WATER QUALITY STANDARDS QUARTERLY MEETING

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LAURA COOPER

ASSISTANT DIRECTOR DWWM, WATER QUALITY STANDARDS

LAURA.K.COOPER@WV.GOV

west virginia department of environmental protection

AGENDA

- **Introductions – WQS Staff & Attendees**
- **Legislative Session in Review**
- **Harmonic Mean Discussion**
- **Other Water Quality Standards Topics**

WATER QUALITY STANDARDS UPDATE

Since last meeting in November 2016

- **DEP developed and shared**
  "**WV DEP Selenium Chronic Aquatic Life Criteria Implementation**"
- **Still no approval or disapproval from EPA on**
  - **WV DEP Special Reclamation variances for Muddy Creek and Sandy Creek**
  - **Aluminum aquatic life criterion**

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WATER QUALITY STANDARDS 2017 WV LEGISLATURE

- **DEP withdrew its proposed WQS rule revisions on December 1st**
- **Bills were introduced affecting WQS in Legislative session**
  - **HB 2506, amended §22-11-7b, passed March 28, signed by Governor on April 8**
  - **SB 687, amended §22-11-7b, passed April 8, signed by Governor April 26**

WHAT HOUSE BILL 2506 SAID

HB 2506, Committee Substitute , from subsection (c)

For implementing human health criteria for the protection of drinking water, the Secretary shall calculate permit limits using the harmonic mean flow and may determine the point of compliance for a permittee's discharge pursuant to the mixing zone provisions of the Legislative rule entitled Requirements Governing Water Quality Standards, 47 C.S.R. 2: *Provided*, That the Secretary may allow mixing zones to overlap, but not to go beyond a point one-half mile upstream of a public water supply.

2506 did not make any changes to Subsection (f)

WHAT SENATE BILL 687 SAID

SB 687, originated in Committee, subsection (f)

(f) The secretary shall propose rules measuring compliance with the ~~biologic~~ aquatic life component of West Virginia's narrative water quality standard requires evaluation of the holistic health of the aquatic ecosystem and a determination that the stream: ~~(i) Supports a balanced aquatic community that is diverse in species composition; (ii)~~ (i) contains appropriate trophic levels of fish, in streams that have flows sufficient to support fish populations; and ~~(iii)~~ (ii) the aquatic community is composed of benthic invertebrate assemblages sufficient to perform the biological functions necessary to support fish communities within the assessed reach, or, if the

Likewise, 687 did not make any changes to Subsection (c)

WATER QUALITY STANDARDS RULE PLAN FOR 2017

- **DEP is not proposing to revise the Water Quality Standards rule in 2017**
- **WQS program will continue to have quarterly public meetings to discuss standards, and hear any information about desired revisions**
- **Will continue to review potential revisions and prepare for Triennial Review**

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WHAT *IS* HARMONIC MEAN FLOW?

Harmonic mean flow—The flow that is determined by taking the reciprocal of the arithmetic mean of reciprocals of daily flow values. *(from PA code, Chapter 96)*

Example, given flow values of 20 cfs, 23 cfs, 7 cfs, 17 cfs

Arithmetic mean: 20 + 23 + 7 + 17 = 67 / 4 = **16.75**

Harmonic mean: 1/20 + 1/23 + 1/7 + 1/17 = 0.07 1 / 0.07 = **13.55**

From Wikipedia: "Harmonic mean is appropriate for situations when the average of rates is desired."

Harmonic mean is one of the 3 Pythagorean means (arithmetic, geometric, and harmonic) – harmonic mean is always the least of these 3 means (geometric being in between, arithmetic always being greatest)

WHAT WATER QUALITY STANDARDS RULE SAYS

47 CSR 2 Section 8.2 – Criteria for Toxicants

8.2.a. Toxicants which are carcinogenic have human health criteria (Water Use Categories A and C) based upon an estimated risk level of one additional cancer case per one million persons (10^{-6}) and are indicated in Appendix E, Table 1 with an endnote ([b]).

8.2.b. For waters other than the Ohio River between river mile points 68.0 and 70.0, a final determination on the critical design flow for carcinogens is not made in this rule, in order to permit further review and study of that issue. Following the conclusion of such review and study, the Legislature may again take up the authorization of this rule for purposes of addressing the critical design flow for carcinogens: Provided, That until such time as the review and study of the issue is concluded or until such time as the Legislature may again take up the authorization of this rule, the regulatory requirements for determining effluent limits for carcinogens shall remain as they were on the date this rule was proposed.

Language in 8.2.b has been in place since 1993, other than reference to Ohio River added in 2011

8.2.b.1. For the Ohio River between river mile points 68.0 and 70.0 the critical design flow for determining effluent limits for carcinogens shall be harmonic mean flow.

WHAT WV WATER POLLUTION CONTROL ACT SAYS

§22-11-7b

Water Quality Standards; implementation of antidegradation procedures; procedure to determine compliance with the biologic component of the narrative water quality standard

Subsection (c) In order to carry out the purposes of this chapter, the secretary shall promulgate legislative rules in accordance with the provisions of article three, chapter twenty-nine-a of this code setting standards of water quality applicable to both the surface waters and groundwaters of this state. Standards of quality with respect to surface waters shall protect the public health and welfare, wildlife, fish and aquatic life and the present and prospective future uses of the water for domestic, agricultural, industrial, recreational, scenic and other legitimate beneficial uses thereof. The water quality standards of the secretary may not specify the design of equipment, type of construction or particular method which a person shall use to reduce the discharge of a pollutant.

This language has been in place since: perhaps forever?

HOW DO OTHER STATES DETERMINE CRITICAL LOW FLOW FOR PERMIT LIMITS ?

(in fresh water, as opposed to salt water)

Kentucky

Harmonic mean for cancer-linked substances, for domestic water supply protection at point of withdrawal

7Q10 for noncancer
7Q10 for aquatic life
7Q10 for water-based recreation
Harmonic Mean for fish consumption
7Q10 for aesthetics

401 KAR 10:031

Virginia

Harmonic mean for carcinogens

30Q5 for noncarcinogens
1Q10 for acute aquatic
7Q10 for chronic aquatic
30Q10 for chronic ammonia

9VAC25-260-140

Maryland

Mean annual flow value for human health toxicants

Design stream flow for acute
30Q5 for chronic

MD Code 26.08.02.05.E

Pennsylvania

Harmonic mean for carcinogens
(for nonthreshold effect human health)

7Q10 for threshold effect human health
7Q10 aquatic life
30Q10 ammonia-nitrogen

PA Code 25-96

Ohio

Harmonic mean ("HMQ") for carcinogens and non-carcinogens

1Q10 for acute aquatic
7Q10 for chronic aquatic

OAC Ch 3745-2-05

ORSANCO (Ohio River)

Harmonic mean for carcinogens

7Q10 for noncarcinogens

ORSANCO WQS Ch 5.2

WHAT EPA HAS SAID REGARDING THE USE OF HARMONIC MEAN

In 1991: Technical Support Document for Water Quality-based Toxics Control (pg 88)

For Carcinogens

The long-term harmonic mean flow is recommended as the design flow for carcinogens. The recommendation of long-term harmonic mean flow has been derived from the definition of the human health criteria (HHC) for carcinogenic pollutants. The adverse impact of carcinogenic pollutants is estimated in terms of receptors (human) lifetime intakes. To be within the acceptable level of life-time body-burden of any carcinogen, such intakes should not exceed the HHC during the average life-time of the receptor. A life-time for exposure to carcinogenic pollutants is defined as 70 years, or approximately 365 (days/year) multiplied by 70 years.

The harmonic mean is always less than the arithmetic mean. The harmonic mean is the appropriate design flow for determining long-term exposures using steady-state modeling of effluents. The arithmetic mean flow is not appropriate as the design flow since it overstates the dilution available. Extreme value statistics (such as 7Q10 or 30Q5) are also not appropriate since they have no consistent relationship with the long-term mean dilution. However, for situations involving seasonably variable effluent discharge rates, hold-and-release treatment systems, and effluent-dominated sites, the harmonic mean may not be appropriate. In these cases, the effluent load and downstream flow are not independent (i.e., they are correlated). Modeling techniques that can calculate an average daily concentration over a long period of time are more appropriate to determine the long-term exposure in these cases.

WHAT EPA HAS SAID REGARDING THE USE OF HARMONIC MEAN

In 1991, Technical Support Document for Water Quality-based Toxics Control (pg 89)

For Noncarcinogens

The choice of average period represents a level-of-protection consideration inherent in the risk management decision to be made by the permitting agency. If a short-term duration of exposure is chosen (i.e., 90 days or less), design flows may be appropriately based on extreme value statistics. Because the effects from noncarcinogens are more often associated with shortened exposures, EPA suggests the use of 30Q5. However, in the comparisons of flows for smaller rivers (i.e., low flow of 50 cfs), the 30Q5 flow was, on the average, only 1.1 times that of the 7Q10. For larger rivers (i.e., low flow of 600 cfs), the factor was, on the average, 1.4 times. **If the effects from certain noncarcinogens are manifested after a lifetime of exposure, then a harmonic mean flow may be appropriate.**

WHAT EPA HAS SAID REGARDING THE USE OF HARMONIC MEAN

In 2014, EPA Water Quality Standards Handbook, Chapter 5 (pg 13)

Table 5.1: EPA-recommended Critical Low Flows for Aquatic Life and Human Health Criteria

Criteria	Hydrologically Based Flow	Biologically Based Flow
Acute Aquatic Life	1Q10	1B3
Chronic Aquatic Life	7Q10	4B3
Human Health	Harmonic mean	

The EPA recommends the harmonic mean flow for implementing human health criteria. The concept of a harmonic mean is a standard statistical data analysis technique. The EPA's model for human health effects assumes that such effects occur because of a long-term exposure to low concentrations of a toxic pollutant (e.g., two liters of water per day for seventy years). The harmonic mean flow allows for estimating the concentration of toxic pollutant contained in those two liters of water per day when the daily variation in the flow rate is high. Therefore, the EPA recommends use of the harmonic mean flow in computing critical low flows for human health criteria rather than using other averaging techniques.

WHAT EPA HAS SAID REGARDING THE USE OF HARMONIC MEAN

In August, 2016: EPA's Comments on WQS rule proposed changes (8/9/16 letter to WVDEP)

West Virginia is proposing to redefine critical design flow for human health criteria by using harmonic mean flow for carcinogens, and 30Q5 flow for noncarcinogens. In the preamble to the Federal Register notice announcing the availability of EPA's 2000 Methodology for Deriving Ambient Water Quality Criteria for the Protection of Human Health, EPA recommends the harmonic mean flow as the design flow to be used to implement both carcinogen and noncarcinogen human health criteria. 65 FR 66450. Harmonic mean flow should be used to implement human health criteria because, by and large, human health criteria are designed to protect an individual over a lifetime of exposure. By this recommendation, EPA is attempting to match the longest stream flow averaging period (using harmonic mean) with the criterion which is protective over a human lifetime. EPA recommends that WVDEP modify this revision to reflect harmonic mean flow as the critical design flow for both carcinogens and noncarcinogens. However, West Virginia has the prerogative to retain flows that will result in a more stringent application of the State's human health criteria.

DISCUSSION

What comments and questions do you have regarding Harmonic Mean?

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OTHER WATER QUALITY STANDARDS TOPICS

What water quality standards would you like to present on and/or discuss?

Next WQS Quarterly Meeting

Should be in September, maybe September 19th

Will be somewhere other than Charleston, maybe Morgantown?

WQS is going on the road!

Reach me at:

Laura Cooper

Office: 304-926-0499 x1110

Email: Laura.K.Cooper@wv.gov