



west virginia department of environmental protection

May 14, 2021

Human Health Criteria Recommendations for West Virginia

for consideration by
WV DEP Cabinet Secretary

Prepared by the
West Virginia Human Health Criteria Work Group

a joint effort of the
WV Department of Environmental Protection and
WV Environmental Protection Advisory Council



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Introduction

The West Virginia Human Health Criteria Work Group (HHC Work Group) has prepared the following recommendations for WV Department of Environmental Protection Cabinet Secretary, Harold Ward, for his consideration regarding the adoption of updated West Virginia water quality standards for the protection of human health. After researching and reviewing the numeric human health criteria in Legislative Rule 47 C.S.R. 2, Requirements Governing Water Quality Standards, the work group has a better understanding of the methods used to determine standards of water quality and how recent changes to nationally recommended criteria were calculated by the United States Environmental Protection Agency (EPA). The HHC Work Group has agreed to the methodology used in the enclosed set of science-based standards which will protect West Virginia citizens against water pollution and has provided the following description of the work group's progress and background for the Secretary's consideration.

Background

The 2019 West Virginia Legislature added Subsection 8.6 to Legislative Rule 47 C.S.R. 2, Requirements Governing Water Quality Standards, requiring the West Virginia Department of Environmental Protection (DEP) to propose updates to numeric human health criteria. Specifically, the language passed by Legislature read:

47 C.S.R. 2-8.6 (2019). On or before April 1, 2020, the Secretary shall propose updates to the numeric human health criteria found in Appendix E., subsection 8.23. Organics and subsection 8.25 Phenolic Materials to be presented to the 2021 Legislative Session. The Secretary shall allow for submission of proposed human health criteria until October 1, 2019, and for public comment and agency review for an appropriate time thereafter.

Pursuant to the language of this subsection, DEP accepted public submissions of proposed human health criteria until October 2019. DEP received proposed human health criteria from both the West Virginia Manufacturers Association (WVMA 2019) and the West Virginia Rivers Coalition (WVRC 2019). The WVMA suggested DEP revise its human health criteria by adjusting U.S. Environmental Protection Agency (EPA) 2015 human health criteria revisions (EPA 2015) to use EPA's 2002 Bioconcentration Factors (BCFs) rather than the Bioaccumulation Factors (BAFs)



used by EPA in the 2015 revisions. WVMA also suggested DEP not propose criteria for bis(2-ethylhexyl) phthalate (BEHP) because it is a common laboratory contaminant and thus difficult to quantify in samples. The WVRC recommended DEP revise its human health criteria by adopting only those EPA 2015 criteria revisions which resulted in criteria more stringent (lower in concentration) than current WV human health criteria, suggesting WV reject any EPA criteria revisions that would make WV criteria less stringent (higher in concentration). WVRC also recommended that DEP adopt EPA's 2015 recommended human health criteria for the compounds which are not currently present in West Virginia's water quality standards.

DEP took both proposals into consideration when proposing to adopt EPA 2015 recommended criteria to replace 24 of WV's human health criteria on March 31, 2020. These revisions represented criteria that did not vary greatly from the criteria WVMA proposed to DEP, and just over half of the revisions (13) would meet WVRC's request for more stringent criteria, while the remaining 11 EPA recommended criteria would become less stringent. For the remaining 35 WV human health criteria, DEP proposed revised language for 47 C.S.R. 2-8.6 which would create a Human Health Criteria Work Group that would take a closer look at WV's human health criteria to decide upon revisions to propose to the DEP Cabinet Secretary in May 2021. The language was passed by the 2021 West Virginia Legislature, signed by the Governor on April 7, 2021, and was submitted as a final filing to the WV Secretary of State on April 22, 2021. Effective May 22, 2021, 47 C.S.R. 2 now includes EPA's 2015 recommended criteria for 24 WV compounds, both for Category A and Category C, and subsection 2.8.6. now reads:

47 C.S.R. 2-8.6 (2021). The Secretary shall appoint a work group consisting of DEP employees (one of whom shall serve as a chairperson) and the DEP Environmental Protection Advisory Council. The work group will meet monthly from June 2020 to May 2021 to research and review remaining numeric human health criteria found in Appendix E, subsection 8.23 Organics and subsection 8.25 Phenolic Materials, in order to make a recommendation to the Secretary for the proposal of additional updates to the numeric human health criteria, if necessary, to be presented to the 2022 Legislative Session.

The HHC Work Group, consisting of DEP staff as well as members of the environmental and regulated communities, formed and began having monthly meetings in June 2020. This report provides an overview of the work done by this group and provides recommended revisions for human health criteria which have been agreed upon by the members of the work group. This



report is being provided to DEP Cabinet Secretary Harold Ward for his consideration of proposal to the 2022 WV Legislature.

Work Group Progress

The West Virginia HHC Work Group began meeting monthly in Summer 2020 to learn about human health criteria, especially studying how it was recalculated by EPA in its 2015 criteria revision. The work group studied methodology used in the 2015 recalculation of criteria, which included the change from using fish bioconcentration factors to bioaccumulation factors, incorporating newer human toxicity data, the use of a relative source contribution factor, and revising human fish consumption, drinking water consumption, and body weight. The group learned how each of these factors affect the overall human health criteria value, as well as learning where the data came from that EPA used and what decision-making was put into using one set of data versus another.

In October the HHC Work Group invited staff from EPA headquarters as well as from Region 3 to discuss the 2015 revisions and answer questions work group members had regarding the bioaccumulation factors used in the 2015 criteria. EPA staff who worked directly on the 2015 criteria revisions were able to attend this meeting, answering specific questions about EPA's decision-making. Questions included EPA's decision to use the octanol-water coefficient (K_{ow}) to estimate bioaccumulation factors in many instances and whether EPA had looked for newer or more scientifically valid studies relating to BAFs.

After learning how human health criteria are calculated and having the opportunity to speak to EPA about their criteria revisions, the HHC Work Group moved on to studying how EPA's Integrated Risk Information System (IRIS) identifies credible health hazards associated with a chemical and the quantitative relationship between chemical exposure and these health hazards. The work group studied in detail one polycyclic aromatic hydrocarbon (benzo(a)pyrene) for which the IRIS toxicity value has been updated since the 2015 EPA criteria revision. This 2017 IRIS update would cause the cancer slope factor for this chemical to go from 7.3 down to 1, which would affect the criterion by increasing it a factor of 7.3.

After learning all about human health criteria, EPA's 2015 revision, and the IRIS database, the work group moved on to finalizing its goals and using what had been learned to progress



towards gaining agreement on criteria that could be proposed in this report. Finalized HHC Work Group goals are as follows:

To Learn:

- About water quality standards
- How science is used to determine these standards
- About recent changes made by the EPA

To Reach Consensus:

- On science-based standards that protect West Virginia citizens against water pollution

To Recommend to the Secretary:

- The above standards for approval by the EPA and Legislature

Once the work group had a distinct set of agreed-upon goals as well as a good understanding of how human health criteria are calculated, the group began to study EPA's 2015 revised criteria for the remaining 35 WV compounds. Because the work group had already concluded EPA's decision-making was appropriate for many of the factors that go into human health criteria, the work group focused on two of the calculation factors: human toxicity and fish bioaccumulation factors. When studying toxicity, the work group began to develop a decision tree which would aid the group in deciding the acceptability of data choices EPA made when determining appropriate toxicity factors. In drafting this decision-making flowchart, the work group took into consideration the group's stated goal to attempt to "reach consensus on science-based standards that protect West Virginia citizens against water pollution." Using this as a guide, the HHC Work Group generally concluded that toxicity factors should be drawn from the most recent reliable data.

In comparing the HHC Work Group's decision-making conclusions to EPA's, the work group learned that several databases were utilized by EPA for toxicity factors, each of which is placed into a hierarchy or tiered ranking based on the level of data review. The Tier 1 database is EPA's Integrated Risk Management System (IRIS); this is followed by the Tier 2 database, EPA's Provisional Peer-Reviewed Toxicity Values (PPRTV). Finally, there are Tier 3 databases like California EPA, Health Canada, and others. The HHC Work Group reviewed each of EPA's decisions to use either reference doses (RfDs) for non-carcinogenic effects, or cancer slope



factors (CFDs) for carcinogenic effects, and compared EPA's data decisions to determine if the most recent and reliable data had been used.

After reviewing EPA's data decisions, the work group had additional questions for EPA regarding 7 criteria revisions and posed these questions to EPA headquarters and Region 3 staff. The questions were regarding EPA's decisions to use toxicity factors which were in favor of less recent data, or in some cases the decision to remain with a non-cancer effect reference dose when a more conservative cancer slope factor was available. EPA was able to get answers back to the work group in a timely manner, and the group reviewed their answers to determine that although not much additional information had been provided, EPA did seem to generally have followed their own decision-making process when selecting the toxicity factors used in their 2015 criteria revisions.

Finally, the work group was able to move on to the final and probably most confounding factor in EPA's 2015 criteria revision: the use of bioaccumulation factors. Bioaccumulation factors, or BAFs, were known to be one of the most significant changes in determining water quality criteria since the previous methodology, which had utilized bioconcentration factors, or BCFs. From one of EPA's Update of Human Health Ambient Water Quality Criteria documents for specific chemicals, EPA defines bioaccumulation as "the uptake and retention of a chemical by an aquatic organism from all surrounding media, such as water, food, and sediment" whereas the previous method of determining the level of a chemical in fish tissue was based on bioconcentration, defined as "the uptake and retention of a chemical by an aquatic organism from water only" (EPA 2015). As the HHC Work Group learned more about the difference between BAF and BCF, work group members agreed that the BAF concept of taking the entire environmental exposure into consideration was an improvement over the BCF's assumption that fish only take in chemicals through exposure to the water around them.

To determine procedures for selecting BAFs from chemical properties and available data, EPA employed the use of its technical support document on the development of national bioaccumulation factors (EPA 2003). Specifically, EPA used its "Framework for selection of methods for deriving national BAFs," or Figure 3-1 from the technical support document (EPA 2003). EPA's framework takes into consideration known and measured properties of a given chemical such as whether an organic chemical is ionic or nonionic, the chemical's hydrophobicity, and its water-octanol coefficient (K_{ow}). Moving a chemical through EPA's framework results in a



hierarchy of data sources which should be used for that chemical. In every case, the hierarchy leads to a preference for field-measured BAF data; when this data is unavailable, lab-measured BCF data that can be converted to an estimated BAF is preferred. For highly metabolized nonionic organic chemicals, a K_{ow} may be used; for the rest, a K_{ow} is determined not to be appropriate for BAF determination.

Due to limited sources of data resulting in field-measured bioaccumulation of specific chemicals in fish, EPA had to estimate BAFs in many cases from other sources of information. In fact, only 4 of the 35 criteria the work group reviewed are based on actual field measured BAFs, while 12 are estimated from $\log K_{ow}$. For 13 of the chemicals, EPA used an estimated BAF based on BCF data, and BAFs for the remaining chemicals were copied from BCF data for benzo(a)pyrene. Furthermore, of the 161 studies EPA used to calculate BAFs, 149 of them were published prior to the year 2000; only 12 were completed in the last 20 years. The concept of developing actual field-measured BAFs for particular chemicals is relatively new, and data is still in the process of being developed. Despite the various methods and age of data EPA used for calculating and estimating BAFs, the HHC Work Group was able to determine that EPA adhered to its framework for selection of methods for deriving the BAFs. In addition, as previously stated, the concept of using bioaccumulation factors takes into consideration more of the actual environment fish are exposed to than the previous calculation method which only took into consideration fish exposure to the chemical from water.

In summary, the HHC Work Group set out to learn about water quality standards, how scientific methods were used to determine these standards, and how recent changes made by the EPA have affected water quality standards for the protection of human health. The work group studied how EPA's 2015 criteria were calculated, asked questions of EPA regarding their methodology, and considered how specific data decisions were made by EPA. In most cases, EPA's data decisions matched how the HHC Work Group would approach the same decision-making. For BAFs, in many cases EPA had to use its less-preferred methods and limited data in determining to what extent chemicals bioaccumulate in fish tissue. Upon extensive review and after receiving answers from EPA on questions about methodology, the HHC Work Group determined that EPA seemed to adhere to its methodologies in data decisions, despite when data was limited.



Conclusions and Recommendation

The HHC Work Group's stated goals were to reach consensus on science-based standards that protect West Virginia citizens against water pollution and to recommend these standards to the Secretary for approval by the EPA and Legislature. Despite varying opinions among work group members, who ranged from the executive director of a leading West Virginia environmental coalition to the president of an organization representing industries across the state, the HHC Work Group was determined to reach consensus. Work group members put policy differences largely aside to focus on the research and methodology that went into the development of water quality standards in EPA's revisions of the 35 criteria not yet updated in West Virginia's standards rule (Table 1). After this review, WVRC maintains its policy position that none of West Virginia's current human health criteria should be made less stringent, which is supported by EPAC members on the work group representing organizations advocating environmental protection. These members also note that there remain 35 additional criteria included in EPA's 2015 recommended updates that are not present in West Virginia's standards rule and believes these remaining criteria should be immediately considered for potential future updates. One thing agreed upon by the entire HHC Work Group is that some of the data behind EPA's 2015 revisions were limited and warrant further research.

Monthly work group meetings from June 2020 to May 2021 provided the time necessary to fully understand how EPA's approach to the data informed EPA's 2015 revision of human health criteria. What time did not allot for, however, was the time necessary to determine whether newer research on human toxicity factors or fish bioaccumulation factors could supply more appropriate science than was used in the 2015 revisions. While adopting EPA's 2015 revisions for the 35 remaining chemicals would represent more improved science than West Virginia's current water quality standards, it is also important that West Virginia and EPA continue to consider improved data to further develop protective human health criteria. The HHC Work Group agrees that this work should continue as part of the quarterly Water Quality Standards Program's public meetings, as well as regular consultation and reporting to the Environmental Protection Advisory Council.

Based on limitations of the data used in EPA's 2015 revisions, to move forward with recommending the 35 criteria updates, WVMA and EPAC members representing industries regulated by DEP would require memorializing a process like the one outlined in 8.2.c. below to evaluate criteria on a case-by-case basis as part of the NPDES permitting process, including EPA



303(c) water quality standards review. However, EPAC members representing organizations advocating environmental protection oppose recommending the process outlined in paragraph 8.2.c., stating that it is outside of the HHC Work Group's established goals.

Given these opposing views, the HHC Work Group presents the following alternatives. EPAC members representing organizations advocating environmental protection recommend the DEP Cabinet Secretary propose the following 35 criteria listed in Table 1 reflecting updates from WV's current criteria to EPA's 2015 national recommended human health criteria. The EPAC members representing industries regulated by DEP recommend that the DEP Cabinet Secretary propose adoption of the 35 criteria in Table 1 only with adoption of the following paragraph 8.2.c. for WV's Water Quality Standards Rule, 47 C.S.R. 2:

8.2.c. The components and other aspects of the human health criteria based on EPA's 2015 national recommended human health criteria were developed using available data, which in some cases may have been limited. The bioaccumulation factors, relative source contributions, and other relevant factors used in development of the human health criteria may be evaluated on a case-by-case basis as part of the NPDES permitting process or by petition to the Secretary. Permit limits based on revisions to the human health criteria made in accordance with this paragraph are subject to a 45-day public comment period and are subject to EPA review under CWA 303(c), but are not subject to review by the Legislative Rule-Making Review Committee in accordance with the rule-making procedures of the West Virginia Administrative Procedures Act.

Since not every HHC in the rule uses EPA's 2015 criteria, a footnote will be added to all criteria in Appendix E Table 1 which are based upon 2015-revised criteria:

ⁱ Category A and C criteria reflect EPA's 2015 national recommended human health criteria and are subject to evaluation described in subsection 8.2.c.



Table 1. WV Human Health Criteria which have not yet been updated to EPA National Recommended Criteria

Compound	Units	Category C		Category A	
		WV Current	EPA 2015	WV Current	EPA 2015
1,2-dichlorobenzene	mg/l	17	3	2.7	1
2,4,6-Trichlorophenol	µg/l	6.5	2.8	2.1	1.5
2,4-Dichlorophenol	µg/l	790	60	93	10
2-Chloronaphthalene	µg/l	1,600	1,000	1,000	800
Acenaphthene	µg/l	990	90	670	70
Aldrin	ng/l	0.071	0.00077	0.071	0.00077
alpha-BHC (alpha-Hexachlorocyclohexane)	µg/l	0.013	0.00039	0.0039	0.00036
Anthracene	µg/l	40,000	400	8,300	300
Benzo(a) Anthracene	µg/l	0.018	0.0013	0.0038	0.0012
Benzo(a) Pyrene	µg/l	0.018	0.00013	0.0038	0.00012
Benzo(b) Fluoranthene	µg/l	0.018	0.0013	0.0038	0.0012
Benzo(k) Fluoranthene	µg/l	0.018	0.013	0.0038	0.012
beta-BHC (beta- Hexachlorocyclohexane)	µg/l	0.046	0.014	0.014	0.008
Butylbenzyl Phthalate	µg/l	*	0.10	*	0.10
Chlordane	ng/l	0.46	0.32	0.46	0.31
Chlorobenzene	mg/l	21	0.8	0.68	0.1
Chrysene	µg/l	0.018	0.13	0.0038	0.12
Cyanide	µg/l	5	400	5	4
DDT	ng/l	0.024	0.030	0.024	0.030
Dibenzo(a,h)Anthracene	µg/l	0.018	0.00013	0.0038	0.00012
Dieldrin	ng/l	0.071	0.0012	0.071	0.0012
Diethyl Phthalate	µg/l	*	600	*	600
Dimethyl Phthalate	µg/l	*	2,000	*	2,000
Di-n-Butyl Phthalate	µg/l	*	30	*	20
Ethylbenzene	mg/l	29	0.13	3.1	0.068
Fluoranthene	µg/l	370	20	300	20
Fluorene	µg/l	5,300	70	1,100	50
gamma-BHC	µg/l	0.063	4.4	0.019	4.2
Heptachlor	ng/l	0.21	0.0059	0.21	0.0059
Hexachlorobenzene	ng/l	0.77	0.079	0.72	0.079
Indeno(1,2,3-cd) Pyrene	µg/l	0.018	0.0013	0.0038	0.0012
Methoxychlor	µg/l	0.03	0.02	0.03	0.02
Methyl Bromide	µg/l	1,500	10,000	47	100
Pentachlorophenol	µg/l	8.2	0.04	0.28	0.03
Pyrene	µg/l	4,000	30	830	20

*No current human health criterion, but existing aquatic life criterion of 3.0 µg/l for Phthalate esters includes footnote 6 of 47 C.S.R. 2 Appendix E Table 1 which states "Phthalate esters are determined by the summation of the concentrations of Butylbenzyl Phthalate, Diethyl Phthalate, Dimethyl Phthalate, Di-n-Butyl Phthalate and Di-n-Octyl Phthalate"



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