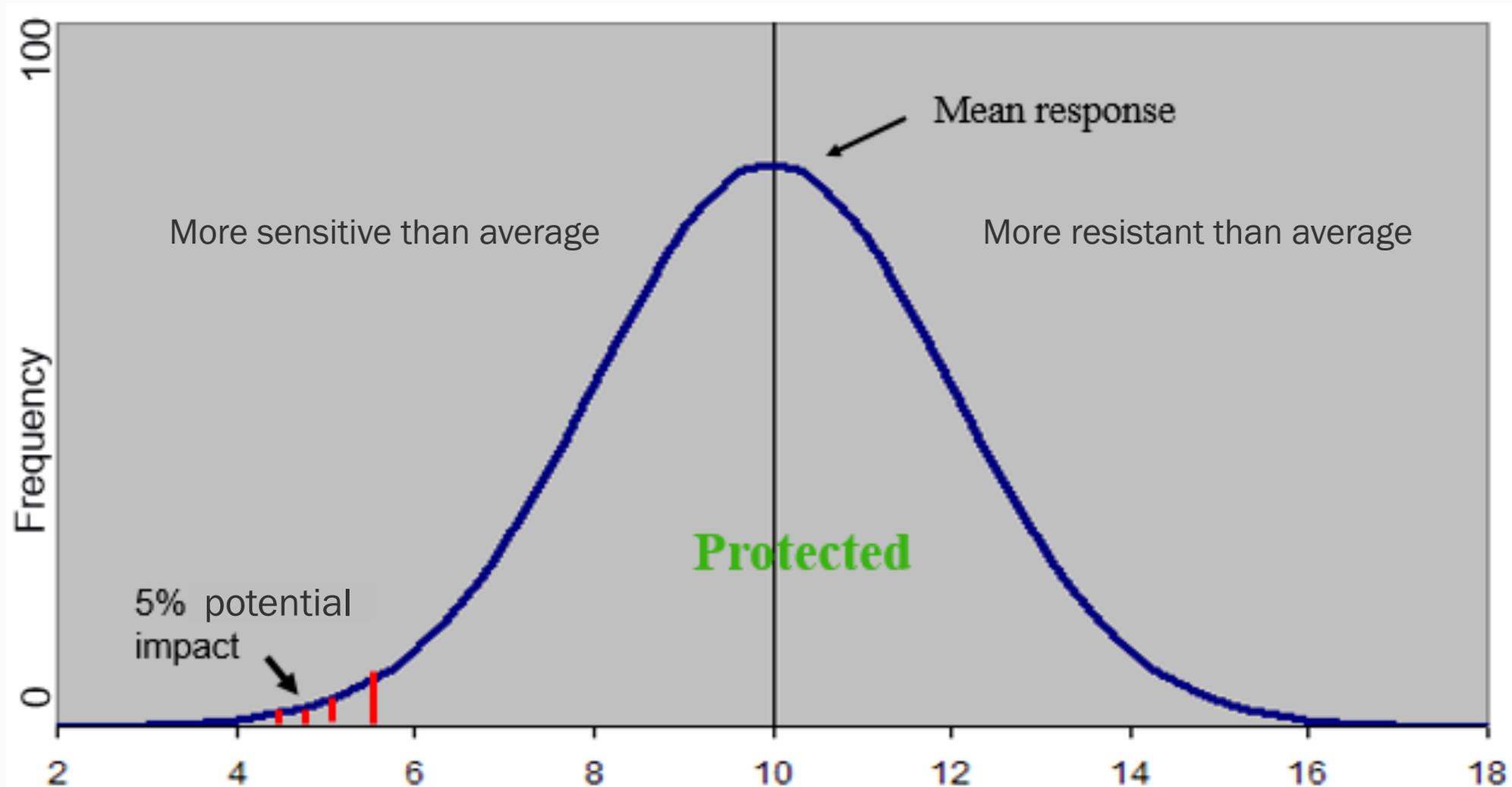
Polychaetes



Copepods



EPA Criteria Target: Protect 95% of species 99% of the time



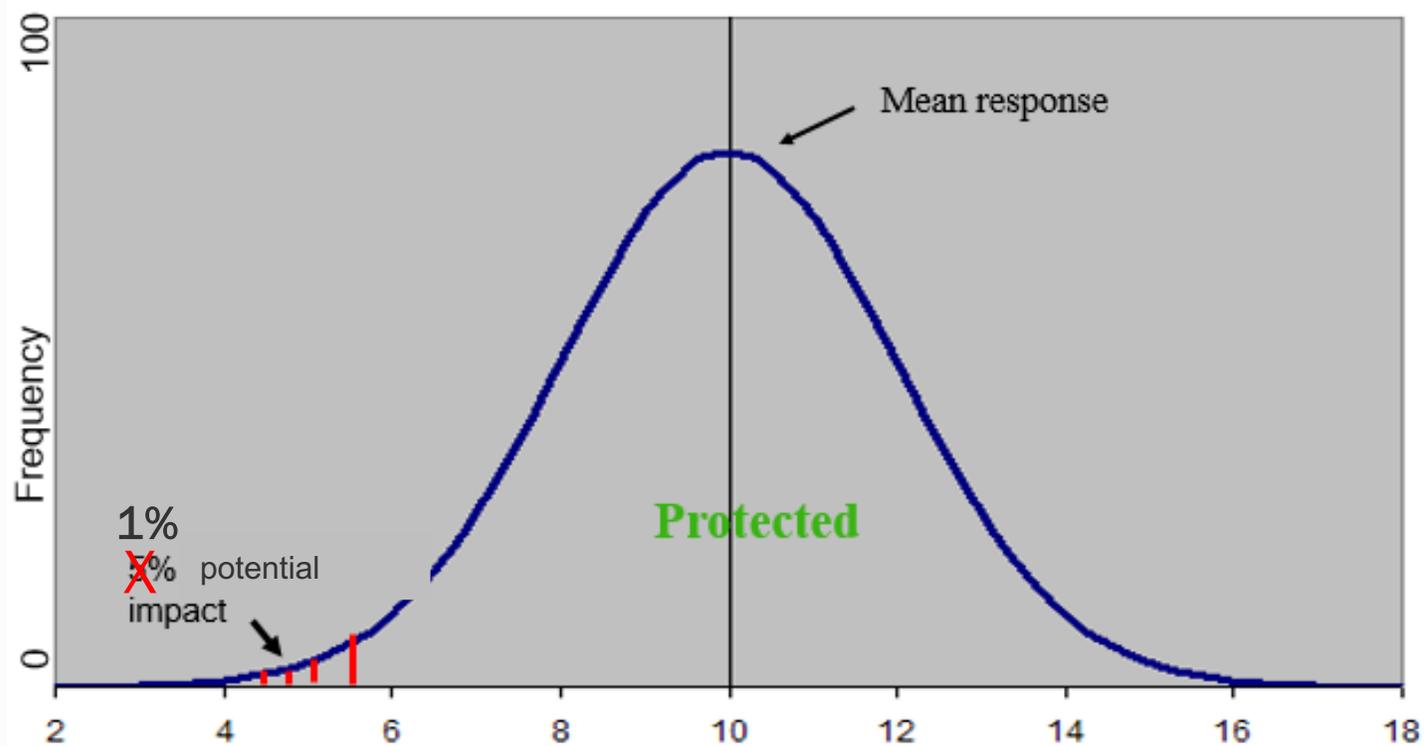
Endangered Species Act Consultation

- EPA approves water quality standards for CWA
 - EPA sends state rules to sister agencies (NOAA/USFWS) for Endangered Species Act (ESA) consultation
 - NOAA/USFWS evaluate if rule will adversely affect endangered species
 - Can result in acceptance, conditional acceptance, or jeopardy
- Clean Water Act vs. Endangered Species Act
 - Some of EPA's CWA recommendations are not protective of WA endangered species populations
 - Ecology may need to develop state-specific criteria that better align with endangered species protection



Strategy for ESA issues

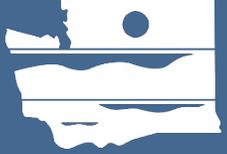
- Review new science and/or derive criteria from 1st percentile of the genus toxicity data distribution for toxics not meeting ESA requirements and adopt EPA recommendations for all other toxics
- Protect 99% of species 99% of the time



Overview of Models to Develop Criteria

- Basis:
 - Toxicity of some chemicals are dependent on water quality conditions
 - Site-specific water quality information used in models to predict toxicity
 - BLM/MLR models evaluate the bioavailability of metals in aquatic environment to bind to aquatic life based on water quality
- BLM (biotic ligand model)
 - Based on 12 parameters: pH, dissolved organic carbon (DOC), calcium, magnesium, sodium, potassium, sulfate, chloride, alkalinity, temperature, humic acid (not required), and sulfide (not required)
- MLR (multiple linear regression) model
 - Based on 3 parameters: hardness (Ca + Mg), pH, and DOC

Example: Chronic criteria = $e^{(0.855 \cdot \ln(\text{DOC}) + 0.221 \cdot \ln(\text{hardness}) + 0.216 \cdot \text{pH} - 1.402)}$



Aquatic Life Toxics Criteria

Overview

Preliminary: Toxics Not Changed

- 4,4'-DDT (and metabolites)
- Chlordane
- Chloride
- Chlorine
- Chlorpyrifos
- Endosulfan (alpha & beta)
- Heptachlor
- Lead
- Parathion
- Polychlorinated biphenyls (PCBs)
- Toxaphene

Meets EPA
recommendation
s and no ESA
jeopardy calls

Preliminary: New Toxics

- **6PPD-quinone** (state-specific)
- Aluminum (MLR model)
- Acrolein
- Carbaryl
- Demeton
- Diazinon
- Guthion
- Malathion
- Methoxychlor
- Mirex
- **Nonylphenol** (state-specific)
- PFOS (draft; water/tissue based)
- PFOA (draft; water/tissue based)
- Silver FW and SW chronic
- Tributyltin

Adopt EPA recommendations for new toxics to Washington (except for 6PPD-q and nonylphenol)

Preliminary: Toxics Not Adopted

- Iron
- Heptachlor epoxide
- Hydrogen sulfide



Do not plan to
adopt EPA
recommendation
s

Preliminary: Toxics Changing

Metals

- Arsenic
- Cadmium
- Chromium III
- Chromium VI
- Copper (MLR model)
- Mercury
- Nickel
- Silver
- Zinc

Organics

- Aldrin
- Cyanide
- Dieldrin
- Endrin
- Lindane
- Nonylphenol
- Pentachlorophenol

Criteria changing to match EPA recommendations, address ESA concerns, or updated derivation methods were applied

Acrolein

	FW Acute (ug/L)	FW Chronic (ug/L)	SW Acute (ug/L)	SW Chronic (ug/L)
Washington	-	-	-	-
EPA	3 (1-hour)	3 (4-day)	-	-
Draft Proposal	3 (1-hour)	3 (4-day)	-	-

- New toxic to WA water quality standards
- Plan to adopt EPA recommendations
- Regulated in the irrigation permit

Aluminum

	FW Acute (ug/L)	FW Chronic (ug/L)	SW Acute (ug/L)	SW Chronic (ug/L)
Washington	-	-	-	-
EPA	Multiple Linear Regression Model (1-hour)	Multiple Linear Regression Model (4-day)	-	-
Draft Proposal	780 (default) Multiple Linear Regression Model (1-hour)	390 (default) Multiple Linear Regression Model (4-day)	-	-

- EPA provides an excel based criteria calculator
- Default MLR-based criteria provided using statewide data
 - Model based on pH, hardness, and dissolved organic carbon
- Regulated in Aquatic Pesticide and Algae Management permit

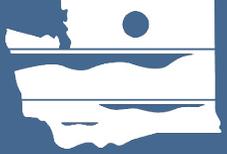
Copper

	FW Acute (ug/L)	FW Chronic (ug/L)	SW Acute (ug/L)	SW Chronic (ug/L)
Washington	Hardness based (1-hour)	Hardness based (4-day)	4.8 (1-hour)	3.1 (4-day)
EPA	Biotic Ligand Model (1-hour)	Biotic Ligand Model (4-day)	4.8	3.1
Draft Proposal	Multiple Linear Regression Model (1-hour)	Multiple Linear Regression Model (4-day)	No change	No change

- MLR model is the future direction of metal-based models
- Default MLR-based criteria provided using statewide data
 - pH, hardness, and dissolved organic carbon
- Regulated in the irrigation and aquatic invasive species permits

Aluminum and Copper MLR Model

- We are developing statewide default criteria values
 - Based on concurrently sampled pH, hardness, and dissolved organic carbon throughout the state
 - Converted conductivity data to hardness to increase sample size
 - Converted total organic carbon to dissolved organic carbon
- Results
 - 3,337 sampling events across 646 unique locations
 - Intend to apply 10th percentile of statewide criteria outputs from state data as the default criteria
 - Site-specific data will supersede the default criteria



Implementation Considerations

Implementation

- Permits
 - PARIS Query
 - Aimed at reviewing effluent limits and priority pollutant scans for all permits to determine the impact of this rulemaking
 - Updated during 5-year renewal with new limits (after rule is approved)
 - Possible new monitoring if reasonable potential is determined
 - MLR model for aluminum and copper could result in lower or higher effluent limits depending on site-specific water quality



Implementation

- Irrigation Permits
 - Will need to use statewide default criteria for copper or collect site-specific data for pH, hardness, and DOC from receiving water body
 - New acrolein criteria will need to be integrated into permit
- Aquatic Plant and Algae Management Permit
 - Continued use of the short-term modification for ALUM treatment
 - Aluminum criteria will need integrated into permit
 - Possibly additional monitoring of water quality
- Aquatic Invasive Species Management Permit
 - Continued use of the short-term modification for chelated copper treatment
 - Copper criteria will need to be integrated into permit
 - Possibly additional monitoring of water quality

Implementation

- TMDLs
 - TMDLs in progress should evaluate updated criteria (once rule is approved)
 - No changes to currently approved TMDLs
 - TMDLs may need amended if new criteria is not met during effectiveness monitoring
- 303(d) Listing Methodology
 - Will need updated to accommodate tissue elements of selenium & PFOA/PFOS and the MLR model for aluminum and copper

Timeline

June 2022

Announced rulemaking:
Begin outreach and develop criteria

Oct 2022

Introductory webinar:
Provide overview of the rule and gauge interest and concerns

April 2023

Status update webinar: Discuss derivation process and the direction of the rule

Fall 2023

Preliminary decisions webinar:
Provide preliminary proposal and receive feedback

Winter 2024

Rule proposal:
Announce draft rule, public comment period, and hearings

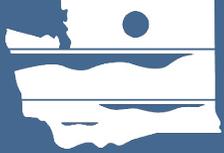
Spring 2024

Rule adoption:
Make decision on rule adoption

Questions?

Bryson.finch@ecy.wa.gov





Metals

Preliminary draft values

1 H																	2 He						
3 Li	4 Be	Metal										Metalloid		Nonmetal				5 B	6 C	7 N	8 O	9 F	10 Ne
11 Na	12 Mg																	13 Al	14 Si	15 P	16 S	17 Cl	18 Ar
19 K	20 Ca	21 Sc	22 Ti	23 V	24 Cr	25 Mn	26 Fe	27 Co	28 Ni	29 Cu	30 Zn	31 Ga	32 Ge	33 As	34 Se	35 Br	36 Kr						
37 Rb	38 Sr	39 Y	40 Zr	41 Nb	42 Mo	43 Tc	44 Ru	45 Rh	46 Pd	47 Ag	48 Cd	49 In	50 Sn	51 Sb	52 Te	53 I	54 Xe						
55 Cs	56 Ba	57-71	72 Hf	73 Ta	74 W	75 Re	76 Os	77 Ir	78 Pt	79 Au	80 Hg	81 Tl	82 Pb	83 Bi	84 Po	85 At	86 Rn						
87 Fr	88 Ra	89-103	104 Rf	105 Db	106 Sg	107 Bh	108 Hs	109 Mt	110 Ds	111 Rg	112 Cn	113 Uut	114 Fl	115 Uup	116 Lv	117 Uus	118 Uuo						
			57 La	58 Ce	59 Pr	60 Nd	61 Pm	62 Sm	63 Eu	64 Gd	65 Tb	66 Dy	67 Ho	68 Er	69 Tm	70 Yb	71 Lu						
			89 Ac	90 Th	91 Pa	92 U	93 Np	94 Pu	95 Am	96 Cm	97 Bk	98 Cf	99 Es	100 Fm	101 Md	102 No	103 Lr						

Aluminum

	FW Acute (ug/L)	FW Chronic (ug/L)	SW Acute (ug/L)	SW Chronic (ug/L)
Washington	-	-	-	-
EPA	Multiple Linear Regression Model (1-hour)	Multiple Linear Regression Model (4-day)	-	-
Draft Proposal	Multiple Linear Regression Model (1-hour)	Multiple Linear Regression Model (4-day)	-	-

- No known ESA concerns
- EPA provides an excel based criteria calculator
- Default MLR-based criteria provided using statewide data
 - Model based on pH, hardness, and dissolved organic carbon

Arsenic

	FW Acute (ug/L)	FW Chronic (ug/L)	SW Acute (ug/L)	SW Chronic (ug/L)
Washington	360 [^] (1-hour)	190 [^] (4-day)	69 [^] (1-hour)	36 [^] (4-day)
EPA	340 [^] (1-hour)	150 [^] (4-day)	69 [^] (1-hour)	36 [^] (4-day)
Draft Proposal	300 [^] (1-hour)	130 [^] (4-day)	27 [^] (1-hour)	12 [^] (4-day)

[^] Presented as the dissolved fraction

- ESA protection concerns for FW and SW chronic criteria
- Preliminary FW and SW criteria used new science and 1st percentile of toxicity data distribution

Cadmium

	FW Acute (ug/L)	FW Chronic (ug/L)	SW Acute (ug/L)	SW Chronic (ug/L)
Washington	3.7* [^] (1-hour)	1.0* [^] (4-day)	42 [^] (1-day)	9.3 [^] (4-day)
EPA	1.8* [^] (1-hour)	0.72* [^] (4-day)	33 [^] (1-hour)	7.9 [^] (4-day)
Draft Proposal	1.3* [^] (1-hour)	0.43* [^] (4-day)	33 [^] (1-day)	7.9 [^] (4-day)

* Hardness based criteria (numeric value shown based on 100 mg/L)

[^] Presented as the dissolved fraction

- ESA protection concerns for FW criteria
- FW acute criteria used single species method
- Updated hardness-based equations for FW

Chromium III

	FW Acute (ug/L)	FW Chronic (ug/L)	SW Acute (ug/L)	SW Chronic (ug/L)
Washington	550* [^] (1-hour)	180* [^] (4-day)	-	-
EPA	570* [^] (1-hour)	74* [^] (4-day)	-	-
Draft Proposal	570* [^] (1-hour)	74* [^] (4-day)	-	-

* Hardness based criteria (numeric value shown based on 100 mg/L)

[^] Presented as the dissolved fraction

- No known ESA concerns

Chromium VI

	FW Acute (ug/L)	FW Chronic (ug/L)	SW Acute (ug/L)	SW Chronic (ug/L)
Washington	15 [^] (1-hour)	19 [^] (4-day)	1100 [^] (1-hour)	50 [^] (4-day)
EPA	16 [^] (1-hour)	11 [^] (4-day)	1100 [^] (1-hour)	50 [^] (4-day)
Draft Proposal	8.2 [^] (1-hour)	2.1 [^] (4-day)	No change	No change

[^] Presented as the dissolved fraction

- ESA concerns for FW chronic criteria (no jeopardy but adverse effects reported)
- Preliminary FW criteria used new science

Copper

	FW Acute (ug/L)	FW Chronic (ug/L)	SW Acute (ug/L)	SW Chronic (ug/L)
Washington	Hardness based (1-hour)	Hardness based (4-day)	4.8 (1-hour)	3.1 (4-day)
EPA	Biotic Ligand Model (1-hour)	Biotic Ligand Model (4-day)	4.8	3.1
Draft Proposal	Multiple Linear Regression Model (1-hour)	Multiple Linear Regression Model (4-day)	No change	No change

- MLR model is the future direction of metal-based models
- Default MLR-based criteria provided using statewide data
 - pH, hardness, and dissolved organic carbon

Lead

	FW Acute (ug/L)	FW Chronic (ug/L)	SW Acute (ug/L)	SW Chronic (ug/L)
Washington	65* [^] (1-hour)	2.5* [^] (4-day)	210 [^] (1-hour)	8.1 [^] (4-day)
EPA	65* [^] (1-hour)	2.5* [^] (4-day)	210 [^] (1-hour)	8.1 [^] (4-day)
Draft Proposal	No change	No change	No change	No change

* Hardness based criteria (numeric value shown based on 100 mg/L)

[^] Presented as the dissolved fraction

- ESA concerns for FW criteria (no jeopardy call but adverse effects reported)
- Preliminary FW criteria used new science and the 1st percentile of toxicity data distribution
- Updated hardness-based equation for FW

Mercury

	FW Acute (ug/L)	FW Chronic (ug/L)	SW Acute (ug/L)	SW Chronic (ug/L)
Washington	2.1* (1-hour)	0.012^ (4-day)	1.8* (1-hour)	0.025^ (4-day)
EPA	1.4* (1-hour)	0.77* (4-day)	1.8* (1-hour)	0.94* (4-day)
Draft Proposal	1.4* (1-hour)	No change	No change	No change

* Presented as dissolved fraction

^ Presented as total recoverable fraction

- ESA concerns for FW chronic criterion
- EPA working on new national mercury recommendations

Nickel

	FW Acute (ug/L)	FW Chronic (ug/L)	SW Acute (ug/L)	SW Chronic (ug/L)
Washington	1415* [^] (1-hour)	157* [^] (4-day)	74 [^] (1-hour)	8.2 [^] (4-day)
EPA	470* (1-hour)	52* (4-day)	74 [^] (1-hour)	8.2 [^] (4-day)
Draft Proposal	55* [^] (1-hour)	6.5* [^] (4-day)	No change	No change

* Hardness based criteria (numeric value shown based on 100 mg/L)

[^] Presented as the dissolved fraction

- ESA concerns for FW chronic criteria
- Preliminary FW criteria used new science
- Updated hardness-based equation for FW

Selenium

	FW Acute	FW Chronic	SW Acute (ug/L)	SW Chronic (ug/L)
Washington	20 ug/L	5 ug/L	290	71
EPA	15.1 mg/kg dry weight (egg-ovary) OR 8.5 mg/kg dry weight (whole-body) OR 11.3 mg/kg dry weight (muscle) OR 1.5 ug/L (lentic) AND 3.1 ug/L (lotic) OR $WQC_{int} = WQC_{30\text{-day}} - C_{bkgnd} (1 - f_{int}) / f_{int}$		290	71
Draft Proposal	Adopt EPA recommendation		No change	No change

- Tissue and water-based criteria (hierarchy)

Silver

	FW Acute (ug/L)	FW Chronic (ug/L)	SW Acute (ug/L)	SW Chronic (ug/L)
Washington	3.4* [^] (1-hour)	-	1.9 [^] (1-hour)	-
EPA	3.2* [^] (instantaneous)	-	1.9 [^] (instantaneous)	-
Draft Proposal	0.24* [^] (1-hour)	0.095* [^] (4-day)	1.4 (1-hour)	0.57 (4-day)

* Hardness based criteria (numeric value shown based on 100 mg/L)

[^] Presented as the dissolved fraction

- ESA concerns for FW criteria
- Preliminary FW criteria used new science
- Updated hardness-based equation for FW

Zinc

	FW Acute (ug/L)	FW Chronic (ug/L)	SW Acute (ug/L)	SW Chronic (ug/L)
Washington	114* [^] (1-hour)	105* [^] (4-day)	90 [^] (1-hour)	81 [^] (4-day)
EPA	120* [^] (1-hour)	120* [^] (4-day)	90 [^]	81 [^]
Draft Proposal	37* [^] (1-hour)	26* [^] (4-day)	No change	No change

* Hardness based criteria (numeric value shown based on 100 mg/L)

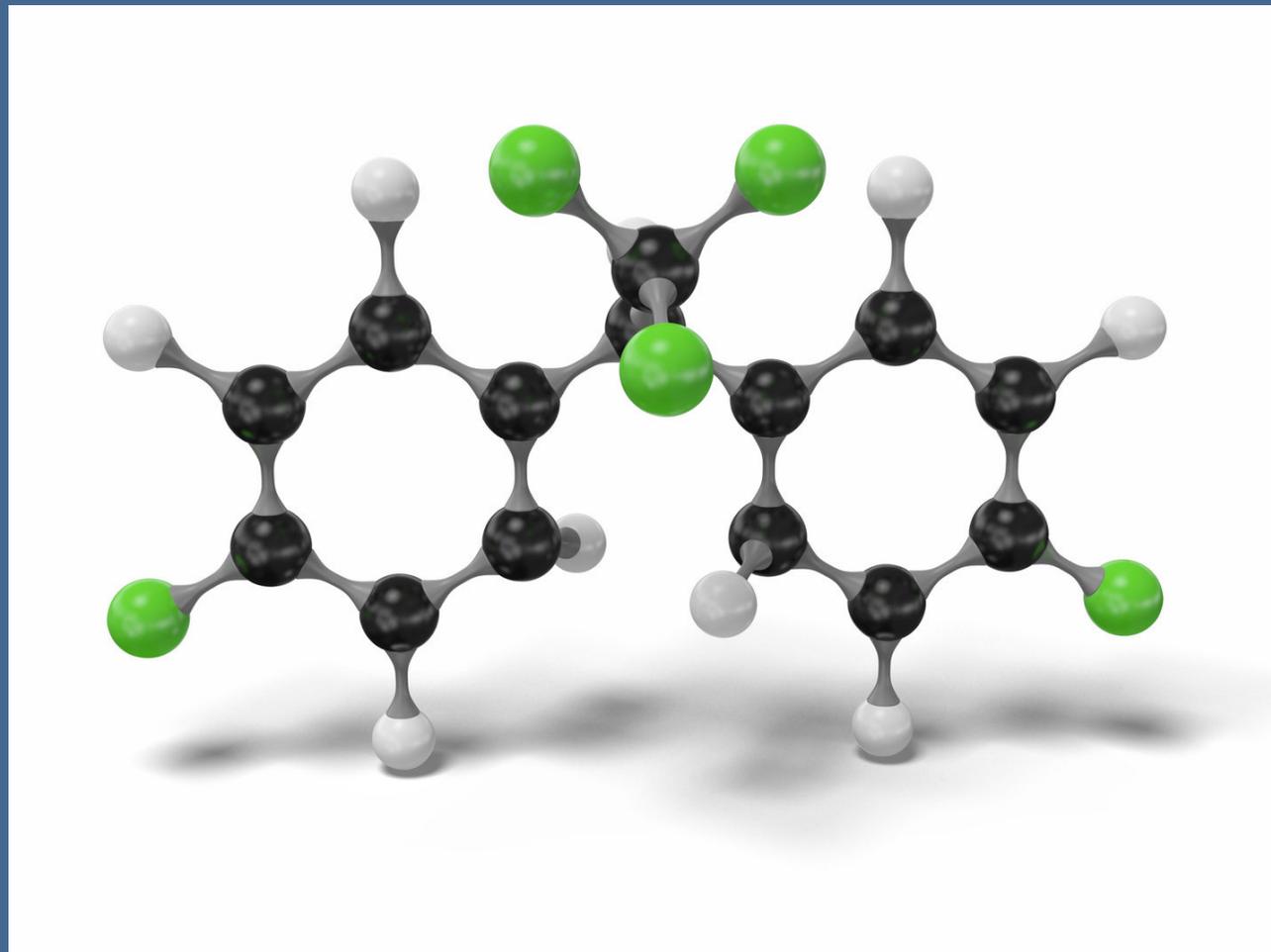
[^] Presented as the dissolved fraction

- ESA concerns for FW criteria
- Preliminary FW criteria used new science
- Updated hardness-based equation for FW



Organics

Preliminary draft values



6PPD-quinone

	FW Acute (ug/L)	FW Chronic (ug/L)	SW Acute (ug/L)	SW Chronic (ug/L)
Washington	-	-	-	-
EPA	-	-	-	-
Draft Proposal	Coming Soon	-	-	-

- ESA consultation not completed
- New toxic with no EPA recommendation

Aldrin

	FW Acute (ug/L)	FW Chronic (ug/L)	SW Acute (ug/L)	SW Chronic (ug/L)
Washington	2.5 (instantaneous)	0.0019 (24-hour)	0.71 (instantaneous)	0.0019 (24-hour)
EPA	3 (instantaneous)	-	1.3 (instantaneous)	-
Draft Proposal	1.9 (1-hour)	No change	0.77 (1-hour)	No change

- No known ESA issues
- FW and SW acute criteria were recalculated using EPA recommended methods to align with dieldrin (breakdown product)

Cyanide

	FW Acute (ug/L)	FW Chronic (ug/L)	SW Acute (ug/L)	SW Chronic (ug/L)
Washington	22 (1-hour)	5.2 (4-day)	1 (1-hour)	1 (4-day)
EPA	22 (1-hour)	5.2 (4-day)	1 (1-hour)	1 (4-day)
Draft Proposal	12 (1-hour)	2.7 (4-day)	No change	No change

- ESA concerns for FW criteria
- Preliminary FW criteria used new science and 1st percentile of toxicity data distribution
- EPA litigation surrounding failure to complete ESA consultation

Dieldrin

	FW Acute (ug/L)	FW Chronic (ug/L)	SW Acute (ug/L)	SW Chronic (ug/L)
Washington	2.5 (instantaneous)	0.0019 (24-hour)	0.71 (instantaneous)	0.0019 (24-hour)
EPA	0.24 (1-hour)	0.056 (4-day)	0.71 (instantaneous)	0.0019 (24-hour)
Draft Proposal	0.25 (1-hour)	0.058 (4-day)	0.33 (1-hour)	0.078 (4-day)

- No known ESA concerns
- Recalculation of SW criteria to align with FW criteria averaging periods

Endrin

	FW Acute (ug/L)	FW Chronic (ug/L)	SW Acute (ug/L)	SW Chronic (ug/L)
Washington	0.18 (instantaneous)	0.0023 (24-hour)	0.037 (instantaneous)	0.0023 (24-hour)
EPA	0.086 (1-hour)	0.036 (4-day)	0.037 (instantaneous)	0.0023 (24-hour)
Draft Proposal	0.086 (1-hour)	0.036 (4-day)	0.017 (1-hour)	0.0086 (4-day)

- No known ESA concerns
- Recalculation of SW criteria to align with FW criteria averaging periods

gamma-BHC (Lindane)

	FW Acute (ug/L)	FW Chronic (ug/L)	SW Acute (ug/L)	SW Chronic (ug/L)
Washington	2 (instantaneous)	0.08	0.16 (instantaneous)	-
EPA	0.95 (1-hour)	-	0.16 (instantaneous)	-
Draft Proposal	0.95 (1-hour)	-	0.11 (1-hour)	-

- No known ESA concerns
- Recalculation of SW criteria to align with FW criteria averaging periods

Nonylphenol

	FW Acute (ug/L)	FW Chronic (ug/L)	SW Acute (ug/L)	SW Chronic (ug/L)
Washington	-	-	-	-
EPA	28 (1-hour)	6.6 (4-day)	7 (1-hour)	1.7 (4-day)
Draft Proposal	21 (1-hour)	5.7 (4-day)	4.8 (1-hour)	1.2 (4-day)

- ESA concerns for FW and SW criteria
- Preliminary FW and SW criteria used new science and the 1st percentile of toxicity data distribution

Pentachlorophenol

	FW Acute (ug/L)	FW Chronic (ug/L)	SW Acute (ug/L)	SW Chronic (ug/L)
Washington	20* (1-hour)	13* (4-day)	13 (1-hour)	7.9 (4-day)
EPA	19* (1-hour)	15* (4-day)	13 (1-hour)	7.9 (4-day)
Draft Proposal	5.4* (1-hour)	2.7* (4-day)	6.5 (1-hour)	3.2 (4-day)

* pH dependent criteria (numeric values based on pH of 7.8)

- ESA concerns for FW and SW criteria
- Preliminary FW and SW criteria used new science and the 1st percentile of toxicity data distribution
- Updated pH-based equation for FW