Water Quality Policy 1-11 Updates

Human Health Criteria

February 2017

Outline of Issues covered:

I. Background

The surface water quality standards include a section on toxic substances (WAC 173-201A-240) for the protection of designated uses. Numeric criteria have been developed for the designated uses of aquatic life and the protection of human health. Uses associated with human health are fish and shellfish harvesting (consumption of fish) and domestic water supply (drinking water). Human health-based water quality criteria used by the state prior to December 2016 were contained in the National Toxics Rule. Currently approved human health criteria (HHC) for Washington are a combination of state-adopted criteria and EPA promulgated criteria.

In previous Water Quality Assessments, toxics data from fish tissue was used to assess for the protection of human health, deriving a Fish Tissue Equivalent Concentration (FTEC) as a means to back-calculate fish tissue pollutant concentrations to approximate surface water pollutant concentrations. This was done by applying bioconcentration factors (BCF) that were used to derive the HHC in the National Toxics Rule. The intent of the FTEC used for the past several years was to represent a water column criteria equivalent.

On December 14, 2016, Ecology held a public dialogue session on human health criteria. There was general support by attendees for the continued use of fish tissue data to determine human health protection in a waterbody. In addition, there was strong support for using a multiple

lines of evidence (MLE) concept that Ecology introduced, expanding beyond fish tissue. Ecology proposed to expand the approach of just using FTECs to also consider MLEs associated with direct comparison to the criteria as well as assessment of the designated uses associated with the HHC: harvesting (consumption of fish) and domestic water supply (drinking).

Attendees expressed support for MLE but also emphasized the need to have this done in a methodical fashion so that it would be reproducible. One suggestion made at the end of the session was to update FTEC values for the new human health criteria and then use multipliers to determine categories of clean, a water of concern, or impairment, with MLE information used where appropriate to help with determinations.

Using this suggestion as a starting place, Ecology agreed to offer further agency perspectives on the use of tissue and water sample data, and to research ideas for multiple lines of evidence.

II. Factors to consider for the use of tissue samples

In August 2016 Ecology adopted new human health criteria into the surface water quality standards based in part on bioconcentration factors (BCFs) and a relative source contribution (RSC) = 1 for non-carcinogens. EPA subsequently partially disapproved Washington's criteria, and promulgated a final rule for Washington in November 2016 that includes criteria that are based on a combination of BCFs and bioaccumulation factors (BAFs), as well as varying RSCs for non-carcinogens. This situation resulted in the current Clean Water Act-approved criteria list having a mixture of different input assumptions. Because (1) there does not appear to be consistency in EPA's decisions to approve Washington's new criteria based on either BCFs or BAFs, and (2) both BAFs and BCFs differ among waterbodies, Ecology is rethinking how it might use an FTEC, or whether the FTEC is appropriate to use, as currently derived, for assessment and 303(d) listing purposes.

Ecology notes that because the new HHC for methylmercury are already expressed as tissue, we will deal with methylmercury separately from the other chemicals that are based on numeric levels in the water column.

Tissue sample representativeness

Ecology recommends the fish tissue sample characteristics below for use in the process of comparing results to the fish exposure pathway. These recommendations conform to, or are very similar to, guidance from EPA (https://www.epa.gov/fish-tech/epa-guidance-developing-fish-advisories). WDOH also uses these sample characteristics in assessing risk and developing Fish Consumption Advisories.

The use of composite samples is widely accepted and recognized as a cost-effective way to reduce sample variability and obtain adequate sample mass for laboratory analyses of target chemicals. The use of replicate samples allow calculation of a mean sample concentration and associated variability, which in turn allows for better estimates of the population mean.

Recommended characteristics:

- Minimum of 3 composite samples with each composite having a minimum of 3 individual fish (for a total of 9 fish).
- All fish in these composites must be of the same species and of a size considered large enough to be harvestable.
- The fish used in each composite should be of similar size (i.e. total length of smallest being no less than 75% the total length of the largest).
- Each composite can represent different size classes, or all can be the same size class (e.g. composite #1 could be small fish, #2 be medium fish, #3 be large fish).
- If single fish results are available, the single results from 3 or more fish may be arithmetically averaged to create a single "mean concentration" sample. The individual fish must meet the species and size characteristics above.

Species to represent segment/site fidelity

Policy 1-11 currently requires that all tissue samples used for the Assessment must be from resident fish. Fin fish fillet tissue samples, whole shellfish tissue samples, and edible shellfish muscle samples must have at least three single-fish samples or a single composite sample made up of at least three separate fish of the same species (the three fish with the three highest concentrations if more than three individual fish samples are available). Fin fish fillet tissue samples may be analyzed with skin on or skin off.

Ecology has not made any decisions on expanding the use of resident fish for tissue analyses, and is interested in feedback on migratory species, or species that do not represent water quality at the site of sampling. These species may not represent the waterbody at the time when they are harvested although we recognize that they nevertheless may have levels of toxins that may be a human health concern.

III. Factors to consider for the use of water samples

If water column data are used to directly compare with the HHC then the following issues will need to be considered:

- How sensitive are the chemical analytical methods used to measure pollutants in water samples?? Many of the HHC aren't measured at the criterion concentrations because the criteria concentrations are below detection and quantification limits.
- Data that are above detection limits and below quantification levels are in a gray area. These levels vary among labs. How should pollutant concentration data that are above detection limits and below quantification levels be considered in assessing ambient waters?
- If quantifiable data from one or very few grab samples from a limited span of time are available (probably the most common situation), how should these data be use in the assessment?

IV. Lines of evidence

The HHC are intended to protect humans from pollutants that can contaminate fish and shellfish tissue and surface waters. In other words, the HHC are designed to protect the uses associated with consuming fish from the waters (harvesting) and ingesting untreated surface water (drinking)). Lines of evidence that are directly related to the numeric HHC, and that could be used to assess both harvesting and drinking water uses include using the HHC equation as a basis for:

- Determining a Tissue Exposure Concentration (TEC)—explained below.
- Determining a Drinking Exposure Concentration (DEC)—explained below.
- Use of water column data to directly compare to HHC.

Ecology also considered other lines of evidence that are intended to assess the status of the designated uses individually, apart from the numeric HHC, in particular:

- Department of Health (DOH) Fish Advisories to protect harvesting use.
- Safe Drinking Water Act (SDWA) Maximum Contaminant Levels (MCL) to protect drinking water use.

Each of these are discussed briefly below and will be further discussed and explored at the February 9th public meeting/webinar.

Tissue exposure concentration (TEC)

Ecology is considering the viability of assessing the status of harvesting uses by using a simplified equation (derived from the equations used to develop the HHC) to determine the tissue concentrations of pollutants that would correspond to the criteria equations, but with a tissue-only exposure pathway (drinking water exposure removed). This would change the current practice of using an FTEC to represent a water column criteria to using a calculated tissue concentration to represent a tissue-only exposure level for fish consumption. For purposes of discussion, we could refer to this as use of a Tissue Exposure Concentration (TEC). Simply put, the TEC calculates the tissue level of concern based on the human health criteria. It would start with the HHC equation as the basis but eliminate the BCF, BAF, relative source contribution (RSC) and drinking water intake from the equation, which would then allow one to solve for exposure from fish consumption:

For non-carcinogens:
(Reference dose)(Body weight) ÷ Fish consumption rate = TEC

For carcinogens:
(Risk level)(Body weight) ÷ (Cancer slope factor)(Fish consumption rate) = TEC

The TECs could be compared with tissue data and used as lines of evidence to assess the status of the harvest use. When using the TEC with tissue data the issues described in Section II (Factors to be considered for the use of tissue samples) also would apply.

Drinking exposure concentration (DEC)

Ecology is considering the viability of assessing the status of the drinking water use associated with the HHC by using a simplified equation to determine the water concentrations of pollutants that would correspond to the criteria equations, but with a drinking water-only exposure pathway (tissue exposure removed). For purposes of discussion, we could refer to this as a Drinking Exposure Concentration (DEC). It would start with the HHC equation as the basis but eliminate the factors associated with fish and shellfish tissue, as well as other factors (such as RSC), which would then allow one to solve for exposure from drinking water:

For non-carcinogers:
(Reference dose)(Body weight) ÷ Drinking water rate = DEC

For carcinogens:
(Risk level)(Body weight) ÷ (Cancer slope factor)(Drinking water rate) = DEC

When using the DEC with water data the issues described in Section III (Factors to be considered for the use of water samples) also would apply.

Use of water column data

In previous Assessments, Ecology did not use water column data for a direct comparison of the HHC, but rather relied on the use of the FTEC for human health determinations for toxic criteria. However, Ecology is willing to reconsider the use of water column sampling data as a direct comparison to the numeric human health criteria to determine whether the criteria concentrations are being met. The direct application of the numeric criteria protects for both harvesting and drinking water uses that are associated with the full HHC equation. Issues described in Section III (Factors to be considered for the use of water samples) also would apply.

DOH Fish advisories to protect harvesting use

DOH Fish Advisories represent a direct relation to an impaired use of harvest. Therefore, waterbody segments with data associated with the Fish Advisory could be used in the Assessment process as a multiple line of evidence.

SDWA MCLs to Protect Drinking Water Use

SDWA MCLs represent a direct relation to protection of drinking water sources. Therefore, waterbody segments with data associated with the drinking water MCLs could be used in the Assessment process as a multiple line of evidence.

V. Weight of evidence

In some cases a decision on the proper category for a waterbody might not be clear-cut. For instance, there might be sample results for only two composite samples of fish tissue for a waterbody (not the three recommended above in order to get a representative average), but those samples might both be of a concentration exceeding the TEC, and a single water sample might also exceed the DEC by a large factor. In situations like this Ecology proposes using a "weight of evidence" approach to assess impairment that would include use of multiple lines of evidence.

An example of the weight of evidence approach is used by California's State Water Resources Control Board in its *Water Quality Control Policy For Developing California's Clean Water Act Section 303(d) List*:
(http://www.waterboards.ca.gov/board_decisions/adopted_orders/resolutions/2015/020315_8_amendment_clean_version.pdf)

The following excerpt from the California Policy (page 8) is included below:

"3.11 Situation-Specific Weight of Evidence Listing Factor"

When all other Listing Factors do not result in the listing of a water segment but information indicates non-attainment of standards, a water segment shall be evaluated to determine whether the weight of evidence demonstrates that a water quality standard is not attained. If the weight of evidence indicates non-attainment, the water segment shall be placed on the section 303(d) list.

When making a listing decision based on the situation-specific weight of evidence, the Regional Water Board must justify its recommendation by:

- *Providing any data or information including current conditions supporting the decision;*
- *Describing in fact sheets how the data or information affords a substantial basis in fact from which the decision can be reasonably inferred;*
- *Demonstrating that the weight of evidence of the data and information indicate that the water quality standard is not attained; and*
- *Demonstrating that the approach used is scientifically defensible and reproducible.*"

VI. Category determinations

Ecology has not yet come up with definitive category determinations for the various lines of evidence but is interested in feedback from participants.

For purposes of discussion, the following is an Oregon example of how toxics listings are determined for the Category 5/303(d) List:

- Two or more valid results[1] not meeting the most stringent applicable criterion for concentrations of a specific toxic substance in the water column.

Or

- A fish consumption advisory issued for a specific water body based on pollutants in fish tissue issued by the Oregon Department of Human Services. Fish advisories are posted at: http://www.oregon.gov/DHS/ph/envtox/fishadvisories.shtml),

[1] Oregon's Assessment Methodology describes what a valid result is, mainly having to do with whether the contaminant in the sample is below or above the method detection limit.