# Draft Guidance for Implementing the January 2001 Methylmercury Water Quality Criterion

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1200 Pennsylvania Ave., NW
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EPA-823-B-04-001
www.epa.gov/waterscience
August 2006

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The suggested citation for this document is:

USEPA. 2006. *Draft Guidance for Implementing the January 2001 Methylmercury Water Quality Criterion*. EPA 823-B-04-001. U.S. Environmental Protection Agency, Office of Water, Washington, DC.

# 3 Water Quality Criteria and Standards Adoption

## 3.1 What must states and authorized tribes include as they adopt the methylmercury criterion?

### *3.1.1 What do the CWA and EPA's regulations require?*

The CWA and EPA's regulations specify the requirements for adoption of water quality criteria. States and authorized tribes must adopt water quality criteria[3] that protect designated uses (see CWA section 303(c)(2)(A)). Water quality criteria must be based on a sound scientific rationale and must contain sufficient parameters or components to protect the designated uses (see 40 CFR 131.11). States and authorized tribes must adopt criteria for all toxic pollutants for which EPA has established AWQC where the discharge or presence of these pollutants could reasonably interfere with the designated uses (see CWA 303(c)(2)(B)). EPA issued guidance on how states and authorized tribes may comply with section 303(c)(2)(B), which is now contained in the *Water Quality Standards Handbook: Second Edition* (USEPA 1994). This document provides three options for compliance:

> Option 1—states and authorized tribes may adopt statewide or reservation-wide numeric chemical-specific criteria for all toxic pollutants[4] for which EPA has issued CWA section 304(a) criteria guidance.
>
> Option 2—states and authorized tribes may adopt numeric chemical-specific criteria for those stream segments where the state or tribe determines that the priority toxic pollutants for which EPA has issued CWA section 304(a) criteria guidance are present and can reasonably be expected to interfere with designated uses.
>
> Option 3—states or authorized tribes may adopt a chemical-specific translator procedure[5] that can be used to develop numeric criteria as needed.

To protect human health from contaminants in fish, EPA considers the 2001 methylmercury criterion a sound, scientifically based approach for meeting human health designated uses. Thus, EPA strongly encourages states and authorized tribes to adopt the 2001 methylmercury criterion or any sound, scientifically based approach into their water quality standards to fulfill the requirements of 40 CFR Part 131.

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[3] The term "water quality criteria" has two different definitions under the CWA. Under section 304(a), EPA publishes water quality criteria that consist of scientific information regarding concentrations of specific chemicals or levels of parameters in water that protect aquatic life and human health. The 2001 methylmercury criterion is an example of a section 304(a) criterion. States may use these criteria as the basis for developing water quality standards. Water quality criteria are also elements of state water quality standards adopted under CWA section 303(c).

[4] CWA section 307(a) identifies a list of toxic pollutants that EPA has published at 40 CFR 401.16.

[5] A translator procedure is simply the detailed process, published by a state or authorized tribe that explains how the state or authorized tribe will interpret its narrative criteria for toxics so that a quantifiable term can be used in assessment, permitting, and TMDL development. For example, a state or tribe could use EPA's water quality criteria as the means for interpreting its narrative criteria.

Water quality criteria generally consist of three components: magnitude, duration, and frequency (USEPA 1994). Water quality criteria for human health are typically expressed as an allowable magnitude. A criterion is calculated to protect against long-term chronic, human health effects. Thus, the duration of exposure assumed in deriving the criterion is a lifetime exposure even though the criterion is expressed as a magnitude of contaminant per day (USEPA 1991).

### 3.1.2 What is the recommended form of the methylmercury criterion?

EPA's current recommended 304(a) water quality criterion for methylmercury is expressed as a fish[6] tissue concentration value (0.3 milligram methylmercury per kilogram of wet-weight fish tissue, or 0.3 mg/kg). With the publication of this 304(a) criterion, EPA withdrew the previous ambient human health water quality criterion for mercury as the recommended section 304(a) water quality criterion for states and authorized tribes to use as guidance in adopting water quality standards (USEPA 2001b). States and authorized tribes that decide to use the recommended criterion as the basis for new or revised methylmercury water quality standards have the option of adopting the criterion as a fish tissue residue concentration into their water quality standards, or adopting it as a traditional water column concentration. However, if states and authorized tribes choose to use both approaches, they should clearly describe how each will be used for specific applications in their standards and describe applicable implementation procedures. States and authorized tribes remain free not to use EPA's current recommendations, provided that their new or revised water quality criteria for methylmercury protect the designated uses and are based on a scientifically defensible methodology. In doing this, states and authorized tribes should consider bioaccumulation, local or statewide fish consumption, and exposure to mercury from other sources (relative source contribution (RSC)). EPA will evaluate criteria submitted by states and authorized tribes on a case-by-case basis.

#### 3.1.2.1 Why is the fish tissue concentration criterion recommended?

EPA recommends that states and authorized tribes adopt new or revised methylmercury water quality criteria in the form of a fish tissue methylmercury concentration. The following reasons make this the preferred form:

- A fish tissue concentration value water quality criterion is closely tied to the "fishable" designated use goal applied to nearly all waterbodies in the United States.
- A fish tissue concentration value is expressed in the same form (fish tissue) that humans are exposed to methylmercury.
- A fish tissue concentration value is more consistent with how fish advisories are issued.

[6] The criterion applies to both finfish and shellfish. For purposes of simplifying language in this document, the term "fish" means both finfish and shellfish.

- A fish tissue sample is currently easier to analyze for methylmercury and analysts are more experienced in analyzing methylmercury in fish tissue than in water samples.
- A fish tissue concentration avoids the need for BAFs[7] that are necessary to translate between a tissue concentration and water concentration when deriving a water concentration-based criterion. This is significant because bioaccumulation of methylmercury by aquatic organisms is temporally and spatially variable such that site-specific BAFs, which can be costly to develop, are the preferred approach for translating tissue concentrations into water concentrations.

### 3.1.2.2 How is the fish tissue concentration criterion calculated?

The derivation of a methylmercury water quality criterion uses a human health toxicological risk assessment (e.g., a reference dose (RfD)), exposure data (e.g., the amount of pollutant ingested, inhaled, or absorbed per day), and data about the target population to be protected. The methylmercury fish tissue criterion for the protection of human health is calculated as:

$$\text{TRC} = \frac{BW \times (RfD - RSC)}{\sum_{i=2}^{4} FI} \qquad \text{(Equation 1)}$$

Where:

*TRC* = Fish tissue residue criterion (mg methylmercury/kg fish tissue) for freshwater and estuarine fish and shellfish.
*RfD* = Reference Dose (based on noncancer human health effects). For methylmercury it is 0.1 µg/kg body weight/day.
*RSC* = Relative source contribution (subtracted from the RfD to account for methylmercury in marine fish consumed[8]) estimated to be 0.027 µg/kg body weight/day.
*BW* = Human body weight (default value of 70 kg for adults).
*FI* = Fish intake at trophic level (TL) *i* (*i* = 2, 3, 4); total default intake of uncooked freshwater and estuarine fish is 17.5 g fish/day for the general U.S. adult population.[9]

This equation and all values used in the equation are described in *Water Quality Criterion for the Protection of Human Health, Methylmercury* (USEPA 2001c). This equation is

[7] A BAF is a ratio (in milligrams/kilogram per milligrams/liter, or liters per kilogram) that relates the expected concentration of a chemical in commonly consumed aquatic organisms in a specified trophic level to the concentration of the chemical in water (USEPA 2001c).

[8] The RSC accounts for exposures from all anticipated sources so that the entire RfD is not apportioned to freshwater/estuarine fish and shellfish consumption alone. In the assessment of human exposure in the methylmercury water quality criterion document, EPA found that human exposures to methylmercury were negligible except from freshwater/estuarine and marine fish. Therefore, in developing the criterion on the basis of consumption of freshwater/estuarine fish, EPA subtracted the exposure due to consumption of marine fish. See 66 *Federal Register* 1354-1355.

[9] The value of 17.5 grams uncooked fish per day is the 90$^{th}$ percentile of freshwater and estuarine fish consumed by the public according to the *1994–96 Continuing Survey of Food Intakes by Individuals* (USEPA 2000i). EPA uses this value as the default consumption rate in development of water quality criteria. The default trophic level values for the general population are 3.8 g fish/day for TL2, 8.0 g fish/day for TL3, nd 5.7 g fish/day for TL4. The rationale behind the selection of this value is described in the Human Health Methodology (USEPA 2000e).

essentially the same equation used in the 2000 Human Health Methodology to calculate a water quality criterion for a pollutant that may cause noncancerous health effects. Here, it is rearranged to solve for a protective concentration in fish tissue rather than in water. Thus, it does not include a BAF or drinking water intake value (methylmercury exposure from drinking water is negligible (USEPA 2001b)). When all the numeric values are put into the generalized equation, the TRC of 0.3 mg methylmercury/kg fish is the concentration in fish tissue that should not be exceeded on the basis of a consumption of 17.5 g fish/day of freshwater or estuarine fish. EPA encourages states and authorized tribes to develop a water quality criterion for methylmercury using local or regional data rather than the default values if they believe that such a water quality criterion would be more appropriate for their target population.

The TRC value is not based on any default breakout of fish consumption by trophic level. The trophic levels assigned to the fish consumption value should reflect those that each target population consumes. For assessing impairment or attainment of the TRC, a state or authorized tribe may choose to assign the TRC value to only trophic level 4 or to the highest trophic level consumed. This will result in a conservative assumption, thereby protecting most, if not all, populations at an uncooked freshwater or estuarine fish consumption rate of 17.5 grams/day. If a state or authorized tribe wishes to calculate the TRC value on the basis of consumption at each trophic level for monitoring and compliance purposes, it would first determine consumption patterns at each trophic level for the target population(s). (For guidance on determining consumption patterns see section 4.)

EPA acknowledges that implementation of a TRC entails more technical steps than implementation of a water column criterion. Although water quality standards programs traditionally use water column values, states and authorized tribes may not find it necessary to translate this fish tissue based-criterion into a water column value for all implementation methodologies. Later chapters on TMDLs and NPDES permits in this guidance offer some methodologies that use the fish tissue value without translating from fish tissue to water column values.

### 3.1.3 Can states or authorized tribes adopt a water column concentration criterion?

EPA recognizes that a fish tissue residue water quality criterion is new to states and authorized tribes and might pose implementation challenges for traditional water quality standards programs. Water quality standards, water quality-based effluent limits (WQBELs), TMDLs, and other activities generally employ a water column value. If states and authorized tribes decide to adopt the tissue criterion expressed as fish tissue concentration, per EPA recommendation, without translating to a traditional water column concentration, they will make a choice on how to implement the tissue criterion. A state or authorized tribe could decide to directly develop TMDLs and to calculate WQBELs[10] in NPDES permits without first measuring or calculating a BAF. This guidance provides some options for such approaches in sections 6 and 7.

[10] A WQBEL is a requirement in an NPDES permit that is derived from, and complies with, all applicable water quality standards and is consistent with the assumptions and requirements of any approved wasteload allocation (see 40 CFR 122.44(d)(1)(vii)).

Alternatively, a state or authorized tribe may decide to adopt a tissue concentration-based standard with a site-specific procedure for translating the tissue concentration-based standard to a water column concentration. Because methylmercury bioaccumulation can vary substantially from one location to another, this option allows for the tissue concentration-based standard to be translated to water concentration-based standards using site-specific information on methylmercury bioaccumulation (i.e., site-specific BAFs) while ensuring that a water-expressed standard is ultimately developed for the waterbodies of interest. Administratively, this option might be more efficient when compared to adopting a water concentration-based standard for an entire state or tribal jurisdiction adopting or approving site-specific standards on an individual waterbody basis. Approaches for translating a tissue concentration-based criterion to a water concentration-based criterion are provided in the following section.

States or authorized tribes may also choose to adopt a standard that is expressed as a water column concentration. Conversion of the tissue concentration-based criterion to a water concentration-based criterion may be desirable for various reasons, such as achieving consistency with traditional water column-based AWQCs and/or regulatory simplicity. However, note that this approach requires assessment of methylmercury bioaccumulation on a state or tribal geographic scale. Thus, the uncertainty associated with differential bioaccumulation of methylmercury across sites within a state or authorized tribe will be embedded in the state or tribal water-based criterion. Reducing such uncertainty is one of the primary reasons EPA chose to express its national AWQC for methylmercury as a tissue concentration rather than as a water concentration.

To express the methylmercury concentration-based criterion as a water concentration, a state or authorized tribe would translate the methylmercury concentrations in fish tissue to methylmercury concentrations in the water column. To accomplish this, the state or authorized tribe will develop BAFs. In the Federal Register notice of the methylmercury criterion, EPA identified three possible different approaches for developing a BAF. These approaches are discussed in more detail in section 3.1.3.1. The basic equations used in developing a water column criterion are presented below, and additional discussion of calculating BAFs is presented in the following section.

States and authorized tribes would translate the tissue concentration-based human health AWQC to a water concentration-based methylmercury criterion using a BAF as

$$AWQC = TRC \div BAF \qquad \text{(Equation 2)}$$

Where:

| | | |
|---|---|---|
| *AWQC* | = | Water concentration-based ambient water quality criterion for methylmercury in mg/L |
| *TRC* | = | Tissue concentration (residue)-based ambient water quality criterion for methylmercury in mg/kg |
| *BAF* | = | Bioaccumulation factor for trophic levels 2, 3, and 4, weighted on the basis of fish consumption rates for each trophic level in L/kg |

The BAF is the ratio of the concentration of the chemical in the appropriate tissue of the aquatic organism and the concentration of the chemical in ambient water at the site of sampling. BAFs are trophic level-specific. EPA recommends that they be derived from site-specific, field-measured data as

$$BAF = \frac{C_t}{C_w} \qquad \text{(Equation 3)}$$

Where:

$BAF$ = Bioaccumulation factor, derived from site-specific field-collected samples of tissue and water in L/kg fish

$C_t$ = Concentration of methylmercury in fish tissue in mg/kg (wet tissue weight)

$C_w$ = Concentration of methylmercury in water in mg/L

When such data are unavailable, other approaches for deriving BAFs may be used, as outlined in the following section.

In the calculation to derive an AWQC as a water column concentration, the BAFs for the different trophic levels are combined to provide a weighted BAF value. For example, if a state wants to protect a population that eats on average 17.5 grams per day of uncooked fish from a waterbody, and 75 percent of the fish eaten are in trophic level 4 and 25 percent of the fish eaten are in trophic level 3, the weighted BAF would be the sum of 0.25 times the trophic level 3 BAF and 0.75 times the trophic level 4 BAF. Section 3.2.1.2 provides guidance on estimating fish intake rates.

#### 3.1.3.1 How is the methylmercury fish tissue concentration translated to a methylmercury water concentration?

Should a state or authorized tribe decide to translate the methylmercury fish tissue criterion into a water column concentration, it would assess the extent to which methylmercury is expected to bioaccumulate in fish tissue for the site(s) of interest. Assessing and predicting methylmercury bioaccumulation in fish is complicated by a number of factors that influence bioaccumulation. Some of these factors include the age or size of the organism; food web structure; water quality parameters such as pH, DOC, sulfate, alkalinity, and dissolved oxygen; mercury loadings history; proximity to wetlands; watershed land use characteristics; and waterbody productivity, morphology, and hydrology. In combination, these factors influence the rates of mercury bioaccumulation in various—and sometimes competing—ways. For example, these factors might act to increase or decrease the delivery of mercury to a waterbody, alter the net production of methylmercury in a waterbody (i.e., via changes in methylation and/or demethylation rates), or influence the bioavailability of methylmercury to aquatic organisms. Although bioaccumulation models have been developed to address these and other factors for mercury, their broad application can be limited by the site- or species-specific nature of many of the factors and by limitations in the data parameters necessary to run the models.

The bioaccumulation of nonionic organic chemicals can also be affected by a number of these same physico-chemical factors (e.g., loading history, food web structure, dissolved oxygen, DOC). However, a substantial portion of the variability in bioaccumulation for nonionic organic chemicals can be reduced by accounting for lipid content in tissues, and organic carbon content in water, and "normalizing" BAFs using these factors (Burkhard et al. 2003, USEPA 2003b). Normalizing to the age or size (length, weight) of fish has been shown to reduce variability in measures of bioaccumulation (Sorensen et al. 1990, Glass et al. 2001, Brumbaugh et al. 2001, Sonesten 2003, Wente 2004). The United States Geological Survey (USGS) developed a procedure called the National Descriptive Model of Mercury and Fish Tissue (Wente 2004). This model provides a translation factor to convert a mercury concentration taken from one species/size/sample method to an estimated concentration for any other user predefined species/size/sample method; EPA used this model to normalize national data sets of fish tissue for analysis supporting the CAMR (USEPA 2005a).

Taking into account the previous discussion, EPA recommends three different approaches for relating a concentration of methylmercury in fish tissue to a concentration of methylmercury in ambient water:

1. Use site-specific methylmercury BAFs derived from field studies.
2. Use a scientifically defensible bioaccumulation model.
3. When derivation of site-specific field-measured BAFs or use of a model are not feasible, use national methylmercury BAFs derived from empirical data.

Of these approaches, 1 and 2 are preferred over 3 for reasons discussed below. However, the hierarchy assigned to the approaches is not intended to be inflexible. Some situations might indicate that greater uncertainty is likely to occur when applying a BAF derived from a "more highly preferred" approach (e.g., a field-measure BAF) than with a "less preferred" approach, for example, when data from the more preferred method have less representativeness, quantity, or quality relative to the less preferred approach. In these situations, data from the less preferred, but less uncertain, approach would be used to derive BAFs.

#### *3.1.3.1.1 Site-specific bioaccumulation factors derived from field studies*

The use of site-specific BAFs based on data obtained from field-collected samples of tissue from aquatic organisms that people eat and water from the waterbody of concern—referred to as a "field-measured site-specific BAF"—is the most direct and most relevant measure of bioaccumulation. This approach is consistent with EPA's bioaccumulation guidance contained in the 2000 Human Health Methodology (USEPA 2000e) and its Technical Support Document for developing national BAFs (USEPA 2003b). Although a BAF is actually a simplified form of a bioaccumulation model, the field-measured site-specific BAF approach is discussed separately here because of its widespread use and application. A field-measured site-specific BAF is derived from measurements of methylmercury concentrations in tissues of aquatic organisms and the ambient water that they inhabit. Because the data are collected from a natural aquatic ecosystem, a field-measured BAF reflects an organism's exposure to a chemical through all relevant exposure routes (e.g., water, sediment, diet). The BAF can be measured for the aggregate of fish in a location or specific to each trophic level. A field-measured site-specific BAF also reflects biotic and abiotic factors at a location that influence the bioavailability and metabolism of a chemical that might occur in the aquatic organism or its food web.

However, states should exercise caution in developing a site-specific BAF for a migratory fish because its exposure to methylmercury reflects areas other than where the fish was caught. By incorporating these factors, field-measured site-specific BAFs account for the uptake and accumulation of the chemical.

For the purposes of developing a human health water quality criterion, states and tribes should calculate the BAF as the ratio of the concentration of methylmercury in the tissue of aquatic organisms that people eat to the concentration of methylmercury in water (Equation 3). To predict the corresponding methylmercury concentration in water for a site, the tissue-based methylmercury criterion would then be divided by the site-specific BAF. Using the site-specific BAF approach assumes that at steady state, the accumulation of methylmercury by the aquatic organism varies in proportion to the methylmercury concentration in the water column (specifically methylmercury) and that the site-specific BAF is independent of water column concentration.

As an example, the State of California is currently employing a site-specific BAF approach in its Central Valley Region. In this approach, California evaluated graphs of average concentrations of methylmercury in water and the corresponding concentrations in fish at multiple sites in a watershed. Researchers found statistically significant, positive relationships between concentrations of unfiltered methylmercury in water and in various trophic levels of the aquatic food chain (Slotton, 2004). California linearly regressed fish tissue methylmercury concentrations for specific trophic level 3 and 4 fish against aqueous methylmercury concentrations ($P<0.001$, $R2=0.98$, and $P<0.01$, $R2=0.9$, respectively), and determined methylmercury concentrations in unfiltered water that correspond to the fish tissue criteria (0.15 ng/l for TL3 fish and 0.14 ng/l for TL4 fish) that were used in the TMDL analyses. (Central Valley Water Board, 2005). California assumed that sites that fit in a statistically significant regression have similar processes controlling methylmercury accumulation. In other words, site-specific BAFs are nearly identical.

Strengths associated with using a site-specific BAF approach include simplicity, widespread applicability (i.e., site-specific BAFs can be derived for any waterbody, fish species, and the like), and that the net effects of biotic and abiotic factors that affect bioaccumulation are incorporated within the measurements used to derive the BAF. Specifically, it is not required that the exact relationship between methylmercury accumulation and the factors that can influence it be understood or quantified to derive a site-specific BAF. By measuring the methylmercury concentrations empirically, such factors have been incorporated such that site-specific BAFs provide an accounting of the uptake and accumulation of methylmercury for an organism in a specific location and point in time.

Limitations to the site-specific BAF approach relate primarily to its cost and empirical nature. For example, the level of effort and associated costs of developing site-specific BAFs increases as the spatial scale of the site of interest increases. Furthermore, the amount of data necessary to obtain a representative characterization of methylmercury in the water and fish might take considerable time to gather. (For a discussion on sampling considerations for developing a site-specific BAF see section 3.1.3.2.) The strictly empirical nature of this approach is also a barrier to extrapolating BAFs among species, across space, and over time because the site-specific factors that might influence bioaccumulation are integrated within the tissue concentration measurement and thus, cannot be individually adjusted to extrapolate to other conditions.

#### *3.1.3.1.2 Bioaccumulation models*

Bioaccumulation models for mercury vary in the technical foundation on which they are based (empirically or mechanistically based), spatial scale of application (specific to waterbodies, watersheds or regions, and species of fish), and level of detail in which they represent critical bioaccumulation processes (simple, mid-level, or highly detailed representations). Thus, it is critical that states and tribes use a model that is appropriately developed, validated, and calibrated for the species and sites of concern.

Empirical bioaccumulation models that explicitly incorporate organism-, water chemistry-, waterbody/watershed-specific factors that might affect methylmercury bioaccumulation (e.g., fish species, age, length, pH, DOC, sulfate, alkalinity, sediment acid volatile sulfide concentration, proximity to wetlands, land use, morphology, hydrology, productivity) usually take the form of multivariate regression models. Many examples of such models are available in the literature (e.g., Sorensen et al. 1990, Kamman et al. 2004, Brumbaugh et al. 2001). The model developed by Brumbaugh et al. (2001) is based on a national pilot study of mercury in 20 watersheds throughout the United States. Specifically, Brumbaugh et al. (2001) developed a multiple regression relationship between five factors: length-normalized mercury concentration in fish, methylmercury concentration in water, percent wetland area in the watershed, pH, and acid volatile sulfide concentration in sediments ($r^2 = 0.45$; all fish species). When data were restricted to a single species (e.g., largemouth bass) and a single explanatory variable (e.g., methylmercury in water), a highly significant relationship was found ($p < 0.001$) with a similar degree of correlation ($r^2 = 0.50$). This demonstrates the importance of species specificity on the strength of such regression relationships and, in this case, methylmercury in water as an explanatory variable.

States and tribes should consider several important issues when using regression-based bioaccumulation models for translating from a tissue concentration to a water column concentration. First, a number of such regression models have been developed without explicitly incorporating methylmercury (or mercury) concentrations in the water column. Instead, the models relate fish tissue methylmercury concentrations to variables that serve as proxies for methylmercury exposure (e.g., atmospheric deposition rates, ratio of the watershed drainage to the wetland area, pH, lake trophic status) often due to the costs associated with obtaining accurate measurements of mercury in the water column. Obviously, such models cannot be directly solved for the parameter of interest (methylmercury in water). Second, correlation among independent or explanatory variables in these multiple regressions is common and expected (e.g., pH and methylmercury concentration in water). Such correlations among explanatory variables can cause bias and erroneous estimates of an explanatory variable (in this case, methylmercury concentration in water) when back-calculated from the regression equation (Neter et al. 1996). In such cases, use of the underlying data set to develop a separate regression model with methylmercury concentration in water as the dependent variable is more appropriate. Last, because these regression models are based on empirical data, uncertainty is introduced when the results are extrapolated to aquatic ecosystems with different conditions. Only in a few cases have such models been tested using independent data sets (e.g., Kamman et al. 2004).

Mechanistic bioaccumulation models are mathematical representations of the natural processes that influence bioaccumulation. Three examples of mechanistic type bioaccumulation models are: the Dynamic Mercury Cycling Model (D-MCM) (EPRI 2002), BA (BASS) (Barber 2002), and the Quantitative Environmental Analysis Food Chain model (QEAFDCHN) (QEA 2000). The conceptual advantage of mechanistically based bioaccumulation models is that predictions of methylmercury bioaccumulation can be made under different conditions (e.g., different growth rates of fish, different water chemistry conditions, different mercury loading scenarios), because the models include mathematical representations of the various processes that affect bioaccumulation. This advantage comes at the cost of additional input data necessary to run the model. Notably, only a few models have been used to predict methylmercury bioaccumulation. Such models have not been widely used and have been applied only to mercury in a few aquatic ecosystems under specific environmental conditions. Of the examples listed above, only the D-MCM was developed specifically for mercury. The D-MCM has not yet been applied to lotic systems. The other models have been developed more generally, for nonionic organic chemicals that bioaccumulate and that require substantial modification and validation for application to mercury.

Most mechanistic bioaccumulation models use a chemical mass balance approach to calculate bioaccumulation into fish or other aquatic organisms. This approach requires considerable understanding of mercury loadings to and cycling within the environment. None of the example models presented can predict bioaccumulation without considerable site-specific information, at least some degree of calibration to the waterbody of interest, and in some cases, considerable modification of the model. The amount and quality of data necessary for proper model application may equal or exceed that necessary to develop site-specific methylmercury BAFs, although these models might also help in determining BAFs if the kinetic condition in the waterbody is not steady-state.

Regardless of the type of model used, states' and authorized tribes' methodologies should be consistent with the *Methodology for Deriving Ambient Water Quality Criteria for the Protection of Human Health* (section 5.6: National Bioaccumulation Factors for Inorganic and Organometallic Chemicals; USEPA 2000e) and *Technical Support Document Volume 2: Derivation of National Bioaccumulation Factors* (USEPA 2003b). These documents provide detailed discussion of topics such as BAF derivation procedures, bioavailability, and the steps involved in Procedures 5 and 6 of the Human Health Methodology. States and tribes should document how they derive site-specific parameters used in the bioaccumulation models, and should describe the uncertainty associated with the BAFs derived using any of the models.

#### *3.1.3.1.3 Draft national bioaccumulation factors*

EPA acknowledges that using site-specific BAFs or model-derived BAFs might not be feasible in all situations. Without site-specific methylmercury bioaccumulation data or an appropriate bioaccumulation model, another approach is to use EPA's empirically derived draft national methylmercury BAFs. EPA used the BAF guidance in the 2000 Human

Health Methodology (USEPA 2000e, 2003b) and the BAF methods in Volume III, Appendix D of the *Mercury Study Report to Congress* (USEPA 1997b) to derive draft methylmercury BAFs as part of its initial efforts to derive a water column-based recommended section 304(a) ambient water quality criterion for methylmercury. These draft national BAFs were developed from field data collected from across the United States and reported in the published literature. These draft national BAFs and the uncertainties associated with them are discussed in Appendix A, section I of *Water Quality Criterion for the Protection of Human Health: Methylmercury* (USEPA 2001c). The draft national BAFs ($50^{th}$ percentile values) are listed by trophic level in Table 1. The $5^{th}$ and $95^{th}$ percentile values are also provided to show the distribution of national BAF values.

**Table 1. National draft BAFs for dissolved methylmercury**

| | BAF trophic level 2 (L/kg) | BAF trophic level 3 (L/kg) | BAF trophic level 4 (L/kg) |
|---|---|---|---|
| $5^{th}$ Percentile | 18,000 | 74,300 | 250,000 |
| $50^{th}$ Percentile (Geometric mean) | 117,000 | 680,000 | 2,670,000 |
| $95^{th}$ Percentile | 770,000 | 6,230,000 | 28,400,000 |

(USEPA 2001c)
(mg methylmercury/kg fish tissue per mg methylmercury/L water)

To develop the national BAFs for each trophic level, EPA calculated the geometric mean of the field-measured BAFs obtained from the published literature. EPA believes the geometric mean BAFs are the best available central tendency estimates of the magnitude of BAFs nationally, understanding that the environmental and biological conditions of the waters of the United States are highly variable. EPA generally does not recommend basing an AWQC on BAF values near the extremes of the distribution (e.g., $10^{th}$ or $90^{th}$ percentile) because such values might introduce an unacceptable level of uncertainty into the calculation of a water column-based AWQC.

When states and authorized tribes calculate a water column-based criterion using draft national BAFs that differ greatly from the BAFs for the waterbody of concern, the resulting water column-based criterion will be either over- or under-protective. As a result, evaluation of the results of the analysis of water samples might result in the false conclusion that a fish tissue concentration has been exceeded (when it actually has not) or a false conclusion that a fish tissue concentration has not been exceeded (when it actually has). The following examples illustrate the potential impact of calculating a water quality criterion using a BAF that is substantially different from the actual BAF.

*Underprotective scenario*

A state uses the draft national BAF of 2,670,000 L/kg for trophic level 4 fish, but the BAF based on site-specific data for the trophic level 4 fish in the waterbody is three times that, or 8,100,000 L/kg. In using the draft national BAF, a state would consider water column concentrations up to 0.11 nanogram per liter (ng/L) (0.3 mg/kg ) 2,670,000 L/kg) to indicate attainment of the water quality column criterion. However, using the BAF based on site-specific data, a water column criterion of 0.11 ng/L would correspond to a fish tissue concentration of 0.9 mg/kg, which is three times the 0.3 mg/kg criterion recommended to protect human health. Thus, load reduction or permits using the national BAF of 2,670,000 L/kg would be under-protective.

*Overprotective scenario*

A state uses the draft national BAF of 2,670,000 L/kg for trophic level 4 fish, but the BAF based on site-specific data for the trophic level 4 fish in the waterbody is one third of that, or 900,000 L/kg. As a result, a state would consider water column concentrations up to 0.11 ng/L (0.3 mg/kg ) 2,670,000 L/kg) to indicate attainment of the water quality criterion. However, using the BAF based on site-specific data, attainment of the water quality criterion could be achieved at a higher water column concentration of 0.33 ng/L. Thus, load reductions or permits using the national BAF of 2,670,000 L/kg would be over-protective.

EPA cautions water quality managers that methylmercury bioaccumulation is generally viewed as a site-specific process and that BAFs can vary greatly across ecosystems. The uncertainty in the estimates of a draft national BAF comes from uncertainty arising from natural variability, such as size of individual fish, and from uncertainty due to measurement error, such as error in measurements of mercury in water or lack of knowledge of the true variance of a process (e.g., methylation). Users of the draft national BAFs are encouraged to review Appendix A of *Water Quality Criterion for the Protection of Human Health: Methylmercury* (USEPA 2001c) that describes the uncertainties inherent in these values. The following is a synopsis of the discussion of uncertainty in that Appendix.

- Uncertainty due to sampling and chemical analysis: In many cases, water methylmercury concentrations reported in the available studies incorporated limited or no cross-seasonal variability, incorporated little or no spatial variability, and were often based on a single sampling event. Because fish integrate exposure of mercury over a lifetime, comparing fish concentrations to a single sample or mean annual concentrations introduces bias to the estimates. The geographic range represented by the waterbodies was also limited.

- Uncertainty due to estimation method: The approaches used to estimate the draft national BAFs have their own inherent uncertainties. The approaches assume that the underlying process and mechanisms of mercury bioaccumulation are the same for all species in a given trophic level and for all waterbodies. They are also based on a limited set of data.

- Uncertainty due to biological factors: With the exception of deriving BAFs on the basis of river or lake waterbody type, there were no distinctions in the BAFs as to the size or age of fish, waterbody trophic status, or underlying mercury uptake processes. In reality, methylmercury bioaccumulation for a given species can vary as a function of the ages (body size) of the organisms examined.

- Uncertainty due to universal application of BAFs: There is uncertainty introduced by failure of a single trophic level-specific BAF to represent significant real-world processes that vary from waterbody to waterbody. The simple linear BAF model relating methylmercury in fish to total mercury in water simplifies a number of nonlinear processes that lead to the formation of bioavailable methylmercury in the water column and subsequent accumulation. Much of the variability in field data applicable to the estimation of mercury BAFs can be attributed to differences in biotic factors (e.g., food chain, organism age or size, primary production, methylation or demethylation rates), and abiotic factors (e.g., pH, organic matter, mercury loadings, nutrients, watershed type or size) between aquatic systems. Unfortunately, while the concentration of methylmercury in fish tissue is presumably a function of these varying concentrations, published BAFs are generally estimated from a small number of measured water values whose representativeness of long-term exposure is not completely understood. Furthermore, although it is known that biotic and abiotic factors control mercury exposure and bioaccumulation, the processes are not well understood, and the science is not yet available to accurately model bioaccumulation on a broad scale.

The peer reviewers of the draft national BAFs expressed concerns about the use of the draft national BAFs to predict bioaccumulation across all ecosystems and about using them to derive a national recommended section 304(a) water quality criterion for methylmercury that would suitably apply to waterbodies across the nation. EPA recognized the peer reviewers' concerns and acknowledges that these national BAF values might significantly over- or underestimate site-specific bioaccumulation. As a result, EPA decided not to use the draft national BAFs to develop a national water column-based AWQC for methylmercury. Furthermore, the draft national BAFs are EPA's least preferred means for assessing the BAF. However, EPA may revise its guidance should significant new information become available to support developing a final national BAF.

EPA believes that the draft national methylmercury BAFs in Table 1 sufficiently represent bioaccumulation such that they may be used to implement a fish tissue-based methylmercury water quality criterion in a state's or authorized tribe's water quality standards in the absence of any other site-specific bioaccumulation data. Thus, EPA is likely to approve water quality standards for mercury on the basis of these draft national BAFs in the absence of information indicating that the water quality criteria do not protect human health in the waters to which the standards apply. Risk managers should also understand that in using the draft national BAFs, one assumes that the biotic and abiotic processes affecting mercury fate and bioaccumulation are similar across different waterbodies, and therefore using the draft national BAFs does not address site-specific factors that might increase or decrease methylation and bioaccumulation. The decision to allow the use of the draft national BAFs is a risk management decision. It reflects judgment that human health is better protected if the water quality criteria reflect the new science associated with methylmercury, even if that means using a draft national BAF value, rather than not adopting a criterion because the state or authorized tribe lacks resources to conduct site-specific studies or to run an appropriate bioaccumulation model.

#### 3.1.3.2 What are the sampling considerations for deriving site-specific field-measured BAFs?

For both fish tissue and water, states and authorized tribes should analyze for methylmercury when deriving site-specific BAFs. EPA has not yet published analytical methods to measure methylmercury in either water or fish in 40 CFR Part 136. However, for fish tissue, states and authorized tribes can measure methylmercury concentrations using the same analytical method used to measure for total mercury at least for upper trophic level fish (i.e., levels 3 and 4). This is because 80 to 100 percent of the mercury found in the edible portions of freshwater fish greater than 3 years of age from these two trophic levels is in the form of methylmercury (USEPA 2000c). In fish greater than approximately 3 years of age, mercury has had sufficient time to bioaccumulate to roughly steady levels in the fish. Appendix E summarizes seven studies of the relative proportion of the mercury concentration in North American freshwater fish that is in the form of methylmercury. In six of the seven studies, methylmercury on average accounted for more than 90 percent of the mercury concentration in fish tissue.

States and tribes should consider a number of issues when sampling aquatic organism tissue and water to derive a site-specific BAF. The goal of deriving site-specific methylmercury BAFs is to reflect or approximate the long-term bioaccumulation of methylmercury in commonly consumed aquatic organisms of a specified trophic level. Hence, an important sample design consideration is how to obtain samples of tissue and water that represent long-term, average accumulation of methylmercury. Methylmercury is often slowly eliminated from fish tissue. Therefore, concentrations of methylmercury in fish tissue tend to fluctuate much less than the concentration of methylmercury in water. Thus, for calculating representative site-specific BAFs, states and tribes should consider how to integrate spatial and temporal variability in methylmercury concentrations in both water and tissue. States and tribes should address the variability in methylmercury concentrations in fish tissue with age or size of the organism either by restricting sample collection to organisms of similar age or size classes or through appropriate normalization techniques. EPA's fish sampling guidance recommends that fish should be of similar size so that the smallest individual in a composite is no less than 75 percent of the total length (size) of the largest individual (USEPA 2000c). One way of normalizing data is by use of the National Descriptive Model for Mercury in Fish Tissue (NDMMF) (Wente 2004). The NDMMF is a statistical model that normalizes Hg fish tissue concentration data to control for species, size, and sample type variability. An example use of the NDMMF is in the combination of mercury fish tissue data from two databases (USEPA 2005b).

States and tribes should assess the fish consumption patterns of the exposed human population when designing a site-specific sampling plan. Because the age and size of aquatic organisms is correlated with the magnitude of methylmercury accumulation, the types and sizes of aquatic organisms being consumed should be considered when determining what fish to sample for deriving BAFs. This information should also guide the decision on whether the site-specific BAF should be based on a single trophic level (e.g., trophic level 4) or on multiple trophic levels.

States and tribes should review site-specific data used to calculate a field-measured BAFs, and thoroughly assess the quality of the data and the overall uncertainty in the BAF values. Consider the following general factors when determining the acceptability of field-measured BAFs reported in the published scientific literature. Address the same general issues and questions also when designing a field study to generate site-specific field-measured BAFs.

- Calculate a field-measured BAF using aquatic organisms that are representative of those aquatic organisms that are commonly consumed at the site of interest (e.g., river, lake, ecoregion, state). Review information on the ecology, physiology, and biology of the target organisms when assessing whether an organism is a reasonable surrogate of a commonly consumed organism.

- Determine the trophic level of the study organism by taking into account its life stage, diet, and the food web structure at the study location. Information from the study site (or similar sites) is preferred when evaluating trophic status. If such information is lacking, states and authorized tribes can find general information for assessing trophic status of aquatic organisms in *Guidance for Assessing Chemical Contaminant Data for Use in Fish Advisories. Volume 1: Fish Sampling and Analysis* (USEPA 2000c).

- Collect length, weight, and age data for any fish used in deriving a field-measured BAF because current information suggests that variability in methylmercury accumulation is dependent on fish age and size (USEPA 2001c). This information helps normalize the BAF to a standardized fish size within the range of fish sizes and species known to be consumed by the human population of interest.

- Verify that the study used to derive the field-measured BAF contains sufficient supporting information from which to determine that tissue and water samples were collected and analyzed using appropriate, sensitive, accurate, and precise analytical methods.

- Verify that the water concentrations used to derive a BAF reflect the average exposure of the aquatic organism of concern that resulted in the concentration measured in its tissue. Concentrations of methylmercury in a waterbody vary seasonally and diurnally (Cleckner et al. 1995) due to a variety of biological and physical factors.

- Attempt to design a field sampling program that addresses potential temporal and spatial variability and that allows estimation of average exposure conditions. The study should be designed to sample an area large enough to capture the more mobile organisms and also to sample across seasons or multiple years when methylmercury concentrations in waters are expected to have large fluctuations. Longer sampling durations are necessary for waters experiencing reductions in mercury loadings, changes in water chemistry that affect methylation, and changes in the composition of the food web.

Volume I of the *Guidance for Assessing Chemical Contaminant Data for Use in Fish Advisories* (USEPA 2000c) provides additional guidance on selecting target species to sample, specific sampling design procedures, analytical measurement procedures, and quality assurance guidance. Chapter 10 of EPA's *Exposure Factors Handbook* provides additional guidance on collecting information about local species (USEPA 1997e). Additional guidance on evaluating existing site-specific bioaccumulation studies for use in deriving trophic level-specific BAFs and designing sampling plans for obtaining data for deriving site-specific BAFs is provided in *Technical Support Document—Volume 2: Developing National Bioaccumulation Factors* (USEPA 2003b). In addition, EPA expects to publish specific guidance for deriving site-specific BAFs from field studies in the future. Until then, the EPA guidance cited above and a recent publication by Burkhard (2003) are good sources of information on the design of BAF field studies and on deriving field-measured site-specific BAFs.

## 3.2 What options are available to address for site-specific conditions and concerns?

### *3.2.1 How can the methylmercury water quality criterion be modified for site-specific conditions?*

The 2000 Human Health Methodology (USEPA 2000e) describes how states and authorized tribes can adopt site-specific modifications of a 304(a) criterion to reflect local environmental conditions and human exposure patterns. "Local" may refer to any appropriate geographic area where common aquatic environmental or exposure patterns exist. Thus, local may signify a statewide or regional area, a river reach, or an entire river. Such site-specific criteria may be developed as long as the site-specific data, either toxicological or exposure-related, is justifiable. For example, when using a site-specific fish consumption rate, a state or authorized tribe should use a value that represents at least the central tendency of the population surveyed (either sport or subsistence, or both) to eat fish from the local area. When a state or authorized tribe develops a site-specific criterion on the basis of local fish consumption, site-specific BAFs, or a site-specific RSC, EPA will likely review the data supporting the site-specific criterion when EPA approves or disapproves state or tribal water quality standards under section 303(c).

States and authorized tribes may modify EPA's recommended 304(a) criteria for methylmercury by using other scientifically defensible methods, or by using different assumptions for certain components of EPA's criterion to derive a criterion that maintains and protects the designated uses. For example:

- Use an alternative RSC factor
- Use a daily uncooked freshwater and estuarine fish consumption rate that is more reflective of local or regional consumption patterns than the 17.5 grams/day default value. EPA encourages states and authorized tribes to consider using local or regional consumption rates instead of the default values if these would better reflect the target population.

If a state or authorized tribe intends to modify both the RSC and fish consumption rate, it may find it advantageous to collect the data at the same time.

#### 3.2.1.1 How does one modify the RSC?

Section 5 of the methylmercury criterion document (USEPA 2001c) provides detailed discussions on how EPA assessed exposure to methylmercury and how EPA derived the RSC factor used in calculating the criterion. The methylmercury RSC is an exposure, subtracted from the reference dose to account for exposure to methylmercury from sources other than freshwater or estuarine fish. By accounting for other known exposures, the RSC seeks to ensure that methylmercury exposures do not exceed the RfD. To change the RSC used by EPA, states and authorized tribes should review section 5 of the methylmercury criterion document and modify the media specific exposure estimates found in Table 5-30 using local data that reflect the exposure patterns of their populations. Of the six exposure media presented in Table 5-30, the exposure from ingestion of marine fish comprised greater than 99.9 percent of the total exposure to methylmercury, and thus ingestion of fish would be the focus of any modification to the RSC. To modify this factor, states and authorized tribes should review the amount of marine fish and shellfish estimated to be consumed (Table 5-1; USEPA 2001c) and the concentration of methylmercury in the commonly consumed marine species (Table 5-14; USEPA 2001c). States and authorized tribes should document the modifications with data supporting the modifications, and ideally should share the proposed modifications to the RSC with EPA prior to recalculating the criterion. See Appendix B for the tables included from the methylmercury criterion document.

#### 3.2.1.2 How does one modify the daily fish intake rate?

EPA derived the recommended methylmercury water quality criterion on the basis of a default fish intake rate  for the general population (consumers and nonconsumers) of 17.5 grams/day[11] (uncooked) (USEPA 2001c). States and authorized Tribes can choose to apportion an intake rate to the highest trophic level consumed for their population or use a different intake rate based on local or regional consumption patterns. The fish consumption value in the TRC equation can be changed if the target population eats a higher or lower amount of fish. For example, if the 90th percentile of a target population eats approximately 15 grams/day of freshwater and estuarine fish of various trophic levels, the fish intake value in the above equation would simply be 15 grams/day, rather than the national default value of 17.5 grams/day used in calculating the 0.3 mg/kg TRC.

EPA encourages states and authorized tribes to develop a water quality criterion for methylmercury using local or regional fish consumption data rather than the default values, if they believe that such a water quality criterion would be more appropriate for their target population. However, states and authorized tribes should consider whether the consumption rates reflect existing public concern about contamination of fish when collecting survey data, rather than local preference for fish consumption. In this instance, the state or authorized tribe should not use the survey data because it does not represent what the local population would eat if the fish was not already contaminated.

EPA suggests that states and authorized tribes follow a hierarchy when deriving fish intake estimates (USEPA 2000e). From highest preferred to lowest preferred, this hierarchy is as follows (1) use local data when available, (2) use data reflecting similar geography or population groups, (3) use data from national surveys, and (4) use EPA's default fish intake rates. Additional discussion of these four preferences is provided below.

[11] This value represents the 90th percentile of freshwater and estuarine finfish and shellfish consumption reported by the 1994–96 *Continuing Survey of Food Intakes by Individuals*. For more information, see *Methodology for Deriving Ambient Water Quality Criteria for the Protection of Human Health* (USEPA 2000e).

#### 3.2.1.2.1 Use local data

EPA's first preference is that states and authorized tribes modify the water quality criterion using fish intake rates derived from studies of consumption of local fish, such as results of surveys designed to obtain information on the consumption of freshwater or estuarine species caught from local watersheds within the state or tribal jurisdiction. EPA recognizes that states and authorized tribes may choose to develop a fish intake rate for highly exposed subpopulations (e.g., sport anglers, subsistence fishers), and if this is the case, the states and authorized tribes should collect the intake rates from these subpopulations.

States and authorized tribes might wish to conduct their own surveys of fish intake. *Guidance for Conducting Fish and Wildlife Consumption Surveys* (USEPA 1998a) provides EPA guidance on methods for conducting such studies. States and authorized tribes should take care to ensure that the local data are of sufficient quality and scope to support development of a criterion and are representative of the population of people who eat local fish. EPA's consumption survey guidance offers recommendations on how to develop appropriate quality assurance and control procedures to help assure the quality of the survey. Results of studies of broader geographic regions in which the state or authorized tribe is located can also be used, but might not be as applicable as study results for local watersheds. Because such studies would ultimately form the basis of a state or authorized tribe's methylmercury criterion, EPA would review any surveys of fish intake for consistency with the principles of EPA's guidance as part of the Agency's review of water quality standards under CWA section 303(c).

States and authorized tribes may use either high-end (such as $90^{th}$ or $95^{th}$ percentile) or central tendency (such as median or mean) consumption values for the population of interest (e.g., subsistence fishers, sport fishers, or the general population). EPA generally recommends that a central tendency value be the lowest value states or authorized tribes should use when deriving a criterion. When considering median values from fish consumption studies, states and authorized tribes should ensure that the distribution is based on survey respondents who reported consuming fish because surveys of both consumers and nonconsumers can often result in median values of zero. EPA believes the approach described above is a reasonable procedure and is also consistent with the recent Great Lakes Water Quality Initiative (known as the "GLI") (USEPA 1995a).

#### 3.2.1.2.2 Use similar geography or population groups

If surveys conducted in the geographic area of the state or authorized tribe are not available, EPA's second preference is that states and authorized tribes consider results from existing surveys of fish intake in similar geographic areas and population groups (e.g., from a neighboring state or authorized tribe or a similar watershed type) and follow the method described above regarding target values to derive a fish intake rate. For instance, states or tribes with subsistence fisher populations might wish to use consumption rates from studies that focus specifically on these groups, or, at a minimum, use rates that represent high-end values from studies that measured consumption rates for a range of types of fishers (e.g., recreational or sport fishers, subsistence, minority populations). A state or tribe in a region of the country might consider using rates from studies that surveyed the same region; for example, a state or tribe that has a climate that allows year-round fishing may underestimate consumption if rates are used from studies taken in regions where individuals fish for only one or two seasons per year. A state or tribe that has a high percentage of an age group (such as elderly individuals, who have been shown to have higher rates in certain surveys) may wish to use age-specific consumption rates, which are available from some surveys. EPA has published guidance for selecting a study from a similar geographic area or population group (USEPA 1998c) Again, EPA recommends that states and tribes use only uncooked weight intake values and freshwater or estuarine species data.

#### *3.2.1.2.3 Use national surveys*

If applicable consumption rates are not available from local, state, or regional surveys, EPA's third preference is that states and authorized tribes select intake rate assumptions for different population groups from national food consumption surveys. EPA has analyzed two such national surveys, the 1994–96 and 1998 Continuing Survey of Food Intakes by Individuals (CSFII). These surveys, conducted by the U.S. Department of Agriculture (USDA), include food consumption information from a probability sample of the population of all 50 states. Respondents to the survey provided 2 days of dietary recall data. A separate EPA report provides a detailed description of the combined 1994–96 and 1998 CSFII surveys, the statistical methodology, and the results and uncertainties of the EPA analyses (USEPA 2002f). The estimated fish consumption rates in the CSFII report are by fish habitat (i.e., freshwater or estuarine, marine, and all habitats) for the following population groups (1) all individuals, (2) individuals age 18 and over, (3) women ages 15–44, and (4) children age 14 and under. Three kinds of estimated fish consumption rates are provided (1) per capita rates (i.e., rates based on consumers and nonconsumers of fish from the survey period), (2) by consumers-only rates (i.e., rates based on respondents who reported consuming finfish or shellfish during the 2-day reporting period), and (3) per capita consumption by body weight (i.e., per capita rates reported as milligrams of fish per kilogram of body weight per day). For purposes of revising the fish consumption rate in the methylmercury criterion, EPA recommends using the rates for freshwater and estuarine fish and shellfish.

**Table 2. Estimates of freshwater and estuarine combined finfish and shellfish consumption from the combined 1994–96 and 1998 CSFII surveys**

| | Mean | Median | 90th | 95th | 99th |
|---|---|---|---|---|---|
| All Ages | 6.30 | N/a | 11.65 | 41.08 | 123.94 |
| Age 18 and Over | 7.50 | 0.00[12] | 17.37 | 49.59 | 143.35 |
| Women Ages 15-44 | 5.78 | N/a | 6.31 | 32.37 | 109.79 |
| Children Ages 14 and Under | 2.64 | 0.00 | 0.00 | 13.10 | 73.70 |

Note: (all values as g/day for uncooked fish)

The CSFII surveys have advantages and limitations for estimating per capita fish consumption. The primary advantage of the CSFII surveys is that USDA designed and conducted them to support unbiased estimation of food consumption across the

[12] The median value of 0 grams/day may reflect the portion of individuals in the population who never eat fish as well as the limited reporting period (2 days) during which intake was measured.

population in the United States and the District of Columbia. One limitation of the CSFII surveys is that individual food consumption data were collected for only 2 days—a brief period that does not necessarily depict "usual intake." Usual dietary intake is defined as "the long-run average of daily intakes by an individual." Upper percentile estimates might differ for short-term and long-term data because short-term food consumption data tend to be inherently more variable. It is important to note, however, that variability due to duration of the survey does not result in bias of estimates of overall mean consumption levels. Also, the multistage survey design does not support interval estimates for many of the subpopulations because of sparse representation in the sample. Subpopulations with sparse representation include Native Americans on reservations and certain ethnic groups. While these individuals were participants in the survey, they were not present in sufficient numbers to support fish consumption estimates. The survey does support interval estimates for the U.S. population and some large subpopulations (USEPA 2002f).

##### *3.2.1.2.4 Use EPA default fish intake rates*

EPA's fourth preference is that states and authorized tribes use as fish intake assumptions the following default rates, on the basis of the 1994–96 CSFII data, which EPA believes are representative of freshwater and estuarine fish and shellfish intake for different population groups: 17.5 grams/day for the 90$^{th}$ percentile of the general adult population, an average of 17.5 grams/day for sport fishers, and an average of 142.4 grams/day for subsistence fishers. EPA has made these risk management decisions after evaluating numerous fish intake surveys. These values represent the uncooked weight intake of freshwater and estuarine finfish and shellfish. As with the other preferences, EPA requests that states and authorized tribes routinely consider whether a substantial population of sport fishers or subsistence fishers exists in the area when establishing water quality criteria rather than automatically using data for the general population.

The CSFII surveys also provide data on marine species, but EPA considered only freshwater and estuarine fish intake values for determining default fish consumption rates, because EPA considered exposure from marine species of fish in calculating an RSC for dietary intake.[13] States and tribes should ensure that when evaluating overall exposure to a contaminant, marine fish intake is not double-counted with the other dietary intake estimate used. Coastal states and authorized tribes that believe accounting for total fish consumption (i.e., fresh or estuarine *and* marine species) is more appropriate for protecting the population of concern may do so, provided that the marine intake component is not double-counted with the RSC estimate (USEPA 2000e).

Because the combined 1994–96 CSFII survey is national in scope, EPA uses the results from it to estimate fish intake for deriving national criteria. The estimated mean of freshwater and estuarine uncooked fish intake for adults from the CSFII study is 7.5 grams/day, and the median is 0 grams/day. The estimated 90$^{th}$ percentile is 17.53 grams/day; the estimated 95$^{th}$ percentile is 49.59 grams/day; and the estimated 99$^{th}$ percentile is 142.41 grams/day. The median value of 0 grams/day reflects the portion of individuals in the population who never eat fish as well as the limited reporting period (2

[13] See the discussion of the RSC in sections 3.1.2.2. and 3.2.1.1.

days) during which intake was measured. By applying as a default 17.5 grams/day for the general adult population, EPA selected an intake rate that is protective of a majority of the population (again, the 90th percentile of consumers and nonconsumers according to the 1994–96 CSFII survey data). In apportioning the default consumption rate to fish in different trophic levels, EPA uses the following breakout: TL2 = 3.8 grams/day; TL3 = 8.0 grams/day; and TL4 = 5.7 grams/day (USEPA 2000e)

Similarly, EPA believes that the 99th percentile of 142.4 grams/day is within the range of consumption estimates for subsistence fishers according to the studies reviewed, and represents an average rate for subsistence fishers. EPA knows that some local and regional studies indicate greater consumption among Native American, Pacific Asian American, and other subsistence consumers, and recommends the use of those studies in appropriate cases, as indicated by the first and second preferences. Again, states and authorized tribes have the flexibility to choose intake rates higher than average values for these population groups. If a state or authorized tribe has not identified a separate well-defined population of exposed consumers and believes that the national data from the 1994–96 CSFII are representative, they may choose these recommended rates.

### 3.2.2 How do water quality variances apply?

A state or authorized tribe may provide NPDES dischargers temporary relief from a water quality standard by granting a temporary variance to that standard. The variance would then, in effect, serve as a substitute standard for a point source, and the WQBEL contained in an NPDES permit would then be based on the variance. As a change to the otherwise applicable water quality standard (designated use and criteria), water quality variances must be supported by one of the six justifications[14] under 40 CFR 131.10(g) where a state or authorized tribe believes the standard cannot be attained in the immediate future. Variances are tied to the discharger's ability to meet a WQBEL and, therefore, are considered after an evaluation of controls necessary to implement water quality standards., Typically, variances apply to specific pollutants and facilities, which means that a water quality standard variance for mercury would apply only to the new human health methylmercury criterion in a stated waterbody and specifically to the discharger requesting the variance, but the State may provide justification for more than one discharger or for an entire waterbody or segment to receive a variance (as discussed in section 3.2.2.3 of this document).

#### 3.2.2.1 When is a variance appropriate?

Typically, variances provide a bridge when a state or authorized tribe needs additional data or analyses before making a determination of whether the designated use is

[14] These six justifications are the ones allowed for use attainability analyses (1) Naturally occurring pollutant concentrations prevent the attainment of the use; (2) Natural, ephemeral, intermittent or low-flow conditions or water levels prevent the attainment of the use, unless these conditions may be compensated for by the discharge of sufficient volume of effluent discharges without violating state water conservation requirements to enable uses to be met; (3) Human caused conditions or sources of pollution prevent the attainment of the use and cannot be remedied or would cause more environmental damage to correct than to leave in place; (4) Dams, diversions or other types of hydrologic modifications preclude the attainment of the use, and it is not feasible to restore the waterbody to its original condition or to operate such modification in a way that would result in the attainment of the use; (5) Physical conditions related to the natural features of the waterbody, such as the lack of a proper substrate, cover, flow, depth, pools, riffles, and the like, unrelated to water quality, preclude attainment of aquatic life protection uses; or (6) Controls more stringent than those required by sections 301(b) and 306 of the CWA would result in substantial and widespread economic and social impact.

attainable and when the state or authorized tribe adopts an alternative use on the basis of a determination under 40 CFR 131.10(g). In the case of methylmercury, such a variance might also be appropriate where implementation tools are not available or feasible, particularly where a state or authorized tribe has not yet developed a TMDL. With EPA's belief that a number of waterbodies will be added to CWA section 303(d) listings for mercury following adoption of the new methylmercury criterion, variances could provide a short-term solution until development of the TMDL. Further, given limited resources, a state or authorized tribe might decide to focus on controlling significant mercury sources one at a time, beginning with a source other than effluent discharges (e.g., sediment, atmospheric deposition) and employing variances in the interim.

EPA believes that a large number of regulated point sources discharging mercury may apply for variances because they discharge into impaired waters where the largest source of mercury comes from atmospheric deposition, and expects there to be commonality in the grounds for these variances. The most likely scenarios to prompt a variance request are listed below. Many point source dischargers contribute a relatively small percentage of the mercury in an aquatic system. These scenarios are examples of demonstrations that could satisfy the requirements under 40 CFR 131.10(g). These demonstrations are more thoroughly explained below and in the *Water Quality Standards Handbook* (USEPA 1994).

> *Economic or social impacts*—Demonstrate that, in the short term, the costs of constructing controls necessary to meet the methylmercury criterion (beyond those required by sections 301(b)(1)(A) and (B) and 306 of the CWA) would result in substantial and widespread economic and social impact.
>
> *Human caused conditions that cannot be remedied*—Demonstrate that, in the short term, none of the present technologies for improving the quality of an effluent are capable of bringing methylmercury levels down to the criterion (i.e., no technological remedy or it is technologically infeasible). For example, atmospheric deposition originating overseas could be the source of elevated mercury levels in a local stream, yet the lack of an international agreement or treaty to cut mercury emissions worldwide prevents attainment of the mercury criterion, despite local efforts of reduction. In this instance, if air deposition modeling shows that the atmospheric deposition from outside the United States was a substantial cause of the impairment, the variance may be warranted.
>
> *Natural conditions preclude attainment*—Demonstrate that local conditions of an aquatic system result in high methylmercury levels. This could result from two conditions. The first is that elevated mercury concentrations occur naturally. The second is that conditions of the area or the waterbody itself—whether it be the soil or sediment composition, microbial community, or the aquatic biota interactions—might favor a high level of methylation such that low levels of atmospherically-derived or ambient water column levels of mercury can amplify into high concentrations in fish tissues. In other words, bioaccumulation might occur at a higher rate under certain natural conditions and prevent the criterion from being attained.

#### 3.2.2.2 What considerations should a state or tribe consider before granting a variance?[15]

In general, the temporary standard established by a variance is set as close as possible to the numerical criterion for the designated use and is always retained at the level needed to preserve the existing use. This is done to protect the existing uses, and to ensure progress toward ultimate attainment of the designated use. Regarding procedural considerations, the same requirements apply for a variance as for a new or revised standard (e.g., public review and comment, EPA approval or disapproval) because a variance is a change in the water quality standards. In addition, the following describes more specific issues that states and authorized tribes should take into account when considering granting a variance.

> *Performance-based approach*—Unlike the typical numeric chemical criterion, EPA based the recommended methylmercury criterion on a fish tissue concentration, thus requiring a nontraditional expression of the criterion. States and authorized tribes have flexibility in how a variance is expressed in their water quality standard regulations. One approach is to incorporate the temporary fish tissue-based criterion established by the variance directly in the standards, and another is to use a performance-based approach. In the performance-based approach, the state or authorized tribe adopts into its water quality standards the procedure for calculating a new criterion on the basis of the variance. Such a procedure should fully lay out the calculations and default values necessary to derive an alternative fish tissue criterion using more site-specific numbers. To implement a performance-based approach, a state or tribe would maintain a publicly available, comprehensive list of all site-by-site decisions made using the procedures; however, such decisions would not, as a federal matter, have to be codified in state or tribal regulations. In addition, the public notice requirements for adopting variances could be satisfied through the process of issuing the NPDES permit that incorporates such temporary limits.
>
> States and authorized tribes may find a performance-based approach advantageous in the case of variances to the methylmercury criterion because once the state or authorized tribe has submitted—and EPA has approved—these procedures, performance-based variances could be issued without subsequent individual approvals. The key advantage of this approach is that adoption of sufficiently detailed implementation procedures, with suitable safeguards, does not require EPA approval of every application of the variance.
>
> *Time frames*—A variance is typically a time-limited change in the water quality standards. Although EPA regulations do not specify a time limit for variances, EPA regulations at 40 CFR 131.20 provide an opportunity to consider new information every three years for the purpose of reviewing water quality standards and, as appropriate, modifying and adopting standards. For this reason, states typically limit the time frame of a variance to 3 to 5 years, with renewals

[15] Federal or state regulations also govern the granting of a variance. For example, regulations promulgated under 40 CFR Part 132, Appenidx F, Procedure 2 specifies the conditions for granting variances in the Great Lakes, and prohibits the granting of variances to new dischargers or recommencing Great Lakes dischargers.

possible following a sufficient demonstration that the variance is still necessary. Variances that extend longer than 3 years are traditionally revisited in the context of a triennial review to justify their continuation. While the discharger makes this demonstration, the discharger also shows that it made reasonable progress to control mercury in the discharge during the period of the previous variance. In terms of methylmercury, there will likely be a time lag between implementing controls and seeing results (i.e., there may be unaddressed sources, continual leaching of mercury from sediments and so on). EPA modeled the response in fish tissue to a 50 percent reduction in mercury loadings to four lakes as part of the analysis supporting the CAMR and estimated that it would take between 1 to 56 years for the lakes to reach 90 percent of the estimated steady state fish tissue methylmercury concentration (USEPA 2005b). To address this issue, states and authorized tribes could develop an expedited variance adoption process, especially if legislative deliberations or administrative procedures are necessary to adopt variances into water quality standards. Namely, a specific provision within a variance for methylmercury could describe a less comprehensive demonstration for renewals by making use of information already available.

Another perspective regarding the life span of a variance is that a 3-year timeframe is mainly associated with a triennial review; there is no specific federal regulatory requirement for a variance to expire in 3 years. Regardless, as with any other revision to the water quality standards, the permit and permit conditions implementing the variance do not automatically change back to the previous permit conditions if the variance expires, unless that is a condition of a variance and permit. Although water quality standards can change with every triennial review, states and authorized tribes are not obliged to reopen and modify permits immediately to reflect those changes before issuance of a new permit.

*Antidegradation*—Permits with effluent limits based on a variance for methylmercury must conform to the state or authorized tribe’s antidegradation policy.

*Pollutant Minimization Plans*—Pollution Minimization Plans (PMPs) may serve as a pollution prevention measure that states and authorized tribes could require of dischargers receiving a variance. By reducing mercury sources up front, as opposed to traditional reliance of treatment at the end-of-pipe, PMPs might partially counter the effects of a variance by improving the water quality.

#### 3.2.2.3 What is involved in granting a variance on a larger scale?

Traditionally, variances are specific to a pollutant and a facility. However, for situations where a number of NPDES dischargers are located in the same area or watershed and the circumstances for granting a variance are the same, EPA encourages states and authorized tribes to consider administering a multiple-discharger variance for a group of dischargers collectively. Such a group variance can be based on various scales and may depend largely on the rationale for adopting a variance for methylmercury. Possible applications of a group variance may include any or some combination of the following:

## Case study:
## Ohio statewide variance for mercury

Ohio adopted a statewide mercury variance applicable to any point source dischargers in the state that meet several criteria. Specifically, Ohio adopted, and EPA approved, a rule that finds complying with a mercury WQBEL on the basis of the Great Lakes Guidance criteria applied at the end-of-pipe (i.e., without a mixing zone) would result in widespread adverse social and economic impacts, relieving individual permittees of the burden of making this demonstration on an individual basis. However, to obtain individual coverage under the Ohio group variance, a permittee must do the following:

1. Demonstrate that it can (or will within 5 years) achieve an average annual effluent concentration no greater than 12 ng/L mercury
2. Document that it is currently unable to comply with what would be the WQBEL for mercury in the absence of a variance (based on the guidance wildlife criterion of 1.3 ng/L)
3. Provide a plan of study to document known and suspected sources of mercury
4. Describe control measures taken to date as well as planned future measures to reduce or eliminate mercury from the discharger's effluent
5. Explain why there are not readily available means of complying with the WQBEL for mercury without construction of end-of-pipe controls

As a condition for receiving the variance, the discharger must accept permit conditions needed to implement the plan of study regarding the identification and evaluation of mercury sources and potential control measures. Further, the rule requires public notice of the preliminary decision and the supporting materials (including the plan of study). Ohio also requires monitoring as necessary to assess the impacts of the variance on public health, safety, and welfare. If the discharger still cannot meet the standard following completion of actions addressed in the plan of study and in the PMP, Ohio may take action (through permit modification or permit reissuance) to delete the variance or impose additional pollutant minimization steps (after consideration of public comment). Ohio also retains the right to request that a discharger submit an individual variance application.

*Similar costs, discharge processes* —A type of industry or effluent treatment process may be targeted on the basis of the associated costs or available technology (i.e., publicly owned treatment works (POTWs), mining operations, and so on). A state or authorized tribe can choose to adopt a variance with tiered requirements, depending on the type of industry requesting coverage. For example, due to the differing cost implications, one industry would be required to meet a variance of 10 parts per billion (ppb) above the criterion, whereas another industry would be required to meet a variance of 20 ppb above the criterion.

## Case study:
## Michigan's mercury multiple discharger variance

Until recently, analytical methods for detecting mercury in effluents at levels below the water quality criterion (1.3 ng/L for the protection of wildlife) were lacking. Due to the inability to quantify effluent mercury concentrations at low levels, most monitoring resulted in no detects. Because of these monitoring results, facilities did not receive effluent limits for mercury or were considered in compliance with effluent limits. EPA's new method (1631) makes possible quantification of effluent mercury concentrations to levels less than the criterion (quantification level = 0.5 ng/L).

Application of EPA's new method is expected to result in additional permit limits for mercury and better detection of noncompliance with permit limits. Michigan expects that many facilities with mercury limits will be unable to comply with the limits. No known, demonstrated treatment technologies for removing mercury from effluents at low nanogram per liter levels exist. Consequently, efforts intended to achieve compliance with water quality-based effluent limits for mercury focus on the identification and reduction of sources of mercury to a wastewater treatment system. Often, it is difficult to identify such sources and to quantify the expected effects of source controls on effluent mercury concentrations. Given the uncertainty in the ability to comply and the timing of compliance, Michigan invoked a provision of this water quality standards (R 323.1103(9)) that authorizes multiple-discharger variances where the Michigan Department of Environmental Quality determines, "that a multiple discharger variance is necessary to address widespread UQS compliance issues, including the presence of ubiquitous pollutants or naturally high background levels of pollutants in a watershed" for mercury.

Where the available data indicate that a limit on mercury is needed, Michigan imposes a limit that reflects the level currently achievable (10 ng/L expressed as a rolling 12 month average). The permit requires reasonable progress towards achieving the limit on the basis of the water quality criterion over the course of the permit. The permit requires the permittee to develop and implement a pollutant minimization plan to identify and eliminate sources of mercury. Effluent data will be generated using Method 1631. The variance is not available to new dischargers.

Rather than having each of these individual facilities apply for and receive an individual variance, the multiple discharger variance allows Michigan to respond to this issue consistently and efficiently and to get in place permits that require pollutant minimization plans that produce reductions in mercury effluent concentrations.

*Watershed basis*—A variance on a watershed scale might be a sensible approach, particularly for those states that issue NPDES permits on a watershed basis. As with other pollutants, methylmercury concentrations can be monitored to gain site-specific information (perhaps for calculating site specific BAFs) in key watersheds for a given year. A state or authorized tribe using a watershed approach to permitting will be collecting data from a watershed in 1 year for the purpose of issuing NPDES permits in a subsequent year. The state or authorized tribe could use these data for the purpose of revising a previously issued water quality variance. Meanwhile, variances for other watersheds remain the same or are renewed with unchanged variance requirements until monitoring occurs, with variance time frames coinciding with the permitting cycle. This way, the WQBELs will reflect a more "real-time" variance limit.

*Statewide*—Analogous to a general NPDES permit, a statewide variance is made available by the state or authorized tribe. Individual dischargers may apply for coverage under the variance upon fulfillment of certain conditions. One example of this approach is Ohio's statewide variance for mercury, which is described below.

It is important to note that, despite the coverage of a multiple source variance, an individual discharger must still demonstrate that the underlying criterion is not attainable with the technology-based controls identified by CWA sections 301(b) and 306 and with cost effective and reasonable best management practices (BMPs) for nonpoint sources (40 CFR 131.10(h)(2)).

### 3.2.3 How are use attainability analyses conducted?

#### 3.2.3.1 What is a use attainability analysis?

A UAA is defined in 40 CFR 131.3(g) as a structured scientific assessment of the factors affecting the attainment of a use, which may include physical, chemical, biological, and economic factors that must be conducted whenever a state wishes to remove a designated use specified in section 101(a)(2) of the CWA, or to adopt subcategories of uses specified in section 101(a)(2) of the CWA, which require less stringent criteria (see 40 CFR 131.3 and 40 CFR 131.10(g)).

#### 3.2.3.2 What is EPA's interpretation of CWA section 101(a)?

CWA section 101(a)(2) establishes as a national goal "water quality [that] provides for the protection and propagation of fish, shellfish, and wildlife and provides for recreation in and on the water," wherever attainable. These goals are commonly referred to as the "fishable/swimmable" goals of the CWA. EPA interprets fishable/swimmable as providing for the protection of aquatic communities and human health related to consumption of fish and shellfish. In other words, EPA views fishable/swimmable to mean that fish and shellfish can thrive in a waterbody, and when caught, can also be safely eaten by humans. This interpretation also satisfies the CWA section 303(c)(2)(A) requirement that water quality standards protect public health. Including human consumption of fish and shellfish as the appropriate interpretation of the definition of section 101(a)(2) fishable/swimmable uses is not new. For example, in the National Toxics Rule, all waters designated for even minimal aquatic life protection (and therefore a potential fish and shellfish consumption exposure route) are protected for human health (57 FR 60859, December 22, 1992).

#### 3.2.3.3 What is the rebuttable presumption of CWA section 101(a)?

EPA regulations effectively establish a rebuttable presumption that fishable/swimmable uses are attainable and therefore should apply to a waterbody unless it is affirmatively demonstrated that such uses are not attainable. The rebuttable presumption approach preserves states' and authorized tribes' paramount role in establishing water quality standards in weighing any available evidence regarding the attainable uses of a waterbody. If the water quality goals articulated by Congress cannot be met in a waterbody, the regulations simply require that such a determination be based upon a credible structured scientific assessment (e.g., a UAA). EPA believes that the rebuttable presumption policy reflected in the federal regulations is an essential foundation for effective implementation of the CWA as a whole. The use of a waterbody is the most fundamental articulation of its role in the aquatic and human environments, and all the water quality protections established by the CWA follow from the water's designated use. If a use lower than a fishable/swimmable use is designated on the basis of inadequate information or superficial analysis, water quality-based protections that might have enabled the water to achieve the goals articulated by Congress in section 101(a) may not be put in place.

#### 3.2.3.4 When is a UAA needed for a fishable use?

Under 40 CFR 131.10(j) of the Water Quality Standards Regulation, states and authorized tribes are required to conduct a UAA whenever the state or authorized tribe designates or has designated uses that do not include the fishable/swimmable use specified in CWA section 101(a)(2); or the state or authorized tribe wishes to remove a designated use that is specified in CWA section 101(a)(2), or adopt subcategories of the uses specified in that section that require less stringent criteria. An important caveat to the process of removing a designated use is that states and authorized tribes may not remove an "existing use" as defined by the Water Quality Standards Regulation. Existing uses are defined in 40 CFR 131.3(c) as any use that has been actually attained on or after November 28, 1975, when the CWA regulations regarding use designation were originally established. In practical terms, waters widely used for recreational fishing would not be good candidates for removing a "fishable" use, especially if the associated water quality supports, or has until recently supported, the fishable use, on the basis, in part, of the "existing use" provisions of EPA's regulations. In addition, designated uses are considered by EPA to be attainable, at a minimum, if the use can be achieved (1) through effluent limitations under CWA sections 301(b)(1)(A) and (B) and 306 and (2) through implementation of cost effective and reasonable BMPs on nonpoint sources. The federal regulation 40 CFR 131.10(g) further establishes the basis for finding that attaining the designated use is not feasible, as long as the designated use is not an existing use. EPA emphasizes that when adopting uses and appropriate criteria, states and authorized tribes must ensure that such standards provide for the attainment and maintenance of the downstream uses. States are not required to conduct UAAs when designating uses that include those specified in CWA section 101(a)(2), although they may conduct these or similar analyses when determining the appropriate subcategories of uses.

#### 3.2.3.5 What conditions justify changing a designated use?

EPA's regulations at 40 CFR 131.10(g) lists the following six reasons for states or authorized tribes to use to support removal of a designated use or adoption of a subcategory of use that carries less stringent criteria:

- Naturally occurring pollutant concentrations prevent the attainment of the use
- Natural, ephemeral, intermittent, or low-flow conditions or water levels prevent the attainment of the use, unless these conditions may be compensated for by the discharge of sufficient volume of effluent discharges without violating state water conservation requirements to enable uses to be met
- Human caused conditions or sources of pollution prevent the attainment of the use and cannot be remedied or would cause more environmental damage to correct than to leave in place

- Dams, diversions, or other types of hydrologic modifications prevent the attainment of the use, and it is not feasible to restore the waterbody to its original condition or to operate such modification in a way that would result in attainment of the use
- Physical conditions related to the natural features of the waterbody, such as the lack of a proper substrate, cover, flow, depth, pools, riffles, and the like, unrelated to water quality, prevent attainment of aquatic protection uses
- Controls more stringent than those required by CWA sections 301(b) and 306 would result in substantial and widespread economic and social impact

In addition to citing one or more of these factors to support removal of a use, states and authorized tribes use the same six factors to serve the purpose of guiding analysis and decision making with respect to establishing an attainable use. Of the six factors above, it is most likely that human caused conditions that cannot be remedied, naturally occurring pollutant concentrations, or substantial and widespread social and economic impact resulting from additional controls would be the reason cited in a UAA addressing methylmercury impacted waters. In all cases, states and authorized tribes must obtain scientifically sound data and information to make a proper assessment. It is also recommended that they conduct pollutant source surveys to define the specific dominant source of mercury in the waterbody. Sources may include: point source loadings, air deposition, mining waste or runoff, legacy levels (e.g., mercury resulting from historical releases), and geologic "background levels." This is similar to source assessments under the TDML program. Existing documents provide guidance on obtaining data and conducting analyses for the other components of a UAA. *The Technical Support Manual: Waterbody Surveys and Assessments for Conducting Use Attainability Analyses* (USEPA 1983) covers the physical and chemical components of UAAs. Technical support for assessing economic and social impacts is offered through the *Interim Economic Guidance for Water Quality Standards Workbook* (USEPA 1995b).