

**7050.0218 METHODS FOR DETERMINATION OF CRITERIA FOR TOXIC POLLUTANTS, FOR WHICH NUMERIC STANDARDS NOT PROMULGATED.**

Subpart 1. **Purpose.** The Class 2 and Class 7 numeric water quality standards for toxic pollutants in parts 7050.0220, 7050.0222, and 7050.0227 do not address all pollutants which may be discharged to surface waters and cause toxic effects. Therefore, methods are established in this part to address on a site-by-site and case-by-case basis the discharge into surface waters of toxic pollutants not listed in parts 7050.0220, 7050.0222, and 7050.0227.

The agency may also adopt new standards according to Minnesota Statutes, chapter 14, to replace those listed in parts 7050.0220 to 7050.0227 that are more stringent or less stringent if new scientific evidence shows that a change in the standard is justified.

Subp. 2. **Site-specific criteria.** Class 2 and Class 7 site-specific criteria for toxic pollutants shall be derived by the commissioner using the procedures in this part.

A. A site-specific criterion so derived is specific to the point source being addressed. Any effluent limitation derived from a site-specific criterion under this subpart shall only be required after the discharger has been given notice of the specific proposed effluent limitations and an opportunity to request a hearing as provided in part 7000.1800.

B. A site-specific criterion so derived for remedial action cleanup activities is specific to the affected surface water body.

Subp. 3. **Definitions.** For the purposes of parts 7050.0217 to 7050.0227, the following terms have the meanings given them.

A. "Acute-chronic ratio" or "ACR" means the ratio of the acute toxicity, expressed as a LC50 or EC50, of a toxicant to its chronic toxicity expressed as the chronic value. The ACR is used as a factor for estimating chronic toxicity on the basis of acute toxicity.

B. "Acute toxicity" means a stimulus severe enough to rapidly induce a response. In toxicity tests, a response is normally observed in 96 hours or less. Acute effects are often measured in terms of mortality or other debilitating effects, represented as LC50s or EC50s, and expressed as concentrations of mass per unit volume, percent effluent, or toxic units.

C. "Available scientific data" means information derived from scientific literature including: published literature in peer reviewed scientific journals, USEPA ambient water quality criteria documents, and other reports or documents published by the USEPA or other governmental agencies.

D. "Bioaccumulation factor" or "BAF" means the concentration of a pollutant in one or more tissues of an aquatic organism, exposed from any source of the pollutant but primarily from the water column, diet, and bottom sediments, divided by the average

concentration in the solution in which the organism had been living, under steady state conditions.

E. "Bioconcentration factor" or "BCF" means the concentration of a pollutant in one or more tissues of an aquatic organism, exposed only to the water as the source of the pollutant, divided by the average concentration in the solution in which the organism had been living, under steady state conditions.

F. "Cancer potency factor" or "ql\*" means a factor indicative of a chemical's human cancer causing potential. The ql\* is the upper 95 percent confidence limit (one-sided) of the slope from a linear nonthreshold dose-response model used by the USEPA to provide an upper bound estimate of incremental cancer risk. The ql\* assumes a lifetime exposure and is expressed in days times kilogram body weight per milligram toxicant (d x kg/mg).

G. "Chronic toxicity" means a stimulus that lingers or continues for a long period of time, often one-tenth the life span or more. A chronic effect can be mortality, reduced growth, reproduction impairment, harmful changes in behavior, and other nonlethal effects.

H. "Chronic criterion" or "CC" means the highest water concentration of a toxicant or effluent to which organisms, including humans or wildlife, can be exposed indefinitely without causing chronic toxicity. "CC<sub>df</sub>" means a chronic criterion based on protecting humans from exposure to the pollutant from both drinking water and eating sport-caught fish. "CC<sub>f</sub>" means a chronic criterion based on protecting humans from exposure to the pollutant from eating sport-caught fish only. "CC<sub>w</sub>" means a chronic criterion based on protecting wildlife from exposure to the pollutant from eating aquatic organisms.

I. "Chronic standard" or "CS" means the highest water concentration of a toxicant to which organisms can be exposed indefinitely without causing chronic toxicity. Chronic standards are listed in parts 7050.0220 and 7050.0222.

J. "Chronic value" means the geometric mean of the highest tested concentration that did not cause an unacceptable adverse effect and the lowest tested concentration that did cause an unacceptable adverse effect, and in which all higher test values cause an effect, in an approved chronic test.

K. "Cold water fisheries" means a community of fish including species of trout and salmon from the Salmonidae family that inhabit trout waters as defined in part 7050.0420.

L. "Criterion" means a number or numbers established for a pollutant derived under this part, or issued by the USEPA, to protect aquatic life, humans, or wildlife.

M. "Duration" means the time over which the instream concentration of a pollutant is averaged for comparison with the standard or criterion.

N. "Effect concentration" or "EC50" means the toxicant concentration that causes equilibrium loss, immobilization, mortality, or other debilitating effects in 50 percent of the exposed organisms during a specific time of observation.

O. "Final acute value" or "FAV" means an estimate of the concentration of a pollutant corresponding to the cumulative probability of 0.05 in the distribution of all the acute toxicity values for the genera or species from the acceptable acute toxicity tests conducted on a pollutant. The FAV is the acute toxicity limitation applied to mixing zones in part 7050.0210, subpart 5; and to dischargers in parts 7053.0215, subpart 1; 7053.0225, subpart 6; and 7053.0245, subpart 1.

P. "Genus mean acute value" or "GMAV" means the geometric mean of the SMAVs available for the genus.

Q. "Lethal concentration" or "LC50" means the toxicant concentration killing 50 percent of the exposed organisms in a specific time of observation.

R. "Lowest observable adverse effect level" or "LOAEL" means the lowest tested concentration that caused a statistically significant occurrence of an adverse effect in comparison with a control when all higher test concentrations caused adverse effects.

S. "Maximum criterion" or "MC" means the highest concentration of a toxicant in water to which aquatic organisms can be exposed for a brief time with zero to slight mortality. The MC equals the FAV divided by two.

T. "Maximum standard" or "MS" means the highest concentration of a toxicant in water to which aquatic organisms can be exposed for a brief time with zero to slight mortality. The MS equals the FAV divided by two. Maximum standards are listed in part 7050.0222.

U. "National methods" means the methods the USEPA uses to develop aquatic life criteria as described in Stephan, C.E., D.J. Mount, D.J. Hansen, J.H. Gentile, G.A. Chapman, and W.A. Brungs, 1985, "Guidelines for Deriving Numerical National Water Quality Criteria for the Protection of Aquatic Organisms and Their Uses," USEPA, Office of Research and Development, Environmental Research Laboratories, Duluth MN; Narragansett, RI, Corvallis, OR. 98 p; available through the National Technical Information Service, Springfield, VA.

V. "No observable adverse effect level" or "NOAEL" means the highest tested concentration that did not cause a statistically significant occurrence of an adverse effect in comparison with a control when no lower test concentration caused an injurious or adverse effect.

W. "Octanol to water partition coefficient" or " $K_{ow}$ " means the ratio of the concentration of a substance in the octanol phase to its concentration in the aqueous phase of a two-phase octanol to water system after equilibrium of the substance between the

two phases has been achieved. The  $\log_{10} K_{ow}$  has been shown to be proportional to the bioconcentration potential of lipophilic organic chemicals.

X. "Parachor" means the surface tension adjusted molar volume, and specifically is the molecular weight of a liquid times the fourth root of its surface tension, divided by the difference between the density of the liquid and the density of the vapor in equilibrium with it; essentially constant over wide ranges of temperature. Parachor relates to the physical properties of a molecule that affect its potential to bioaccumulate in aquatic organisms.

Y. "Percent effluent" means the representation of acute or chronic toxicity of an effluent as a percent of whole effluent mixed in dilution water, where acute toxicity is expressed by LC50s or EC50s and chronic toxicity is expressed by NOAELs.

Z. "Reference dose" or "RfD" means an estimate of a daily exposure to the human population, including sensitive subpopulations, that is likely to be without appreciable risk or deleterious effects over a lifetime. The RfD is expressed in units of daily dose, mg/kg/day.

AA. "Relative source contribution factor" or "RSC" means the fraction of the total allowable daily dose of a toxic pollutant that is attributed to drinking water and fish consumption relative to other sources of the pollutant to humans, such as air or food, in the calculation of criteria. In the absence of sufficient data to establish a chemical-specific RSC value, the RSC is 0.2.

BB. "Species mean acute value" or "SMAV" means the geometric mean of all the available and acceptable acute values for a species.

CC. "Standard" means a number or numbers established for a pollutant or water quality characteristic to protect a specified beneficial use as listed in parts 7050.0221 to 7050.0227. The standard for a toxic pollutant includes the CS, MS, and FAV. Some pollutants do not have an MS or an FAV due to insufficient data. For these pollutants, the CS alone is the standard.

DD. "Toxic pollutant" has the meaning given it in part 7050.0185, subpart 2, item F.

EE. "Toxic unit" means a measure of acute or chronic toxicity in an effluent. One acute toxic unit (TUa) is the reciprocal of the effluent concentration that causes 50 percent effect or mortality to organisms for acute exposures (100/LC50); one chronic toxic unit (TUc) is the reciprocal of the effluent concentration that causes no observable adverse effect level on test organisms for chronic exposures (100/NOAEL).

FF. "USEPA" means the United States Environmental Protection Agency.

GG. "Water quality characteristic" means a characteristic of natural waters, such as total hardness or pH. Some water quality characteristics can affect the toxicity of pollutants to aquatic organisms.

HH. "Whole effluent toxicity test" means the aggregate toxic effect of an effluent measured directly by a toxicity test. Effects on tested organisms are measured and expressed as toxic units or percent effluent for both acute and chronic whole effluent toxicity tests.

Subp. 4. **Adoption of USEPA national criteria.** The USEPA establishes aquatic life criteria under section 304(a)(1) of the Clean Water Act, United States Code, title 33, section 1314. The USEPA criteria, subject to modification as described in this subpart, are applicable to Class 2 waters of the state. The USEPA has described the national methods for developing aquatic life criteria in "Guidelines for Deriving Numerical National Water Quality Criteria for the Protection of Aquatic Organisms and Their Uses."

USEPA criteria that vary with an ambient water quality characteristic such as total hardness or pH will be established for specific waters or reaches using data available to the commissioner. Central values such as the means or medians for the characteristic will be used unless there is evidence to support using different values. Values for water quality characteristics can be estimated for specific waters or reaches that have no data by using data from a nearby watershed with similar chemical properties.

A. The USEPA criteria are adopted unchanged by the agency, unless modified under item C, as the criteria applicable to designated trout waters. Trout (Class 2A) waters are listed in parts 7050.0420 and 7050.0470.

B. The USEPA criteria are adopted, subject to modification as described in this item or item C, for application to cool and warm water fisheries habitats and wetlands. Cool and warm water fisheries (Class 2Bd, 2B, and 2C) waters are defined in part 7050.0430 or listed in part 7050.0470. Wetlands (Class 2D) waters are defined in part 7050.0425 or listed in part 7050.0470.

(1) Acute data, in the form of the ranked genus mean acute values used by the USEPA to determine the national criteria, are the data used to determine the Class 2Bd, 2B, 2C, and 2D criteria.

(2) GMAVs for fish in the family Salmonidae are deleted from the lowest of the ranked GMAVs so that all of the lowest four GMAVs in the USEPA data set are for nonsalmonid species. Following these deletions, no other salmonid GMAVs are deleted. If none of the lowest four GMAVs in the USEPA data set are for salmonid species, no GMAVs are deleted. The minimum of eight GMAVs specified in the national methods must be met, except that nonsalmonid fish can take the place of the salmonid requirement if the prescribed deletions eliminate all salmonids from the national data set.

(3) The number of GMAVs in the USEPA criteria data set is reduced by the number of salmonid GMAVs deleted.

(4) The FAV is determined according to the national methods as follows:

(a) for each species for which one or more acute value is available, a SMAV is calculated as the geometric mean of all the acceptable acute values;

(b) for each genus for which one or more SMAV is available, a GMAV is calculated as the geometric mean of all the SMAVs;

(c) the GMAVs are ranked from the lowest to the highest;

(d) a rank is assigned to the GMAVs from "1" for the lowest to "N" for the highest, and if two or more GMAVs are identical, successive ranks are arbitrarily assigned;

(e) the cumulative probability (P) for each GMAV is calculated as rank/(N+1);

(f) the four GMAVs that have cumulative probabilities closest to 0.05 are selected, and if there are less than 59 GMAVs, these will always be the lowest four GMAVs; and

(g) using the selected GMAVs and their respective cumulative probabilities, calculate:

$$S^2 = \frac{\Sigma((\ln \text{ GMAV})^2) - ((\Sigma(\ln \text{ GMAV}))^2/4)}{\Sigma(P) - ((\Sigma(\text{square root of } P))^2/4)}$$

$$L = \frac{\Sigma(\ln \text{ GMAV}) - S(\Sigma(\text{square root of } P))}{4}$$

$$A = S(\text{square root of } 0.05) + L$$

$$\text{FAV} = e^A$$

where: FAV = final acute value

N = number of GMAVs

P = rank/N+1

ln = natural logarithm to base e S, L, and A are intermediate steps

(5) If, as a result of the recalculation of the USEPA criterion for application to Class 2Bd, 2B, 2C, and 2D waters, the FAV for these water classes is lower than the FAV for Class 2A waters, the Class 2Bd, 2B, 2C, or 2D FAV will be changed to equal the Class

2A FAV, unless the lower Class 2Bd, 2B, 2C, or 2D FAV is justified based on the available toxicological data.

(6) The MC is the FAV divided by two.

(7) The CC is determined using the national methods. If sufficient chronic data is available to determine the CC directly from chronic values, salmonid chronic values will be deleted from the national data set following the same procedures used for acute data in this item. If sufficient chronic data is not available, the USEPA ACR, subject to modification under item C, is divided into the FAV to determine the CC.

C. If the commissioner finds that the information that supports a USEPA criterion is no longer current or complete for reasons including, but not limited to, changes to the relationship between a water quality characteristic and toxicity; the ACR; the weight given to toxicity data for a commercially or recreationally important species; the RfD; the ql\*; or the BAF; then the commissioner shall evaluate all available information and modify the criterion according to the information and with the objectives in part 7050.0217. Any effluent limitation determined to be necessary based on criteria derived under this item shall only be required after the discharger has been given notice to the specific proposed effluent limitations and an opportunity to request a hearing as provided in part 7000.1800.

Subp. 5. **Toxicity-based criteria.** Toxicity-based aquatic life criteria shall be determined using the methods in this subpart when no USEPA criterion is available.

A. Criteria shall be determined using the USEPA national method if the minimum data required in this item and item B are met. Data for saltwater organisms can be used for nonionizable organic chemicals. Data for saltwater organisms cannot be used for ionizable organic or inorganic chemicals. Data for all North American species can be used. A minimum of eight GMAVs representing the following groups must be available:

- (1) species in three families in the phylum Chordata, one of which must be a salmonid;
- (2) a freshwater or saltwater crustacean;
- (3) a freshwater cladoceran;
- (4) a family in a phylum other than Chordata or Arthropoda; and
- (5) two other families not in the phylum Chordata.

B. The additional acute data requirements in subitems (1) and (2) apply when developing criteria for pesticides.

- (1) If the chemical is an insecticide, one of the eight GMAVs required in item A, subitem (5), must be for an insect.

(2) If the chemical is a herbicide, the eight GMAVs required in item A must be supplemented with acute data for two plant species, one of which is an algal species.

C. The FAV is calculated as described in subpart 4, item B, subitem (4). No more than two of the lowest four GMAVs may be for a saltwater species.

D. The MC is the FAV divided by two.

E. The CC is the FAV divided by an ACR. Available chronic data are used to determine ACRs as described in item F and measured chronic values are compared to the CC. If an approved chronic value for a commercially, recreationally, or ecologically important freshwater species is lower than the CC, the CC will be set to equal that chronic value.

F. The ACR is determined according to subitems (1) to (3).

(1) A measured ACR is determined by dividing the acute value by the chronic value for the same species from tests that meet the requirements for determining ACRs in the national method. If more than one ACR is available for a species, a species mean ACR is calculated as the geometric mean of the available ACRs.

(2) A minimum of three measured ACRs, each for a different species, must be available to determine a final measured ACR. The final measured ACR is the geometric mean of all the available species mean ACRs.

(3) If no measured ACRs are available, the following default ACRs shall be used:

(a) an ACR of 20 is used with nonpesticide, nonbioaccumulative organic chemicals with  $\log K_{ow}$  values of three or less; and

(b) an ACR of 55 is used with pesticides, inorganic chemicals, or bioaccumulative organic chemicals with  $\log K_{ow}$  values greater than three.

(4) If two or fewer measured ACRs are available, the default ACRs in subitem (3) are incorporated into the calculation of the final ACR as follows:

(a) if two measured ACRs are available, the final ACR is the geometric mean of the two measured ACRs and the appropriate default ACR; and

(b) if one measured ACR is available, the final ACR is the geometric mean of the measured ACR and two appropriate default ACRs.

G. If the acute data available do not meet the requirements in items A and B, toxicity-based criteria can be determined by the method in this item. This method is not

applicable to ionizable organic chemicals, or to bioaccumulative organic chemicals and pesticides with BCFs greater than 5,000 or log  $K_{ow}$  values greater than 5.19.

(1) Acute data are assembled. A minimum of two acute values in the following groups must be available:

(a) a member of the class Osteichthyes (fish); and

(b) a member of one of the following genera in the family Daphnidae: *Daphnia*, *Ceriodaphnia*, *Simocephalus*.

(2) For insecticides, a third acute value must be available for an insect species in addition to the acute values required in subitem (1).

(3) For herbicides, two acute values for plant species, one of which is an algal species, must be available in addition to the acute values required in subitem (1).

(4) Data for saltwater species shall not be used except for purposes of determining ACRs.

(5) SMAVs are calculated as the geometric mean of all the acute values for one species.

(6) GMAVs are calculated as the geometric mean of the SMAVs.

(7) The lowest GMAV from among the available GMAVs is selected.

(8) The FAV is calculated by dividing the lowest GMAV by the appropriate factor listed below, depending on the number of GMAVs available that meet the minimum data requirements in subitems (2) and (3) and in item A.

| Number of GMAVs | Factor |
|-----------------|--------|
| 2               | 13.0   |
| 3               | 8.0    |
| 4               | 7.0    |
| 5               | 6.1    |
| 6               | 5.2    |
| 7               | 4.3    |

(9) The MC is calculated by dividing the FAV by two.

(10) A final ACR is determined as described in item F, except that the default ACR shall be 18 for all chemicals for which this method is applicable as specified in this item.

(11) The CC is calculated by dividing the FAV by the appropriate ACR.

(12) If chronic data are available, they are used to determine measured ACRs as described in item F, and chronic data are compared to the CC.

Subp. 6. **Human health-based criteria.** Human health-based aquatic life criteria protect humans from potential adverse effects of eating fish and edible aquatic organisms from Class 2 waters and from the consumption of drinking water from Class 1 surface waters (includes Class 2A and 2Bd waters).

The RfDs used to calculate criteria for noncarcinogenic chemicals and the ql\*s used to calculate criteria for carcinogenic chemicals are obtained from the Integrated Risk Information System (IRIS), online, maintained, and made available by the USEPA.

A. Criteria for noncarcinogenic chemicals applicable to surface waters designated Class 2A or 2Bd are calculated as follows:

$$CC_{df} \text{ mg/L} = \frac{\text{RfD mg/kg/day} \times 70 \text{ kg} \times \text{RSC}}{2 \text{ L/day} + [0.030 \text{ kg/day} \times \text{BAF}]}$$

where:  $CC_{df}$  = drinking water plus fish consumption chronic criterion in mg/L

RfD = reference dose in mg/kg/day

70 kg = standard weight of an adult

RSC = relative source contribution factor (see item E)

2 L/day = two liters of water consumed per day

0.030 kg/day = amount of fish assumed to be consumed per day

BAF = final BAF in L/kg

B. Criteria for noncarcinogenic chemicals applicable to Class 2B, 2C, or 2D surface waters are calculated as follows:

$$CC_f \text{ mg/L} = \frac{\text{RfD mg/kg/day} \times 70 \text{ kg} \times \text{RSC}}{0.01 \text{ L/day} + [0.030 \text{ kg/day} \times \text{BAF}]}$$

where:  $CC_f$  = fish consumption chronic criterion in mg/L

0.01 L/day = assumed incidental ingestion of water other variables as previously identified

C. Criteria for carcinogenic chemicals applicable to surface waters designated Class 2A or 2Bd are calculated as follows:

$$CC_{df} \text{ mg/L} = \frac{70 \text{ kg} \times 10^{-5}}{q1^* \times [2 \text{ L/day} + (0.030 \text{ kg/day} \times \text{BAF})]}$$

where:  $10^{-5}$  = a cancer risk level of one chance in 100,000

$q1^*$  = the cancer potency factor in days times kg/mg other variables as previously identified

D. Criteria for carcinogenic chemicals applicable to Class 2B or 2C surface waters are calculated as follows:

$$CC_f \text{ mg/L} = \frac{70 \text{ kg} \times 10^{-5}}{q1^* \times [0.01 \text{ L/day} + (0.030 \text{ kg/day} \times \text{BAF})]}$$

where: variables as previously identified

E. A default relative source contribution factor (RSC) of 0.2 must be used unless the Minnesota Department of Health uses a different exposure value in the calculation of a drinking water criterion, or sufficient exposure data is available to support an alternative value.

Subp. 7. **Bioaccumulation.** A final BAF can be determined either from bioaccumulation measurements in the field or from laboratory bioconcentration experiments. Laboratory tests should have a duration of at least 28 days, or the bioconcentration should have achieved steady state. Bioconcentration tests should meet the requirements in the national methods.

If measured BAFs and BCFs are not available for lipophilic organic chemicals, a final BAF can be estimated using the relationship between bioconcentration and the log of the octanol to water partition coefficient ( $\log K_{ow}$ ) as described in item D.

A. A final BAF for inorganic chemicals is equal to the geometric mean of the available BCFs and BAFs. The BCFs and BAFs can be for either whole body or edible tissue, or both.

B. A final BAF for lipophilic organic chemicals is determined when measured BAFs or BCFs and percent lipid data are available according to subitems (1) to (10).

(1) Measured BAFs and BCFs are assembled from USEPA documents, scientific literature, and other available sources of scientific data. BAFs and BCFs may be for edible portions of aquatic organisms or for the whole body.

(2) Normalized BAFs and BCFs are obtained by dividing the BAFs and BCFs by the arithmetic average percent lipid for the test organisms.

(3) Species mean BAFs are calculated as the geometric mean of all the normalized BAFs for a species. Species mean BCFs are calculated as the geometric mean of all the normalized BCFs for a species.

(4) A chemical-specific mean BAF or BCF is calculated as the geometric mean of the species mean BAFs or BCFs. The species mean normalized BAFs and BCFs for chemicals with  $\log K_{ow}$  values less than three are averaged together. The species mean normalized BAFs and BCFs for chemicals with  $\log K_{ow}$  values of three or more are averaged separately.

(5) A final BAF for a chemical with a  $\log K_{ow}$  value of less than three is determined as follows:

(a) for cold water fish, the normalized mean of the combined BAFs and BCFs is multiplied by six percent lipid; and

(b) for cool and warm water fish, the normalized mean of the combined BAFs and BCFs is multiplied by 1.5 percent lipid.

(6) A final BAF for a chemical with a  $\log K_{ow}$  value of three or more, for which measured BAFs and percent lipid data are available, is determined by multiplying the normalized mean BAF by six percent lipid for Class 2A waters or 1.5 percent lipid for Class 2Bd, 2B, and 2C waters.

(7) The final BAF for chemicals with a  $\log K_{ow}$  value of three or more, for which BCF and percent lipid data are available, is the value determined in subitem (6), multiplied by the appropriate factor from subitem (8).

(8) The BCF to BAF adjustment factor is applicable to lipophilic organic chemicals with  $\log K_{ow}$  values of three or more, unless chemical-specific data indicates the application of the factor is not appropriate. A value of six is used to calculate the factor for chemicals with  $\log K_{ow}$  values greater than six. The BCF to BAF adjustment factor is calculated using the following equation; the results shall not be less than one nor greater than 15:  $\log_{10}(\text{BCF to BAF factor}) = 0.384 \log_{10} K_{ow} - 0.00055 \text{ Parachor} - 1.128$ .

(9) The following are representative factors from the equation in subitem (8):

| $\log K_{ow}$ | Factor (at Parachor = 500) |
|---------------|----------------------------|
| 3.0           | 0.6 (1.0 is used)          |
| 3.5           | 0.9 (1.0 is used)          |

|     |     |
|-----|-----|
| 4.0 | 1.4 |
| 4.5 | 2.1 |
| 5.0 | 3.3 |
| 5.5 | 5.1 |
| 6.0 | 8.0 |

(10) When both measured BAFs and BCFs are available for chemicals with  $\log K_{ow}$  values of three or more, the commissioner will evaluate both BCFs and BAFs and other available scientific data to select the appropriate values to use.

C. A final BAF is determined for lipophilic organic chemicals having measured BAF or BCF data, but no percent lipid data, as follows:

- (1) the geometric mean of the species mean BAFs is the final BAF;
- (2) the geometric mean of the species mean BCFs and BAFs is the final BAF for chemicals having  $\log K_{ow}$  values less than three; and
- (3) the final BAF for chemicals having  $\log K_{ow}$  values of three or more is the geometric mean of the species mean BCFs multiplied by the appropriate factor from the equation in item B, subitem (8). Chemicals may have both BAF and BCF data. The geometric mean BCF will be adjusted by the factor from the equation in item B, subitem (8), and the results compared to the measured BAFs. The commissioner will evaluate both BCFs and BAFs and other available scientific data to select a final BAF. BAF data are usually preferred over BCF data.

D. A final BAF for lipophilic organic chemicals is determined according to subitems (1) to (4) when no measured BAFs or BCFs are available.

(1) A BCF can be estimated based on the relationship between BCFs and the  $\log K_{ow}$ . A value of six is used to calculate the BCF for chemicals with  $\log K_{ow}$  values greater than six. The equation is:

$$\log_{10} \text{BCF} = 0.79 \log_{10} K_{ow} - 0.40$$

where:  $\log_{10} K_{ow}$  = the log of the octanol to water partition coefficient

If measured  $\log K_{ow}$  values are not available in the scientific literature, they may be estimated using quantitative structure activity relationships. The average percent lipid of the organisms used to establish this relationship is 7.6.

(2) BCFs estimated from the equation in subitem (1) are adjusted for the percent lipid of edible portions.

(a) The BCF for cold water fish equals the estimated BCF from the equation in subitem (1) times 6/7.6.

(b) The BCF for cool and warm water fish equals the estimated BCF from the equation in subitem (1) times 1.5/7.6.

(3) The final BAF for chemicals with  $\log K_{ow}$  values less than three equals the estimated BCF from subitem (2).

(4) The final BAF for chemicals with  $\log K_{ow}$  values of three or more equals the estimated BCF from subitem (2), multiplied by the factor from the equation in item B, subitem (8).

Subp. 8. **Taste and odor criteria.** The agency shall limit the addition of pollutants to surface waters to the extent necessary to protect fish and other edible freshwater organisms from acquiring objectionable tastes and odors. The agency will use the USEPA national organoleptic criteria, established under section 304(a)(1) of the Clean Water Act, United States Code, title 33, section 1314, when establishing concentrations above which unacceptable tastes and odors could be imparted to aquatic organisms.

Subp. 9. **Wildlife-based criteria.** The agency shall use the procedures in this subpart to establish wildlife-based criteria. Wildlife criteria shall protect wildlife consumers of freshwater aquatic organisms from adverse effects of toxic pollutants. Wildlife criteria are applicable to all surface waters, subject to the exceptions in subpart 10, item B, subitem (1).

A. Wildlife-based criteria shall be determined using toxicological information from available sources of scientific data for wildlife or domestic animal species, exposed to toxic pollutants through ingestion including gavage.

B. Wildlife-based criteria are calculated using the following formula:

$$CC_w \text{ mg/L} = \frac{\text{NOAEL} \times \text{BWt} \times \text{SSF}}{\text{DW} + (\text{F} \times \text{BAF})}$$

where:  $CC_w$  = wildlife chronic criterion in mg/L

NOAEL = no observable adverse effect level in mg of substance per kg of body weight per day (mg/kg BWt/day) as derived from mammalian or avian toxicity studies. If the NOAEL is in mg/L, the NOAEL will be multiplied by the average daily volume of water consumed by the test animals in liters per day and divided by the average weight of the test animals in kg. If the NOAEL is in mg/kg of food consumed, the NOAEL will be multiplied by the average amount of food consumed daily by the test animals and divided by the average weight of the test animals in kg

BWt = average body weight of test organisms in kg

SSF = species sensitivity factor to account for difference in the sensitivity in test species. This factor will vary between 1 and 0.1. The appropriate factor will be determined by the commissioner based on available scientific data on the relative sensitivity of the test organism compared to other wildlife species

DW = average volume of water consumed per day by the test animals in liters

F = average amount of food consumed per day by test animals in kg

BAF = BAF in liters per kg

C. Drinking (DW) and feeding (F) rates for test organisms can be estimated using the following equations if these rates are not available from the original study:

(1) for mammalian species:

(a)  $DW = 0.099 \times (BWt)^{0.90}$ ; and

(b)  $F = 0.0687 \times (BWt)^{0.82}$ ; and

(2) for avian species:

(a)  $DW = 0.059 \times (BWt)^{0.67}$ ; and

(b)  $F = 0.058 \times (BWt)^{0.65}$ .

D. A final BAF for calculating a wildlife chronic criterion ( $CC_w$ ) is determined as in subpart 7, except that the BCFs and BAFs are adjusted to represent whole body BCFs and BAFs.

(1) Normalized BCFs and BAFs are multiplied by 12 percent lipid for  $CC_w$  applicable to Class 2A waters.

(2) Normalized BCFs and BAFs are multiplied by five percent lipid for  $CC_w$  applicable to Class 2Bd, 2B, and 2C waters.

(3) If percent lipid data is not available, whole body BCFs and BAFs are used as reported.

(4) BCFs estimated using the relationship between BCFs and the log  $K_{ow}$  are normalized by dividing the estimated BCF by 7.6 and then multiplying by 12 for Class 2A waters or by five for Class 2Bd, 2B, and 2C waters.

(5) Measured or estimated BCFs for lipophilic organic chemicals with log  $K_{ow}$  values in the range of three or more are multiplied by the factor from subpart 7, item B, subitem (8).

Subp. 10. **Applicable criteria.** The criterion for a pollutant includes: the CC, the MC, and the FAV. The criteria for toxic pollutants for surface waters are the lowest of the applicable criteria derived under this part.

A. Applicable criteria for Class 2A, 2Bd, 2B, 2C, and 2D surface waters are the lowest of the following:

- (1) a CC and MC based on toxicity to aquatic organisms from subpart 4 or 5;
- (2) a CC based on plant toxicity from subpart 4 or 5;
- (3) a  $CC_{df}$  or  $CC_f$  from subparts 6 and 7;
- (4) a concentration that will prevent unacceptable taste or odor in water, fish, or other edible aquatic organisms from subpart 8; or
- (5) a  $CC_w$  from subpart 9.

B. Applicable criteria for Class 7 waters are the lowest of the following:

- (1) a  $CC_w$  from subpart 9, if aquatic organisms can be sustained in the Class 7 water so that they are subject to predation by wildlife; or
- (2) other drinking water or aquatic life standards for toxic pollutants, consistent with the uses Class 7 waters are protected for under part 7050.0140.

C. If the site-specific application of criteria developed in this subpart is used to establish an effluent limitation for national pollutant discharge elimination system and state disposal system permits or to establish the degree of remedial action cleanup activities, the provisions of part 7050.0222, subpart 7, items B to E, apply.

**Statutory Authority:** *MS s 14.06; 115.03; 115.44; 116.07*

**History:** *15 SR 1057; 18 SR 2195; 19 SR 1310; 24 SR 1105; 32 SR 1699*

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