ILLINOIS POLLUTION CONTROL BOARD
May 16, 2019

IN THE MATTER OF	)	
	)	
AMENDMENTS TO GENERAL USE	)	R18-32
WATER QUALITY STANDARDS	)	(Rulemaking – Water)
FOR CHLORIDE	)	

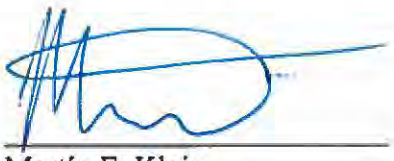
HEARING OFFICER ORDER

On March 14, 2018, Huff & Huff filed an amended proposal with a statement of reasons, technical support documents, and attachments. On February 28, 2019, the hearing officer held a pre-hearing conference, and notified participants that the Board was preparing questions for Huff & Huff (proponent) following the January 23, 2019 hearing.

The Board's Technical Unit has reviewed the January 23, 2019 hearing transcript and the amended proposal and supporting materials, and prepared questions for the proponent. The Board submits questions directed to the proponent with this order. Anyone may respond to the questions attached.

All participants are invited to submit questions on the amended proposal by close of business May 30, 2019, which is 15 days from the date of this order. Responses to all questions must be submitted by close of business July 1, 2019. If additional time is needed, the hearing officer may extend the deadline for good cause shown on a motion requesting an extension. *See* 35 Ill. Adm. Code 101.522. After responses are filed, the hearing officer will schedule a pre-hearing conference to schedule hearings.

IT IS SO ORDERED.



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ATTACHMENT 1
R18-32
AMENDMENTS TO GENERAL USE
WATER QUALITY STANDARDS FOR CHLORIDE

Questions for James Huff and Roger Klocek

Documents

1. Please provide copies of the following documents for the record:

Stephan 2009. Referenced in the Amended Statement of Reasons (SR2) at 3; Amended Technical Support Document (TSD2) at 15; and Klocek Pre-filed Testimony (PFT) at 7.

Stephan, C.E. 2009a. "Calculation of Aquatic Life Criteria for Chloride", U.S. Environmental Protection Agency, Duluth, MN. 09FebChlorideCriteria.wpd. DRAFT 2-10-09.

Stephan, C.E. 2009c. "Summary of Data concerning the Acute Toxicity of Sodium Chloride to Aquatic Animals." U.S. Environmental Protection Agency, Duluth, M., 09FebChlorideAcute.wpd. DRAFT 2-10-09

Stephan, C.E. 2009h. "Results of Literature Search concerning the Toxicity of Chloride to Aquatic Animals." U.S. Environmental Protection Agency, Duluth, MN. 09JanChlorideRefs.wpd. DRAFT 1-15-09.

USEPA. Referenced in TSD2 at 14.

"Guidelines for Deriving Numerical National Water Quality Criteria for the Protection of Aquatic Organisms and Their Uses", USEPA (1985), Stephen C.E., Mount D.I,., Hansen D.J, Gentile J.R., Chapman G.A., Brungs W.A. [1985 USEPA Guidelines]

Iowa Department of Natural Resources. Referenced in Klocek PFT at 7.

Iowa Department of Natural Resources Memo, "Proposed Chloride Criteria Update", 03/02/2009. (Iowa DNR Memo 3/2/09)

Iowa Department of Natural Resources, "Understanding Iowa's Water Quality Standards".

567 Iowa Administrative Code, Chapter 61 Water Quality Standards, 61.3(3) Specific Water Quality Criteria, and Table 1 Criteria for Chemical Constituents.

Iowa Department of Natural Resources, 2009. Water Quality Standards Review:

Chloride, Sulfate and Total Dissolved Solids.

Soucek. Referenced in Soucek PFT, Att. 1 at 6, 7, 11.

Soucek DJ, Linton TK, Tarr CD, Dickinson A, Wickramanayake N, Delos CG, Cruz LA. 2011. Inluence of water hardness and sulfate on the acute toxicity of chloride to sensitive freshwater invertebrates. Environmental Toxicology & Chemistry. 30(4):930-938.

Soucek DJ, Kennedy AJ. 2005. Effects of hardness, chloride, and acclimation on the acute toxicity of sulfate to freshwater invertebrates. Environmental Toxicology and Chemistry 24:1204-1210.

Soucek DJ (PI). 2008. Effects of hardness and sulfate on chloride toxicity to freshwater invertebrates. Great Lakes Environmental Center.

Linton. Referenced in Initial Proposal (Prop.1) at 115[1].

Linton, T.K. & Dickinson, A., Great Lakes Environmental Center (GLEC) and Illinois Natural History Survey (INHS). 2008. Acute Toxicity of Chloride to Select Freshwater Invertebrates. Final Draft Report to USEPA. 9-26-2008. (GLEC/INHS 2008)

Chloride Water Quality Standards in Other States

2. At the January 23, 2019 hearing (Tr.), Mr. Klocek indicated he would provide further information on the citations and summaries of the chloride standards adopted or proposed for Iowa, Indiana, Pennsylvania, Missouri, and Wisconsin. Tr. at 33-37.

   a. In addition, please provide a summary table of chloride water quality standards for aquatic life in surface waters in all states in USEPA Regions 1, 2, and 5. Please include acute and chronic values, USEPA's latest effective date, and internet links to the water quality standards considered in effect for Clean Water Act purposes from USEPA's website at https://www.epa.gov/wqs-tech/state-specific-water-quality-standards-effective-under-clean-water-act-cwa

   b. For states whose chloride water quality standards are mainly site-specific, please provide a general range.

   c. For Missouri and Illinois, please include both the standards currently on the books at the State level as well as the standards USEPA considers in effect for Clean Water Act purposes.

   d. For Pennsylvania, please include the standard proposed in the 2016 Triennial Review. Prop.2, Att. 1.

[1] Citations to Prop.1 are to the bate stamp of the filing.

e. For states that do not have a chloride water quality standard, please include the comparable standards, such as for salinity or Total Dissolved Solids.

f. Based on the state standards, please comment on the most predominant values and forms for chloride or salinity water quality standards, and group states in the table accordingly.

3. **Missouri:**
For Missouri, Mr. Klocek testified that Missouri's revised chloride water quality standard using the equations from the Iowa standard was not approved by USEPA. Mr. Klocek explained that Missouri's chloride water quality standards were not approved because they did not include a database for hardness or data on more recent toxicity testing. Tr. at 34.

a. Please provide a copy of the USEPA January 5, 2015 Action Letter to Missouri regarding disapproval of revised chloride and sulfate criteria at 10 CSR 20-7.031(4)(L). *See* https://www.epa.gov/sites/production/files/2015-09/documents/mowqs.pdf at 3; *see also* Tr. at 35-36.

b. Please elaborate on the testimony regarding USEPA's disapproval in their January 5, 2015 Action Letter. Please also describe any differences between the water quality standards of Iowa, Indiana, and Missouri.

c. Based on USEPA's Action Letter, what do you think Missouri would need to do to make their revised chloride water quality standard, based on the equations from the Iowa standard, approvable by USEPA?

d. Do you know of any efforts by Missouri to resubmit its chloride standards to USEPA or to pursue a standard in a different form?

Table 1. SMAV and GMAV in mg/L Chloride for Updated and Complete Literature Values for Chloride Criteria (Aquatic Life)

4. **Inclusion of Other Recent Data:** Proponent's proposal filed May 21, 2018 (Prop.1) included a Technical Support Document (TSD1), (Prop. at 78). In response to Table 1 in the TSD1 (Prop. at 95), Laura Barghusen suggested that additional new data should also be considered, in particular, for early life stages of mussels: glochidia (larvae) and juvenile. PFT Barghusen at 4. Although Stephan 2009c includes acute values for juvenile *Lampsilis fasciola* (Bringolf et al. 2007) and *Lampsilis siliquoidea* (Bringolf et al. 2007; Wang 2007), Ms. Barghusen supplied copies of two additional reports that examined chloride toxicity to both glochidia and juveniles:

> Gillis, PL. 2011. "Assessing the toxicity of sodium chloride to the glochidia of freshwater mussels: implications for salinization of surface waters." Environmental Pollution 159: 1702-1708. (Gillis 2011)

Wang, N, CD Ivey, RA Dorman, CG Ingersoll, J Steevens, EJ Hammer, CR Bauer, and DR Mount. "Acute toxicity of sodium chloride and potassium chloride to a unionid mussel (*Lampsilis siliquoidea*) in water exposures." Environmental Toxicology and Chemistry. Volume 37, Issue 12. June 2018. (Wang 2018b)[2]

On March 14, 2019, Proponent filed an amended proposal (Prop.2). Proponent's amended proposal included a new Technical Support Document (TSD2). TSD2 includes an updated Table 1. Instead of including data from studies conducted at 10°C in TSD2, Table 1, as was previously done, Mr. Huff included new data from Gillis 2011 and Wang 2018b, as well as other data from the following recent tests conducted at temperatures at or near 25°C:

New England Bioassay, "Acute & Chronic Toxicity Testing at 10°C and 25°C Using *Ceriodaphnia dubia*." November 13, 2017. (New England Bioassay 2017) May 29, 2018 Mot.

Soucek, DJ. Progress Update 12/04/17: Fingernail clams, Mayflies, and Amphipods. Illinois Natural History Survey. (Illinois Natural History Survey 2017) Prop.1 at 214-217.

Jackson JK, Funk DH. 2019. Temperature affects acute mayfly responses to elevated salinity: implications for toxicity of road de-icing salts. Phil. Trans. R. Soc. B 374: 20180081. (Jackson and Funk 2019) PFT Klocek.

Soucek, DJ, A Dickinson. "Full-Life Chronic Toxicity of Sodium Salts to the Mayfly *Neocloeon triangulifer* in Tests with Laboratory Cultured Food" Illinois Natural History Survey, Campaign, Illinois. Environmental Toxicology and Chemistry, Vol. 34, No. 9, pp. 2126-2137. (Illinois Natural History Survey 2015) Prop.2, Att. 1.

Soucek, DJ, DR Mount, A Dickinson, JR Hockett. (2017) "Influence of Dilution Water Ionic Composition on Acute Major Ion Toxicity to the Mayfly *Neocloeon triangulifer*". Illinois Natural History Survey, Champaign, Illinois. Environmental Toxicology and Chemistry, Vol. 37, No. 5, pp. 1330-1339, 2018. (Soucek, Mount, Dickinson, Hockett 2018) Prop.2, Att. 1.

Elphick, JRF, KD Bergh, and HC Baile (2011) "Chronic Toxicity of Chloride to Freshwater Species: Effects of Hardness and Implications for Water Quality

[2] The full report from Wang 2018b was included in the prefiled testimony of Laura Barghusen. TSD.2, Att. 1 includes only the abstract from Wang 2018b on Acute Toxicity along with a separate report on Chronic Toxicity: Wang, N, JL Kunz, RA Dorman, CG Ingersoll, JA Steevens, EJ Hammer, and CR Bauer. "Evaluating Chronic Toxicity of Sodium Chloride or Potassium Chloride to a Unionid Mussel *(Lampsilis Siliquoidea*) in Water Exposures Using Standard and Refined Toxicity Testing Methods." Environmental Toxicology and Chemistry. Volume 37, Issue 12. August 21, 2018.

Guidelines." Nautilus Environmental and Rescan Environmental Services. Environmental Toxicology and Chemistry, Vol. 30, No. 1, pp. 239-246. (Elphick et al, 2011) Prop.2, Att. 1.

Mount, DR, RJ Erickson, RL Highland, JR Hockett, DJ Hoff, CR Jenson, TJ Norbert-King, KN Peterson, ZM Polaske, S Wisniewski. (2016). "The Acute Toxicity of Major Ion Salts to *Ceriodaphnia dubia*: I. Influence of Background Water Chemistry." USEPA, Duluth, Minnesota; EMR, Duluth, Minnesota. Environmental Toxicology and Chemistry, Vol. 35, No. 12, pp. 3039-3057. (Mount et al. 2016) Prop.2, Att. 1.

a. Another source in TSD2, Table 1 is cited as "CCME 2011", however, the document is not included in the amended proposal. Where CCME 2011 is cited, TSD2, Table 1 appears to include only the values from Environ 2009. Citations in the literature provided in TSD2, Att. 1 reference CCME 2011 as one of the documents below. Please comment on the reference to CCME 2011 and the values from CCME 2011 that were used in TSD2, Table 1.

> Canadian Council of Ministers of Environment (CCME). 2011 Canadian water quality guidelines for the protection of aquatic life: chloride. Gatineau,
> Canada: Environment Canada.
>
> Canadian Council of Ministers of the Environment (CCME) 2011. Canadian Water Quality Guidelines: Chloride Ion. Scientific Criteria Document. Winnipeg, Canada.

b. Ms. Barghusen testified that 24-hour EC50 acute values for *Lampsilis silioquoidea* glochidia were reported by Wang 2018b as low as 441 mg/L Cl at 50 mg/L hardness. For *Lampsilis silioquoidea* juveniles, 24-hour EC50 values were reported as low as 911 mg/L Cl at 43 mg/L hardness. Mr. Barghusen noted that Wang 2018b asserted that inclusion of this data in the Stephan 2009a[3],c toxicity database would likely lower result of the USEPA 1988 chloride water quality criteria and the Iowa chloride water quality standard. PFT Barghusen at 4 (*citing* to Wang 2018b at 7-8).

Data for acute values were reported in Gillis 2011 and Wang 2018b in terms of 24-hour or 96-hour EC50 values at various hardness and sulfate levels. In comparison, data for acute values were reported in Stephan 2009c generally in terms of 96-hour LC50 or EC50 values and were normalized to a single hardness level and sulfate level.

[3] Stephan, C.E. 2009a. "Calculation of Aquatic Life Criteria for Chloride", U.S. Environmental Protection Agency, Duluth, MN. 09FebChlorideCriteria.wpd. DRAFT 2-10-09.

Stephan 2009d[4] summarizes USEPA 1985 Guidelines on why some results of toxicity tests should not be used in the derivation of water quality criteria. Under guidance specifically regarding results of acute tests, the summary states, "[O]nly the following kinds of data on acute toxicity to aquatic animals should be used: . . . 2. The result of a test with embryos and larvae of barnacles, bivalve molluscs (clams, mussels, oysters, and scallops), sea urchins, lobsters, crabs, shrimp, and abalones should be the 96-hr EC50 based on the percentage of organisms with incompletely developed shells plus the percent of organisms killed." Stephan 2009d at 2. Dr. Soucek added, "US EPA and the ASTM recommend 48 to 96-hour tests for acute tests depending on the species. In most cases, with a notable exception of *Ceriodaphnia dubia* and other daphnids, 96-hour tests are used." Tr. at 17.

i. TSD2, Table 1 adds the acute toxicity data for the mussel *Lampsilis fasciola* from Gillis 2011 (Table 2) and Wang 2018b (Table 2), which are reported for 24-hour EC50 instead of 96-hour EC50. Is it your opinion that this data meets the USEPA 1985 Guidelines for bivalve molluscs for inclusion in the derivation of a water quality standard? If so, please explain your rationale.

ii. Is it your opinion that the other new acute toxicity data added to TSD2, Table 1 meet the USEPA 1985 Guidelines for inclusion in the derivation of a water quality standard? If so, please explain your rationale.

c. TSD2, Table 1 lists hardness and sulfate concentrations for the various studies referenced.

i. TSD2, Table 1 does not include the sulfate concentrations from Environ 2009 for Bannerfin shiner (68.5 mg/L), Bullfrog (73 mg/L), and Leech (71). However, the normalized acute values for these species in TSD2, Table 1 reflect the sulfate concentrations as reported for Environ 2009 in Stephan 2009a. Should these sulfate values be included in TSD2, Table 1?

ii. The tests in NEB 2017 and Elphick et al. 2011 appear to have been conducted at a different sulfate concentration than listed in TSD2, Table 1. TSD2, Table 1 lists NEB 2017 and Elphick et al. 2011 with a sulfate value of 58.5 mg/L, which is the sulfate concentration in "Duluth 100" test water. *See* Tr. at 23-24. However, NEB 2017 and Elphick et al. 2011 cite to a USEPA method for preparing standard, synthetic, moderately hard freshwater for testing, which provides 81.4 mg/L sulfate. NEB 2017 at 5 of 159; Elphick et al. 2011 at 240 (*citing to* USEPA, 2002); *see* Methods for Measuring the Acute Toxicity of Effluents and Receiving Waters to Freshwater and Marine Organisms 33 Table 7, 5th ed. EPA-821-R-02-012

[4] Stephan, C.E. 2009d. "Description of the Review of Results of Toxicity Tests on Chloride." U.S. Environmental Protection Agency, Duluth, MN,09JanChlorideRev.wpd. DRAFT 1-15-09.

(Oct. 2002)[5]. NEB 2017 also appears to use a hardness of 84 mg/L instead of 90 mg/L as listed in TSD2, Table 1. Should the hardness and sulfate values for NEB 2017 and Elphick et al. 2011 in TSD2, Table 1 be revised?

5. TSD2, Table 1 appears to have some other inadvertent discrepancies with Stephan 2009c and data added from the new literature as listed below.

Report	**°C**	**Hardness (mg/L as CaCO3)**	**Sulfate (mg/L)**	**Reported EC50 (mg/L)**	**Acute Value Normalized to Hardness 300 mg/L, Sulfate 65 mg/L (mg/L)**
Anguilla rostrata (Hinton and Eversole 1978, 1979)	22	42.4	40.7	11,880 (a)	17,343.4 (a)
Onchorhynchus mykiss (Spehar 1986, 1987)	12	46	3.9	6743 (b)	8786.8 (a)
Lampsilis fasciola (2008) – Glochidia (Gillis 2011)		95	58.5	113 (e)	142.1 (e,f)
Lampsilis fasciola (2009) – Glochidia (Gillis 2011)		95	58.5	285 (e)	358.3 (e,f)
Lampsilis siliquoidea - Juvenile (Wang 2007) (g)		169.5	162.7	1905	2294.1
Lampsilis siliquoidea - Juvenile (Bringolf et al, 2007) (g)		169.5	162.7	2766	3331
Lampsilis siliquoidea – Glochidia (Wang 2018b, Table 3) (d)	20	43	13	911	1205.18
	20	109	29	1733	2009.86
	20	193	42	2075	2199.42
	20	265	49	3092	3105.86
Ceriodaphnia dubia (NEB 2017)	25	84 (h)	81.4 (h)	1165 (c) (1920 mg NaCl/L	1539.5 (c)
Procloeon fragile – Larvae (Jackson & Funk 2018)	25	97	17.3	465 (c) (766 mg NaCl/L)	531 (c)
Neocloeon triangulifer (Soucek, Mount, Dickinson, Hockett 2017)	25	30	58.5	490 (i)	781 (i)
	25	141	58.5	1128 (i)	1307 (i)
Neocloeon triangulifer (Jackson & Funk 2018) (h)	25	97	17.3	221 (c,h) (364 mg NaCL/L)	252 (c,h)
	20	97	17.3	1671 (b,c,h) (2755 mg NaCl/L)	1910 (b,c,h)

[5] *Available at* https://www.epa.gov/sites/production/files/2015-08/documents/acute-freshwater-and-marine-wet-manual_2002.pdf (last visited Apr. 4, 2019).

Please comment on the following discrepancies:

a TSD2, Table 1, Footnote "a" indicates value is adjusted for temperature to 25°C using the following equation: [AV + (25-T)*48]*[(300/Hardness) $^{0.205797}$]*[(65/Sulfate) $^{-0.07452}$]. However, the Acute Value the Normalized Acute Value shown don't appear to follow the temperature adjustment in the equation in Footnote "a".

b Value not yet adjusted for temperature based on equation in Footnote "a".

c Converted from value reported as NaCl based on the ratio of atomic mass of Na to Cl [35.453/(35.453+22.990) = 0.60662]. PFT Klocek at 3.

d Value from report appears to be missing from TSD2, Table 1 and has not been adjusted for temperature.

e Results are for 24-hour EC50.

f Value in TSD2, Table 1 doesn't appear to be consistent with normalizing method in Stephan 2009c.

g Authors of the studies were interchanged in TSD2, Table 1.

h Value in TSD2, Table 1 doesn't seem to agree with values in report as shown.

i Value from report appears to be missing from TSD2, Table 1.

6. Depending on your answers to 4(a) - (c) and 5(a) – (i), please comment on revising TSD2, Table 1 accordingly.

Derivation of an Equation Variable for Temperature

7. The amended proposal explores a linear relationship between temperature and chloride toxicity, and derives a variable for temperature to be used in the proposed equation for the acute and chronic water quality standards. Based on INHS 2017 and NEB 2017, the change in acute toxicity in terms of mg/L chloride per degree Celsius is listed for each species tested: *Ceriodaphnia dubia* (-68.8), *Spaherium similie* (-83.1), *Neocloeon triangulifer* (-31.2), and *Hyallea azteca* (-30.1). The change is represented by a slope that is calculated as the result of LD50 at 10°C minus the LD50 at 25°C divided by the change in temperature of 15°C. Combining data from INHS 2017 and NEB 2017 with data from Jackson and Funk 2019, a second list is presented with slopes from each of the tests. For the Jackson and Funk 2019 tests, slopes are listed as: *Neocleon traingulifer* (-305.2), *Procloeon fragile* (-237.4), *Leptophlebia cupida* (-243.7), and *Maccaffertium modestum* (-201.1) mg/L chloride per degree Celsius. Prop.2, TSD2 at 4.

   Jackson and Funk 2019 lists the slopes differently than the values that appear in TSD2, Table 2: *Neocleon traingulifer* (-503.7), *Procloeon fragile* (-391.8), *Leptophlebia cupida* (-402.2), and *Maccaffertium modestum* (-331.9) mg/L chloride per degree Celsius. Jackson and Funk 2018 Figure 4 and Table 3 at 6. Please comment on why the slopes in the TSD are different than the slopes in Jackson and Funk 2019.

8. In addition to multi-temperature toxicity tests from INHS 2017, NEB 2017, and Jackson and Funk 2019, TSD2, Table 1 notes toxicity tests for Rainbow Trout (Oncorhynchus

mykiss) were also run for both cool and warm temperatures by Spehar 1986, 1987 at 12°C and by Elphick et a. 2011 at 25°C. Prop.2, TSD2, Table 1.

a. Please comment on including data for the Rainbow Trout at 12°C and 25°C in the derivation of a temperature variable to represent vertebrates.

b. Please comment on whether the data for the Rainbow Trout at 12°C and 25°C would be useful for addressing the requirement under 35 Ill. Adm. Code 302.618(b) derive a slope for at least one fish.

9. TSD2 explains that the slopes for each species used to represent the change in toxicity with temperature were normalized based on the LC50 results. TSD2 at 4. As such, Mr. Huff quantified a change in chloride toxicity of 4.5% per degree Celsius decrease in temperature that would be applicable to all species. This new temperature variable was included in the equation as a term that would be multiplied by the Final Acute Value (also Criterion Maximum Concentration, CMC) and the Criterion Continuous Concentration (CCC) in the form: $[1 + (0.045)(25°C – T)]$. Prop.2, TSD2 at 4.

a. Please provide the detailed calculations that were used in normalizing the change in toxicity based on the LC50 results and in arriving at the value of 4.5%.

b. Please explain how you arrived at the multiplier $[1 + (0.045)(25°C – T)]$.

c. Please also comment on using the multiplier $[1 + (0.045)(25°C – T)]$ rather than a slope consistent with the way slopes are used for the hardness and sulfate components of the equation derived by Stephan 2009f.[6]

10. Jackson and Funk 2019 uses linear regression to describe the relationship between temperature and acute chloride toxicity as a slope for each species. Jackson and Funk 2019, Figure 4 and Table 3 at 6.

The Board's rules contain specific procedures on deriving acute aquatic toxicity criterion dependent on water chemistry. *See* 35 Ill. Adm. Code 302.618 (Determining the Acute Aquatic Toxicity Criterion – Toxicity Dependent on Water Chemistry). Section 302.618 provides procedures for calculating criterion if data are available to show that a relationship exists between a water quality characteristic and acute toxicity to two or more species. Such water quality characteristics include temperature, hardness, and pH. The Board's rules provide, "[t]he procedures of [35 Ill. Adm. Code 302.618] must be used if the toxicity of a substance is dependent upon some other water quality characteristic." 35 Ill. Adm. Code 302.612(b). The procedures may require a transformation of the "variables to obtain a least squares linear regression of the transformed acute toxicity values on the transformed values of the water quality characteristic." 35 Ill. Adm. Code 302.618.

[6] Stephan, C.E. 2009f. "Multiple Regression Equation for Chloride." U.S. Environmental Protection Agency, Duluth, MN. 09JanChlorideEq.wpd. DRAFT 1-15-09.

Please comment on using the procedures in 35 Ill. Adm. Code 302.618 or Jackson and Funk 2019 to derive either a multiplier or a slope to express the temperature parameter in the equations for the proposed acute and chronic water quality standards.

11. TSD2, Table 1 contains a footnote indicating: "SMAV was recalculated for the temperature adjustment to 25°C, using the following equation:

> $[AV + (25-T)*48]*[(300/Hardness)^{0.205797}]*[(65/Sulfate)^{-0.07452}]$."
>
> Prop.2, TSD2, Table 1 at 4.

This equation was used to adjust the toxicity for tests that were conducted at temperatures other than 25°C. This temperature parameter in the equation is different than the one in the equation derived for the proposed water quality standards:

> Acute Chloride Standard = $[1 + (0.045 \times (25°C – T))] \times$ (Normalized Final Acute Value) $\times (300/Hardness)^{0.205797} \times (65/Sulfate)^{-0.07452}$
> Prop.2 at 6.

Please explain why. Please show the calculations behind the temperature adjustment for *Anguilla rostrat*a and *Onchorhynchus mykiss*. Please comment on alternatively applying the same temperature parameter from the equation derived for the water quality standard to the adjustment of acute values in TSD2, Table 1.

12. Equations derived for proposed Acute and Chronic Water Quality Standards are shown in the TSD2 and proposed rule language, although they are slightly different. *See* Prop.2, Statement of Reasons at 5; Prop.2, TSD2 at 4. The equations use the normalized acute and chronic values of 518 mg/L and 300 mg/L instead of simply the acute and chronic values dependent on hardness and sulfate. As such, the equations require division by the hardness and sulfate concentrations of 300mg/L and 65 mg/L as well as multiplication by the site-specific hardness and sulfate concentrations.

Stephan 2009a simplifies the equation that uses the normalized data to an equation that is simply dependent on hardness and sulfate as follows:

$$\begin{aligned} CMC &= (682.0 \text{ mg chloride/L}) \times (Hardness/300)^{0.205797} \times (Sulfate/65)^{-0.07452} \\ &= (287.8 \text{ mg chloride/L}) \times (Hardness)^{0.205797} \times (Sulfate)^{-0.07452} \end{aligned}$$

Please comment on proposing equations that do not need to be adjusted for the normalized data and are simply dependent on hardness and sulfate in addition to any temperature parameter.

Table 2: Ranked GMAV in mg Cl/L; Calculation of Final Acute Value (FAV) and Criterion Maximum Concentration (CMC)

13. Based on your revisions to TSD2, Table 1, if any, please comment on updating the calculations performed in TSD2, Table 2 for the Final Acute Value (FAV) and Criterion Maximum Concentration.

Table 4: Ranked Predicted Genus Mean Chronic Values (pGMCV) in mg Cl/L; Calculation of Final Acute Chronic Ratio (FACR) and Final Chronic Value (FCV), or Criterion Continuous Concentration (CCC).

14. Based on your revisions to TSD2, Table 1, if any, please comment on updating the calculations performed in TSD2, Table 4 for the Final Acute Chronic Ratio (FACR) and Final Chronic Value (FCV), or Criterion Continuous Concentrations (CCC).

Table 3: Calculation of Acute Water Quality Standard for Chloride at Varying Water Temperature, Hardness, and Sulfate
and
Table 5: Calculation of Chronic Water Quality Standard for Chloride at Varying Water Temperature, Hardness, and Sulfate

15. Please comment on recalculating the Acute and Chronic Water Quality Standards at varying temperature, hardness, and sulfate in TSD2, Table 3 and Table 5 based on the recalculation of the terms in the equations discussed above.

16. Please comment on including a revised TSD2, Table 3 and Table 5 in the proposed rule language as a lookup table of acute and chronic values like Indiana's. *See* 327 Indiana Administrative Code 2-1-6.

Communication with USEPA

17. **Standards Development:** At hearing, the Board asked if Mr. Huff tried contacting Charles E. Stephan, author of USEPA's chloride nation criteria document (1988) and updates (Stephan 2009). Mr. Huff replied that Dr. Stephan retired, and he did not try to contact anyone else in his lab at USEPA in Duluth, Minnesota about exploring the temperature variable in chloride toxicity testing. Tr. at 27. Some of the recent studies included in the amended proposal list authors who are also from USEPA's Environmental Effects Research Laboratory in Duluth, Minnesota.

    Have you attempted to communicate with someone at the USEPA lab in Duluth, Minnesota to obtain feedback on testing the temperature variable in chloride toxicity since the January 23, 2019 hearing? If so, please comment on whether you discussed:

    a. What it would take to identify any gaps in the current research;

b. If they are aware of any new or ongoing research results that should be considered in the proposal;

c. Whether they have recommendations for what to use to support the derivation of a chloride water quality standard dependent on temperature, hardness and sulfate; and

d. Whether they provided any preliminary comments on whether the proposed rulemaking has the necessary elements to be approvable by USEPA for Clean Water Act purposes or if something else is needed? *See* 33 USC 1313, 40 CFR 131.21.

18. **USEPA Standards Approval Process:** The proposal states that under the Clean Water Act, States are responsible for setting water quality standards for interstate waters and submitting revisions to those standards to USEPA for approval. 33 USC 1313. Prop. at 8. Under 40 CFR 131.21, USEPA approves or disapproves of revisions to water quality standards, thereby determining which water quality standards are in effect for Clean Water Act purposes. USEPA has 60 days for approval or 90 days for disapproval. When USEPA disapproves of a water quality standard revision, USEPA provides an explanation of why the State standard is not in compliance with the Clean Water Act. *See* 40 CFR 131.21.

In a recent rulemaking, the petitioner worked with both IEPA and USEPA throughout the rulemaking process to develop a site-specific water quality standard for nickel. *See* In the Matter of: Proposed Site-Specific Rule for Sanitary District of Decatur from 35 Ill. Adm. Code 302.208(e), R14-24 (November 15, 2018). The Sanitary District of Decatur worked with IEPA and USEPA on the test methods and the proposed language of the rule. The Board adopted the site-specific rule on November 15, 2018. IEPA submitted the rule package with the Illinois Attorney General's Office Certification to USEPA. IEPA and the Sanitary District of Decatur are currently waiting on USEPA's approval or disapproval, which is expected by April 22, 2019 if approved and by May 22, 2019 if disapproved. *See* Sanitary District of Decatur v. IEPA, PCB 14-111, Status Report (February 22, 2019).

a. Have you shared your revised proposal with USEPA's Region 5, Water Division, Water Quality Branch, Standards Section for review and a preliminary indication of the proposal's approvability and compliance with the Clean Water Act?

b. If so, please comment on any response you received from USEPA?