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INFORMATIONAL DOCUMENT

Public Scoping Meeting for Proposed Methylmercury Objectives for Inland Surface Waters, Enclosed Bays, and Estuaries in California

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DIVISION OF WATER QUALITY
STATE WATER RESOURCES CONTROL BOARD
CALIFORNIA ENVIRONMENTAL PROTECTION AGENCY

Introduction

The California State Water Resources Control Board (State Water Board) is considering adopting a statewide policy for methylmercury that would apply to inland waters, enclosed bays, and estuaries in the State. Based on the U.S. Environmental Protection Agency's (USEPA's) revised methylmercury (MeHg) fish tissue-based criteria guidance (USEPA, 2001), elements of the proposed policy may include a methylmercury fish tissue objective, a total mercury water quality objective, a methylmercury water quality objective, or some combination of these objectives. The proposed policy may also include implementation procedures related to the National Pollutant Discharge Elimination System (NPDES) permitting process. This document provides a summary of issues to be addressed and elements that may be included in the proposed policy.

Background

Under the Clean Water Act (CWA), states have primary authority for establishing designated uses for water bodies and for developing water quality criteria (referred to as water quality objectives under state law) to protect those designated uses. Under section 303(c)(2)(B) of the CWA, whenever a state adopts new water quality standards or reviews or revises existing water quality standards, it must adopt numeric water quality criteria for priority toxic pollutants [as defined by section 307(a) of the CWA and for which the Agency has issued a criteria guidance document per section 304(a) of the CWA] if the absence of such criteria could reasonably be expected to interfere with a designated use of a water body.

In 2000, USEPA promulgated the California Toxics Rule (CTR; USEPA, 2000) to bring California into compliance with CWA section 303(c)(2)(B). With the CTR, USEPA promulgated total recoverable mercury criteria for the protection of human health for California waters of 0.050 micrograms per liter (µg/L) for consumption of water and organisms, and 0.051 µg/L for consumption of organisms only. Some California Regional Water Quality Control Boards (Regional Water Boards), however, have water quality control plans (Basin Plans) that contain mercury objectives that are as stringent as, or more stringent than, the CTR criteria. If there is both a CTR criterion and an applicable objective for a water body, the more stringent of the two values applies.

Under section 304(a) of the CWA, USEPA must periodically revise criteria for water quality to accurately reflect the latest scientific knowledge on the kind and extent of all identifiable effects of pollutants on human health. After review of the mercury human health criteria, USEPA concluded that it was more appropriate to derive a section 304(a) criteria guidance for methylmercury based on fish tissue (including shellfish) concentrations, rather than water column-concentrations. An acceptable fish tissue concentration is more closely tied to the CWA goal of protecting the public health because it is based directly on the dominant human exposure route for methylmercury. Therefore, USEPA published revised methylmercury fish tissue criteria guidance in 2001 (USEPA, 2001).

In promulgating the CTR in 2000, USEPA agreed to update the CTR's mercury criteria based on consultation with the U.S. Fish and Wildlife Service (USFWS) and the U.S. National Marine Fisheries Service (USNMFS), pursuant to the Endangered Species Act. However, USEPA has not yet proposed revisions to the mercury criteria in the CTR, therefore the State Water Board is considering adopting objectives based on USEPA's 2001 criteria document, as well as implementation procedures based on Water Code considerations.

Potential Objectives Subject to Scoping Consideration

USEPA's recommended fish tissue criterion for methylmercury (USEPA, 2001) is based on the concentration of methylmercury in fish tissue, calculated using the following equation (USEPA, 2001):

$$TRC = \frac{BW*(RfD - RSC)}{\sum_{i=2}^{4} FI_i}$$

where:

TRC = tissue residue concentration: milligrams (mg) methylmercury/kilogram (kg) fish tissue

BW = human body weight default value of 70 kg

RfD = reference dose based on noncancer human health effects of 0.0001 mg methylmercury/kg body weight-day

RSC = relative source contribution, estimated at 2.7×10^{-5} mg methylmercury/kg body weight-day [subtracted from the reference dose to account for fish consumption from other sources (e.g., marine fish)]

FI_i = human fish consumption of trophic level[1] i (kg fish/day).

The criterion can either be implemented as is (i.e., a fish tissue-based objective or FTO), or it can be converted into an ambient methylmercury water quality objective (AWQO) using bioaccumulation factors [(BAFs) see appendix - Calculations for Alternative Objectives]:

$$AWQO = (RfD - RSC)\left[\frac{BW}{DI + \sum_{i=2}^{4}(FI_i * BAF_i)}\right]$$

where:

AWQO= ambient water quality criterion in mg MeHg/L

BW = human body weight default value of 70 kg

[1] Trophic levels are defined by the food relationship of fish in the food chain. There are four trophic levels that make up the aquatic food chain: trophic level 1 consists of primary producers such as phytoplankton and other plants; trophic level 2 contains zooplankton, benthic filter feeders, grazers, and herbivorous fish; trophic level 3 consists of fish that eat prey items from the trophic level 2 group; and trophic level 4 consists of fish that eat prey items from the trophic level 3 group.

RfD = reference dose based on noncancer human health effects of 0.0001 mg MeHg/kg body weight-day
RSC = relative source contribution, estimated at 2.7×10^{-5} mg MeHg/kg body weight-day
DI = drinking water intake default value of 2 Liters (L) of water/day
FI_i = human fish consumption of trophic level i (kg fish/day)
BAF_i = bioaccumulation factor for trophic level i (L/kg fish).

In converting to an AWQO, the FI_i values can reflect USEPA's default total fish consumption rate of 0.0175 kg fish/day or site-specific consumption rates that more accurately reflect actual consumption patterns. California-specific consumption information is available from a study conducted by the San Francisco Estuary Institute (SFEI, 2000) and was used in developing the draft San Francisco Bay Total Maximum Daily Load for mercury (San Francisco Bay Water Board, 2006). SFEI (2000) estimated that the 95th percentile consumption rate for consumers of San Francisco Bay fish is 0.032 kg fish/day. Note that this value is adjusted for avidity bias to more closely reflect consumption patterns of the general population of San Francisco Bay anglers. Thus, the SFEI (2000) consumption rate may more closely estimate the amount of fish eaten from inland waters, enclosed bays, and estuaries in California than the USEPA consumption rate.

Any adopted fish tissue objective should be protective of the populations most likely to consume fish and should be representative of the types of fish that those populations are most likely to eat. If target populations consume fish from different trophic levels, the State Water Board may consider factoring the consumption by trophic level in computing the average mercury in fish tissue (i.e., calculate a consumption-weighted average fish tissue mercury concentration). Conversely, to choose a method likely to be more protective, the State Water Board may consider only the highest trophic level fish that inhabit a given water body. In most cases, this will be trophic level 4 fish; however, in some water bodies, only lower trophic level organisms may be present.

As part of the endangered species consultation with the USFWS and the USNMFS on the CTR, the USFWS evaluated whether USEPA's human health methylmercury criterion of 0.3 mg/kg would be sufficient to protect federally listed aquatic and aquatic-dependent wildlife species in California. The USFWS found that the criterion of 0.3 mg/kg would only be sufficiently protective of four of seven species evaluated (USFWS, 2003). Lower criteria values would be necessary to protect all seven of the species, including the California Least Tern.

Exhibit 1 provides a summary of alternatives for revising the mercury objectives.

Exhibit 1. Alternatives for Human and Wildlife Health Objectives for Mercury

Option	Consumption Rate	Protection of Human Health					Protection of Wildlife	
		MeHg FTO	Dissolved MeHg AWQO	Total Hg AWQO			MeHg FTO[2]	MeHg FTO, 50 mm[3]
				Lake	River	Estuary		
1 – No action (CTR criteria)[1]	18.7 g/day	NA	NA	50/51 ng/L	50/51 ng/L	50/51 ng/L	NA	NA
2 – USEPA default values to convert human health TRC to AWQO; wildlife objectives based on USFWS evaluation.	17.5 g/day	0.3 mg/kg	0.24 ng/L	7.5 ng/L	17.1 ng/L	17.1 ng/L	0.20 mg/kg	0.03 mg/kg
3 – USEPA default values applied to trophic level 4 (TL_4) fish only to convert human health TRC to AWQO; wildlife objectives based on USFWS evaluation.	17.5 g/day	0.3 mg/kg	0.11 ng/L	3.4 ng/L	7.7 ng/L	7.7 ng/L	0.20 mg/kg	0.03 mg/kg
4 – CA-specific consumption rate; USEPA default values to convert human health TRC to AWQO; wildlife objectives based on USFWS evaluation.	32 g/day[4]	0.16 mg/kg	0.13 ng/L	4.1 ng/L	9.4 ng/L	9.4 ng/L	0.20 mg/kg	0.03 mg/kg
5 – CA-specific consumption rate; USEPA default values applied to TL_4 fish only to convert to AWQO; wildlife objectives based on USFWS evaluation.	32 g/day[4]	0.16 mg/kg	0.06 ng/L	1.8 ng/L	4.2 ng/L	4.2 ng/L	0.20 mg/kg	0.03 mg/kg
6 – CA-specific consumption rate; do not convert to AWQO; wildlife objectives based on USFWS evaluation.	32 g/day[4]	0.16 mg/kg	NA	NA	NA	NA	0.20 mg/kg	0.03 mg/kg

AWQO = Ambient water quality objective; FTO = fish tissue objective; Hg = mercury; MeHg = methylmercury; NA = not applicable

TRC = tissue residue concentration in mg methylmercury/kg fish

1. The human health criteria are 50 ng/l to protect for consumption of water and organisms, and 51 ng/L to protect for consumption of organisms only.
2. Protective of 6 of 7 sensitive species that the USFWS (2003, 2004) evaluated, based on consumption of highest trophic level fish.
3. Site-specific wildlife objectives apply where sensitive species (e.g., California Least Tern) exist. The FTO in small fish 30-50 mm, protective of the Least Tern as evaluated by the USFWS (2003), applies to water bodies where California Least Tern are found.
4. Source: SFEI (2000).

Implementation Procedures

For alternatives in which the fish tissue objective is converted to a water column objective, the Policy for Implementation of Toxics Standards for Inland Surface Waters, Enclosed Bays, and Estuaries of California (SIP) contains procedures for implementing water column objectives for toxic pollutants in permits. In particular, the SIP addresses how to determine whether a permit must include a water quality-based effluent limitation and, if a limit is necessary, how to calculate it. For a fish tissue-based objective that is not converted to a water column value, procedures are needed to implement the objective in NPDES permits and other water quality regulatory programs (see Exhibit 2). Additional monitoring requirements may be needed for any alternative.

Exhibit 2 provides examples of implementation procedures for the alternative objectives.

Exhibit 2. Potential Implementation Procedures for Point Sources

Option	Reasonable Potential (RP)	Effluent Limits	Monitoring Requirements	Variance Requirements
1-5	---------- Requirements are contained within the SIP ----------			
6	Fish tissue exceeds a screening level based on a margin of safety (e.g., 80% of FTO); water column exceeds AWQO calculated using USEPA default values (for BAFs and translators). [1]	If RP exists, implement PMP and limit mercury as appropriate.	RP or no data Effluent: Hg and MeHg monthly Water column: Hg and MeHg quarterly Fish tissue: MeHg yearly No RP Effluent: Hg and MeHg quarterly Fish tissue: MeHg yearly	Not applicable

AWQO = ambient water quality objective
BAF = bioaccumulation factor
Hg = mercury
MeHg = methylmercury
PMP = pollutant minimization program
RP = reasonable potential
1. Or site-specific values, where available.

If the State Water Board adopts a water column objective for methylmercury, point source dischargers may not be able to feasibly meet the low mercury effluent limitations implementing the objective. In this case, a variance procedure (for individual discharges or statewide), with certain requirements [e.g., pollutant minimization program (PMP) implementation], could provide regulatory relief while ensuring that all cost-effective mercury control measures are implemented. Any variance procedure would need to conform with the requirements in 40 Code of Federal Regulations 131.10(g).

Under a fish tissue only objective, PMPs may be required as well as a numeric effluent limit (e.g., for the mass loading of mercury established at the existing effluent level or

any existing numeric limit), as appropriate. Possible PMP requirements could include:

- Pollution prevention
- Source control
- Actions to reduce or eliminate mercury discharges
- Treatment optimization and cost-effective control measures (including Best Management Practices)
- Public outreach and education efforts

Possible implementation requirements could include:

- Source identification and tracking
- Monitoring influent, effluent, and biosolids
- Schedule for achieving reductions in mercury concentrations in the discharge
- Annual status reports on the PMP program

The state will also consider recommendations for implementation of a fish tissue objective contained in draft USEPA mercury guidance.[2]

[2] 71 Fed. Reg. 45560-45564 (August 9, 2006).

Appendix

Calculations for Alternative Objectives

This section describes the calculation of a Bioaccumulation Factor and provides the values for calculating the proposed mercury human health objective alternatives.

A BAF is a ratio that relates the concentration of a chemical in water to its expected concentration in commonly consumed aquatic organisms (USEPA, 2001):

$$BAF = \frac{C_{FT}}{C_{WC}}$$

where:

C_{FT} = concentration of methylmercury in fish tissue in mg MeHg/kg-fish
C_{WC} = concentration of dissolved methylmercury in water column in mg MeHg/L

The following equation converts the dissolved methylmercury AWQO to a total mercury AWQO (USEPA, 2001):

$$AWQO_{Hg} = \frac{AWQO_{MeHg}}{f_d}$$

where:

$AWQO_{Hg}$ = total mercury ambient water quality criterion
$AWQO_{MeHg}$ = dissolved methylmercury ambient water quality criterion
f_d = translator, ratio of dissolved methylmercury to total mercury in the water column

Exhibit 3 illustrates the calculation of the human health objectives.

Exhibit 3. Calculation of Alternatives for Human Health Objectives for Mercury [1]

Parameter	1 – No action (CTR criteria)[1]	2 – USEPA defaults to convert TRC to AWQO[2]	3 – USEPA defaults applied to TL4 fish only to convert TRC to AWQO	4 – CA-specific consumption; USEPA defaults to convert to AWQO[3]	5 – CA-specific consumption; USEPA BAF for TL4 fish only; default translators to convert to AWQO	6 – CA-specific consumption; not converted to AWQO
Fish Consumption (FI) (g/day)	18.7	17.5	17.5	32[4]	32[4]	32[4]
Trophic Level 2 (FI_2)	NA	3.8	NA	6.9	NA	NA
Trophic Level 3 (FI_3)	NA	8.0	NA	14.6	NA	NA
Trophic Level 4 (FI_4)	NA	5.7	17.5	10.4	32	NA
Body weight (kg)	70	70	70	70	70	70
Reference Dose (RfD) (mg/kg-day)	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
RSC (mg/kg-day)	0.000027	0.000027	0.000027	0.000027	0.000027	0.000027
Methylmercury TRC (FTO) (mg/kg)	NA	0.3	0.3	0.16	0.16	0.16
Drinking Water Intake (DI) (L/day)	2	2	2	2	2	2
Bioaccumulation Factors (BAF) (L/kg)						
Trophic Level 2 (BAF_2)	NA	120,000	NA	120,000	NA	NA
Trophic Level 3 (BAF_3)	NA	680,000	NA	680,000	NA	NA
Trophic Level 4 (BAF_4)	NA	2,700,000	2,700,000	2,700,000	2,700,000	NA
Methylmercury AWQO (ng/L)	NA	0.24	0.11	0.13	0.06	NA
Total Mercury translator (f_d) (unitless)						
River	NA	0.014	0.014	0.014	0.014	NA
Lake	NA	0.032	0.032	0.032	0.032	NA
Estuary	NA	0.014	0.014	0.014	0.014	NA
Total Mercury AWQO (ng/L)						
River	50	17.1	7.7	9.4	4.2	NA
Lake	50	7.5	3.4	4.1	1.8	NA
Estuary	51	17.1	7.7	9.4	4.2	NA

AWQO = ambient water quality objective
FTO = fish tissue objective
RSC = relative source contribution
TRC = tissue residual concentration

1. Source: USEPA (2000).
2. Source: USEPA (2001).
3. Consumption allocated to trophic level based on USEPA (2001) defaults: TL2=21.7%; TL3=45.7%; TL4=32.6%
4. Source: SFEI (2000).

References

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