

Water Quality Standards Human Health Criteria Workgroup

October 28, 2020

Laura Cooper
Assistant Director DWWM, Water Quality Standards
Laura.k.cooper@wv.gov



Oct 28, 2020 Meeting Agenda

Human Health Criteria (HHC) Workgroup

- Introductions & Welcome of EPA Staff
- Quick review our previous meetings, July - September
- Q&A with EPA on HHC bioaccumulation factors
- Revisit HHC Workgroup Plan & outcomes
- Plan next meeting and conclude

Agenda uploaded on 10/27/20 to

<https://dep.wv.gov/WWE/Programs/wqs/Pages/WQSpblicmeetings.aspx>

Review of HHC Workgroup Meetings

July

- Calculation changes in EPA 2015 recommended criteria
- WV Risk Factor for carcinogens: 1 in a million
- Went over each factor in EPA's equation
- Other States - what neighboring states are doing on HHC

Equation for calculation Consumption of Water & Fish

$$AWQC (\mu\text{g/L}) = \frac{\text{toxicity value (mg/kg-d)} \times BW (\text{kg}) \times 1,000 (\mu\text{g/mg})^b}{DI (\text{L/d}) + \sum_{i=2}^4 (\text{FCR}_i (\text{kg/d}) \times \text{BAF}_i (\text{L/kg}))}$$

AWQC	= ambient water quality criteria
toxicity value	= either reference dose multiplied by relative source contribution or cancer slope factor, adjusted by 10^{-6}
BW	= body weight
DI	= drinking water intake
$\sum_{i=2}^4$	= sum of values for aquatic trophic levels
FCR_i	= fish consumption rate for aquatic Trophic Levels 2, 3, and 4
BAF_i	= bioaccumulation factor for aquatic TLs 2, 3, and 4

Review of HHC Workgroup Meetings

August

- IRIS updates to toxics data after EPA's 2015 revision, esp. Benzo(a)pyrene
- Went thru example EPA criteria document
- EPA's decision-making on drinking water intake and body weight numbers

Table 3-33. Consumers-Only^a Estimates of Combined Direct and Indirect^b Water Ingestion Based on NHANES 2003–2006: Community Water (mL/day)

Age	Sample size	Mean	Percentile						
			10	25	50	75	90	95	99
Birth to <1 month	51	409*	72*	172*	399*	492*	851*	852*	990*
1 to <3 months	85	531*	103*	341*	513*	745*	957*	1,019*	1,197*
3 to <6 months	192	520*	89*	312*	530*	739*	880*	929*	1,248*
6 to <12 months	416	356	43*	94	270	551	772*	948*	1,161*
1 to <2 years	534	277	36*	88	199	377	627*	781*	1,277*
2 to <3 years	508	321	43*	105	227	448	722*	911*	1,374*
3 to <6 years	985	382	53	137	316	515	778	999	1,592*
6 to <11 years	1,410	511	79	178	413	690	1,072	1,404	2,099*
11 to <16 years	2,113	637	77	192	436	808	1,535	1,976	3,147
16 to <18 years	944	702	97	236	515	966	1,571	1,883	3,467
18 to <21 years	1,086	816	88	216	503	1,065	1,921	2,818	4,106
≥21 years	7,616	1,227	192	469	991	1,741	2,546	3,092	4,576
≥65 years	1,974	1,288	325	628	1,137	1,760	2,395	2,960	4,137
All ages	15,940	1,033	124	333	743	1,474	2,318	2,881	4,312

^a Excludes individuals who did not ingest water from the source during the survey period.
^b Direct water is defined as water ingested directly as a beverage; indirect water is defined as water added in the preparation of food or beverages.
^{*} Estimates are less statistically reliable based on guidance published in the *Joint Policy on Variance Estimation and Statistical Reporting Standards on NHANES III and CSFII Reports: NHIS/NCHS Analytical Working Group Recommendations* (NCHS, 1993).

Source: U.S. EPA analysis of NHANES 2003–2006 data.

USEPA Water Intake Origins & Options

- Can calculate an age-weighted value for the mean & each percentile w/this data
- Data includes age range of birth to 78 years
- 5th percentile would be LEAST conservative
- 95th percentile would be MOST conservative

EPA HHC uses 90th percentile of adults >21

Review of HHC Workgroup Meetings

September

- Studied Bioaccumulation factor data in more detail
- Examined EPA spreadsheets on BAF data
- Discussed questions for October meeting

Human Health Criteria EPA Decision Tree / Framework

Figure 3-1 from EPA Methodology

For example, **anthracene**:

- Nonionic organic chemical
- Mod-high hydrophobicity ($K_{ow} > 4$)
- High metabolism

For anthracene EPA was not able to locate peer-reviewed BAFs or lab-measured BCFs for all three trophic levels, so EPA used available BCF for TL 2 & TL3 to estimate and derive **national BAF for anthracene of 610 L/kg**

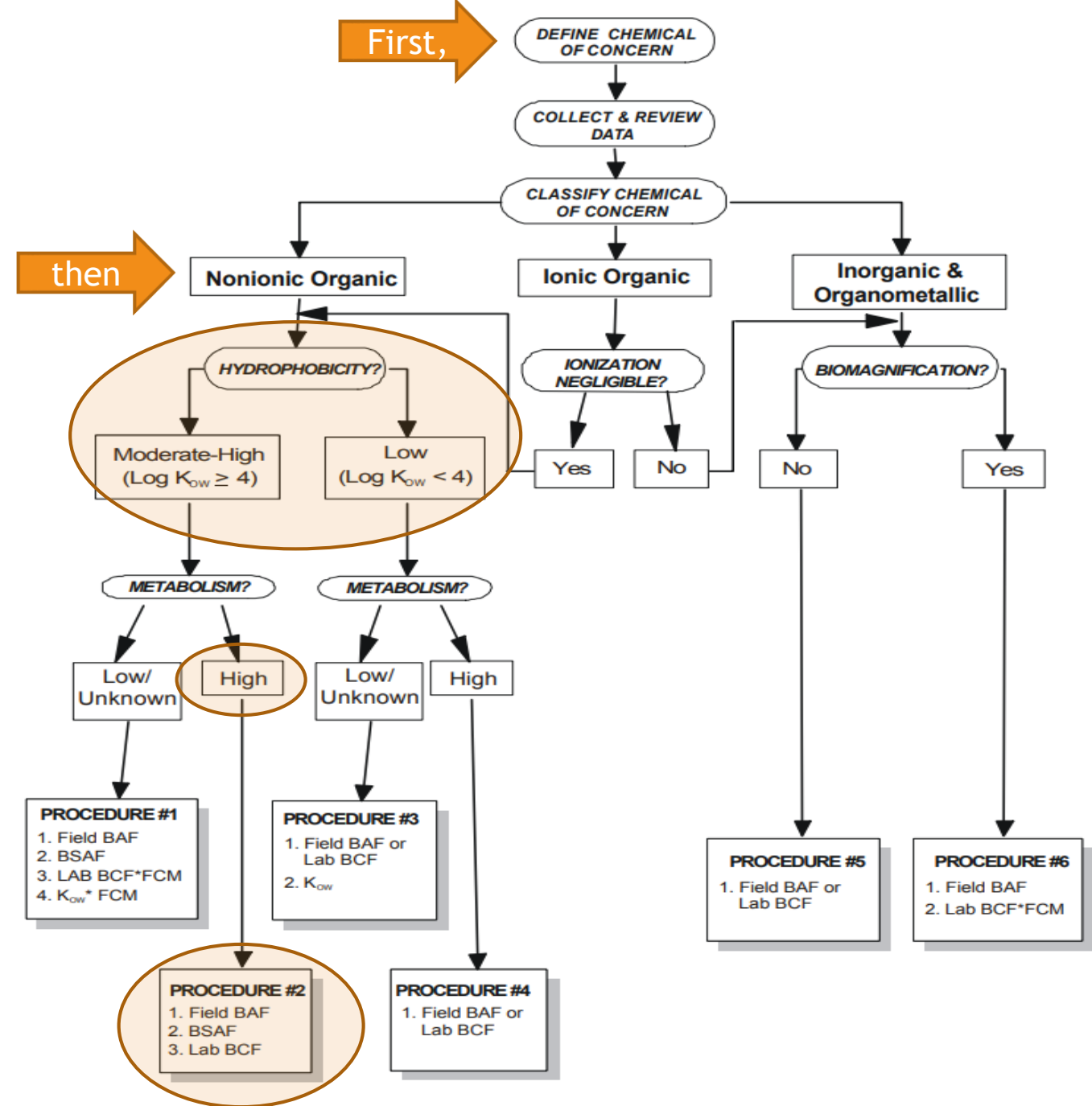


Figure 3-1. Framework for selection of methods for deriving national BAFs.

Questions for EPA Folks

The decision tree in many cases led to the use of the octanol-water coefficient, the least preferred method for determining a BAF.

Can you expound on the use of K_{ow} as far as your confidence in its accuracy in determining bioaccumulation, and whether that confidence changes from one type of chemical to another?

Most EPA's BAFs were calculated from Log K_{ow} :

Calculated from K_{ow}	59
BCF Method	6
BAF Method	11
Copied from Benzo(a)pyrene	6
Other alternative Method	12
<hr/>	
TOTAL	94

Questions for EPA Folks

In several instances, data was used from a study for some chemicals, but not for other chemicals tested in the same study. For instance, Freitag et al 1985 was used for 1,2,4-Trichlorobenzene, 2,4-Dichlorophenol, and a few others, but the Freitag paper actually studied several other HHC chemicals for which the study was not used.

Could you give some insight as to how this was done?

Table 3: Bioaccumulation of Organic Chemicals in Fish (Golden ide)

$$\text{Bioaccumulation factor: } BF_n = \frac{\text{concentration of chemical in fish (}\mu\text{g/g)}^*}{\text{medium conc. of chemical in water (}\mu\text{g/g)}}$$

n = 3 days

2,5,4'-Trichlorobiphenyl	3,850	2,6-Dichlorobenzonitrile	40
2,4'-Dichlorobiphenyl	3,550	Malonic acid diethyl ester	40
2,4,6,2'-Tetrachlorobiphenyl	3,150	Carbaryl	30
Dieldrin	3,010	Naphthalene	30
Pentachlorobenzene	3,000	Acetic acid ethyl ester	30
Aldrin	2,760	Chlorferon	20
2,2'-Dichlorobiphenyl	2,420	Monolinuron	20
Hexachlorobenzene	2,320	Phenol	20
2,4,6,2,4'-Pentachlorobiphenyl	2,320	3-Cresol	20
DDT	1,900	Dibenz(a,h)anthracene	10
Phenanthrene	1,760	4-Chloroaniline	10
Hexachlorocyclopentadiene	1,230	Capten	10
Quintozene	1,140	Cortisone acetate	10
Anthracene	910	Sencor	10
2,6-Di-tert-butylphenol	660	Ethylene glycol	10
3,3'-Dichlorobenzidine	610	2,6-Dichlorobenzamide	10
Kepone	570	Docosane	10
1,2,4-Trichlorobenzene	490	Acetic acid (Na-salt)	<10
Benzo(a)pyrene	480	Lineb	<10
1-Hexachlorocyclohexane	450	Maneb	<10
Cypermethrin	420	Succinic anhydride	<10
1-Hexachlorocyclohexane	371	Perylene	<10
Benzo(a)anthracene	350	4-Bromobenzoic acid	<10
2,4,6-Trichloroaniline	330	p-Phenylenediamine(hydrochloride)	<10
2,4,6-Trichlorophenol	310	(2,4-Dichlorophenoxy)acetic acid	<10
Biphenyl	280	Benzene	<10
Pentachlorophenol	260	Benzoic acid	<10
4-Isopropylnitrobenzene	190	Methanol	<10
Dodecylbenzenesulphate (Na-salt)	130	Aniline	<10
4-tert-Butylphenol	120	Tristearin	<10
Palmitic acid ethyl ester	110	Maleic acid	<10
Coumaphos	110	N-Benzyl-N-methylnitrosamine	<10
Diethylene glycol	100	4-Chlorobenzoic acid	<10
2,4-Dichlorophenol	100	Carbon tetrachloride	<10
Toluene	90	Belgard	<10
Trichloroethylene	90	Atrazine	<10
2,4-Dichloronitrobenzene	80	Urea	<10
Benzidine	80	ADPA	<10
Chlorobenzene	70	Nitrobenzene	<10
Palmitic acid	60	Vinyl chloride	<10
Hexadecanol	60	2,4-Dichlorobenzoic acid	<10
Dodecane	50	Thiourea	<10
Bromobenzene	50	Ethylenediamine(hydrochloride)	<10
1,4-Dichlorobenzene	50	ICM 2100	<10
4-Nitrophenol	40	2-Nitropropane	<10
Chlorhexidine	40	Propylene thiourea	<10
Hydroquinone	40	Ethylene thiourea	<10
Phthalic acid bis-		Coumarin	<10
(2-ethylhexyl)ester	40		

Questions for EPA Folks

What are your plans to recalculate these criteria due to recent updates to toxicity research in the IRIS database?

Likewise, as a large majority of the studies used to calculate BAFs were done before 2000. Do you plan to re-examine these criteria with more recent BAF/BCF data?

EPA's data is very old:

Undated	2
2010-2019	3
2000-2009	9
1990-1999	50
1980-1989	63
1970-1979	34
<hr/>	
TOTAL	161

Questions for EPA Folks

There isn't a lot of information on how you moved through the decision tree on the last row of the decision tree, when you decided between using a the BAF method, BCF method, or K_{ow} method to determine a National BAF.

Can you tell us more about how you made those decisions, for instance when you had BCF data but decided to use the K_{ow} anyway?

Questions for EPA Folks

Chemical Name	Mean Log Kow	BCF from 2002/2003 HHAWQC (L/kg-tissue)	Log Kow Method			BAF Method			BCF Method			Alternative BCF (L/kg-tissue)	Selected Values Used for AWQC Calculations			
			National BAF TL 2 (L/kg-tissue)	National BAF TL 3 (L/kg-tissue)	National BAF TL 4 (L/kg-tissue)	National BAF TL 2 (L/kg-tissue)	National BAF TL 3 (L/kg-tissue)	National BAF TL 4 (L/kg-tissue)	National BAF TL 2 (L/kg-tissue)	National BAF TL 3 (L/kg-tissue)	National BAF TL 4 (L/kg-tissue)		National BAF TL 2 (L/kg-tissue)	National BAF TL 3 (L/kg-tissue)	National BAF TL 4 (L/kg-tissue)	Alternative BCF (Rounded) (L/kg-tissue)
Acenaphthene	3.98	242	180	250	290	--	--	--	3,500,000	510	3.5	510	ND	ND	ND	510
Acrolein	-0.01	215	1.0	1.0	1.0	--	--	--	--	28	--		1.0	1.0	1.0	ND
Acrylonitrile	-0.92	30	1.0	1.0	1.0	--	--	--	--	38	--		1.0	1.0	1.0	ND
Aldrin	6.5	4670	18,000	310,000	650,000	--	--	--	--	38,000	--		18,000	310,000	650,000	ND
alpha-BHC	3.8	130	120	160	190	1,700	1,400	1,500	--	86	710		1,700	1,400	1,500	ND
alpha-Endosulfan	3.83	270	130	180	200	--	--	--	47	4,700	--		130	180	200	ND
Anthracene	4.45	30	530	1,200	1,100	11,000	--	--	460	800	--	606.6300355	ND	ND	ND	610
Benzene-Lower CSF	2.13	5.2	3.6	4.5	5.0	--	--	--	4.3	--	11		3.6	4.5	5.0	ND
Benzene-Upper CSF	2.13	5.2	3.6	4.5	5.0	--	--	--	4.3	--	11		3.6	4.5	5.0	ND
Benidine	1.34	87.5	1.4	1.6	1.7	--	--	--	700	57	--		1.4	1.6	1.7	ND
Benzo (a) Anthracene	5.61	30	6,000	55,000	77,000	--	--	--	3,800	21,000	--	3889.730068	ND	ND	ND	3,900
Benzo (a) Pyrene	6.06	30	12,000	170,000	300,000	13,000	--	--	8,900	1,700	--	3889.730068	ND	ND	ND	3,900
Benzo (b) Fluoranthene	6.04	30	12,000	160,000	290,000	--	--	--	2,800	150,000	--	3889.730068	ND	ND	ND	3,900
Benzo (k) Fluoranthene	6.06	30	12,000	170,000	300,000	--	--	--	69,000	--	--	3889.730068	ND	ND	ND	3,900
beta-BHC	3.78	130	110	160	180	--	--	--	--	--	130		110	160	180	ND
beta-Endosulfan	3.62	270	80	110	130	--	--	--	47	3,700	--		80	110	130	ND
Bis(Chloromethyl) Ether	-0.38	63	1.0	1.0	1.0	--	--	--	--	--	--		1.0	1.0	1.0	ND
Bis(2-Chloroethyl) Ether	1.34	6.9	1.4	1.6	1.7	--	--	--	--	5.3	--		1.4	1.6	1.7	ND
*Bis(2-Chloro-1-Methylethyl) Ether	2.48	2.47	6.7	8.8	10	--	--	--	--	5.0	--		6.7	8.8	10	ND
Bis(2-Ethylhexyl) Phthalate	7.5	130	25,000	390,000	690,000	--	680	750	150	9,000	--	714.1428429	ND	ND	ND	710
Bromoform	2.4	3.75	5.8	7.5	8.5	--	--	--	3.2	7.6	--		5.8	7.5	8.5	ND
Butylbenzyl Phthalate	4.73	414	980	2,900	2,600	--	15,000	24,000	--	3.3	--	18973.66596	ND	ND	ND	19,000
Carbon Tetrachloride	2.64	18.75	9.3	12	14	--	--	--	--	5.0	44		9.3	12	14	ND
Chlordane	5.54	14100	5,300	44,000	60,000	--	--	--	--	67,000	--		5,300	44,000	60,000	ND
Chlorobenzene	2.84	10.3	14	19	22	--	390	120	1,400	8.8	--		14	19	22	ND

Additional questions for EPA

Further discussion on bioaccumulation factors and toxicity data



HHC Workgroup Goals

a work in progress



1. **Reasonable standards** - approvable by WV Legislature & EPA
2. **Protective regulations** - protect West Virginians
3. **Learn** - broaden horizons, gain better understanding
4. **Consensus** - agree on what to propose in 2021

November meeting

What would you like us to discuss at the November meeting?

Does Wednesday Nov 18 at 9AM work for everyone?

