

1.1 **Pollution Control Agency**

1.2 **Adopted Permanent Rules Relating to Human Health Methods for Water Quality**

1.3 **7050.0150 DETERMINATION OF WATER QUALITY, BIOLOGICAL AND**  
1.4 **PHYSICAL CONDITIONS, AND COMPLIANCE WITH STANDARDS.**

1.5 [For text of subps 1 to 6, see M.R.]

1.6 **Subp. 7. Impairment of waters relating to fish for human consumption.**

1.7 A. In evaluating whether the narrative standards in subpart 3, which prevent  
1.8 harmful pesticide or other toxic pollutant residues in aquatic flora or fauna, are being met,  
1.9 the commissioner must use the methods in:

1.10 (1) parts 7050.0218 and 7050.0219 for site-specific fish tissue-based  
1.11 chronic criterion ( $CC_{ft}$ ); or

1.12 (2) parts 7050.0222 and 7052.0100 for fish tissue-based chronic standard  
1.13 ( $CS_{ft}$ ).

1.14 B. If  $CS_{ft}$  has not been established for a pollutant with chronic standards (CS)  
1.15 applicable in water ( $CS_{dfr}$ ,  $CS_{dev}$ , or  $CS_{fr^2}$  as defined in parts 7050.0218, subpart 3, item Q,  
1.16 and 7050.0219, subpart 13, item B), the residue levels in fish muscle tissue established by  
1.17 the Minnesota Department of Health must be used to identify surface waters supporting  
1.18 fish for which the Minnesota Department of Health recommends a reduced frequency of  
1.19 fish consumption for the protection of public health. A water body will be considered  
1.20 impaired when the recommended consumption frequency is less than one meal per week,  
1.21 such as one meal per month, for any member of the population. That is, a water body will  
1.22 not be considered impaired if the recommended consumption frequency is one meal per  
1.23 week, or any less restrictive recommendation such as two meals per week, for all members  
1.24 of the population. The impaired condition must be supported with measured data on  
1.25 the contaminant levels in the resident fish.

2.1 C. When making impairment determinations in an individual water body  
2.2 for a pollutant with both a fish tissue-based  $CC_{ft}$  or  $CS_{ft}$  and a CS applicable in water,  
2.3 comparison of fish tissue data to the  $CC_{ft}$  or  $CS_{ft}$  must be the basis for the final impairment  
2.4 determination.

2.5 [For text of subp 8, see M.R.]

2.6 **7050.0217 OBJECTIVES FOR PROTECTION OF SURFACE WATERS FROM**  
2.7 **TOXIC POLLUTANTS.**

2.8 Subpart 1. **Purpose and applicability.** The purpose of this part is to establish the  
2.9 objectives for developing numeric water quality standards listed in parts 7050.0220,  
2.10 7050.0222, 7050.0227, and 7052.0100 and site-specific water quality criteria for toxic  
2.11 pollutants or chemicals developed in the absence of numeric standards. The listed numeric  
2.12 standards for toxics and site-specific numeric criteria established by methods in parts  
2.13 7050.0218 and 7050.0219 protect Class 2 waters for the propagation and maintenance of  
2.14 fish and aquatic life, the consumption of fish and edible aquatic life by humans, the use of  
2.15 surface waters for public and private domestic consumption where applicable, and the  
2.16 consumption of aquatic organisms by wildlife. These criteria also protect the uses assigned  
2.17 to Class 7, limited resource value, waters as described in parts 7050.0140 and 7050.0227.

2.18 Subp. 2. **Objectives.**

2.19 A. Protection of the aquatic community from the toxic effects of pollutants  
2.20 means the protection of no less than 95 percent of all the species in any aquatic community.  
2.21 Greater protection may be applied to a community if economically, recreationally, or  
2.22 ecologically important species are very sensitive.

2.23 B. Protection of human consumers of fish, other edible aquatic organisms,  
2.24 and water for drinking from surface waters means that exposure from noncarcinogenic  
2.25 chemicals, including nonlinear carcinogens (NLC), singly or in mixtures, must be below  
2.26 levels expected to produce known adverse effects; the combined risk from mixtures of

3.1 noncarcinogens and NLC must not exceed the common health risk index endpoints or  
3.2 health endpoints described in part 7050.0222, subpart 7, item D; and the incremental  
3.3 cancer risk from exposure to carcinogenic chemicals, singly or in mixtures, must not  
3.4 exceed one in 100,000. The combined risk from mixtures of linear carcinogens (C) will be  
3.5 determined as described in part 7050.0222, subpart 7, item E.

3.6 C. Protection of wildlife that eat aquatic organisms means the protection of the  
3.7 most sensitive wildlife species or populations. Greater protection may be applied if the  
3.8 exposed animals include endangered or threatened wildlife species listed in chapter 6134,  
3.9 or in Code of Federal Regulations, title 50, part 17, under the Endangered Species Act of  
3.10 1973, United States Code, title 16, sections 1531 to 1543.

3.11 **7050.0218 FOR TOXIC POLLUTANTS: DEFINITIONS AND METHODS FOR**  
3.12 **DETERMINATION OF HUMAN HEALTH-BASED NUMERIC STANDARDS**  
3.13 **AND SITE-SPECIFIC NUMERIC CRITERIA FOR AQUATIC LIFE, HUMAN**  
3.14 **HEALTH, AND FISH-EATING WILDLIFE.**

3.15 Subpart 1. **Purpose.** The methods in this part and part 7050.0219 meet the  
3.16 objectives in part 7050.0217 and provide the basis for developing human health-based  
3.17 numeric chronic standards and site-specific numeric criteria for aquatic toxicity, human  
3.18 health, and fish-eating wildlife. The agency may also adopt new standards according to  
3.19 Minnesota Statutes, chapter 14, to replace those listed in parts 7050.0220 to 7050.0227  
3.20 and 7052.0100 that are more stringent or less stringent if new scientific evidence shows  
3.21 that a change in the standard is justified.

3.22 Subp. 2. **Site-specific criteria.** The Class 2 and Class 7 numeric water quality  
3.23 standards for toxic pollutants in parts 7050.0220, 7050.0222, 7050.0227, and 7052.0100  
3.24 do not address all pollutants that may be discharged to surface waters and cause toxic  
3.25 effects. Therefore, methods are established in this part and part 7050.0219 to address on a  
3.26 site-specific basis the discharge into surface waters of toxic pollutants not listed in parts  
3.27 7050.0220, 7050.0222, 7050.0227, 7052.0100. Class 2 and Class 7 site-specific numeric

4.1 criteria for toxic pollutants shall be derived by the commissioner using the procedures in  
4.2 this part.

4.3 [For text of items A and B, see M.R.]

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

4.6 [For text of items A and B, see M.R.]

4.7 C. "Adjustment factor, lifetime" or " $AF_{lifetime}$ " means the numeric multiplier  
4.8 used to modify the adult-based cancer slope factor for lifetime (70 years standard in risk  
4.9 characterization) exposure based on chemical-specific data.

4.10 D. "Adverse effect" means a biochemical change, functional impairment, or  
4.11 pathologic lesion that affects the performance of the whole organism or reduces an  
4.12 organism's ability to respond to an additional environmental challenge.

4.13 E. "Age-dependent adjustment factor" or "ADAF" means the default numeric  
4.14 modifiers to the cancer slope factor that account for the increased susceptibility to cancer  
4.15 from early-life exposures to linear carcinogens in the absence of chemical-specific data.  
4.16 For default use, there are three ADAF:

4.17 (1)  $ADAF_{0<2} = 10$ , for birth up to two years of age;

4.18 (2)  $ADAF_{2\text{ to }<16} = 3$ , for two up to 16 years of age; and

4.19 (3)  $ADAF_{16+} = 1$ , for 16 years of age and older.

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

5.1 G. "Bioaccumulation factor" or "BAF" means the concentration of a pollutant  
5.2 in one or more tissues of an aquatic organism, exposed from any source of the pollutant  
5.3 but primarily from the water column, diet, and bottom sediments, divided by the average  
5.4 concentration in the solution in which the organism had been living, under steady state  
5.5 conditions.

5.6 H. "Bioaccumulative chemical of concern" or "BCC" has the meaning given in  
5.7 part 7052.0010, subpart 4.

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

5.12 J. "Biomagnification" means the increase in tissue concentration of a pollutant  
5.13 in aquatic organisms at successive trophic levels through a series of predator-prey  
5.14 associations, primarily occurring through dietary accumulation. The expression used to  
5.15 quantify this increase is the biomagnification factor or "BMF." For a given water body,  
5.16 the BMF is calculated as:

5.17 (1) the ratio of the tissue concentration of a pollutant in a predator at a  
5.18 particular trophic level to the tissue concentration in its prey at the next lower trophic  
5.19 level; or

5.20 (2) the ratio estimated from a comparable laboratory model.

5.21 K. "Biota-sediment accumulation factor" or "BSAF" means the ratio  
5.22 (in kilogram of organic carbon/kilogram of lipid) of a pollutant's lipid-normalized  
5.23 concentration in tissue of an aquatic organism to its organic carbon-normalized  
5.24 concentration in surface sediment, where:

5.25 (1) the ratio does not change substantially over time;

6.1 (2) both the organism and its food are exposed; and

6.2 (3) the surface sediment is representative of average surface sediment  
6.3 in the vicinity of the organism.

6.4 L. "Cancer potency slope factor" or "CSF" means a factor indicative of a  
6.5 chemical's human cancer causing potential and an upper-bound estimate of cancer risk  
6.6 per increment of dose that can be used to estimate cancer risk probabilities for different  
6.7 exposure levels. CSF is expressed in units of cancer incidence per milligram of pollutant  
6.8 per kilogram of body weight-day (mg/kg-day)<sup>-1</sup>.

6.9 M. "Cancer risk level" or "CR" means the probability that daily exposure to a  
6.10 carcinogen over a lifetime may induce cancer. CR refers to an incremental or additional  
6.11 excess cancer risk equal to  $1 \times 10^{-5}$  (1 in 100,000) and is applied with the cancer potency  
6.12 slope factor for single chemicals and for mixtures.

6.13 N. "Carcinogen, linear" or "C" means a chemical agent for which, either by  
6.14 a known mode of action or a conservative assumption, the associated cancer risk varies  
6.15 in direct proportion to the extent of exposure and for which there is no risk-free level of  
6.16 exposure. The toxicological value for a C is the cancer potency slope factor. Seventy years  
6.17 is the standard lifetime duration used by United States Environmental Protection Agency  
6.18 in the characterization of lifetime cancer risk.

6.19 O. "Carcinogen, nonlinear" or "NLC" means a chemical agent for which,  
6.20 particularly at low doses, the associated cancer risk does not rise in direct proportion to  
6.21 the extent of exposure and for which a threshold level of exposure exists below which  
6.22 there is no cancer risk. For NLC, the reference dose is the toxicological value used as the  
6.23 threshold for cancer risk.

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

7.1 Q. "Chronic criterion" or "CC" and "chronic standard" or "CS" mean the highest  
7.2 water concentration or fish tissue concentration of a toxicant or effluent to which aquatic  
7.3 life, humans, or wildlife, ~~or other organisms~~ can be exposed indefinitely without causing  
7.4 chronic toxicity. CC represents a site-specific chronic criterion developed under this part  
7.5 and part 7050.0219 or part 7052.0110. CS represents a chronic standard listed in parts  
7.6 7050.0220 and 7050.0222 or in part 7052.0100. CC and CS are further distinguished by  
7.7 the organisms they are developed to protect and medium in which they apply:

7.8 (1)  $CC_{tox}$  or  $CS_{tox}$  represent values applied in surface water developed to  
7.9 protect aquatic life from chronic toxicity;

7.10 (2)  $CC_{dfr}$  or  $CS_{dfr}$  represent values applied in surface water based on  
7.11 protecting humans from exposure to the pollutant from drinking water, eating fish, and  
7.12 aquatic recreation;

7.13 (3)  $CC_{fr}$  or  $CS_{fr}$  represent values applied in surface water based on  
7.14 protecting humans from exposure to the pollutant from eating fish and aquatic recreation;

7.15 (4)  $CC_{ft}$  or  $CS_{ft}$  represent values applied in fish tissue based on protecting  
7.16 humans from exposure to the pollutant from eating fish; and

7.17 (5)  $CC_w$  represents values applied in surface water based on protecting  
7.18 wildlife from exposure to the pollutant from eating aquatic organisms.

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

7.23 S. "Cold water fisheries" means a community of fish including species of  
7.24 trout and salmon from the Salmonidae family that inhabit trout waters as defined in part  
7.25 7050.0420.

8.1 T. "Criterion" means a number or numbers established for a pollutant derived  
8.2 under this part or part 7050.0219 or 7052.0110, or issued by the USEPA, to protect aquatic  
8.3 life, humans, or wildlife.

8.4 U. "Developmental health endpoint" or "developmental toxicity" means an  
8.5 adverse effect on the developing organism that may result from parental exposure prior to  
8.6 conception, maternal exposure during prenatal development, or direct exposure postnatally  
8.7 until the time of sexual maturation. Developmental toxicity may be detected at any point in  
8.8 the lifespan of the organism. The major manifestations of developmental toxicity include:

8.9 (1) death of the developing organism;

8.10 (2) structural abnormality;

8.11 (3) altered growth; or

8.12 (4) functional deficiency.

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

8.15 W. "Durations for human health-based algorithms" or "D" means the length of  
8.16 the exposure period under consideration for noncancer and linear cancer algorithms.

8.17 (1) The four default D used in developing reference doses and  
8.18 corresponding intake rates are:

8.19 (a) acute: a period of 24 hours or less;

8.20 (b) short-term: a period of more than 24 hours, up to 30 days;

8.21 (c) subchronic: a period of more than 30 days, up to eight years  
8.22 based on application of the less than ten percent standard life expectancy of 70 years  
8.23 for humans; or

8.24 (d) chronic: a period of more than eight years.



9.1 (2) The default durations for use in the linear cancer algorithms with age  
9.2 dependent adjustment factors are:

9.3 (a) two years for the birth up to two-year age group;

9.4 (b) 14 years for the two- up to 16-year age group; and

9.5 (c) 54 years for the 16- up to 70-year age group.

9.6 For any algorithm, use of chemical-specific data to define durations for noncancer or linear  
9.7 cancer algorithms are preferred when acceptable data are available.

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

9.11 Y. "Endocrine" or "E" means a change in circulating hormone levels or  
9.12 interactions with hormone receptors, regardless of the organ or organ system affected.  
9.13 Health endpoints with or without the E designation are deemed equivalent, for example,  
9.14 thyroid (E) = thyroid, and must be included in the same health risk index equation.

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

9.21 AA. "Food chain multiplier" or "FCM" means the ratio of a bioaccumulation  
9.22 factor by trophic level to an appropriate bioconcentration factor. FCM refers to values  
9.23 developed using USEPA models or from available and reliable field studies.

10.1 BB. "Frequency" means the number of times a standard can be exceeded in a  
10.2 specified period of time without causing acute or chronic toxic effects on the aquatic  
10.3 community, human health, or fish-eating wildlife.

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

10.6 DD. "Health risk index" means the sum of the quotients calculated by identifying  
10.7 all chemicals that share a common health endpoint or are based on linear carcinogenicity  
10.8 and dividing the water or fish tissue concentration for each chemical (measured or  
10.9 statistically derived) by its applicable chronic standard or chronic criterion. To meet the  
10.10 objectives in part 7050.0217, the health risk index must not exceed a value of one. The  
10.11 equations for the risk indices are found in part 7050.0222, subpart 7, items D and E.

10.12 EE. "Health risk index endpoint" or "health endpoint" means the general  
10.13 description of toxic effects used to group chemicals for the purpose of calculating a health  
10.14 risk index.

10.15 FF. "Intake rate" or "IR" means rate of ingestion, inhalation, or dermal contact,  
10.16 depending on the route of exposure, expressed as the amount of a media taken in, on a  
10.17 per body weight and daily basis, for a specified duration.

10.18 GG. "Lethal concentration" or "LC50" means the toxicant concentration killing  
10.19 50 percent of the exposed organisms in a specific time of observation.

10.20 HH. "Lowest observable adverse effect level" or "LOAEL" means the lowest  
10.21 exposure level that caused a statistically or biologically significant increase in the  
10.22 frequency or severity of adverse effects observed between the exposed population and its  
10.23 appropriate control group.

10.24 II. "Magnitude" means the acceptable amount of a toxic pollutant in water or  
10.25 fish tissue expressed as a concentration.

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

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

11.8 LL. "MDH" means the Minnesota Department of Health.

11.9 MM. "Mode of action" or "MOA" means the sequence of key events following  
11.10 pollutant or chemical exposure upon which the toxic outcome depends.

11.11 NN. "National methods" means the methods the USEPA uses to develop  
11.12 aquatic life criteria as described in Stephan, C.E., D.J. Mount, D.J. Hansen, J.H. Gentile,  
11.13 G.A. Chapman, and W.A. Brungs, 1985, "Guidelines for Deriving Numerical National  
11.14 Water Quality Criteria for the Protection of Aquatic Organisms and Their Uses," USEPA,  
11.15 Office of Research and Development, Environmental Research Laboratories, Duluth  
11.16 MN; Narragansett, RI, Corvallis, OR. 98 p; available through the National Technical  
11.17 Information Service, Springfield, VA. (Publication PB85-227049)

11.18 OO. "No observable adverse effect level" or "NOAEL" means an the highest  
11.19 exposure level at which there is no statistically or biologically significant increase in  
11.20 the frequency or severity of adverse effects between the exposed population and its  
11.21 appropriate control group.

11.22 PP. "Octanol to water partition coefficient" or " $K_{ow}$ " means the ratio of the  
11.23 concentration of a chemical in the octanol phase to its concentration in the aqueous phase  
11.24 of a two-phase octanol to water system after equilibrium of the chemical between the two  
11.25 phases has been achieved. The base 10 logarithm of the  $K_{ow}$  or  $\log K_{ow}$  is used in the

12.1 calculation of bioaccumulation factors. The log  $K_{ow}$  has been shown to be proportional to  
12.2 the bioconcentration potential of lipophilic organic chemicals.

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

12.6 RR. "Reference dose" or "RfD" means an estimate of a dose for a given duration  
12.7 to the human population, including susceptible subgroups such as infants, that is likely  
12.8 to be without an appreciable risk of adverse effects during a lifetime. It is derived from  
12.9 a suitable dose level at which there are few or no statistically or biologically significant  
12.10 increases in the frequency or severity of an adverse effect between the dosed population  
12.11 and its associated control group. The RfD includes one or more divisors, applied to the  
12.12 suitable dose level, accounting for:

12.13 (1) uncertainty in extrapolating from mammalian laboratory animal data to  
12.14 humans;

12.15 (2) variation in toxicological sensitivity among individuals in the human  
12.16 population;

12.17 (3) uncertainty in extrapolating from effects observed in a short-term study  
12.18 to effects of long-term exposure;

12.19 (4) uncertainty in using a study in which health effects were found at  
12.20 all doses tested; and

12.21 (5) uncertainty associated with deficiencies in the available data.

12.22 The product of the divisors is not to exceed 3,000 in an RfD used for a chronic standard.

12.23 The RfD is expressed in units of daily dose as milligrams of chemical per kilogram of  
12.24 body weight-day or mg/kg-day.

13.1 SS. "Relative source contribution factor" or "RSC" means the percentage or  
13.2 apportioned amount (subtraction method) of the reference dose for a pollutant allocated to  
13.3 surface water exposures from drinking or incidental water ingestion and fish consumption.  
13.4 In the absence of sufficient data to establish a pollutant- or chemical-specific RSC value,  
13.5 the default RSC is 0.2 or 0.5 as described in part 7050.0219, subpart 5.

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

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

13.13 VV. "Toxic effect" means an observable or measurable adverse biological event  
13.14 in an organ, tissue, or system. The designation of health endpoints does not exclude  
13.15 other possible observable or measurable biological events. For the purpose of grouping  
13.16 chemicals and creating a health risk index when multiple chemicals are present, toxic  
13.17 effects may be ascribed to more general health risk index endpoints or health endpoints.

13.18 WW. "Toxic pollutant" has the meaning given it in part 7050.0185, subpart 2,  
13.19 item F. Toxic pollutant is used interchangeably in this part and parts 7050.0217, 7050.0219,  
13.20 and 7050.0222, subpart 7, items B to G, with the terms "pollutant" and "chemical."

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

14.1 YY. "Trophic level" or "TL" means the food web level in an ecosystem that is  
14.2 occupied by an organism or group of organisms because of what they eat and how they are  
14.3 related to the rest of the food web. For example, trophic level 3 in an aquatic ecosystem  
14.4 consists of small fish such as bluegills, crappies, and smelt and trophic level 4 consists of  
14.5 larger carnivorous fish such as walleye, northern pike, and most trout species.

14.6 ZZ. "USEPA" means the United States Environmental Protection Agency.

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

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

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

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

15.1 A. The USEPA aquatic life criteria are adopted unchanged by the agency,  
15.2 unless modified under item C, as the criteria applicable to designated Class 2A waters in  
15.3 parts 7050.0420 and 7050.0470.

15.4 [For text of item B, see M.R.]

15.5 C. If the commissioner finds that the information that supports a USEPA  
15.6 criterion is no longer current or complete for reasons including, but not limited to, changes  
15.7 to the relationship between a water quality characteristic and toxicity; the ACR; the  
15.8 weight given to toxicity data for a commercially or recreationally important species;  
15.9 or the human health-based methods; then the commissioner shall evaluate all available  
15.10 information and modify the criterion according to the information and with the objectives  
15.11 in part 7050.0217 and the methods in this part and part 7050.0219. Any effluent limitation  
15.12 determined to be necessary based on site-specific criteria derived under this item shall  
15.13 only be required after the discharger has been given notice to the specific proposed effluent  
15.14 limitations and an opportunity to request a hearing as provided in part 7000.1800.

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

15.17 [For text of items A to D, see M.R.]

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

15.23 [For text of item F, see M.R.]

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

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

16.3 [For text of subitems (1) to (10), see M.R.]

16.4 (11) The  $CC_{tox}$  is calculated by dividing the FAV by the appropriate ACR.

16.5 (12) If chronic data are available, they are used to determine measured  
 16.6 ACR as described in item F, and chronic data are compared to the  $CC_{tox}$ .

16.7 Subp. 6. [See repealer.]

16.8 Subp. 7. [See repealer.]

16.9 [For text of subp 8, see M.R.]

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

16.14 [For text of item A, see M.R.]

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

$$16.16 \quad \text{NOAEL} \times \text{BWt} \times \text{SSF}$$

$$16.17 \quad CC_w \text{ mg/L} = \frac{\text{NOAEL} \times \text{BWt} \times \text{SSF}}{\text{DW} + (\text{F} \times \text{BAF})}$$

16.18

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

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



- 17.1 BWt = average body weight of test organisms in kg  
17.2 SSF = species sensitivity factor to account for difference in the sensitivity in test  
17.3 species. This factor will vary between 1 and 0.1. The appropriate factor will be  
17.4 determined by the commissioner based on available and reliable scientific data  
17.5 on the relative sensitivity of the test organism compared to other wildlife species  
17.6 DW = average volume of water consumed per day by the test animals in liters  
17.7 F = average amount of food consumed per day by test animals in kg  
17.8 BAF = BAF in liters per kg

17.9 [For text of items C and D, see M.R.]

17.10 Subp. 10. **Applicable criteria or human health-based standard.** The final criteria  
17.11 or chronic standard for human health for toxic pollutants for surface waters must be the  
17.12 lowest of the applicable criteria or standards for human health derived under this part  
17.13 and part 7050.0219.

17.14 A. Applicable criteria or standards for human health by use for Class 2A, 2Bd,  
17.15 2B, 2C, and 2D surface waters are listed for each applicable population protected (aquatic  
17.16 life, humans, and fish-eating wildlife). The applicable criteria or standards for human  
17.17 health must be the lowest of the CC or CS as described in subitems (1) to (3):

17.18 (1) for aquatic life toxicity: a  $CC_{tox}$  and MC based on toxicity to aquatic  
17.19 organisms from subpart 4 or 5 or a  $CC_{tox}$  based on plant toxicity from subpart 4 or 5;

17.20 (2) for human health: a CC or CS by medium (water or fish) as described in  
17.21 part 7050.0219, subpart 2, or a concentration that will prevent unacceptable taste or odor  
17.22 in water, fish, or other edible aquatic organisms from subpart 8; or

17.23 (3) when available, for fish-eating wildlife: a  $CC_w$  from subpart 9.

17.24 B. Applicable criteria for Class 7 waters must be the lowest of the following:

17.25 [For text of subitems (1) and (2), see M.R.]

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

18.5 D. The CS or CC and MS or MC must be averaged over the durations described  
18.6 in part 7050.0222, subpart 7, item C.

18.7 **7050.0219 HUMAN HEALTH-BASED CRITERIA AND STANDARDS.**

18.8 Subpart 1. **Objective.** Human health-based criteria and standards protect humans  
18.9 from potential adverse effects of eating fish and edible aquatic organisms and incidental  
18.10 ingestion of water while recreating in Class 2 waters and from the consumption of  
18.11 drinking water from Class 1 surface waters (includes Class 2A and 2Bd waters). Human  
18.12 health-based criteria and standards must be determined using the methods in this part.

18.13 Subp. 2. **Applicability of methods.** Human health-based chronic criteria (CC) or  
18.14 chronic standards (CS) must be evaluated based on the pollutant's toxicological profile:  
18.15 noncarcinogen or nonlinear carcinogen (NLC), developmental susceptibility, and linear  
18.16 carcinogen (C).

18.17 A. Algorithms for these toxicological profiles by Class 2 subclasses are  
18.18 described in subparts 13 to 15. Other scientifically defensible algorithms may be applied by  
18.19 the commissioner on a chemical-specific basis for evaluating developmental susceptibility  
18.20 to toxic pollutants in fish tissue based on the consideration listed in subparts 3 to 5.

18.21 B. The most stringent CC or CS by medium (water or fish tissue), Class  
18.22 2 subclass, and toxicological profile, or taste and odor criteria as described in part  
18.23 7050.0218, subpart 8, are the final applicable human health-based CC or CS.

19.1 Subp. 3. **Available and reliable scientific data.** The data and information used to  
19.2 develop a site-specific CC or CS must be approved by the commissioner. The commissioner  
19.3 must consider measures of availability and reliability of the data and information.

19.4 Subp. 4. **Toxicological values.** The RfD used to calculate criteria for  
19.5 noncarcinogenic and nonlinear carcinogenic chemicals (NLC) and the CSF and  $AF_{lifetime}$   
19.6 or CSF and ADAF used to calculate CC or CS for linear carcinogenic (C) chemicals are  
19.7 obtained from the MDH or developed according to parts 4717.7820, subparts 5 and 21,  
19.8 and 7050.0218, subpart 3.

19.9 Subp. 5. **Exposure values.** Drinking water intake rates are obtained from the MDH.  
19.10 RSC uses a default value of 0.2 for most pollutants, unless:

19.11 A. there are no significant known or potential sources other than those addressed  
19.12 for the designated use, then 0.5 must be used; or

19.13 B. sufficient exposure data are available to support an alternative  
19.14 pollutant-specific value between 0.2 and 0.8.

19.15 Subp. 6. **Bioaccumulation factors.** This subpart describes the process and data for  
19.16 deriving bioaccumulation factors (BAF) used in the calculation of the human health-based  
19.17 chronic criteria (CC) or chronic standards (CS).

19.18 A. Information used for defining BAF must be consistent with the pollutant  
19.19 form used to derive the RfD or CSF. BAF development must also consider other forms  
19.20 that bioaccumulate in fish tissue. The preferred bioaccumulation data are available and  
19.21 reliable field and laboratory studies.

19.22 B. A general description of the steps and data used to determine final state or  
19.23 site BAF are listed in subitems (1) to (6) and described in detail in subparts 7 to 12.

20.1 (1) Categorize the pollutant based on certain properties into one of three  
20.2 broadly defined chemical categories: nonionic organic, ionic organic, or inorganic and  
20.3 organometallic chemicals as described in subpart 7.

20.4 (2) Define the methods for developing baseline BAF as described in  
20.5 subpart 8. A baseline BAF is the expression of the BAF based on the bioavailable or freely  
20.6 dissolved fraction of a pollutant in the ambient water and normalized concentration of  
20.7 the pollutant within the organism.

20.8 (3) Determine the relevant procedure (1 to 6) for identifying the acceptable  
20.9 baseline BAF methods (maximum of four) and their hierarchy for developing individual  
20.10 or aquatic species-specific baseline BAF as described in subpart 9.

20.11 (4) Calculate species mean baseline BAF from acceptable individual  
20.12 baseline BAF as described in subpart 10.

20.13 (5) Determine final baseline BAF for TL<sub>3</sub> and TL<sub>4</sub> as described in subpart 11.

20.14 (6) Develop final state or site BAF for TL<sub>3</sub> and TL<sub>4</sub> based on default  
20.15 parameters by Class 2 subclass or site-specific data as described in subpart 12.

20.16 Subp. 7. **Chemical categorization.** For BAF purposes, organic chemicals that have  
20.17 no or negligible ionization at the pH range of ambient surface waters are categorized as  
20.18 nonionic organic chemicals; organic chemicals that undergo ionization at the pH range of  
20.19 ambient surface waters are categorized as ionic organic chemicals and further delineated  
20.20 for BAF development based on subpart 9, item C; organometallic chemicals and other  
20.21 chemicals or elements are categorized as organometallic and inorganic chemicals.

20.22 Subp. 8. **Methods for baseline BAF.** The four methods for developing baseline BAF  
20.23 in items A to D are listed in a hierarchy from most preferred to least preferred, except as  
20.24 noted in subpart 9: use of field-measured BAF studies (field BAF); use of field-measured  
20.25 BSAF studies (field BSAF); use of laboratory-measured BCF studies with food chain

21.1 multipliers (lab BCF\*FCM); and use of octanol-water partition coefficients with food  
 21.2 chain multipliers ( $K_{ow}$ \*FCM). Where relevant, differences in the baseline BAF methods  
 21.3 are described by chemical categorization.

21.4 A. Method 1: Field BAF. The field-measured BAF for a nonionic organic  
 21.5 chemical is calculated based on the total concentration of the chemical in the appropriate  
 21.6 tissue of the aquatic organism (on a wet tissue basis) and the total concentration of  
 21.7 chemical in ambient surface water at the site of sampling ( $BAF_T^t$ ).

21.8 measured  $BAF_T^t = C_t/C_w$

21.9 where:  $BAF_T^t$  = field-measured BAF based on total concentration in tissue and water  
 21.10 (L/kg)

21.11  $C_t$  = total concentration of the chemical in the specified wet tissue ( $\mu\text{g}/\text{kg}$ )

21.12  $C_w$  = total concentration of the chemical in water ( $\mu\text{g}/\text{L}$ )

21.13 The measured  $BAF_T^t$  is converted to a baseline BAF or  $BAF_1^{fd}$  by the following equation:

$$\text{baseline } BAF_1^{fd} = \left[ \frac{\text{measured } BAF_T^t}{f_{fd}} \right] \left( \frac{1}{f_l} \right)$$

21.14 where: baseline  $BAF_1^{fd}$  = BAF expressed on a freely dissolved and lipid-normalized  
 21.15 basis (L/kg)

21.16  $f_l$  = fraction of the tissue that is lipid

21.17  $f_{fd}$  = fraction of the total chemical that is freely dissolved in ambient surface water

21.18 The freely dissolved fraction or  $f_{fd}$  is the portion of the nonionic organic chemical that is  
 21.19 not bound to particulate organic carbon or dissolved organic carbon and is calculated:

21.20 
$$f_{fd} = \frac{1}{[1 + (\text{POC} \times K_{OW}) + (\text{DOC} \times 0.08 \times K_{OW})]}$$

21.21

21.22

- 22.1 where: POC = concentration of particulate organic carbon (kg/L)
- 22.2 DOC = concentration of dissolved organic carbon (kg/L)
- 22.3  $K_{OW}$  = n-octanol water partition coefficient for the chemical

22.4 POC and DOC concentrations are obtained from the original study from which the  
 22.5 field-measured BAF is determined. If POC and DOC concentrations are not reported in  
 22.6 the BAF study, reliable estimates of POC and DOC are obtained from other studies at  
 22.7 closely related sites within the same water body. If no study data are available, the USEPA  
 22.8 national default DOC and POC values are used, as they are representative of average  
 22.9 ambient surface water conditions. The USEPA national default values are DOC of 2.9  
 22.10 mg/L and POC of 0.5 mg/L, converted to kg/L by dividing by 1,000,000.

22.11 For the field-measured BAF for a chemical classified as inorganic and organometallic,  
 22.12 the field BAF is equal to the baseline BAF and is not expressed on a lipid or freely  
 22.13 dissolved fraction basis. Normalization on other characteristics must be supported by  
 22.14 chemical-specific data.

22.15 B. Method 2: Field BSAF. For nonionic organic chemicals, the field-measured  
 22.16 BSAF is determined by relating lipid-normalized concentration of the chemical in the  
 22.17 appropriate tissue of the aquatic organism to organic carbon-normalized concentrations of  
 22.18 the chemical in surface sediment.

22.19 
$$\text{BSAF} = \frac{C_1}{C_{\text{soc}}}$$

22.22 where: BSAF = biota-sediment accumulation factor for the chemical (kg of sediment  
 22.23 organic carbon/kg of lipid)

22.24  $C_1$  = lipid-normalized concentration of the chemical in the specified wet tissue  
 22.25 ( $\mu\text{g/g}$  lipid), calculated as:

$$C_1 = \frac{C_t}{f_1}$$

where:  $f_1$  = fraction lipid content in the tissue

Other variables as defined under item A

$C_{\text{soc}}$  = organic-carbon normalized concentration of a chemical in surface sediment samples ( $\mu\text{g/g}$  sediment organic carbon), calculated as:

$$C_{\text{soc}} = \frac{C_s}{f_{\text{oc}}}$$

where:  $C_s$  = concentration of chemical in dry sediment ( $\mu\text{g/g}$  sediment)

$f_{\text{oc}}$  = fraction organic carbon in dry sediment

The measured BSAF is converted to a baseline BAF or  $\text{BAF}_1^{\text{fd}}$  by the following equation:

$$(\text{baseline BAF}_1^{\text{fd}})_i = (\text{BSAF})_i \frac{(\Pi_{\text{socw}})_r (D_{i/r}) (K_{\text{OW}})_i}{(K_{\text{OW}})_r}$$

where:  $(\text{baseline BAF}_1^{\text{fd}})_i$  = BAF expressed on a freely dissolved and lipid-normalized basis for chemical of interest "i" or the chemical that is the basis of the criteria (L/kg)

$\text{BSAF}_i$  = measured BSAF for the chemical "i" (kg organic carbon/kg of lipid)

$(\Pi_{\text{socw}})_r$  = sediment to water partition coefficient or sediment organic carbon to freely dissolved concentration ratio of the reference chemical "r." Reference chemicals with  $(\Pi_{\text{socw}})_r / (K_{\text{OW}})_r$  similar to that of the chemical of interest are preferred for this method (L/kg sediment organic carbon)

$$\left( \Pi_{\text{socw}} \right)_r = \frac{(C_{\text{soc}})_r}{(C_w^{\text{fd}})_r}$$

- 24.1 where:  $(C_{soc})_r$  = concentration of the reference chemical "r" in dry sediment normalized  
 24.2 to sediment organic carbon ( $\mu\text{g}/\text{kg}$  sediment organic carbon)  
 24.3  $(C_w^{fd})_r$  = concentration of the reference chemical "r" freely dissolved in water  
 24.4 ( $\mu\text{g}/\text{L}$ )  
 24.5  $(D_{i/r})$  = ratio between  $\Pi_{socw}/K_{ow}$  for chemicals "i" and reference chemical "r"; a  
 24.6 ratio equal to or close to one is preferred  
 24.7  $(K_{ow})_i$  = octanol-water partition coefficient for the chemical "i"  
 24.8  $(K_{ow})_r$  = octanol-water partition coefficient for the reference chemical "r"  
 24.9 Other variables as defined under item A

- 24.10 C. Method 3: Lab BCF\*FCM. The laboratory-measured BCF for nonionic  
 24.11 organic chemicals is calculated based on the total concentration of the chemical in  
 24.12 the appropriate tissue of the aquatic organism (on a wet tissue basis) and the total  
 24.13 concentration of chemical in the study water ( $BCF_T^t$ ).

$$\text{measured } BCF_T^t = \frac{C_t}{C_w}$$

- 24.17 where:  $C_w$  = total concentration of chemical in the laboratory test water ( $\mu\text{g}/\text{L}$ )  
 24.18 Other variables as defined under item A

- 24.19 Baseline  $BAF_1^{fd}$  equation:

$$\text{baseline } BAF_1^{fd} = (\text{FCM}) \left[ \frac{\text{measured } BCF_T^t}{f_{fd}} - 1 \right] \times \left( \frac{1}{f_1} \right)$$

- 24.20 where:  $f_{fd}$  = fraction of the total chemical in the test water that is freely dissolved,  
 24.21 where POC and DOC or reasonable estimates based on total organic carbon  
 24.22 (TOC) values measured in the test water are used, unless not available, then the  
 24.23 following defaults are used based on typical lab water characteristics: DOC of  
 24.24 2.5 mg/L and POC at 0 mg/L, converted to kg/L by dividing by 1,000,000  
 24.25 FCM = food chain multiplier  
 24.26 Other variables as defined under item A



25.1 For ionic organic, inorganic, and organometallic chemicals, based on available data,  
 25.2 the laboratory BCF is equal to the baseline BAF and is not expressed on a lipid or freely  
 25.3 dissolved fraction basis. Normalization on other characteristics must be supported by  
 25.4 chemical-specific data. FCM must come from field BAF studies.

25.5 D. Method 4:  $K_{ow} * FCM$ . In this method,  $K_{ow}$  is assumed to be equal to the  
 25.6 baseline  $BAF_1^{fd}$  for certain nonionic organic chemicals described in the procedures.

25.7 
$$\text{baseline } BAF_1^{fd} = (FCM) \times (K_{ow})$$

25.8 where: Variables as defined under items A and C

25.9 Subp. 9. **Hierarchy of acceptable baseline BAF methods.** Determine the hierarchy  
 25.10 of acceptable baseline BAF methods available under subpart 8 for appropriate use based  
 25.11 on the chemical categorization of the pollutant and other relevant properties as described  
 25.12 under Procedures 1 to 6.

25.13 A. Procedures 1 to 6 are used for defining the hierarchy and use of the four  
 25.14 baseline BAF methods based on chemical categorization and a chemical's ionization state  
 25.15 in ambient surface waters, hydrophobicity, biomagnification, and metabolism in aquatic  
 25.16 organisms, primarily freshwater fish species. Table 1 provides the basic information  
 25.17 for identifying the acceptable procedures and hierarchy for baseline BAF methods as  
 25.18 described under items B to D:

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25.27

Table 1.			
Chemical Categorization			
Nonionic Organic and Ionic (negligible ionization) Organic Chemicals		Inorganic, Organometallic, and Ionic Chemicals	
Hydrophobicity		Biomagnification Factor (BMF)	
$\log K_{ow} \geq 4$	$\log K_{ow} < 4$	BMF $\leq$ 1,000	BMF $>$ 1,000
Metabolism in Aquatic Organisms (Fish)			
Low or Unknown	High	Low or Unknown	High
Procedures:			

Procedure 1	Procedure 2	Procedure 3	Procedure 4	Procedure 5	Procedure 6
1) Field BAF	1) Field BAF	1) Field BAF or	Field BAF or	Field BAF or	1) Field BAF
2) Field BSAF	2) Field BSAF	Lab BCF	Lab BCF	Lab BCF	2) Lab
3) Lab BCF*FCM	3) Lab BCF	2) $K_{ow}$			BCF*FCM
4) $K_{ow}$ *FCM					

26.6 B. For nonionic (neutral) organic chemicals, defined as chemicals that have no  
 26.7 or negligible ionization in ambient surface water, Procedures 1 to 4 describe the hierarchy  
 26.8 of acceptable baseline BAF methods to use.

26.9 (1) Procedure 1 applies to nonionic organic chemicals with moderate to  
 26.10 high hydrophobicity defined as  $\log K_{ow}$  greater than or equal to ( $\geq$ ) 4 and either a low level  
 26.11 of documented metabolism in aquatic organisms or lack of sufficient data to characterize  
 26.12 metabolism. All four baseline BAF methods are available for use based on the stated  
 26.13 hierarchy in Table 1 and availability of acceptable data.

26.14 (2) Procedure 2 applies to nonionic organic chemicals with moderate to  
 26.15 high hydrophobicity defined as  $\log K_{ow} \geq 4$  and a high level of documented metabolism in  
 26.16 aquatic organisms. The acceptable methods are field BAF, BSAF, and lab BCF\*FCM,  
 26.17 where FCM is equal to one.

26.18 (3) Procedure 3 applies to nonionic organic chemicals with low  
 26.19 hydrophobicity defined as  $\log K_{ow}$  less than ( $<$ ) 4 and either a low level of documented  
 26.20 metabolism in aquatic organisms or lack of sufficient data to characterize metabolism. The  
 26.21 acceptable methods are field BAF or lab BCF\*FCM, with equal preference given, and  
 26.22  $K_{ow}$ \*FCM, where FCM is equal to one in both methods.

26.23 (4) Procedure 4 applies to nonionic organic chemicals with low  
 26.24 hydrophobicity defined as  $\log K_{ow} < 4$  and high levels of documented metabolism in  
 26.25 aquatic organisms. Equal preference is given to both acceptable methods: field BAF or  
 26.26 lab BCF\*FCM, where FCM is equal to one.

27.1 C. For ionic organic chemicals (defined as chemicals that can readily accept or  
27.2 donate protons) the procedures that define the available hierarchy and appropriate baseline  
27.3 BAF methods depend on further characteristics of the chemical. The main characteristics  
27.4 relate to exhibiting primarily nonionic (neutral) characteristics (ionization is negligible)  
27.5 or ionic characteristic in average surface water pH ranges based on its acid dissociation  
27.6 constant ( $K_a$ ) expressed as the negative base 10 log ( $pK_a$ ) and functional group or groups:

27.7 (1) When ionization is negligible, the chemical is categorized as a nonionic  
27.8 organic chemical and baseline BAF procedures are applied based on hydrophobicity and  
27.9 metabolism characteristics described for Procedures 1 to 4 under item B, subitems (1) to (4).

27.10 (2) In all other cases, the chemical is categorized with inorganic and  
27.11 organometallic chemicals and addressed with Procedure 5 or 6 under item D, subitem  
27.12 (1) or (2).

27.13 Available chemical-specific data that supports more defensible baseline BAF methods  
27.14 must be used in place of these default assignments.

27.15 D. Inorganic and organometallic chemicals are defined as inorganic minerals,  
27.16 other inorganic chemicals, and elements: metals and metalloids and organometallic  
27.17 chemicals, and Procedures 5 and 6 define the use of acceptable baseline BAF methods.  
27.18 Procedures 5 and 6 are distinguished by the determination of whether the chemical  
27.19 demonstrates biomagnifications through field BAF or laboratory BCF studies, with BAF  
27.20 or BMF greater than 1,000 being the cut-off for this purpose. BMF is calculated using  
27.21 chemical concentrations in the tissue of aquatic organisms at two successive trophic  
27.22 levels as:

27.23 
$$BMF_{(TL, n)} = C_{t (TL, n)} / C_{t (TL, n-1)}$$

28.1 where:  $C_{t(TL, n)}$  = total concentration of relevant chemical form or forms in appropriate  
 28.2 tissue of predator organism at trophic level "n" (may be either wet weight or dry  
 28.3 weight concentration so long as both the predator and prey concentrations are  
 28.4 expressed in the same manner) ( $\mu\text{g}/\text{kg}$ )

28.5  $C_{t(TL, n-1)}$  = total concentration of relevant chemical form or forms in appropriate  
 28.6 tissue of prey organism at the next lower trophic level from the predator (may be  
 28.7 either wet weight or dry weight concentration so long as both the predator and  
 28.8 prey concentrations are expressed in the same manner) ( $\mu\text{g}/\text{kg}$ )

28.9 (1) Procedure 5 applies when geometric mean BAF or BMF is less than or  
 28.10 equal to 1,000 when comparing successive trophic level ratios up through trophic level 4.  
 28.11 Equal preference is given to field BAF or lab BCF\*FCM, where FCM is equal to one. For  
 28.12 this procedure, field BAF or lab BCF is applied as the baseline BAF.

28.13 measured  $\text{BAF}_T^t = C_t/C_w$  or  $\text{BCF}_T^t = C_t/C_w$  are applied as the baseline BAF.

28.14 where: Variables as defined under subpart 8

28.15 (2) Procedure 6 applies when geometric mean BAF or BMF is greater than  
 28.16 1,000 when comparing successive trophic level ratios up through trophic level 4. The  
 28.17 acceptable methods are field BAF or lab BCF\*FCM, with preference for field BAF. For  
 28.18 this procedure, field BAF or lab BCF is applied as the baseline BAF.

28.19 measured  $\text{BAF}_T^t = C_t/C_w$  or  $\text{BCF}_T^t = C_t/C_w$  are applied as the baseline BAF.

28.20 where: Variables as defined under subpart 8

28.21 Subp. 10. **Species mean baseline BAF.** Calculate species and mean baseline BAF  
 28.22 from acceptable individual baseline BAF.

28.23 A. For each appropriate baseline BAF method, calculate species-mean baseline  
 28.24 BAF using the geometric mean.

28.25 B. Any baseline BAF with large differences between species (greater than ten  
 28.26 percent) needs additional justification for use in a species-mean baseline BAF.

29.1 C. Evaluate data uncertainties for consideration in method hierarchy application  
 29.2 for calculating trophic level baseline BAF.

29.3 Subp. 11. **Final baseline BAF by trophic level.** Determine the final baseline BAF  
 29.4 by trophic level (TL):

29.5 A. Calculate geometric mean baseline BAF for TL<sub>3</sub> and TL<sub>4</sub> using available  
 29.6 species-means for each baseline BAF method. For Class 2A water, preference is given  
 29.7 for *Salmonidae* data and developed as a single representative TL<sub>4</sub> baseline BAF for  
 29.8 cold-water aquatic communities.

29.9 B. Combine species-means for methods that have equal preference in  
 29.10 procedural hierarchies and have similarly reliable baseline BAF based on evaluation of  
 29.11 data uncertainties for a final baseline BAF for TL<sub>3</sub> where applicable, and final baseline  
 29.12 BAF for TL<sub>4</sub>.

29.13 C. For some pollutants, TL<sub>3</sub> and TL<sub>4</sub> baseline BAF may be identical when not  
 29.14 dependent on trophic level factors, such as lipid partitioning.

29.15 Subp. 12. **Final state or site BAF by trophic level.** Calculate final state or site BAF  
 29.16 for TL<sub>3</sub> where applicable and TL<sub>4</sub> for use in developing human health-based chronic  
 29.17 criteria or standards.

29.18 A. For nonionic organic chemicals and ionic organic chemicals with no or  
 29.19 negligible ionization as defined under subpart 7, for each TL<sub>3</sub> and TL<sub>4</sub>, calculate a state  
 29.20 or site BAF using the following equation:

$$\text{state or site BAF}_{(TL\ n)} = \left[ (\text{final baseline BAF}_1^{\text{fd}})_{TL\ n} \times (f_l)_{TL\ n+1} \right] \times (f_{\text{fd}})$$

29.21 where:  $(\text{final baseline BAF}_1^{\text{fd}})_{TL\ n}$  = final trophic-level-mean baseline BAF expressed on  
 29.22 a freely dissolved and lipid-normalized basis for trophic level "n" (L/kg)

29.23  $(f_l)_{TL\ n}$  = lipid fraction of aquatic species consumed at trophic level "n" by Class 2  
 29.24 subclass: Class 2A = 0.06; Class 2Bd/2B/2C/2D = 0.02 for TL<sub>3</sub> and 0.015 for TL<sub>4</sub>

30.1  $f_{fd}$  = fraction of the total chemical in water that is freely dissolved in ambient  
 30.2 waters

30.3 The default DOC and POC values for the state ambient Class 2 surface waters are  $7.5 \times$   
 30.4  $10^{-6}$  kg/L (7.5 mg/L) and  $5 \times 10^{-7}$  kg/L (0.5 mg/L), respectively. For a site BAF for use in  
 30.5 site-specific criteria development, the DOC and POC values are from the site monitoring  
 30.6 data, if available; in all other cases, the state defaults are used.

30.7 B. For inorganic and organometallic chemicals and ionic organic chemicals  
 30.8 with ionization in natural waters, the baseline  $BAF_T^t$  using total chemical concentrations  
 30.9 or bioavailable forms are directly applied as the state or site BAF:

30.10 state  $BAF_{(TL\ n)}$  or site BAF = final baseline  $BAF_{(TL\ n)}$

30.11 Subp. 13. **Algorithms for Class 2A or 2Bd surface waters.** This subpart describes  
 30.12 human health-based criteria or standards for classes of surface waters designated for  
 30.13 drinking water, fish consumption, and recreational use. To develop a final chronic criteria  
 30.14 ( $CC_{dfr}$ ) or standard ( $CS_{dfr}$ ) applicable to surface waters designated Class 2A or 2Bd, items A  
 30.15 to D must be evaluated for use based on the pollutant's toxicological profile: noncarcinogen  
 30.16 or nonlinear carcinogen (NLC); developmental susceptibility; or linear carcinogen (C).

30.17 A. Algorithm for noncarcinogenic or NLC chemicals applicable to surface  
 30.18 waters designated Class 2A or 2Bd to calculate:  $CC_{dfr}$  or  $CS_{dfr} =$

30.19  $RfD_{chronic}$  (mg/kg-d) x RSC (no units) x 1,000  $\mu$ g/mg

30.20 

---

30.21  $\{DWIR_{chronic}$  (L/kg-d) +  $FCR_{adult}$  (kg/kg-d)[(0.24 x  $BAF_{TL3}$  (L/kg)) + (0.76 x  $BAF_{TL4}$  (L/kg))]

30.22 where:  $CC_{dfr}$  or  $CS_{dfr}$  = drinking water plus fish consumption and recreation chronic  
 30.23 criterion or standard in  $\mu$ g/L

30.24  $RfD_{chronic}$  = reference dose for chronic duration in mg/kg-day

30.25 RSC = relative source contribution factor

30.26 1,000  $\mu$ g/mg = a factor used to convert milligram (mg) to microgram ( $\mu$ g);

- 31.1 there are 1,000 micrograms per milligram
- 31.2  $DWIR_{\text{chronic}}$  = drinking water intake rate for the chronic duration based on a 95<sup>th</sup>
- 31.3 percentile time-weighted average from MDH; rate may be chemical-specific with
- 31.4 sufficient data or use the default rate of 0.043 L/kg-d
- 31.5  $FCR_{\text{adult}}$  = fish consumption intake rate of 0.00043 kg/kg-d based on 0.030
- 31.6 kg/day of amount of fish assumed to be consumed per day and 70 kg adult body
- 31.7 weight or rate may be chemical-specific with sufficient data
- 31.8  $BAF_{\text{TL3}}$  = final BAF for TL<sub>3</sub> fish in L/kg; accounts for 24 percent of fish consumed
- 31.9  $BAF_{\text{TL4}}$  = final BAF for TL<sub>4</sub> fish in L/kg; accounts for 76 percent of fish
- 31.10 consumed; for Class 2A, the  $BAF_{\text{TL4}}$  is applied to 100 percent of the FCR

- 31.11 B. Supplemental algorithm for developmental susceptibility for noncarcinogenic
- 31.12 or NLC chemicals applicable to surface waters designated Class 2A or 2Bd to calculate:

31.13  $CC_{\text{dev}}$  or  $CS_{\text{dev}}$  =

31.14 
$$\frac{RfD_{\text{duration_(acute, short-term, or subchronic)}} \text{ (mg/kg-d)} \times RSC \text{ (no units)} \times 1,000 \text{ } \mu\text{g/mg}}{DWIR_{\text{duration_(acute, short-term, or subchronic)}} \text{ (L/kg-d)}}$$

31.15

31.16

- 31.17 where:  $CC_{\text{dev}}$  or  $CS_{\text{dev}}$  = developmental-based drinking water chronic criterion or
- 31.18 standard in  $\mu\text{g/L}$  applied when shorter duration adverse effects and exposure
- 31.19 parameters result in a more stringent chronic criterion or standard than calculated
- 31.20 from item A

- 31.21  $RfD_{\text{duration}}$  = reference dose for acute, short-term, or subchronic duration in
- 31.22 mg/kg-day
- 31.23  $DWIR_{\text{duration}}$  = drinking water intake rate for acute, short-term, or subchronic
- 31.24 duration in L/kg-d; drinking water intake rate for the acute, short-term, and
- 31.25 subchronic durations based on a 95<sup>th</sup> percentile time-weighted average from
- 31.26 MDH; rate may be chemical-specific with sufficient data or use default rates of
- 31.27 0.289, 0.289, and 0.077 L/kg-d, respectively
- 31.28 Other variables as defined under item A

- 31.29 C. Algorithm for linear carcinogenic chemicals with lifetime adjustment factors
- 31.30 ( $AF_{\text{lifetime}}$ ) applicable to surface waters designated Class 2A or 2Bd to calculate:  $CC_{\text{dfr}}$
- 31.31 or  $CS_{\text{dfr}}$  =

$$\frac{CR (1 \times 10^{-5})}{CSF(mg/kg-d)^{-1} \times AF_{Lifetime}} \times \frac{1000 \mu g/mg}{\{DWIR_{Lifetime}(L/kg-d) + FCR_{Adult} (kg/kg-d) [(0.24 \times BAF_{TL3} (L/kg)) + (0.76 \times BAF_{TL4}(L/kg))]\}}$$

- 32.1 where:  $CC_{dfr}$  or  $CS_{dfr}$  = drinking water plus fish consumption and recreation chronic
- 32.2 criterion or standard in  $\mu g/L$
- 32.3 CR = cancer risk level or an additional excess cancer risk equal to  $1 \times 10^{-5}$  (1 in
- 32.4 100,000)
- 32.5 CSF = cancer potency slope factor in  $(mg/kg-d)^{-1}$
- 32.6  $AF_{lifetime}$  = adjustment factor, lifetime (no units)
- 32.7  $DWIR_{lifetime}$  = drinking water intake rate for lifetime duration; drinking water
- 32.8 intake rate for the lifetime duration based on a 95<sup>th</sup> percentile time-weighted
- 32.9 average from MDH; rate may be chemical-specific with sufficient data or use
- 32.10 default rate of 0.043 L/kg-d
- 32.11 Other variables as defined under item A

- 32.12 D. Algorithm for linear carcinogenic chemicals with age-dependent adjustment
- 32.13 factors (ADAF) applicable to surface waters designated Class 2A or 2Bd to calculate:
- 32.14  $CC_{dfr}$  or  $CS_{dfr}$  =

$$\frac{CR (1 \times 10^{-5}) \times 1000}{\left( \left\{ CSF \times ADAF_{<2} \times D_{<2} \times [DWIR_{<2} + FCR_{<2} \times (0.24BAF_{TL3} + 0.76BAF_{TL4})] \right\} + \left\{ CSF \times ADAF_{2to < 16} \times D_{2to < 16} \times [DWIR_{2to < 16} + FCR_{2to < 16} \times (0.24BAF_{TL3} + 0.76BAF_{TL4})] \right\} + \left\{ CSF \times ADAF_{16to70} \times D_{16to70} \times [DWIR_{16to70} + FCR_{Adult} \times (0.24BAF_{TL3} + 0.76BAF_{TL4})] \right\} \right) / 70yrs}$$

- 32.15 where:  $CC_{dfr}$  or  $CS_{dfr}$  = drinking water plus fish consumption and recreation chronic
- 32.16 criterion or standard in  $\mu g/L$
- 32.17 ADAF = age-dependent adjustment factor by age groups
- 32.18 D = duration corresponding to the three age groups: birth up to two years of age
- 32.19 (two-year duration), two years of age up to 16 years of age (14-year duration),
- 32.20 and 16 years of age up to 70 years of age (54-year duration)
- 32.21 DWIR = drinking water intake rate for age groups; drinking water intake rate
- 32.22 for the lifetime duration based on a 95<sup>th</sup> percentile time-weighted average from
- 32.23 MDH; rate may be chemical-specific with sufficient data or use default rates for:
- 32.24  $DWIR_{0<2}$  = 0.137 L/kg-d, birth up to two years of age



33.1  $DWIR_{2 \text{ to } < 16} = 0.047 \text{ L/kg-d}$ , two up to 16 years of age

33.2  $DWIR_{16 \text{ to } 70} = 0.039 \text{ L/kg-d}$ , 16 up to 70 years of age

33.3 FCR = fish consumption intake rate by age groups:

33.4  $FCR_{0-2} = 0.00086 \text{ kg/kg-d}$

33.5  $FCR_{2 \text{ to } < 16} = 0.00055 \text{ kg/kg-d}$

33.6  $FCR_{16 \text{ to } 70} = 0.00043 \text{ kg/kg-d}$

33.7 Subp. 14. **Algorithm for Class 2B, 2C, or 2D surface waters.** This subpart  
 33.8 describes human health-based criteria or standards for classes of surface waters designated  
 33.9 for fish consumption and recreational use (nondrinking water use). To develop a final  
 33.10 chronic criteria ( $CC_{fr}$ ) or standard ( $CS_{fr}$ ) applicable to surface waters designated Class 2B,  
 33.11 2C, or 2D, items A to C must be evaluated for use based on the pollutant's toxicological  
 33.12 profile: noncarcinogen or nonlinear carcinogen (NLC) or linear carcinogen (C).

33.13 A. Algorithm for noncarcinogenic or NLC chemicals applicable to Class 2B,  
 33.14 2C, or 2D surface waters to calculate:  $CC_{fr}$  or  $CS_{fr} =$

33.15 
$$\frac{RfD_{\text{chronic}} \text{ (mg/kg-d)} \times RSC \text{ (no units)} \times 1,000 \text{ } \mu\text{g/mg}}{\{IWR_{\text{chronic}} \text{ (L/kg-d)} + FCR_{\text{adult}} \text{ (kg/kg-d)}[(0.24 \times BAF_{TL3} \text{ (L/kg)}) + (0.76 \times BAF_{TL4} \text{ (L/kg)})]\}$$

33.16  
 33.17 
$$\{IWR_{\text{chronic}} \text{ (L/kg-d)} + FCR_{\text{adult}} \text{ (kg/kg-d)}[(0.24 \times BAF_{TL3} \text{ (L/kg)}) + (0.76 \times BAF_{TL4} \text{ (L/kg)})]\}$$

33.18 where:  $CC_{fr}$  or  $CS_{fr}$  = fish consumption and recreation chronic criterion or standard  
 33.19 in  $\mu\text{g/L}$

33.20  $IWR_{\text{chronic}} = 0.0013 \text{ L/kg-d}$ ; assumed incidental water intake rate based on  
 33.21 minimum chronic duration

33.22 Other variables as defined under subpart 13

33.23 B. Algorithm for linear carcinogenic chemicals with lifetime adjustment factors  
 33.24 ( $AF_{\text{lifetime}}$ ) applicable to surface waters designated Class 2B, 2C, or 2D to calculate:  $CC_{fr}$   
 33.25 or  $CS_{fr} =$

$$\frac{CR (1 \times 10^{-5})}{CSF \text{ (mg/kg-d)}^{-1} \times AF_{\text{lifetime}}} \times \frac{1000 \text{ } \mu\text{g/mg}}{\{IWR_{\text{chronic}} \text{ (L/kg-d)} + FCR_{\text{adult}} \text{ (kg/kg-d)}[(0.24 \times BAF_{TL3} \text{ (L/kg)}) + (0.76 \times BAF_{TL4} \text{ (L/kg)})]\}}$$

34.1 where:  $CC_{fr}$  or  $CS_{fr}$  = fish consumption and recreation chronic criterion or standard  
 34.2 in  $\mu\text{g/L}$

34.3 Other variables as defined under item A and subpart 13

34.4 C. Algorithm for linear carcinogenic chemicals with age-dependent adjustment  
 34.5 factors (ADAF) applicable to surface waters designated Class 2B, 2C, or 2D to calculate:

34.6  $CC_{fr}$  or  $CS_{fr}$  =

$$\frac{CR (1 \times 10^{-5}) \times 1000}{\left\{ \begin{array}{l} \left\{ CSF \times ADAF_{<2} \times D_{<2} \times [IWR + FCR_{<2} \times (0.24BAF_{TL3} + 0.76BAF_{TL4})] \right\} + \\ \left\{ CSF \times ADAF_{2 \text{ to } <16} \times D_{2 \text{ to } <16} \times [IWR + FCR_{2 \text{ to } <16} \times (0.24BAF_{TL3} + 0.76BAF_{TL4})] \right\} + \\ \left\{ CSF \times ADAF_{16 \text{ to } 70} \times D_{16 \text{ to } 70} \times [IWR + FCR_{\text{Adult}} \times (0.24BAF_{TL3} + 0.76BAF_{TL4})] \right\} \end{array} \right\} / 70 \text{yrs}}$$

34.7 where:  $CC_{fr}$  or  $CS_{fr}$  = fish consumption and recreation chronic criterion or standard  
 34.8 in  $\mu\text{g/L}$

34.9 Other variables as defined under item A and subpart 13

34.10 Subp. 15. **Algorithms for Class 2 fish tissue.** This subpart describes algorithms and  
 34.11 fish tissue criteria ( $CC_{ft}$ ) and standards ( $CS_{ft}$ ) for chemical with BAF greater than 1,000  
 34.12 (BCC threshold) applicable to Class 2 surface waters. Items A to C must be evaluated for  
 34.13 use based on the pollutant's toxicological profile: noncarcinogen or nonlinear carcinogen  
 34.14 (NLC) or linear carcinogen (C).

34.15 A. Algorithm for noncarcinogenic or NLC chemicals applicable to Class 2  
 34.16 surface waters to calculate:  $CC_{ft}$  or  $CS_{ft}$  =

$$\frac{RfD_{\text{chronic}} \text{ (mg/kg-d)} \times RSC \text{ (no units) or - RSC (mg/kg-d)}}{FCR_{\text{adult}} \text{ (kg/kg-d)}}$$

34.20 where:  $CC_{ft}$  or  $CS_{ft}$  = fish tissue-based chronic criterion or standard in mg/kg

34.21 Other variables as defined under subpart 13

35.1 B. Algorithm for linear carcinogenic chemicals with lifetime adjustment factors

35.2 ( $AF_{lifetime}$ ) applicable to Class 2 surface waters to calculate:  $CC_{ft}$  or  $CS_{ft} =$

$$35.3 \frac{CR (1 \times 10^{-5})}{CSF (mg/kg-d)^{-1} \times AF_{lifetime} (no \ units)} \times \frac{1}{FCR_{Adult} (kg/kg-d)}$$

35.6 where:  $CC_{ft}$  or  $CS_{ft}$  = fish tissue-based chronic criterion or standard in mg/kg

35.7 Other variables as defined under subpart 13

35.8 C. Algorithm for linear carcinogenic chemicals with age-dependent adjustment

35.9 factors (ADAFs) applicable to Class 2 surface waters to calculate:  $CC_{ft}$  or  $CS_{ft} =$

$$\frac{CR (1 \times 10^{-5})}{\left[ \frac{(CSF \times ADAF_{<2} \times D_{0-2} \times FCR_{<2}) + (CSF \times ADAF_{2-16} \times D_{2-16} \times FCR_{2-16}) + (CSF \times ADAF_{16-70} \times D_{16-70} \times FCR_{16-70})}{70 \text{ years}} \right]}$$

35.10 where:  $CC_{ft}$  or  $CS_{ft}$  = fish tissue-based chronic criterion or standard in mg/kg

35.11 Other variables as defined under subpart 13

35.12 **7050.0222 SPECIFIC WATER QUALITY STANDARDS FOR CLASS 2 WATERS**  
 35.13 **OF THE STATE; AQUATIC LIFE AND RECREATION.**

35.14 [For text of subps 1 to 6, see M.R.]

35.15 Subp. 7. **Additional standards; Class 2 waters.** The following additional standards  
 35.16 and requirements apply to all Class 2 waters.

35.17 [For text of items A and B, see M.R.]

35.18 C. To prevent chronically toxic conditions, concentrations of toxic pollutants  
 35.19 must not exceed the applicable CS or CC and MS or MC in surface waters outside allowable  
 35.20 mixing zones as described in part 7050.0210, subpart 5. The CS or CC and MS or MC will  
 35.21 be averaged over the following durations: the MS or MC will be a one-day average; the  
 35.22 CS or CC, based on toxicity to aquatic life, will be a four-day average; and the CS or CC,  
 35.23 based on human health and applied in water or wildlife toxicity, will be a 30-day average.

36.1 D. Concentrations of noncarcinogenic or nonlinear carcinogenic (NLC)  
 36.2 chemicals in water or fish tissue from point or nonpoint sources, singly or in mixtures,  
 36.3 must be below levels expected to produce known adverse effects. This is accomplished  
 36.4 through the application of an additive noncancer health risk index using common health  
 36.5 risk index endpoints or health endpoints. Mixtures of chemicals with listed CS or  
 36.6 site-specific CC are evaluated using the following approach:

36.7 Chemicals must be grouped according to medium (water or fish) and each health  
 36.8 endpoint. Chemicals for which no health endpoint is specified are not grouped. Chemicals  
 36.9 that are also linear carcinogens must be grouped as described under item E. Using the  
 36.10 following equation, a noncancer health risk index must be determined for each group  
 36.11 of two or more chemicals that have a common health endpoint listed in this part. To  
 36.12 meet the protection objectives in part 7050.0217, the noncancer health risk index must  
 36.13 not exceed a value of one.

36.14 Noncancer health risk index by  
 36.15 common health endpoint = 
$$\frac{C_1}{\frac{CS_{1\_or}}{CC_1}} + \frac{C_2}{\frac{CS_{2\_or}}{CC_2}} + \dots + \frac{C_n}{\frac{CS_{n\_or}}{CC_n}} \leq 1$$

36.16  
 36.17

36.18 where:  $C_n$  is the concentration of the first to the  $n^{th}$  chemical by common health endpoint  
 36.19 and medium

36.20  $CS_1 \dots CS_n$  is the drinking water plus fish consumption and recreation chronic  
 36.21 standard ( $CS_{dfr}$  or  $CS_{dev}$ ), fish consumption and recreation chronic standard  
 36.22 ( $CS_{fr}$ ), or fish tissue chronic standard ( $CS_{ft}$ ) for the first to  $n^{th}$  chemical by  
 36.23 common health endpoint

36.24  $CC_1 \dots CC_n$  is the drinking water plus fish consumption and recreation chronic  
 36.25 criterion ( $CC_{dfr}$  or  $CC_{dev}$ ), fish consumption and recreation chronic criterion  
 36.26 ( $CC_{fr}$ ), or fish tissue chronic criterion ( $CC_{ft}$ ) for the first to  $n^{th}$  chemical by  
 36.27 common health endpoint

36.28 E. Concentrations of carcinogenic chemicals from point or nonpoint sources,  
 36.29 singly or in mixtures, must not exceed an incremental or additional excess risk level of  
 36.30 one in 100,000 ( $10^{-5}$ ) in surface waters or fish tissue. Carcinogenic chemicals will be

37.1 considered additive in their effect according to the following equation unless an alternative  
 37.2 model is supported by available scientific evidence. The additive equation applies to  
 37.3 chemicals that have a human health-based chronic standard (CS) or site-specific chronic  
 37.4 criterion (CC) calculated with a cancer potency slope factor. To meet the protection  
 37.5 objectives in part 7050.0217, the cancer health risk index must not exceed a value of one.

$$\begin{array}{l}
 37.6 \\
 37.7 \text{ Cancer health risk index} \\
 37.8 \\
 37.9
 \end{array}
 = \frac{C_1}{\frac{CS_{1\_or}}{CC_1}} + \frac{C_2}{\frac{CS_{2\_or}}{CC_2}} + \dots + \frac{C_n}{\frac{CS_{n\_or}}{CC_n}} \leq 1$$

37.10 where:  $C_1 \dots C_n$  is the concentration of the first to the  $n^{\text{th}}$  carcinogen in water or fish  
 37.11 tissue

37.12  $CS_1 \dots CS_n$  is the drinking water plus fish consumption and recreation chronic  
 37.13 standard ( $CS_{\text{dfr}}$ ), fish consumption and recreation chronic standard ( $CS_{\text{fr}}$ ), or  
 37.14 fish tissue chronic standard ( $CS_{\text{ft}}$ ) for the first to  $n^{\text{th}}$  carcinogenic chemical

37.15  $CC_1 \dots CC_n$  is the drinking water plus fish consumption and recreation chronic  
 37.16 criterion ( $CC_{\text{dfr}}$ ) fish consumption and recreation chronic criterion ( $CC_{\text{fr}}$ ), or  
 37.17 fish tissue chronic criterion ( $CC_{\text{ft}}$ ) for the first to  $n^{\text{th}}$  carcinogenic chemical

37.18 F. When monitoring indicates that chemical breakdown products or  
 37.19 environmental degradates are present in surface water or fish tissue, those products must  
 37.20 be considered when meeting the objectives for toxic pollutants in part 7050.0217. When  
 37.21 no human health-based CS or other MDH health-based guidance is available for the  
 37.22 chemical breakdown product, the CS or CC for the parent chemical must be applied for  
 37.23 that product. The parent CS or CC must also be applied to evaluate mixtures of chemicals.

37.24 G. This item applies to maximum standards (MS), final acute values (FAV),  
 37.25 and double dashes (–) in this part and part 7050.0220 marked with an asterisk (\*). For  
 37.26 carcinogenic or highly bioaccumulative chemicals with BCFs greater than 5,000 or log  
 37.27  $K_{\text{ow}}$  values greater than 5.19, the human health-based chronic standard (CS) may be two  
 37.28 or more orders of magnitude smaller than the acute toxicity-based MS.

38.1 If the ratio of the MS to the CS is greater than 100, the CS times 100 must be  
38.2 substituted for the applicable MS, and the CS times 200 must be substituted for the  
38.3 applicable FAV. Any effluent limit derived using the procedures of this item must only be  
38.4 required after the discharger has been given notice of the specific proposed effluent limits  
38.5 and an opportunity to request a hearing as provided in part 7000.1800.

38.6 [For text of subps 8 and 9, see M.R.]

38.7 **7052.0005 SCOPE.**

38.8 A. This chapter establishes aquatic life, human health, and wildlife water  
38.9 quality standards and criteria for Great Lakes Initiative (GLI) pollutants; nondegradation  
38.10 standards for surface waters of the state in the Lake Superior Basin including, on a  
38.11 limited basis as described in item B, Class 7 waters; and implementation procedures  
38.12 for deriving effluent limitations from these standards and criteria. Other water quality  
38.13 standards, nondegradation standards, and implementation procedures applicable to the  
38.14 surface waters of the state in the Lake Superior Basin can be found in chapter 7050 and in  
38.15 parts 7052.0100, subpart 1, items A to G, and 7053.0255.

38.16 [For text of item B, see M.R.]

38.17 **7052.0010 DEFINITIONS.**

38.18 [For text of subps 1 to 10, see M.R.]

38.19 Subp. 11. **Criterion.** "Criterion" means a number or numbers established for a  
38.20 pollutant derived under parts 7050.0218, 7050.0219, 7052.0110, or issued by the EPA, to  
38.21 protect aquatic life, humans, or wildlife.

38.22 [For text of subps 12 to 20, see M.R.]

38.23 Subp. 21. **GLI pollutant.** "GLI pollutant" means a toxic pollutant or chemical listed  
38.24 as a pollutant of initial focus in the GLI Guidance, Code of Federal Regulations, title 40,  
38.25 part 132, Table 6, as amended.

39.1 [For text of subps 22 to 39, see M.R.]

39.2 Subp. 40. **Tier I.** "Tier I" means the methods referenced in part 7052.0110 for  
39.3 developing aquatic life and wildlife standards or criteria.

39.4 Subp. 41. **Tier II.** "Tier II" means the methods referenced in part 7052.0110 for  
39.5 developing aquatic life standards or criteria when there is not a set of data available that  
39.6 meets Tier I data requirements.

39.7 [For text of subps 42 to 45, see M.R.]

39.8 **7052.0100 WATER QUALITY STANDARDS.**

39.9 Subpart 1. **Applicability.**

39.10 A. The ambient water quality standards in subparts 2 to 6 are Class 2 standards  
39.11 for the protection of aquatic life, human health, and wildlife from the GLI pollutants. The  
39.12 numeric standard for a GLI pollutant includes the CS, MS, and FAV. Some pollutants do  
39.13 not have an MS or an FAV because of insufficient data. For these pollutants, the CS is the  
39.14 numeric standard. Additional standards applicable to the surface waters of the state in the  
39.15 Lake Superior Basin are found in chapter 7050, including standards applicable to drinking  
39.16 water sources, which are listed in parts 7050.0220 and 7050.0221.

39.17 B. Some of the GLI pollutants listed in subparts 2 to 6 have both aquatic life  
39.18 and human health standards and four of the GLI pollutants have wildlife standards, as  
39.19 provided in tables 1 to 4 of the GLI Guidance. These standards are listed in subparts 2  
39.20 to 6 to facilitate implementation of the standards under parts 7052.0200, subpart 3, and  
39.21 7052.0210, subpart 1. The most stringent chronic aquatic life, human health, or wildlife  
39.22 standard listed is the applicable standard except when a less stringent chronic or maximum  
39.23 standard applies when setting an effluent limitation under part 7052.0200, subpart 3. For  
39.24 any aquatic life, human health, or wildlife chronic standard, a blank space in subparts 2  
39.25 to 5 means no GLI standard is available and the most stringent listed chronic standard is

40.1 applicable. For the aquatic life MS and FAV, blank spaces mean the GLI guidance lists no  
40.2 MS or FAV, and part 7050.0222 may contain an applicable MS or FAV.

40.3 C. The definitions and methods for human health-based chronic standards and  
40.4 site-specific chronic criteria in parts 7050.0217 to 7050.0219 are incorporated by reference  
40.5 and are further described in part 7052.0110, subpart 4.

40.6 D. The Class 2A human health-based chronic standards listed in chapter 7050  
40.7 are incorporated by reference as modified by the procedures in part 7052.0110, subpart 3.

40.8 E. The *Escherichia (E.) coli* water quality standards in Code of Federal  
40.9 Regulations, title 40, section 131.41, Table (c)(1), that apply to coastal recreation waters  
40.10 are incorporated by reference as:

40.11 (1) *E. coli* bacteria must not exceed 126 organisms per 100 milliliters, as  
40.12 a geometric mean of not less than five samples representative of conditions during any  
40.13 calendar month; or

40.14 (2) *E. coli* bacteria must not exceed 235 organisms per 100 milliliters in  
40.15 more than ten percent of all the individual samples taken during any calendar month.

40.16 The *E. coli* standard under this item applies only between April 1 and October 31.

40.17 F. Standards for metals are expressed as total metal but must be implemented  
40.18 as dissolved metal standards. Conversion factors for converting total to dissolved metal  
40.19 standards are listed in part 7052.0360, and applied under part 7052.0200, subpart 4. The  
40.20 conversion factor for metals not listed in part 7052.0360 is one. Standards for GLI  
40.21 pollutants followed by (TH) or (pH) vary with total hardness or pH. The formulas for these  
40.22 standards are found in subpart 6.

40.23 G. The CS and MS are averaged over the following durations:

40.24 (1) the MS is a one-day average;

40.25 (2) the CS, based on toxicity to aquatic life, is a four-day average; and



41.1 (3) the CS applied in water, based on human health or wildlife toxicity, is  
41.2 a 30-day average.

41.3 [For text of subps 2 to 6, see M.R.]

41.4 **7052.0110 METHODOLOGIES FOR DEVELOPMENT OF STANDARDS AND**  
41.5 **CRITERIA, AND BIOACCUMULATION FACTORS.**

41.6 Subpart 1. **Applicability.** This part identifies the methods that must be used to  
41.7 develop aquatic life and wildlife-based Tier I and Tier II standards and criteria and human  
41.8 health-based chronic standards and criteria. Subparts 3 and 4 also list exceptions to some  
41.9 of the assumptions used in the GLI Guidance methods. These exceptions are based on  
41.10 Minnesota-specific data.

41.11 [For text of subp 2, see M.R.]

41.12 Subp. 3. **Bioaccumulation factors.** Bioaccumulation factors (BAFs) for calculating  
41.13 human health and wildlife standards were developed and BAFs for calculating criteria  
41.14 must be developed using the methodology provided by Code of Federal Regulations, title  
41.15 40, part 132, Appendix B, entitled "Great Lakes Water Quality Methodology for Deriving  
41.16 Bioaccumulation Factors," as amended through March 12, 1997, which is adopted and  
41.17 incorporated by reference in part 7052.0015, item B, except that for human health  
41.18 standards and criteria, the baseline BAF is multiplied by the following lipid fractions  
41.19 which apply to fish in both trophic levels 3 (TL<sub>3</sub>) and 4 (TL<sub>4</sub>), except as noted in item C:

41.20 A. 0.085 for Lake Superior;

41.21 B. 0.06 for Class 2A waters other than Lake Superior; and

41.22 C. 0.015 for TL<sub>4</sub> and 0.020 for TL<sub>3</sub> for Class 2B, 2Bd, 2C, and 2D waters.

41.23 Subp. 4. **Human health.**

41.24 A. Human health standards listed in part 7052.0100 for benzene, chlordane,  
41.25 chlorobenzene, cyanide (free), DDT, dieldrin, 2,4-dimethylphenol, 2,4-dinitrophenol,

42.1 hexachlorobenzene, hexachloroethane, lindane, mercury (total), methylene chloride,  
42.2 PCBs, 2,3,7,8-TCDD, toluene, and trichloroethylene were developed using the Tier I  
42.3 methodology provided by Code of Federal Regulations, title 40, part 132, Appendix C,  
42.4 entitled "Great Lakes Water Quality Initiative Methodology for Development of Human  
42.5 Health Criteria and Values," as amended through March 12, 1997, which is adopted  
42.6 and incorporated by reference in part 7052.0015, item C, except that the daily human  
42.7 consumption of fish caught in the Lake Superior Basin is assumed to be 0.030 kg/day  
42.8 (0.0072 kg/day for TL<sub>3</sub> fish plus 0.0228 kg/day for TL<sub>4</sub> fish).

42.9 B. Changes to the standards established for the pollutants in item A or additional  
42.10 human health-based chronic standards or site-specific chronic criteria must be based on the  
42.11 algorithms and methods in parts 7050.0217 to 7050.0219, with site-specific consideration  
42.12 as provided in part 7052.0270, except the bioaccumulation factor methods in part  
42.13 7052.0110, subpart 3, must be used in place of those listed in part 7050.0219, subpart 6.

42.14 C. Concentrations of noncarcinogenic or nonlinear carcinogenic (NLC)  
42.15 chemicals in water or fish tissue from point or nonpoint sources, singly or in mixtures,  
42.16 must be below levels expected to produce known adverse effects. This is accomplished  
42.17 through the application of an additive noncancer health risk index using common health  
42.18 risk index endpoints or health endpoints as described in part 7050.0222, subpart 7, item D.  
42.19 Concentrations of carcinogenic chemicals from point or nonpoint sources, singly or in  
42.20 mixtures, must not exceed an incremental or additional excess risk level of one in 100,000  
42.21 ( $10^{-5}$ ) in surface waters. The combined risk from mixtures of linear carcinogens (C) is  
42.22 determined as described in part 7050.0222, subpart 7, item E.

42.23 [For text of subp 5, see M.R.]

42.24 **7052.0220 REASONABLE POTENTIAL FOR CHEMICAL-SPECIFIC WQBELS.**

42.25 [For text of subp 1, see M.R.]

43.1 Subp. 2. **Developing preliminary effluent limitations.** The first step in a reasonable  
43.2 potential determination is to calculate a PEL. The procedures in parts 7052.0200 and  
43.3 7052.0210 must be used to determine a PEL from a standard or criterion. If the agency  
43.4 determines that there are insufficient data to calculate a standard or criterion, the procedure  
43.5 in subpart 4 must be followed to determine if data must be generated to calculate a  
43.6 standard or site-specific criterion.

43.7 [For text of subp 3, see M.R.]

43.8 Subp. 4. **Developing data for calculating Tier II aquatic life standards and**  
43.9 **criteria or noncancer human health-based standards or site-specific criteria.** This  
43.10 subpart applies when the agency determines that insufficient data currently exist to  
43.11 calculate aquatic life toxicity-based Tier II or human health-based standards or criteria for  
43.12 GLI pollutants known to be in the discharge, or suspected to be in the discharge based on  
43.13 knowledge of the raw materials used or internal process or waste streams.

43.14 [For text of item A, see M.R.]

43.15 B. Using the provisions in parts 7052.0200 and 7052.0210, the agency must  
43.16 develop PELs based on the estimated ambient screening criteria and compare the PELs  
43.17 with each PEQ developed under subpart 3. If the PEQ exceeds the PEL for any GLI  
43.18 pollutant, the agency must generate or require the permittee to generate the data necessary  
43.19 to derive standards or site-specific criteria to protect human health from noncancer effects  
43.20 and aquatic life from acute and chronic effects using the methods in part 7052.0110 with  
43.21 site-specific consideration as provided in part 7052.0270.

43.22 C. The agency must use the data generated according to item B to calculate  
43.23 standards and site-specific criteria according to the methods in part 7052.0110. The  
43.24 derived standards and criteria must be used to calculate PELs to determine if an effluent  
43.25 limitation must be established in the permit. If the PEQ exceeds the PEL for any GLI  
43.26 pollutant, an effluent limitation must be established in the permit.

44.1 [For text of item D, see M.R.]

44.2 [For text of subs 5 to 7, see M.R.]

44.3 **7052.0230 ADDITIVITY.**

44.4 [For text of subp 1, see M.R.]

44.5 Subp. 2. **Carcinogenic human health GLI pollutant additivity.** The agency  
44.6 must calculate the additive effects of carcinogenic human health pollutants in effluents  
44.7 according to part 7050.0222, subpart 7, item E, for which individual WQBELs have been  
44.8 established under part 7052.0200, subpart 5. Cumulative incremental risk for carcinogens  
44.9 in the effluent must be maintained at  $1 \times 10^{-5}$  or less.

44.10 Subp. 3. **Noncarcinogenic human health GLI pollutant additivity.** The agency  
44.11 must determine the additive effects of noncarcinogenic human health pollutants where  
44.12 individual WQBELs have been established under part 7052.0200, subpart 5, and where  
44.13 the pollutants exhibit the same adverse effects through the same mechanisms of action as  
44.14 established through the use of health risk index endpoints or health endpoints according to  
44.15 part 7050.0222, subpart 7, item D.

44.16 [For text of subs 4 and 5, see M.R.]

44.17 **REPEALER.** Minnesota Rules, part 7050.0218, subparts 6 and 7, are repealed.