Chapter NR 105

SURFACE WATER QUALITY CRITERIA AND SECONDARY VALUES FOR TOXIC SUBSTANCES

NR 105.01 Purpose. The purpose of this chapter is to establish water quality criteria, and methods for developing criteria and secondary values for toxic substances to protect public health and welfare, the present and prospective use of all surface waters for public and private water supplies, and the propagation of fish and aquatic life and wildlife. This chapter also establishes how bioaccumulation factors used in deriving water quality criteria and secondary values for toxic and organoleptic substances shall be determined. Water quality criteria are a component of surface water quality standards. This chapter and chs. NR 102 to 104 constitute quality standards for the surface waters of Wisconsin.

History: Cr. Register, February, 1989, No. 398, eff. 3–1–89; **am. Register, August, 1997, No. 500, eff. 9–1–97.**

NR 105.02 Applicability. The provisions of this chapter are applicable to surface waters of Wisconsin as specified in chs. NR 102 to 104 and in this chapter.

(1) SITE SPECIFIC CRITERIA AND SECONDARY VALUES. A criterion contained within this chapter or a secondary value calculated pursuant to this chapter may be modified for a particular surface water segment or body. A criterion or secondary value may be modified if specific information is provided which shows that the data used to derive the criterion or secondary value do not apply and if additional information is provided to derive a site–specific criterion or secondary value. Site–specific criteria are intended to be applicable to a specific surface water segment. Criteria may be modified for site–specific considerations according to the USEPA "Water Quality Standards Handbook" Second Edition, revised 1994. Any criterion modified for site–specific conditions shall be promulgated in ch. NR 104 before it can be applied on a site–specific basis. Site–specific modifications of criteria and secondary values shall be consistent with the procedures described in 40 CFR Part 132, Appendix F, Procedure 1: Site–specific modifications to criteria and values. 40 CFR Part 132, Appendix F, Procedure 1 as stated on September 1, 1997 is incorporated by reference.

Note: Copies of 40 CFR Part 132 Appendix F, Proc. 1 are available for inspection in the offices of the department of natural resources, secretary of state and the revisor of statutes, Madison, WI or may be purchased from the superintendent of documents, US government printing office, Washington, D.C. 20402.

(2) STATEWIDE CRITERIA. (a) The department may promulgate a less stringent criterion or remove a criterion from this chapter when the department determines that the previously promulgated criterion is more stringent than necessary, or unnecessary for the protection of humans, fish and other aquatic life or wildlife. The modification shall assure that the designated uses are protected and water quality standards continue to be attained.

(b) The department may promulgate a more stringent criterion in this chapter when the department determines that the previously promulgated criterion is inadequate for the protection of humans, fish and other aquatic life or wildlife.

(3) DETERMINATION OF SECONDARY VALUES FOR EFFLUENT LIMITATIONS. If a discharge contains a toxic substance, and if data to calculate a water quality criterion for that substance are not available, then, on a case–by–case basis, the department may calculate a secondary value as defined in this chapter and establish an effluent limitation for the toxic substance if the conditions contained in s. NR 106.05 (1) (b) are met.

History: Cr. Register, February, 1989, No. 398, eff. 3–1–89; **am. (1) and (2), cr. (3), Register, August, 1997, No. 500, eff. 9–1–97.**

NR 105.03 Definitions. (1) "Acute toxicity" means the ability of a substance to cause mortality or an adverse effect in an organism which results from a single or short–term exposure to the substance.

(2) "Acute toxicity criterion" or "ATC" means the maximum daily concentration of a substance which ensures adequate protection of sensitive species of aquatic life from the acute toxicity of that substance and will adequately protect the designated fish and aquatic life use of the surface water if not exceeded more than once every 3 years. If the available data indicate that one or more life stages of a particular species are more sensitive to a substance than other life stages of the same species, the ATC shall represent the acute toxicity of the most sensitive life stage.

(3) "Adequate protection" means a level of protection which ensures survival of a sufficient number of healthy individuals in a population of aquatic species to provide for the continuation of an unreduced population of these species.

(4) "Adverse effect" means any effect resulting in a functional impairment or a pathological lesion, or both, which may affect the performance of the whole organism, or which contributes to a reduced ability to respond to an additional challenge. Adverse effects include toxicant–induced mutagenic, teratogenic, or carcinogenic effects or impaired, developmental, immunological or reproductive effects.

(5) "Baseline BAF" means for organic chemicals, a bioaccumulation factor normalized to 100% lipid that is based on the concentration of a freely dissolved chemical in the ambient water and takes into account the partitioning of the chemical within the organism. For inorganic chemicals, a bioaccumulation factor is based on the wet weight of the tissue.

(6) "Baseline BCF" means for organic chemicals, a bioconcentration factor normalized to 100% lipid that is based on the concentration of freely dissolved chemical in the ambient water and takes into account the partitioning of the chemical within the organism. For inorganic chemicals, a bioconcentration factor is based on the wet weight of the tissue.

(7) "Bioaccumulation" means the net accumulation of a substance by an organism as a result of uptake from all environmental sources.

(8) "Bioaccumulation factor" or "BAF" means the ratio (in L/kg) of a substance's concentration in the tissue of an aquatic organism to its concentration in the ambient water, in situations where both the organism and its food are exposed to the substance and where the ratio does not change substantially over time.

(9) "Bioaccumulative chemical of concern" or "BCC" means any substance that has the potential to cause adverse effects which, upon entering the surface waters, accumulates in aquatic organisms by a human health or wildlife bioaccumulation factor greater than 1000.

(10) "Bioconcentration" means the net accumulation of a substance by an aquatic organism as a result of uptake directly from the ambient water through its gill membranes or other external body surfaces.

(11) "Bioconcentration factor" or "BCF" means the ratio (in L/kg) of a substance's concentration in the tissue of an aquatic organism to its concentration in the ambient water, in situations where the organism is exposed through the water only and where the ratio does not change substantially over time.

(12) "Biota–sediment accumulation factor" or "BSAF" means the ratio (in kg of organic carbon/kg of lipid) of a substance's lipid–normalized concentration in the tissue of an aquatic organism to its organic carbon–normalized concentration in surface sediment, in situations where the ratio does not change substantially over time, both the organism and its food are exposed, and where the surface sediment is representative of the average surface sediment in the vicinity of the organism.

(13) "Carcinogen" means any substance listed in Table 9 or a substance for which the induction of benign or malignant neoplasms has been demonstrated in:

(a) Humans; or

(b) Two mammalian species; or

(c) One mammalian species, independently reproduced; or

(d) One mammalian species, to an unusual degree with respect to increased incidence, shortened latency period, variety of site, tumor type, or decreased age at onset; or

(e) One mammalian species, supported by reproducible positive results in at least 3 different types of short–term tests which are indicative of potential oncogenic activity.

(14) "Chronic toxicity" means the ability of a substance to cause an adverse effect in an organism which results from exposure to the substance for a time period representing that substantial portion of the natural life expectancy of that organism.

(15) "Chronic toxicity criterion" or "CTC" means the maximum 4–day concentration of a substance which ensures adequate protection of sensitive species of aquatic life from the chronic toxicity of that substance and will adequately protect the designated fish and aquatic use of the surface water if not exceeded more than once every 3 years.

(16) "Depuration" means the loss of a substance from an organism as a result of any active or passive process.

(17) "EC_{50}" means a concentration of a toxic substance which causes an adverse effect including mortality in 50% of the exposed organisms in a given time period.

(18) "Food–chain multiplier" or "FCM" means the ratio of a BAF to an appropriate BCF.

(19) "LC_{50}" means a concentration of a toxic substance which is lethal to 50% of the exposed organisms in a given time period.

(20) "LD_{50}" means a dose of a toxic substance which is lethal to 50% of the exposed organisms in a given time period.

(21) "Lipid–soluble substance" means a substance which is soluble in nonpolar organic solvents and which tends to accumulate in the fatty tissues of an organism exposed to the substance.

(22) "Lowest observable adverse effect level" or "LOAEL" means the lowest tested concentration that caused an adverse effect in comparison with a control when all higher test concentrations caused the same effect.

(23) "No observable adverse effect level" or "NOAEL" means the highest tested concentration that did not cause an adverse effect in comparison with a control when no lower test concentration caused an adverse effect.

(24) "Octanol/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 in an equilibrated 2–phase octanol–water system. For log K_{OW}, the log of the octanol–water partition coefficient is a base 10 logarithm.

(25) "Secondary value" means a temporary value that represents the concentration of a substance which ensures adequate protection of sensitive species of aquatic life, wildlife or human health from the toxicity of that substance and will adequately protect the designated use of the surface water until database requirements are fulfilled to calculate a water quality criterion.

(26) "Steady state" means that an equilibrium condition in the body burden of a substance in an organism has been achieved and is assumed when the rate of depuration of a substance matches its rate of uptake.

(27) "Toxic substance" means a substance or mixture of substances which through sufficient exposure, or ingestion, inhalation or assimilation by an organism, either directly from the environment or indirectly by ingestion through the food chain, will cause death, disease, behavioral or immunological abnormalities, cancer, genetic mutations, or developmental or physiological malfunctions, including malfunctions in reproduction or physical deformations, in such organisms or their offspring.

(28) "Trophic level" means a functional classification of taxa within a community that is based on feeding relationships (e.g., aquatic plants comprise the first trophic level, herbivores comprise the second, small fish comprise the third, predatory fish the fourth, etc.).

(29) "Uptake" means the acquisition of a substance from the environment by an organism as a result of any active or passive process.

(30) "Water quality parameter" means one of the indicators available for describing the distinctive quality of water including, but not limited to, hardness, pH, or temperature.

History: Cr. Register, February, 1989, No. 398, eff. 3–1–89; **renum. (5) to (19) to be (11), (13) to (15), (17), (19) to (24), (26), (27) and (30), cr. (5) to (7), (9), (10), (12), (16), (18), (25), (28) and (29) and am. (8), (11) and (24), Register, August, 1997, No. 500, eff. 9–1–97.**

NR 105.04 Determination of adverse effects. **(1)** Substances may not be present in surface waters at concentrations which adversely affect public health or welfare, present or prospective uses of surface waters for public or private water supplies, or the protection or propagation of fish or other aquatic life or wild or domestic animal life.

(2) A substance shall be deemed to have adverse effects on fish or other aquatic life if it exceeds any of the following more than once every 3 years:

(a) The acute toxicity criterion as specified in s. NR 105.05, or

(b) The chronic toxicity criterion as specified in s. NR 105.06.

(c) The acute and chronic toxicity criteria for ammonia nitrogen shall be determined on a case–by–case basis by the department for the appropriate aquatic life use category.

(3) A substance shall be deemed to have adverse effects on wildlife if it exceeds the wildlife criterion as specified in s. NR 105.07.

(4) A substance shall be deemed to have adverse effects on public health and welfare if it exceeds any of the following:

(a) The human threshold criterion as specified in s. NR 105.08; or

(b) The human cancer criterion as specified in s. NR 105.09; or

(c) The taste and odor criterion as specified in s. NR 102.14.

(5) A substance shall be deemed to have adverse effects or the reasonable potential to have adverse effects on aquatic life, wildlife or human health, if it exceeds a secondary value determined according to the procedures in ss. NR 105.05 to 105.08.

(6) The determination of the criteria or secondary values for substances as calculated under ss. NR 105.05 to 105.09 shall be based upon the available scientific data base. References to be used in obtaining scientific data may include, but are not limited to:

(a) "Water Quality Criteria 1972", EPA–R3–73–033, National Academy of Sciences, National Academy of Engineering, United States Government Printing Office, Washington, D.C., 1974.

(b) "Quality Criteria for Water", EPA–440/9–76–003, United States Environmental Protection Agency, Washington, D.C., 1976.

(c) October 1980 and January 1985 U.S. Environmental Protection Agency (EPA) ambient water quality criteria documents.

(d) "Public Health Related Groundwater Standards: Summary of Scientific Support Documentation for NR 140.10", Wisconsin Department of Health and Social Services, Division of Health, September 1985.

(e) "Public Health Related Groundwater Standards – 1986: Summary of Scientific Support Documentation for NR 140.10", Wisconsin Department of Health and Social Services, Division of Health, June 1986.

(f) Health advisories published on March 31, 1987 by EPA, Office of Drinking Water.

(g) Any other reports, documents or information published by EPA or any other federal agency.

(h) Any other reports, documents or information that the department, deems to be reliable.

(7) When reviewing any of the references in sub. (6) to determine the effect of a substance, the department:

(a) Shall use scientific studies on the toxicity of a substance to fish and other aquatic life and wild and domestic animals, indigenous to the state;

(b) May use scientific studies on the toxicity of a substance to fish or other aquatic life, plant, mammalian, avian, and reptilian species not indigenous to the state; and

(c) May consider biomonitoring information to determine the aquatic life toxicity of complex mixtures of toxic substances in addition to the chemical specific criteria specified in this chapter.

History: Cr. Register, February, 1989, No. 398, eff. 3–1–89; **am. (3), renum. (5) and (6) to be (7) and am. (6) (intro.) and (7) (intro.), cr. (5), Register, August, 1997, No. 500, eff. 9–1–97.**

NR 105.05 Acute toxicity criteria and secondary acute values for aquatic life. (1) MINIMUM DATABASE FOR ACUTE CRITERION DEVELOPMENT. (a) To derive an acute toxicity criterion for aquatic life, the minimum information required shall be the results of acceptable acute toxicity tests with one or more species of freshwater animal in at least 8 different families provided that of the 8 species:

1. At least one is a salmonid fish in the family Salmonidae in the class Osteichthyes,

2. At least one is a non–salmonid fish from another family in the class Osteichthyes, preferably a commercially or recreationally important warmwater species,

3. At least one is a planktonic crustacean (e.g., cladoceran, copepod),

4. At least one is a benthic crustacean (e.g., ostracod, isopod, amphipod, crayfish),

5. At least one is an insect (e.g., mayfly, dragonfly, damselfly, stonefly, caddisfly, mosquito, midge),

6. At least one is a fish or amphibian from a family in the phylum Chordata not already represented in one of the other subdivisions.

7. At least one is an organism from a family in a phylum other than Arthropoda or Chordata (e.g., Rotifera, Annelida, Mollusca), and

8. At least one is an organism from a family in any order of insect or any other phylum not already represented in subds. 1. to 7.

9. If all 8 of the families in subds. 1. to 8. are represented, an acute toxicity criterion may be developed for surface waters classified as cold water using information on all of those families. If an acute toxicity criterion is developed for surface waters classified as cold water, acute toxicity criteria may also be developed for any of the surface water classifications in s. NR 102.04 (3)(b) to (e) using the procedure in sub. (2) or (3) and data on families in subds. 1. to 8. which are representative of the aquatic life communities associated with those classifications. For each substance, in no case may the criterion for a lower quality fish and aquatic life subcategory as defined in s. NR 102.04 be less than the criterion for a higher quality fish and aquatic life subcategory.

10. For a substance, if all of the families in subds. 1. to 8. are not represented, an acute toxicity criterion may not be developed for that substance. Instead, any available data may be used to develop a secondary acute value (SAV) for that substance according to s. NR 105.02(3) and sub.(4).

(b) The acceptability of acute toxicity test results shall be judged according to the guidelines in section IV of the United States environmental protection agency's 1985 "Guidelines for Deriving National Numerical Water Quality Criteria for the Protection of Aquatic Organisms and Their Uses" or 40 CFR Part 132, Appendix A. II, IV and V, as stated on September 1, 1997, is incorporated by reference.

Note: Copies of 40 CFR Part 132, Appendix A Sections II, IV and V are available for inspection in the offices of the department of natural resources, secretary of state and the revisor of statutes, Madison, WI or may be purchased from the superintendent of documents, US government printing office, Washington, D.C. 20402.

(2) ACUTE TOXICITY CRITERIA FOR SUBSTANCES WITH TOXICITY UNRELATED TO WATER QUALITY PARAMETERS. If the acute toxicity of a substance has not been adequately shown to be related to a water quality parameter (i.e., hardness, pH, temperature, etc.), the acute toxicity criterion (ATC) is calculated using the procedures specified in this subsection.

(a) 1. For each species for which at least one acute value is available, the species mean acute value (SMAV) is calculated as the geometric mean of all acceptable acute toxicity tests using the guidelines in sub. (1)(b).

2. For each genus for which one or more SMAVs are available, the genus mean acute value (GMAV) is calculated as the geometric mean of the SMAVs available for the genus.

(b) The GMAVs are ordered from high to low.

(c) Ranks (R) are assigned to the GMAVs from 1 for the lowest to N for the highest. If 2 or more GMAVs are identical, successive ranks are arbitrarily assigned.

(d) The cumulative probability (P) is calculated for each GMAVs as $P=R/(N+1)$.

(e) The 4 GMAVs are selected which have P closest to 0.05. If there are less than 59 GMAVs, these will always be the lowest GMAVs.

(f) Using the selected GMAVs and Ps, the ATC is calculated using the following:

1. Let EV = sum of the 4 ln GMAVs,
   EW = sum of the 4 squares of the ln GMAVs,
   EP = sum of the 4 P values,
   EPR = sum of the 4 square roots of P, and
   JR = square root of 0.05.
2. $S = ((EW - (EV)^2/4)/(EP-(EPR)^2/4))^{0.5}$
3. $L = (EV - S(EPR))/4$.
4. $A = (JR)(S) + L$.
5. Final Acute Value (FAV)= e^A.
6. ATC = FAV/2.

(g) If, for a commercially, recreationally or ecologically important species, the geometric mean of the acute values from flow–through tests in which the concentration of test material was measured is lower than the calculated ATC [FAV], then that geometric mean is used as the ATC [FAV] instead of the calculated one.

(h) Table 1 contains the acute toxicity criteria for fish and aquatic life subcategories listed in s. NR 102.04 (3) that are calculated using the procedures described in this subsection for substances meeting the database requirements indicated in sub. (1) (a).

(3) ACUTE TOXICITY CRITERIA FOR SUBSTANCES WITH TOXICITY RELATED TO WATER QUALITY PARAMETERS. If data are available on a substance to show that acute toxicity to 2 or more species is similarly related to a water quality parameter (i.e., hardness, pH, temperature, etc.), the acute toxicity criterion (ATC) is calculated using the procedures specified in this subsection.

(a) For each species for which acceptable acute toxicity tests using the guidelines in sub. (1) (b) are available at 2 or more different values of the water quality parameter, a least squares regression of the acute toxicity values on the corresponding values of the water quality parameter is performed to obtain the slope of the curve that best describes the relationship. Because the most commonly documented relationship is that between hardness and acute toxicity of metals and a log–log relationship fits these data, geometric means and natural logarithms of both toxicity and water quality are used in the rest of this subsection to illustrate this method. For relationships based on other water quality parameters, no transformation or a different transformation might fit the data better, and appropriate changes shall be made as necessary throughout this subsection.

(b) For each species, the geometric mean of the available acute values (W) is calculated and then each of those acute values is divided by the mean for that species. This normalizes the acute values so that the geometric mean of the normalized values for each species individually and for any combination of species is 1.0.

(c) For each species, the geometric mean of the available corresponding water quality parameter values (X) is calculated and then each of those water quality parameter values is divided by the mean for that species. This normalizes the water quality parameter values so that the geometric mean of the normalized values for each species individually and for any combination of species is 1.0.

(d) A least squares regression of all the normalized acute values on the corresponding normalized values of the water quality parameter is performed to obtain the pooled acute slope (V). If the coefficient of determination, or r value, calculated from that regression is found not to be significant based on a standard F–test at a 0.05 level, then the pooled acute slope shall be set equal to zero.

(e) For each species the logarithmic intercept (Y) is calculated using the equation: $Y = \ln W - V(\ln X)$.

(f) 1. For each species the species mean acute intercept (SMAI) is calculated as e^Y.

2. For each genus for which one or more SMAIs are available, the genus mean acute intercept (GMAI) is calculated as the geometric mean of the SMAIs available for the genus.

(g) The GMAIs are ordered from high to low.

(h) Ranks (R) are assigned to the GMAIs from 1 for the lowest to N for the highest. If 2 or more GMAIs are identical, successive ranks are arbitrarily assigned.

(i) The cumulative probability (P) is calculated for each GMAI as P=R/(N+1).

(j) The 4 GMAIs are selected which have P closest to 0.05. If there are less than 59 GMAIs, these will always be the lowest GMAIs.

(k) Using the selected GMAIs and Ps, the ATC is calculated using the following:

1. Let EV = sum of the 4 ln GMAIs,
   EW = sum of the 4 squares of the ln GMAIs,
   EP = sum of the 4 P values,
   EPR = sum of the 4 square roots of P, and
   JR = square root of 0.05.
2. $S = ((EW - (EV)^2/4) / (EP - (EPR)^2/4))^{0.5}$
3. $L = (EV - S(EPR))/4$.
4. $A = (JR)(S) + L$.
5. Final Acute Intercept (FAI) = e^A.
6. Acute Criterion Intercept (ACI) = FAI/2.

(L) The acute toxicity equation (ATE) is written as:

$ATC = e(V \ln(\text{water quality parameter}) + \ln ACI)$.

The ATE shall be applicable only over the range of water quality parameters equivalent to the mean plus or minus 2 standard deviations using the entire fresh water acute toxicity data base and the water quality parameter transformation employed in par. (a). If the value at a specific location is outside of that range, the endpoint of the range nearest to that value shall be used to determine the criterion. Additional information may be used to modify those ranges.

(m) If, for a commercially, recreationally or ecologically important species, the SMAI is lower than the calculated [ACI], then that SMAI is used as the [ACI] instead of the calculated one.

(n) Table 2 contains the acute toxicity criteria for the fish and aquatic life subcategories listed in s. NR 102.04 (3) that are calculated using the procedures described in this subsection for substances meeting the database requirements indicated in sub. (1) (a). Table 2A contains the water quality parameter ranges calculated in par. (L).

(4) SECONDARY ACUTE VALUES. If all 8 minimum data requirements for calculating acute toxicity criteria in sub. (1) (a) are not met, secondary acute values (SAVs) shall be determined using the procedure in this subsection.

(a) In order to calculate a SAV, the database shall contain, at a minimum, a genus mean acute value (GMAV) for one of the following 3 genera in the family Daphnidae – *Ceriodaphnia sp.*, *Daphnia sp.*, or *Simocephalus sp.* To calculate a SAV, the lowest GMAV in the database is divided by the Secondary Acute Factor (SAF). The SAF is an adjustment factor corresponding to the number of satisfied minimum data requirements, listed in sub. (1)(a). SAFs are listed in Table 2B.

(b) Whenever appropriate, the effects of variable water quality parameters shall be considered when calculating a SAV, consistent with the procedures described in sub. (3).

(c) Whenever, for a commercially, recreationally or ecologically important species, the SMAV is lower than the calculated SAV, that SMAV shall be used as the SAV instead of the calculated SAV.

(5) ACUTE TOXICITY CRITERIA EXPRESSED IN THE DISSOLVED FORM. Acute water quality criteria may be expressed as a dissolved concentration. The conversion of an acute water quality criterion expressed as a total recoverable concentration, to an acute water quality criterion expressed as a dissolved concentration, the portion of the substance which will pass through a 0.45 um filter, shall be done using the equations in pars. (a) and (b). Substances which may have criteria expressed as a dissolved concentration are listed in par. (a) with corresponding conversion factors.

(a) The conversion of the water quality criterion expressed as total recoverable ($WQC_{Total\ R.}$) to the water quality criterion expressed as dissolved (WQC_D) shall be performed as follows:

$WQC_D = (CF)(WQC_{Total\ R})$

Where: $WQC_{Total\ R}$ = Criteria from NR 105, Table 1 or 2.
CF = Conversion factor for total recoverable to dissolved.

Conversion factors are as follows:

Arsenic	1.000
Cadmium	0.850
Chromium (III)	0.316
Chromium (VI)	0.982
Copper	0.960
Lead	0.875
Mercury	0.850
Nickel	0.998
Selenium	0.922
Silver	0.850
Zinc	0.978

(b) The translation of the WQC_D into the water quality criterion which accounts for site–specific conditions (WQC_{TRAN}) shall be performed as follows:

$WQC_{TRAN} = (Translator)(WQC_D)$

Where: $Translator\ (unitless) = ((M_P)(TSS) + M_D)/M_D$

M_P = Particle–bound concentration of the pollutant (ug/g) in receiving water.

M_D = Dissolved concentration of the pollutant in receiving water (ug/L).

TSS = Total Suspended Solids (g/L) concentration in receiving water.

(c) The procedures in pars. (a) and (b) may also be used for the conversion of secondary values from total recoverable to dissolved.

History: Cr. Register, February, 1989, No. 398, eff. 3–1–89; **am. (1) (a) 1. to 5., (1) (b), (2) (a) to (f), (3) (a) and (f) to (L), r. and recr. (1) (a) 6., cr. (1) (a) 7. to 10., (4) and (5), Register, August, 1997, No. 500, eff. 9–1–97.**

NR 105.06 Chronic toxicity criteria and secondary chronic values for fish and aquatic life. (1) MINIMUM DATABASE FOR CHRONIC CRITERION DEVELOPMENT. (a) To derive a chronic toxicity criterion for aquatic life, the minimum information required shall be results of acceptable chronic toxicity tests with one or more species of freshwater animal in at least 8 different families provided that of the 8 species:

1. At least one is a salmonid fish, in the family Salmonidae in the class Osteichthyes,

2. At least one is a non–salmonid fish, from another family in the class Osteichthyes, preferably a commercially or recreationally important warmwater species,

3. At least one is a planktonic crustacean (e.g., cladoceran, copepod),

4. At least one is a benthic crustacean (e.g., ostracod, isopod, amphipod, crayfish),

5. At least one is an insect (e.g., mayfly, dragonfly, damselfly, stonefly, caddisfly, mosquito, midge),

6. At least one is a fish or amphibian from a family in the phylum Chordata not already represented in one of the other subdivisions,

7. At least one is an organism from a family in a phylum other than Arthropoda or Chordata (e.g., Rotifera, Annelida, Mollusca), and

8. At least one is an organism from a family in any order of insect or any other phylum not already represented in subds. 1. to 7.

9. If all 8 of the families in subds. 1. to 8. are represented, a chronic toxicity criterion may be developed for surface waters classified as cold water using information on all of those families.

If a chronic toxicity criterion is developed for surface waters classified as cold water, chronic toxicity criteria may also be developed for any of the surface water classifications in s. NR 102.04 (3) (b) to (e) using the procedure in sub. (2) or (3) and data on families in subds. 1. to 8. which are representative of the aquatic life communities associated with those classifications. For each substance, in no case may the criterion for a lower quality fish and aquatic life subcategory as defined in s. NR 102.04 be less than the criterion for a higher quality fish and aquatic life subcategory.

10. For a substance, if all the families in subds. 1. to 8. are not represented, acute–chronic ratios as calculated in sub. (5) may be used to generate the chronic toxicity values necessary to calculate a chronic toxicity criterion.

11. For a substance, if all of the families in subds. 1. to 8. are not represented, a chronic toxicity criterion may not be developed for that substance except as provided in subd. 10. Instead, any available data may be used to develop a secondary acute value (SAV) for that substance according to sub. (4).

(b) The acceptability of chronic toxicity test results shall be judged according to the guidelines in section VI of the United States environmental protection agency's 1985 "Guidelines for Deriving National Numerical Water Quality Criteria for the Protection of Aquatic Organisms and Their Uses" or 40 CFR Part 132 Appendix A, sections VI and VII as stated on September 1, 1997, is incorporated by reference.

Note: Copies of 40 CFR Part 132, Appendix A, Sections VI and VII are available for inspection in the offices of the department of natural resources, secretary of state and the revisor of statutes, Madison, WI or may be purchased from the superintendent of documents, US government printing office, Washington, D.C. 20402.

(2) CALCULATION OF A CHRONIC CONCENTRATION. A chronic concentration is obtained by calculating the geometric mean of the chronic lowest observable adverse effect level and the chronic no observable adverse effect level.

(3) CHRONIC TOXICITY CRITERIA FOR SUBSTANCES WITH TOXICITY UNRELATED TO WATER QUALITY PARAMETERS. If the chronic toxicity of a substance has not been adequately shown to be related to a water quality parameter, i.e., hardness, pH, temperature, etc., the chronic toxicity criterion (CTC) is calculated using the procedures specified in this subsection.

(a) 1. For each species for which at least one chronic value is available, the species mean chronic value (SMCV) is calculated as the geometric mean of all acceptable chronic toxicity tests using the guidelines in sub. (1) (b).

2. For each genus for which one or more SMCVs are available, the genus mean chronic value (GMCV) is calculated as the geometric mean of the SMCVs available for the genus.

(b) The GMCVs are ordered from high to low.

(c) Ranks (R) are assigned to the GMCVs from 1 for the lowest to N for the highest. If 2 or more GMCVs are identical, successive ranks are arbitrarily assigned.

(d) The cumulative probability (P) is calculated for each GMCVs as $P=R/(N + 1)$.

(e) The 4 GMCVs are selected which have P closest to 0.05. If there are less than 59 GMCVs, these will always be the lowest GMCVs.

(f) Using the selected GMCVs and Ps, the final chronic value (FCV) is calculated using the following:

1. Let EV = sum of the 4 ln GMCVs,
EW = sum of the 4 squares of the ln GMCVs,
EP = sum of the 4 P values,
EPR = sum of the 4 square roots of P, and
JR = square root of 0.05.
2. $S = ((EW - (EV)^2/4)/(EP-(EPR)^2/4))^{0.5}$
3. $L = (EV - S(EPR))/4$.
4. $A = (JR)(S) + L$.
5. $FCV = e^A$.

(g) If, for a commercially, recreationally or ecologically important species, the geometric mean of the chronic values is lower than the calculated FCV then that geometric mean is used as the FCV instead of the calculated one.

(h) The chronic toxicity criterion (CTC) equals the lower of the FCV and the final plant value calculated using the procedure in s. NR 105.11.

(i) Table 3 contains the chronic toxicity criteria for the fish and aquatic life subcategories listed in s. NR 102.04 (3) that are calculated using the procedures described in this subsection for substances meeting the database requirements indicated in sub. (1).

(4) CHRONIC TOXICITY CRITERIA FOR SUBSTANCES WITH TOXICITY RELATED TO WATER QUALITY PARAMETERS. (a) If data are available on a substance to show that chronic toxicity to 2 or more species is similarly related to a water quality parameter (i.e., hardness, pH, temperature, etc.), the chronic toxicity criterion (CTC) is calculated using the procedures specified in this paragraph.

1. For each species for which acceptable chronic toxicity tests using the guidelines in sub. (1) (b) are available at 2 or more different values of the water quality parameter, a least squares regression of the chronic toxicity values on the corresponding values of the water quality parameter is performed to obtain the slope of the curve that best describes the relationship. Because the most commonly documented relationship is that between hardness and the chronic toxicity of metals and a log–log relationship fits these data, geometric means and natural logarithms of both toxicity and water quality are used in the rest of this subsection to illustrate this method. For relationships based on other water quality parameters, no transformation or a different transformation might fit the data better, and appropriate changes shall be made as necessary throughout this subsection.

2. For each species, the geometric mean of the available chronic values (W) is calculated and then each of the chronic values is divided by the mean for that species. This normalizes the chronic values so that the geometric mean of the normalized values for each species individually and for any combination of species is 1.0.

3. For each species, the geometric mean of the available corresponding water quality parameter values (X) is calculated and then each of the water quality parameter values is divided by the mean for that species. This normalizes the water quality parameter values so that the geometric mean of the normalized values for each species individually and for any combination of species is 1.0.

4. A least squares regression of all the normalized chronic values on the corresponding normalized values of the water quality parameter is performed to obtain the pooled chronic slope (V). If the coefficient of determination, or r value, calculated from that regression is found not to be significant based on a standard F–test at a 0.05 level, then the pooled chronic slope shall be set equal to zero.

5. For each species the logarithmic intercept (Y) is calculated using the equation: $Y = \ln W - V(\ln X)$.

6. a. For each species the species mean chronic intercept (SMCI) is calculated as e^Y.

b. For each genus for which one or more SMCIs are available, the genus mean chronic intercept (GMCI) is calculated as the geometric mean of the SMCIs available for the genus.

7. The GMCIs are ordered from high to low.

8. Ranks (R) are assigned to the GMCIs from 1 for the lowest to N for the highest. If 2 or more GMCIs are identical, successive ranks are arbitrarily assigned.

9. The cumulative probability (P) is calculated for each GMCI as $P=R/(N + 1)$.

10. The 4 GMCIs are selected which have P closest to 0.05. If there are less than 59 GMCIs, these will always be the lowest GMCIs.

11. Using the selected GMCIs and Ps, the final chronic value (FCV) is calculated using the following:

a. Let EV = sum of the 4 ln GMCIs,
EW = sum of the 4 squares of the ln GMCIs,
EP = sum of the 4 P values,
EPR = sum of the 4 square roots of P, and
JR = square root of 0.05.

b. $S = ((EW-(EV)^2/4)/(EP-(EPR)^2/4))^{0.5}$

c. $L = (EV - S(EPR))/4$

d. $A = (JR)(S) + L$.

e. Final Chronic Intercept (FCI) = e^A.

12. The final chronic equation (FCE) is written as:
$FCV = e(V \ln(\text{water quality parameter}) + \ln FCI)$.

The FCE shall be applicable only over the range of water quality parameters equivalent to the mean ± 2 standard deviations using the entire freshwater chronic toxicity data base and the water quality parameter transformation employed in subd. 1. If the value at a specific location is outside of that range, the endpoint of the range nearest to that value shall be used to determine the criterion. Additional information may be used to modify those ranges.

13. If, for a commercially, recreationally or ecologically important species, the SMCI is lower than the calculated FCI, then that SMCI is used as the FCI instead of the calculated one.

(b) At a value of the water quality parameter, the chronic toxicity criterion (CTC) equals the lower of the FCV and the final plant value calculated using the procedure in s. NR 105.11.

(c) Table 4 contains the chronic toxicity criteria for the fish and aquatic life subcategories listed in s. NR 102.04 (3) that are calculated using the procedures described in this subsection for substances meeting the database requirements indicated in sub. (1). Table 4A contains the water quality parameter ranges calculated in par. (a) 1.

(5) ACUTE–CHRONIC RATIOS. (a) The acute–chronic ratio is used to estimate the chronic toxicity of a substance to fish or other aquatic species when the database of sub. (1) (a) is not satisfied.

(b) The acute–chronic ratio for a species equals the acute concentration from data considered under s. NR 105.05 (1) divided by the chronic concentration from data calculated under sub. (1), subject to the following conditions:

1. If the acute toxicity of a substance is related to any water quality parameter, the acute–chronic ratio shall be based on acute and chronic toxicity data obtained from organisms exposed to test water with similar, if not identical, values of those water quality parameters. Preference under this paragraph shall be given to data from acute and chronic tests done by the same author or reference in order to increase the likelihood of comparable test conditions.

2. If the acute and chronic toxicity data indicate that the acute–chronic ratio varies with changes in the values of the water quality parameters, the acute–chronic ratio used at specified values of the water quality parameters shall be based on the ratios at values closest to that specified.

3. If the acute toxicity of a substance is unrelated to water quality parameters, the acute–chronic ratio may be derived from any acute and chronic test on a species regardless of the similarity in values of those parameters. Preference under this paragraph shall be given to data from acute and chronic tests done by the same author or reference to increase the likelihood of comparable test conditions.

(c) A final chronic value shall be calculated for a substance under this subsection only if at least one acute–chronic ratio is available for at least one species of aquatic animal in at least 3 different families, provided that of the 3 species, one is a fish, one is

an invertebrate, and the third is a relatively sensitive freshwater species on an acute toxicity basis. The other 2 may be saltwater species.

(d) The geometric mean acute–chronic ratio is calculated for each species using the available acute–chronic ratios for that species. That mean ratio shall be called the species mean acute–chronic ratio (SMACR).

(e) For a given substance, if the SMACR appears to increase or decrease as the species or genus mean acute values (SMAVs or GMAVs) calculated for that substance using the procedure described in s. NR 105.05 increase, the final acute–chronic ratio (FACR) shall be equal to the geometric mean of the SMACRs for species with SMAVs closest to the final acute value.

(f) For a given substance, if no trend is apparent regarding changes in SMACRs and GMAVs, the FACR shall be equal to the geometric mean of all SMACRs available for that substance.

(g) For a given substance, the final chronic value (FCV) shall be equal to the final acute value (FAV) divided by the final acute–chronic ratio (FACR). The chronic toxicity criterion shall be equal to the lower of the FCV and the final plant value as calculated using the procedure in s. NR 105.11, if available.

(h) Chronic toxicity criteria for the fish and aquatic life subcategories listed in s. NR 102.04 (3) that are calculated using acute–chronic ratios are listed in Table 5 for substances with acute toxicity unrelated to water quality parameters and in Table 6 for substances with acute toxicity related to water quality parameters. Equations listed in Table 6 are applicable over the same range of water quality parameters as contained in Table 2A.

(6) SECONDARY CHRONIC VALUES. If all 8 minimum data requirements for calculating FCVs in sub. (1)(a) are not met for a substance, secondary chronic values (SCVs) shall be calculated for that substance using the procedure in this subsection.

(a) If any one of the combinations of information in subds. 1. to 3. is available, a SCV may be calculated. To calculate a SCV for a substance, the acute value from subds. 1. to 3. is divided by the applicable acute–chronic ratio in the same subdivision.

1. Calculate a FAV using the procedure in s. NR 105.05(2) and divide it by a secondary acute–chronic ratio (SACR) using the procedure in sub. (7).

2. Calculate a SAV using the procedure in s. NR 105.05 (4) and divide it by a final acute–chronic ratio (FACR) using the procedure in sub. (5).

3. Calculate a SAV using the procedure in s. NR 105.05 (4) and divide it by a SACR using the procedure in sub. (7).

(b) If appropriate, the SCV shall be made a function of a water quality characteristic in a manner similar to that described in sub. (4) (a).

(c) If, for a commercially, recreationally or ecologically important species, the SMCV is lower than the calculated SCV, that SMCV shall be used as the SCV instead of the calculated SCV.

(d) If there is an FPV available using the procedure in s. NR 105.11 which is lower than the calculated SCV, that FPV shall be used as the SCV instead of the calculated SCV.

(7) SECONDARY ACUTE–CHRONIC RATIOS. (a) If a FACR cannot be calculated using the procedure in sub. (5) because SMACRs are not available for a fish, an invertebrate or an acutely sensitive freshwater species, a secondary acute–chronic ratio (SACR) may be calculated using the procedure in this subsection.

(b) The SACR shall be equal to the geometric mean of 3 acute–chronic ratios. Those ratios consist of the SMACRs available for the species in sub. (5)(c). When SMACRs are not available for the species in par. (a), the default acute–chronic ratio to be used is 18. Use of a SACR will result in the calculation of a secondary chronic value.

(8) CHRONIC TOXICITY CRITERIA EXPRESSED IN THE DISSOLVED FORM. Chronic water quality criteria may be expressed as a dissolved concentration. The conversion of a chronic water quality criterion expressed as a total recoverable concentration to a chronic water quality criterion expressed as a dissolved concentration, the portion of the substance which will pass through a 0.45 um filter, shall be done using the equations in pars. (a) and (b). Substances which may have criteria expressed as a dissolved concentration are listed in par. (a) with corresponding conversion factors.

(a) The conversion of the water quality criterion expressed as total recoverable ($WQC_{Total\ R.}$) to the water quality criterion expressed as dissolved (WQC_D) shall be performed as follows:

$$WQC_D = (CF)(WQC_{Total\ R.})$$

Where: $WQC_{Total\ R.}$ = Criteria from NR 105, Table 5 or 6.
CF = Conversion factor for total recoverable to dissolved.

Conversion factors are as follows:

Arsenic	1.000
Cadmium	0.850
Chromium (III)	0.860
Chromium (VI)	0.962
Copper	0.960
Lead	0.792
Nickel	0.997
Selenium	0.922
Zinc	0.986

(b) The translation of the WQC_D into the water quality criterion which accounts for site–specific conditions (WQC_{TRAN}) shall be performed as follows:

$$WQC_{TRAN} = (Translator)(WQC_D)$$

Where: $Translator\ (unitless) = ((M_P)(TSS) + M_D)/M_D$

M_P = Particle–bound concentration of the pollutant (ug/g) in receiving water.

M_D = Dissolved concentration of the pollutant in receiving water (ug/L).

TSS = Total Suspended Solids (g/L) concentration in receiving water.

(c) The procedures in pars. (a) and (b) may also be used for the conversion of secondary values from total recoverable to dissolved.

Table 1
Acute Toxicity Criteria for Substances With Toxicity Unrelated to Water Quality
(in ug/L except where indicated)

Substance	Cold Water	Warm Water Sportfish, Warm Water Forage, and Limited Forage Fish	Limited Aquatic Life
Arsenic (+3)*	339.8	339.8	339.8
Chromium (+6)*	16.02	16.02	16.02
Mercury (+2)*	0.83	0.83	0.83
Cyanide, free	22.4	45.8	45.8
Chlorine*	19.03	19.03	19.03
Gamma – BHC	0.96	0.96	0.96
Dieldrin	0.24	0.24	0.24
Endrin	0.086	0.086	0.12
Toxaphene	0.73	0.73	0.73
Chlorpyrifos	0.041	0.041	0.041
Parathion	0.057	0.057	0.057

Note: * – Criterion listed is applicable to the "total recoverable" form except for chlorine which is applicable to the "total residual" form

Table 2
Acute Toxicity Criteria for Substances With Toxicity Related to Water Quality
(all in ug/L)

Water Quality Parameter: Hardness (in ppm as $CaCO_3$)

$ATC = e^{(V \text{ in hardness}) + \text{In ACI})}$

Substance	V	In ACI	ATC at Various Hardness (pm) Levels 50	100	200
Total Recoverable Cadmium:					
Cold Water	1.147	–3.8104	1.97	4.36	9.65
Warm Water Sportfish, Warm Water Forage and Limited Forage Fish	1.147	–2.9493	4.65	10.31	22.83
Limited Aquatic Life	1.147	–1.9195	13.03	28.87	63.92
Total Recoverable Chromium (+3):					
All Surface Waters	0.819	3.7256	1022	1803	3181
Total Recoverable Copper:					
All Surface Waters	0.8561	–1.1199	9.29	16.82	30.45
Total Recoverable Lead:					
All Surface Waters	0.9662	0.2226	54.73	106.92	208.90
Total Recoverable Nickel:					
All Surface Waters	1.083	2.2289	642.7	1361	2434
Total Recoverable Zinc:					
All Surface Waters	0.8745	0.7634	65.66	120.4	220.7

Water Quality Parameter: pH

$ATC = e^{(V(pH) + \ln ACI)}$

Substance	V	In ACI	506.5	7.8	8.8
Pentachlorophenol:					
All Surface Waters	1.0054	–4.877	5.25	19.40	53.01

Table 2A

Water Quality Parameter Ranges for Substances With Acute Toxicity Related to Water Quality

Substance	Parameter	Applicable Range
Cadmium	Hardness (ppm)	6 – 457
Chromium (+3)	Hardness (ppm)	13 – 301
Copper	Hardness (ppm)	14 – 427
Lead	Hardness (ppm)	12 – 356
Nickel	Hardness (ppm)	19 – 157
Zinc	Hardness (ppm)	12 – 333
Pentachlorophenol	pH (s.u.)	6.6 – 8.8

Table 2B

Secondary Acute Factors

Number of minimum data requirements satisfied	Adjustment factor
1	21.9
2	13.0
3	8.0
4	7.0
5	6.1
6	5.2
7	4.3

Table 3

Chronic Toxicity Criteria for Substances With Toxicity Unrelated to Water Quality(all in ug/L)

Substance	Cold Water	Warm Water Sportfish, Warm Water Forage and Limited Forage Fish	Limited Aquatic Life
		(Reserved)	

Note: This table is reserved for criteria that USEPA has indicated may be available in the near future.

Table 4

Chronic Toxicity Criteria for Substances With Toxicity Unrelated to Water Quality (all in ug/L)

Water Quality Parameter: Hardness (in ppm as $CaCO_3$

$CTC = e^{(V \ln(\text{hardness}) + \ln CCI)}$

Substance	V	In CCI	CTC at Various Hardness (ppm) Levels 50	100	175
Total Recoverable Cadmium:					
All Surface Waters	0.7852	–2.7150	1.43	2.46	3.82

Table 4A

Water Quality Parameter Ranges for Substances With Chronic Toxicity Related to Water Quality

Substance	Parameter	Applicable Range
Cadmium	Hardness (ppm)	18–175

Table 5

Chronic Toxcity Criteria Using Acute–Chronic Ratios for Substances with Toxicity Unrelated to Water Quality (all in ug/L)

Substance	Cold Water	Warm Water Sportfish, Warm Water Forage and Limited Forage Fish	Limited Aquatic Life
Arsenic (+3)*	148	152.2	152.2
Chromium (+6)*	10.98	10.98	10.98
Mercury (+2)*	0.44	0.44	0.44
Cyanide, free	5.22	11.47	11.47
Chlorine*	7.28	7.28	7.28
Dieldrin	0.055	0.077	0.077
Endrin	0.072	0.072	0.10
Parathion	0.011	0.011	0.011

Note: * Criterion listed is applicable to the "total recoverable" form except for chlorine which is applicable to the "total residual" form.

Table 6

Chronic Toxicity Criteria Using Acute–Chronic Ratios for Substances With Toxicity Related to Water Quality (all in ug/L)

Water Quality Parameter: Hardness (in ppm as $CaCO_3$)

$CTC = e^{(V \ln(\text{hardness}) + \ln CCI)}$

Substance	V	ln CCI	CTC at Various Hardness (ppm) Levels 50	100	200
Total Recoverable Chromium (+3):					
Cold Water	0.819	0.6851	48.86	86.21	152.1
Warm Water Sportfish	0.819	1.112	74.88	132.1	233.1
All others	0.819	1.112	74.88	132.1	233.1
Total Recoverable Copper:					
All Surface Waters	0.8561	–1.4647	6.58	11.91	21.57
Total Recoverable Lead:					
All Surface Waters	0.9662	–1.1171	14.33	28.01	54.71
Total Recoverable Nickel:					
All Surface Waters	1.083	0.033	71.50	151.5	270.8
Total Recoverable Zinc					
All Surface Waters	0.8745	0.7634	65.66	120.4	220.7

Water Quality Parameter: pH

$CTC = e^{(V(pH) + \ln CCI)}$

Substance	V	ln CCI	CTC at Various pH (s.u.) Levels 6.5	7.8	8.8
Pentachlorophenol:					
Cold Water	1.0054	–5.1468	4.43	14.81	40.48
All Other Surface Waters	1.0054	–4.9617	5.33	12.82	48.70

History: Cr. Register, February, 1989, No. 398, eff. 3–1–89; am. (5) (f) and Tables 2, 2a, 4, 4a and 6, Register, July, 1995, No. 475, eff. 8–1–95; **am. (1) (a) 1., 2., 4., and 5., (1) (b), (3) (intro.), (a) to (g), (4) (a) 1., 7. to 13., (5) (c), renum. (1) (a) 6. to be (1) (a) 10., (3) (h) to be (3) (i) and am. (1) (a) 10, (4) (a) 6. to be (4) (a) 6. a., (4) (b) to be (4) (c), (5) (e) to (i) to be (5) (d) to (h) and am. (5) (e) to (g), cr. (3) (h), (4) (a) 6. b., (4) (b), (5) (b) 3., (6) to (8), r. and recr., Tables 1 to 2a, 3 to 6, r. (5) (d).**

NR 105.07 Wildlife criteria. (1) The wildlife criterion is the concentration of a substance which if not exceeded protects Wisconsin's wildlife from adverse effects resulting from ingestion of surface waters of the state and from ingestion of aquatic organisms taken from surface waters of the state.

(a) For any substance not shown in Table 7, the wildlife criterion (WC) is the lower of the available mammalian or avian wildlife values (WVs) calculated pursuant to sub. (2). A wildlife criterion protective of Wisconsin's reptile fauna may be calculated pursuant to sub. (2) whenever data specific to reptiles are available.

(b) Table 7 contains the wildlife criteria calculated according to the procedures of this chapter.

Table 7

Wildlife Criteria

Substance	Criteria (in ng/L, except where indicated)
DDT & Metabolites	0.011
Mercury	1.3
Polychlorinated Biphenyls	0.12
2,3,7,8 – TCDD	0.003 (pg/L)

(2) (a) Mammalian and avian wildlife values shall be calculated as follows using information available from scientifically acceptable studies of animal species exposed repeatedly to the substance via oral routes including gavage:

$$WV = \frac{NOAEL \times Wt_A \times SSF}{W + \Sigma[F_{TLi} \times BAF_{TLi}]}$$

Where:

WV= Wildlife value in milligrams per liter (mg/L).

NOAEL= No observed adverse effect level in milligrams of substance per kilogram of body weight per day (mg/kg–d) as derived from subchronic or chronic mammalian or avian studies or as specified in subs. (3) to (5).

Wt= Average weight in kilograms (kg) of the representative species.

W= Average daily volume of water in liters consumed per day (L/d) by the representative species or as specified in sub. (6).

SSF= Species sensitivity factor, ranging between 0.01 and 1 to account for interspecies differences in sensitivity.

F_{TLI}= Average daily amount of food consumed from trophic level i by the representative species in kilograms per day (kg/d) or as specified in sub. (6).

BAF_{TLI}= Bioaccumulation factor for wildlife food in trophic level i with units of liter per kilogram (L/kg) as derived in s. NR 105.10. For consumption of piscivorous birds by other birds (e.g., herring gull by eagles), the BAF is derived by multiplying the trophic level 3 BAF for fish by a biomagnification factor to account for the biomagnification from fish to the consumed birds.

(b) The selection of the species sensitivity factor (SSF) shall be based on the available toxicological data base and available physicochemical and toxicokinetic properties of the substance and the amount and quality of available data.

(c) The bald eagle, kingfisher, herring gull, mink and otter are representative of avian and mammalian species to be protected by wildlife criteria. A NOAEL specific to each taxonomic class is used to calculate WVs for each of the 5 representative species. The avian WV is the geometric mean of the WVs calculated for the 3 representative avian species. The mammalian WV is the geometric mean of the WVs calculated for the 2 representative mammalian species.

(d) In those cases in which more than one NOAEL is available, the following shall apply:

1. If more than one NOAEL is available within a taxonomic class, based on the same endpoint of toxicity, the NOAEL from the most sensitive species shall be used.

2. If more than one NOAEL is available for a given species, based on the same enpoint of toxicity, the NOAEL for that species shall be calculated using the geometric mean of those NOAELs.

(e) Because wildlife consume fish from both trophic levels 3 and 4, baseline BAFs shall be available for both trophic levels 3 and 4 to calculate either a criterion or secondary value for a chemical. When appropriate, ingestion through consumption of invertebrates, plants, mammals and birds in the diet of wildlife species to be protected shall be included.

(3) In those cases in which a no observed adverse effect level (NOAEL) is available from studies of mammalian or avian species exposed repeatedly to the substance via oral routes including gavage, but is available in units other than mg/kg–d as specified in sub. (2), the following procedures shall be used to express the NOAEL prior to calculating the wildlife value:

(a) If the NOAEL is given in milligrams of toxicant per liter of water consumed (mg/L), the NOAEL shall be multiplied by the daily average volume of water consumed by the test animals in liters per day (L/d) and divided by the average weight of the test animals in kilograms (kg).

(b) If the NOAEL is given in milligrams of toxicant per kilogram of food consumed (mg/kg), the NOAEL shall be multiplied by the average amount of food in kilograms consumed daily by the test animals (kg/d) and divided by the average weight of the test animals in kilograms (kg).

(4) In those cases in which a NOAEL is unavailable and a lowest observed adverse effect level (LOAEL) is available from studies of animal species exposed repeatedly to the substance via oral routes including gavage, the LOAEL may be substituted with proper adjustment to estimate the NOAEL. An uncertainty factor of between one and 10 may be applied to the LOAEL, depending on the sensitivity of the adverse effect, to reduce the LOAEL into the range of a NOAEL. If the LOAEL is available in units other than mg/kg–d, the LOAEL shall be expressed in the same manner as that specified for the NOAEL in sub. (3).

(5) In instances where a NOAEL is based on subchronic data, an uncertainty factor may be applied to extrapolate from subchronic to chronic levels. The value of the uncertainty factor may not be less than 0.1 and may not exceed 1.0. This factor is to be used when assessing highly bioaccumulative substances where toxicokinetic considerations suggest that a bioassay of limited length underestimates chronic effects.

(6) If drinking or feeding rates are not available for representative species, drinking (W) and feeding rates (F_{TLi}) shall be calculated for representative mammalian or avian species by using the allometric equations given in pars. (a) and (b).

(a) For mammalian species the allometric equations are as follows:

1. $F_{TLi} = 0.0687 \times (Wt)^{0.82}$

Where:

F_{TLi} = Feeding rate of mammalian species in kilograms per day (kg/d).

Wt = Average weight in kilograms (kg) of the test animals.

2. $W = 0.099 \times (Wt)^{0.90}$

Where: W = Drinking rate of mammalian species in liters per day (L/d).

Wt = Average weight in kilograms (kg) of the test animals.

(b) For avian species the allometric equations are as follows:

1. $F_{TLi} = 0.0582\ (Wt)^{0.65}$

Where: F_{TLi} = Feeding rate of avian species in kilograms per day (kg/d).

Wt = Average weight in kilograms (kg) of the test animals.

2. $W = 0.059 \times (Wt)^{0.67}$

Where: W = Drinking rate of avian species in liters per day (L/d).

Wt = Average weight in kilograms (kg) of the test animals.

Note: Criteria to protect domestic animals will be considered on an as needed basis using a model that accounts for domestic animal exposure through drinking water. Because domestic animals do not regularly consume aquatic organisms, the wildlife exposure model is not appropriate.

History: Cr. Register, February, 1989, No. 398, eff. 3–1–89; am. table 7, Register, July, 1991, No. 427, eff. 8–1–91; **am. (1), (2) (a), (b), (3) (intro.), (6) (intro.), r. and recr. (2) (c), (5), cr. (2) (d), (e), r. (6) (a), renum. (6) (b) and (c) to be (6) (a) and (b) and am., Register, August, 1997, No. 500, eff. 9–1–97.**

NR 105.08 Human threshold criteria. (1) The human threshold criterion (HTC) is the maximum concentration of a substance established to protect humans from adverse effects resulting from contact with or ingestion of surface waters of the state and from ingestion of aquatic organisms taken from surface waters of the state. Human threshold criteria are derived for those toxic substances for which a threshold dosage or concentration can be estimated below which no adverse effect or response is likely to occur.

(2) For noncarcinogenic components of mixtures in effluents, interactions among substances may be additive, antagonistic or synergistic and may be accounted for by a model that is supported by credible scientific evidence. The risks are assumed to be additive when substances are members of the same structural class and cause potential adverse effects via the same mechanism of action, influencing the same kind of endpoint, and shall be accounted for by a model that is supported by credible scientific evidence.

(3) Human threshold criteria are listed in Table 8. Criteria for the same substance may be different depending on the surface water classification, due to the lipid value of representative fish, a component of the BAF, and whether or not the water may be a source of drinking water. Further application of these criteria to protect drinking water and downstream uses in the Great Lakes system shall be according to s. NR 106.06 (1).

(4) To derive human threshold criteria for substances not included in Table 8 the following methods shall be used:

(a) The human threshold criterion shall be calculated as follows:

$$HTC = \frac{ADE \times 70\ kg \times RSC}{W_H + (F_H \times BAF)}$$

Where: HTC = Human threshold criterion in milligrams per liter (mg/L).

ADE = Acceptable daily exposure in milligrams toxicant per kilogram body weight per day (mg/kg–d) as specified in sub. (5).

70 kg = Average weight of an adult male in kilograms (kg).

RSC = Relative source contribution factor used to account for routes of exposure other than consumption of contaminated water and aquatic organisms. In the absence of sufficient data on alternate sources of exposure, including but not limited to non–fish diet and inhalation, the relative source contribution factor shall be set equal to 0.8.

W_H = Average per capita daily water consumption of 2 liters per day (L/d) for surface waters classified as public water supplies or, for all other surface waters, 0.01 liters per day (L/d) for exposure through body contact or ingestion of small volumes of water during swimming or other recreational activities.

F_H = Average per capita daily consumption of sport–caught fish by Wisconsin anglers equal to 0.02 kilograms per day (kg/d).

BAF = Aquatic organism bioaccumulation factor with units of liter per kilogram (L/kg) as derived in s. NR 105.10.

Table 8

Human Threshold Criteria
(ug/L unless specified otherwise)

	Public Water Supply		Non–public Water Supply		
Substance	Warm Water Sport Fish Communities	Cold Water[4] Communities	Warm Water Forage, Limited Forage, and Warm Water Sport Fish Communities	Cold Water Communities	Limited Aquatic Life
Acrolein	7.2	3.4	15	4.4	2800
Antimony[2]	10	10	2200	2200	2200
Benzene[2]	5	5	610	260	4000
Bis(2–chloroisopropyl) ether	1100	1100	55000	34000	220000
Cadmium[2]	10	10	1200	1200	2800
*Chlordane (ng/L)	2.4	0.70	2.4	0.70	310000
Chlorobenzene[2]	100	100	4900	1600	110000
Chromium (+3)	28000	28000	2500000	2500000	5600000
Chromium (+6)	140	140	13000	13000	28000
Cyanide, Total[2]	200	200	40000	40000	120000
*4,4'–DDT (ng/L)	3.0	0.88	3.0	0.88	2800000
1,2–Dichlorobenzene[2]	600	600	6400	1900	500000
1,3–Dichlorobenzene	1400	710	3300	1000	500000
cis–1,2–Dichloroethene[2]	70	70	14000	9000	56000
trans–1,2–Dichloroethene[2]	100	100	24000	13000	110000
Dichloromethane[2] (methylene chloride)	5	5	95000	72000	328000
2,4–Dichlorophenol	74	58	580	180	17000
Dichloropropenes[3] (1,3–Dichloropropene)	8.3	8.2	420	260	1700
*Dieldrin (ng/L)	0.59	0.17	0.59	0.17	280000
2,4–Dimethylphenol	450	430	11000	4500	94000
Diethyl phthalate[2]	5000	5000	68000	21000	4500000
Dimethyl phthalate (mg/L)	241	184	1680	530	56000
4,6–Dinitro–o–cresol	100	96	1800	640	22000
Dinitrophenols[3] (2,4–Dinitrophenol)	55	55	2800	1800	11000
2,4–Dinitrotoluene	0.51	0.48	13	5.3	110
Endosulfan	87	41	181	54	33600
Ethylbenzene[2]	700	700	12000	3700	560000
Fluoranthene	890	610	4300	1300	220000
*Hexachlorobenzene	0.075	0.022	0.075	0.022	4500
Hexachlorocyclopentadiene	50	50	980	310	39000
Hexachloroethane	8.7	3.3	13	3.7	5600
*gamma–BHC (lindane)	0.20	0.20	0.84	0.25	1900
Isophorone	5500	5300	180000	80000	1100000
Lead	10	10	140	140	2240
*Mercury[5]	0.0015	0.0015	0.0015	0.0015	336
Nickel[2]	100	100	43000	43000	110000
*Pentachlorobenzene	0.46	0.14	0.47	0.14	4500
Selenium[2]	50	50	2600	2600	28000
Silver	140	140	28000	28000	28000
*2,3,7,8–TCDD (pg/L)	0.11	0.032	0.11	0.032	7300
*1,2,4,5–Tetrachlorobenzene	0.54	0.17	0.58	0.17	1700
Tetrachloroethene	5.8	4.6	46	15	1300
Toluene[2]	1000	1000	760100	26000	1200000
1,1,1–Trichloroethane[2]	200	200	270000	110000	2000000
2,4,5–Trichlorophenol	1600	830	3900	1200	560000

* Indicates substances that are BCCs.

[1] A human threshold criterion expressed in micrograms per liter (ug/L) can be converted to milligrams per liter (mg/L) by dividing the criterion by 1000.

[2] For this substance the human threshold criteria for public water supply receiving water classifications equal the maximum contaminant level pursuant to s. NR 105.08 (3) (b).

[3] The human threshold criteria for this chemical class are applicable to each isomer.

4 For BCCs, these criteria apply to all water of the Great Lakes system.

[5] The mercury criteria were calculated using 20 g/day fish consumption and the human non–cancer criteria derivation procedure in 40 CFR Part 132, Appendix C. For these criteria, 40 CFR Part 132, Appendix C as stated on September 1, 1997 is incorporated by reference.

(b) For surface waters classified as public water supplies, if the human threshold criterion for a toxic substance as calculated in par. (a) exceeds the maximum contaminant level (MCL) for that substance as specified in ch. NR 809 or the July 8, 1987 Federal Register (52 FR 25690), the MCL shall be used as the human threshold criterion.

(5) The acceptable daily exposure (ADE) referenced in sub. (4) represents the maximum amount of a substance which if ingested daily for a lifetime results in no adverse effects to humans. Paragraphs (a) to (c) list methods for determining the acceptable daily exposure.

(a) The department shall review available references for acceptable daily exposure or equivalent values, such as a reference dose (RfD) as used by the U.S. environmental protection agency, and for human or animal toxicological data from which an acceptable daily exposure can be derived. Suitable references for review include, but are not limited to, those presented in s. NR 105.04 (5).

(b) When human or animal toxicological data are available, the department may derive an acceptable daily exposure by using as guidance procedures presented by the U.S. environmental protection agency in "Water Quality Criteria Documents; Availability" (45 FR 79318, November 28, 1986). Additional guidance for deriving acceptable daily exposures from toxicological data are given in subds. 1 to 4. Alternate procedures may be used if supported by credible scientific evidence.

1. No observable adverse effect levels (NOAELs) and lowest observable adverse effect levels (LOAELs) from studies of humans or mammalian test species shall be divided by an uncertainty factor to derive an acceptable daily exposure. Uncertainty factors reflect uncertainties in predicting acceptable exposure levels for the general human population based upon experimental animal data or limited human data. Factors to be considered when selecting an uncertainty factor include, but are not limited to, interspecies and individual variations in response and susceptibility to a toxicant, and the quality and quantity of the available data. The following guidelines shall be considered when selecting an uncertainty factor:

a. Use an uncertainty factor of 10 when extrapolating from valid experimental results from studies on prolonged ingestion by humans. This 10–fold factor protects sensitive members of the human population.

b. Use an uncertainty factor of 100 when extrapolating from valid results of long–term feeding studies on experimental animals with results of studies of human ingestion not available or insufficient (e.g., acute exposure only). This represents an additional 10–fold uncertainty factor in extrapolating data from the average animal to the average human.

c. Use an uncertainty factor of 1000 when extrapolating from less than chronic results on experimental animals with no useful long–term or acute human data. This represents an additional 10–fold uncertainty factor in extrapolating from less than chronic to chronic exposures.

d. Use an additional uncertainty factor of between 1 and 10 depending on the severity of the adverse effect when deriving an acceptable daily exposure from a lowest observable adverse effect level (LOAEL). This uncertainty factor reduces the LOAEL into the range of a no observable adverse effect level (NOAEL).

e. Use an additional uncertainty factor of 10 when deriving an acceptable daily exposure for a substance which the U.S environmental protection agency classifies as a "group C" carcinogen, but which is not defined as a carcinogen in s. NR 105.03 (13).

2. Results from studies of humans or mammalian test species used to derive acceptable daily exposures shall have units of milligrams of toxicant per kilogram of body weight per day (mg/kg–d). When converting study results to the required units, a water consumption of 2 liters per day (L/d) and a body weight of 70 kilograms (kg) is assumed for humans. The following examples and procedures illustrate the conversion of units:

a. Results from human studies which are expressed in milligrams of toxicant per liter of water consumed (mg/L) are converted to mg/kg–d by multiplying the results by 2 L/d and dividing by 70 kg.

b. Results from animal studies which are expressed in milligrams of toxicant per liter of water consumed (mg/L) are converted to mg/kg–d by multiplying the results by the daily average volume of water consumed by the test animals in liters per day (L/d) and dividing by the average weight of the test animals in kilograms (kg).

c. Results from animal studies which are expressed in milligrams of toxicant per kilogram of food consumed (mg/kg) are converted to mg/kg–d by multiplying the results by the average amount of food consumed daily by the test animals in kilograms per day (kg/d) and dividing by the average weight of the test animals in kilograms (kg).

d. If a study does not specify water or food consumption rates, or body weight of the test animals, standard values taken from appropriate references, such as the National Institute of Occupational Safety and Health, 1980, Registry of Toxic Effects of Chemical Substances, may be used to convert units.

e. Results from animal studies in which test animals were not exposed to the toxicant each day of the test period shall be multiplied by the ratio of days that the test animals were dosed to the total days of the test period. For the purposes of this adjustment, the test period is defined as the interval beginning with the administration of the first dose and ending with the administration of the last dose, inclusive.

3. When assessing the acceptability and quality of human or animal toxicological data from which an acceptable daily exposure can be derived, the department may use the following documents as guidance:

a. "Guidelines for Mutagenicity Risk Assessment", (51 FR 34006, September 24, 1986).

b. "Guidelines for the Health Risk Assessment of Chemical Mixtures", (51 FR 34014, September 24, 1986).

c. "Guidelines for the Health Assessment of Suspect Development Toxicants", (51 FR 34028, September 24, 1986).

d. "Guidelines for Exposure Assessment", (51 FR 34042, September 24, 1986).

e. Any other documents that the department deems reliable.

4. When the available human or animal toxicological data contains conflicting information, the department may consult with experts outside of the department for guidance in the selection of the appropriate data.

(c) Using sound scientific judgment, the department shall select an acceptable daily exposure as derived in pars. (a) and (b) for calculation of the human threshold criterion. When selecting an acceptable daily exposure, the department shall adhere to the following guidelines unless a more appropriate procedure is supported by credible scientific evidence:

1. Acceptable daily exposures based on human studies are given preference to those based on animal studies.

2. When deriving an acceptable daily exposure from animal studies preference is given to chronic studies involving oral routes of exposure, including gavage, over a significant portion of the animals' life span. If acceptable studies using oral exposure routes are not available, acceptable daily exposures derived from studies using alternate exposure routes, such as inhalation, may be used.

3. When 2 or more acceptable daily exposure values are available and have been derived from studies having equal preference as defined in subds. 1. and 2., the lowest acceptable daily exposure is generally selected. If the acceptable daily exposure values differ significantly, the department may consult with experts outside of

the department for guidance in the selection of the more appropriate acceptable daily exposure.

History: Cr. Register, February, 1989, No. 398, eff. 3–1–89; correction in (3) (b) made under s. 13.93 (2m) (b) 7., Stats., Register, September, 1995, No. 477; **renum. (2) to (4) to be (3) to (5) and am., cr. (2), r. and recr. Table 8, am. (5) (intro.), 1. (intro.), d., e., 2 (intro.) and (c) and am., Register, August, 1997, No. 500, eff. 9–1–97.**

NR 105.09 Human cancer criteria. (1) The human cancer criterion (HCC) is the maximum concentration of a substance or mixture of substances established to protect humans from an unreasonable incremental risk of cancer resulting from contact with or ingestion of surface waters of the state and from ingestion of aquatic organisms taken from surface waters of the state. Human cancer criteria are derived for those toxic substances which are carcinogens as defined in s. NR 105.03 (13).

(2) For any single carcinogen or any mixture of carcinogens the incremental cancer risk from exposure to surface waters and aquatic organisms taken from surface waters may not exceed one in 100,000. The combined cancer risk of individual carcinogens in a mixture is assumed to be additive unless an alternate model is supported by credible scientific evidence.

(3) Human cancer criteria are listed in Table 9. Criteria for the same substance may be different depending on the surface water classification, due to the lipid value of representative fish, a component of the BAF, and whether or not the water may be a source of drinking water. Further application of these criteria to protect drinking water and downstream uses in the Great Lakes system shall be according to s. NR 106.06 (1).

Table 9
Human Cancer Criteria
(ug/L unless specified otherwise[1])

	Public Water Supply		Non–public Water Supply		
Substance	Warm Water Sport Fish Communities	Cold Water[4] Communities	Warm Water Forage, Limited Forage, and Warm Water Sport Fish Communities	Cold Water Communities	Limited Aquatic Life
Acrylonitrile	0.57	0.45	4.6	1.5	130
Arsenic[2]	0.185	0.185	50	50	50
*alpha–BHC	0.012	0.0037	0.013	0.0039	11
*gamma–BHC (lindane)	0.052	0.018	0.064	0.019	54
*BHC, technical grade	0.038	0.013	0.047	0.014	39
Benzene[2]	5	5	140	45	1300
Benzidine (ng/L)	1.5	1.5	81	55	300
Beryllium	0.054	0.054	0.33	0.33	16
Bis(2–chloroethyl) ether	0.31	0.29	7.6	3.0	64
Bis(chloromethyl) ether (ng/L)	1.6	1.6	96	79	320
Carbon tetrachloride	2.5	2.1	29	9.5	540
*Chlordane (ng/L)	0.41	0.12	0.41	0.12	54000
Chloroethene (vinyl chloride)	0.18	0.18	10	6.8	37
Chloroform (trichloromethane)	55	53	1960	922	11200
*4,4[1]–DDT (ng/L)	0.22	0.065	0.22	0.065	206000
1,4–Dichlorobenzene	14	12	163	54	2940
3,3[1]–Dichlorobenzidine	0.51	0.29	1.5	0.46	154
1,2–Dichloroethane	3.8	3.8	217	159	770
Dichloromethane[2] (methylene chloride)	5	5	2700	2100	9600
*Dieldrin (ng/L)	0.0091	0.0027	0.0091	0.0027	4400
2,4–Dinitrotoluene	0.51	0.48	13	5.3	110
1,2–Diphenylhydrazine	0.38	0.31	3.3	1.04	88
Halomethanes[3]	55	53	1960	922	11200
*Hexachlorobenzene (ng/L)	0.73	0.22	0.73	0.22	44000
*Hexachlorobutadiene	0.59	0.19	0.69	0.2	910
Hexachloroethane	7.7	2.9	11	3.3	5000
N–Nitrosodiethylamine (ng/L)	2.3	2.3	150	140	460
N–Nitrosodimethylamine	0.0068	0.0068	0.46	0.46	1.4
N–Nitrosodi–n–butylamine	0.063	0.062	2.5	1.3	13
N–Nitrosodiphenylamine	44	23	116	34	13
N–Nitrosopyrrolidine	0.17	0.17	11	11	34
*Polychlorinated biphenyls (ng/L)	0.01	0.003	0.01	0.003	9100
*2,3,7,8–Tetrachlorodibenzo–p–dioxin (pg/L)	0.014	0.0041	0.014	0.0041	930
1,1,2,2–Tetrachloroethane	1.7	1.6	52	22	350
Tetrachloroethene	5.8	4.6	46	15	1300
*Toxaphene (ng/L)	0.11	0.034	0.14	0.034	63600
1,1,2–Trichloroethane[2]	6.0	6.0	195	87	1200
Trichloroethene[2]	5	5	539	194	6400
2,4,6–Trichlorophenol	29	24	30	97	6400

* Indicates substances that are BCCs.

[1] A human cancer criterion expressed in micrograms per liter (ug/L), nanograms per liter (ng/L) or picograms per liter (pg/L) can be converted to milligrams per liter (mg/L) by dividing the criterion by 1000, 1,000,000 or 1,000,000,000, respectively.

[2] For this substance the human cancer criteria for public water supply receiving water classifications equal the maximum contaminant level pursuant to s. NR 105.09 (4) (b)

[3] Human cancer criteria for halomethanes are applicable to any combination of the following chemicals: bromomethane (methyl bromide), chloromethane (methyl chloride), tribromomethane (bromoform), bromodichloromethane (dichloromethyl bromide), dichlorodifluoromethane (fluorocarbon 12) and trichlorofluoromethane (fluorocarbon 11).

[4] For BCCs, these criteria apply to all waters of the Great Lakes system.

(4) To derive human cancer criteria for substances not included in Table 9 the following methods shall be used:

(a) The human cancer criterion shall be calculated as follows:

$$HCC = \frac{RAD \times 70\ kg}{W_H + (F_H \times BAF)}$$

Where:

HCC = Human cancer criterion in milligrams per liter (mg/L).

RAD = Risk associated dose in milligrams toxicant per kilogram body weight per day (mg/kg–d) that is associated with a lifetime incremental cancer risk equal to one in 100,000 as derived in sub. (5).

70 kg = Average weight of an adult male in kilograms (kg).

W_H = Average per capita daily water consumption of 2 liters per day (L/d) for surface waters classified as public water supplies or, for other surface waters, 0.01 liters per day (L/d) for exposure through contact or ingestion of small volumes of water during swimming or during other recreational activities.

F_H = Average per capita daily consumption of sport–caught fish by Wisconsin anglers equal to 0.02 kilograms per day (kg/d).

BAF = Aquatic life bioaccumulation factor with units of liter per kilogram (L/kg) as derived in s. NR 105.10.

(b) For surface waters classified as public water supplies, if the human cancer criterion for a toxic substance as calculated in par. (a) exceeds the maximum contaminant level (MCL) for that substance as specified in ch. NR 809 or the July 8, 1987 Federal Register (52 FR 25690), the MCL shall be used as the human cancer criterion.

(5) The risk associated dose (RAD) referenced in sub. (4) represents the maximum amount of a substance which if ingested daily for a lifetime of 70 years has an incremental cancer risk equal to one case of human cancer in a population of 100,000. Methods for deriving the risk associated dose are specified in pars. (a) to (d).

(a) The department shall review available references for acceptable human and animal studies from which the risk associated dose can be derived. The department shall use sound scientific judgment when determining the acceptability of a study and may use the U.S. environmental protection agency's "Guidelines for Carcinogen Risk Assessment" (FR 51 33992, September 24, 1986) as guidance for judging acceptability. Suitable references for review include, but are not limited to, those presented in s. NR 105.04 (5).

(b) If an acceptable human epidemiologic study is available, contains usable exposure data, and indicates a carcinogenic effect, the risk associated dose shall be set equal to the lifetime average exposure which would produce an incremental cancer risk of one in 100,000 based on the exposure information from the study and assuming the excess cancer risk is proportional to the lifetime average exposure. If more than one human epidemiologic study is judged to be acceptable, the most protective risk associated dose derived from the studies is generally used to calculate the human cancer criterion. If the risk associated dose values differ significantly, the department may consult with experts outside of the department for guidance in the selection of the more appropriate value.

(c) In the absence of an acceptable human epidemiologic study, the risk associated dose shall be derived from available studies which use mammalian test species and which are judged acceptable. Methods for deriving the risk associated dose are specified in subds. 1. to 4.

1. A linear, non–threshold dose–response relationship as applied by the U.S. environmental protection agency in "Water Quality Criteria Documents; Availability" (45 FR 79318, November 28, 1980) shall be assumed unless a more appropriate dose–response relationship or extrapolation model is supported by credible scientific evidence.

Note: The linear non–threshold dose–response model used by the U.S. environmental protection agency provides an upper–bound estimate (i.e., the one–sided 95% upper confidence limit) of incremental cancer risk. The true cancer risk is unknown. While the true cancer risk is not likely to be greater than the upper bound estimate, it may be lower.

2. When a linear, non–threshold dose–response relationship is assumed, the risk associated dose shall be calculated using the following equation:

$$RAD = \frac{1}{q_1^*} \times 0.00001$$

Where:

RAD = Risk associated dose in milligrams toxicant per kilogram body weight per day (mg/kg–d).

0.00001 = Incremental risk of human cancer equal to one in 100,000.

q_1^* = Upper 95% confidence limit (one–sided) of the carcinogenic potency factor in days per milligram toxicant per kilogram body weight (d–kg/mg) as derived from the procedures referenced in subd. 1. and the guidance presented in subd. 3.

3. The department shall adhere to the following guidance for deriving carcinogenic potency factors, or corresponding values if an alternate dose–response relationship or extrapolation model is used, unless more appropriate procedures are supported by credible scientific evidence:

a. If 2 or more mammalian studies are judged acceptable, but vary in either species, strain or sex of the test animals, or in tumor type or site, the study giving the greatest carcinogenic potency factor shall be used. Studies which produce a spuriously high carcinogenic potency factor due to the use of a small number of test animals may be excluded.

b. If 2 or more mammalian studies are judged acceptable, are comparable in size and are identical in regard to species, strain and sex of the test animals and to tumor sites, the geometric mean of the carcinogenic potency factors derived from each study shall be used.

c. If in an acceptable study, tumors were induced at more than one site, the number of animals with tumors at one or more of the sites shall be used as incidence data when deriving the cancer potency factor.

d. The combination of benign and malignant tumors shall be used as incidence data when deriving the cancer potency factor.

e. Calculation of an equivalent dose between animal species and humans using a surface area conversion, and conversion of units of exposure to milligrams of toxicant per day (mg/d) shall be performed as specified by the U.S. environmental protection agency in "Water Quality Criteria Documents; Availability" (45 FR 79318, November 28, 1980).

f. If the duration of the mammalian study (D) is less than the natural life span of the test animal (LS), the carcinogenicity potency factor is multiplied by the factor (D/LS)3.

4. When available mammalian studies contain conflicting information, the department shall consult with the department of health and social services and may consult with experts outside of the department for guidance in the selection of the appropriate study.

(d) If both a human epidemiologic study and a study of mammalian test species are judged reliable but only the animal study indicates a carcinogenic effect, it is assumed that a risk of cancer to humans exists but that it is less than could have been detected in the epidemiologic study. An upper limit of cancer incidence may be calculated assuming that the true incidence is just below the level of detection in the cohort of the epidemiologic study. The department may consult with experts outside of the department for guidance in the selection of the appropriate study.

History: Cr. Register, February, 1989, No. 398, eff. 3–1–89; am. table 9 and (6), Register, July, 1991, No. 427, eff. 8–1–91; correction in (4) (b) made under s. 13.93 (2m) (b) 7., Stats., Register, September, 1995, No. 477; am. (1), (3), r. and recr. Table 9, am. (4) (a), (b), (5) (intro.), (a) (b), (c) (intro.) and 2., r. (6), Register, August, 1997, No. 500, eff. 9–1–97.

NR 105.10 Bioaccumulation factor. (1) The bioaccumulation factor used to derive wildlife, human threshold, human cancer and taste and odor criteria or secondary values is determined from a baseline BAF using the methodology provided in Appendix B to 40 CFR part 132. 40 CFR part 132, Appendix B as stated on September 1, 1997, is incorporated by reference. BAFs shall be used to calculate criteria and secondary values for human health and wildlife. Use of a BAF greater than 1000, as determined from either of the methods referred to in sub. (2)(c) or (d) for organic substances, will result in the calculation of a secondary value. The baseline BAF is based on the concentration of freely dissolved substances in the ambient water to facilitate extrapolation from one water to another.

(2) Baseline BAFs shall be derived using one of the following 4 methods, which are listed from most preferred to least preferred.

(a) A measured baseline BAF for an organic or inorganic substance derived from a field study of acceptable quality;

(b) A predicted baseline BAF for an organic substance derived using field–measured BSAFs of acceptable quality;

(c) A predicted baseline BAF for an organic or inorganic substance derived from a BCF measured in a laboratory study of acceptable quality and a food–chain multiplier. Food–chain multipliers are provided in 40 CFR part 132, Appendix B; or

(d) A predicted baseline BAF for an organic substance derived from a K_{OW} of acceptable quality and a food–chain multiplier.

(3) REVIEW AND SELECTION OF DATA. Measured BAFs, BSAFs and BCFs shall meet the quality assurance requirements provided in 40 CFR part 132, Appendix B and shall be obtained from available sources including the following:

(a) EPA Ambient Water Quality Criteria documents issued after January 1, 1980.

(b) Published scientific literature.

(c) Reports issued by EPA or other reliable sources.

(d) Unpublished data.

(4) HUMAN HEALTH AND WILDLIFE BAFS FOR ORGANIC SUBSTANCES. (a) To calculate human health and wildlife BAFs for organic substances, the K_{OW} of the substance shall be used with a POC concentration of 0.00000004 kg/L and a DOC concentration of 0.000002 kg/L to yield the fraction freely dissolved:

$$f_{fd} = \frac{1}{1 + \frac{(DOC)(K_{ow})}{10} + (POC)(Kow)}$$

$$= \frac{1}{1 + \frac{(0.000002\ kg/L)(K_{ow})}{10} + (0.00000004\ kg/L)(Kow)}$$

$$= \frac{1}{1 + (0.00000024\ kg/L)(K_{ow})}$$

Where:

DOC = concentration of dissolved organic carbon, kg of dissolved organic carbon/L of water.

POC = concentration of particulate organic carbon, kg of particulate organic carbon/L of water.

(b) The human health BAFs for an organic substance shall be calculated using the following equations:

For warm water communities:

Human Health BAF = [(baseline BAF)(0.013)+ 1](f_{fd})

For cold water communities:

Human Health BAF = [(baseline BAF)(0.044)+ 1](f_{fd})

Where: 0.013 and 0.044 are the fraction lipid values for warm and cold water fish and aquatic life communities, respectively, that are required to derive human health criteria and secondary values.

baseline BAF = the baseline BAF calculated according to 40 CFR part 132, Appendix B.

(c) The wildlife BAFs for an organic substance shall be calculated using the following equations:

1. For trophic level 3:
   Wildlife BAF = [(baseline BAF)(0.0646)+ 1](f_{fd})
2. For trophic level 4:
   Wildlife BAF = [(baseline BAF)(0.1031)+ 1](f_{fd})

Where: 0.0646 and 0.1031 are the standardized fraction lipid values for dietary consumption from trophic level 3 and 4 fish taxa, respectively, that are required to derive wildlife criteria and secondary values.

baseline BAF = the baseline BAF calculated according to 40 CFR part 132, Appendix B.

(5) HUMAN HEALTH AND WILDLIFE BAFS FOR INORGANIC SUBSTANCES. (a) *Human health.* 1. Measured BAFs and BCFs used to determine human health BAFs for inorganic substances shall be based on edible tissue (e.g., muscle) of freshwater fish. If it is demonstrated that whole–body BAFs or BCFs are similar to edible–tissue BAFs or BCFs, then these data are acceptable. BCFs and BAFs based on measurements of aquatic plants and invertebrates may not be used in the derivation of human health criteria and values.

2. If one or more field–measured baseline BAFs for an inorganic substance are available from studies conducted in the Great Lakes system with the muscle of fish, the geometric mean of the species mean baseline BAFs shall be used as the human health BAF for that substance.

3. If an acceptable measured baseline BAF is not available for an inorganic substance and one or more acceptable edible–portion BCFs are available for the substance, a predicted baseline BAF shall be calculated by multiplying the geometric mean of the BCFs times a FCM. The FCM will be 1.0 unless chemical–specific biomagnification data support using a multiplier other than 1.0. The predicted baseline BAF shall be used as the human health BAF for that substance.

(b) *Wildlife.* 1. Measured BAFs and BCFs used to determine wildlife BAFs for inorganic substances shall be based on whole–body freshwater fish and invertebrate data. If it is demonstrated

that edible–tissue BAFs or BCFs are similar to whole–body BAFs or BCFs, then these data are acceptable.

2. If one or more field–measured baseline BAFs for an inorganic substance is available from studies conducted in the Great Lakes system with whole body of fish or invertebrates, then the following apply:

a. For each trophic level, a species mean measured baseline BAF shall be calculated as the geometric mean if more than one measured BAF is available for a given species.

b. For each trophic level, the geometric mean of the species mean measured baseline BAFs shall be used as the wildlife BAF for that substance.

3. If an acceptable measured baseline BAF is not available for an inorganic substance and one or more acceptable whole–body BCFs are available for the substance, a predicted baseline BAF shall be calculated by multiplying the geometric mean of the BCFs times a FCM. The FCM shall be 1.0 unless chemical–specific biomagnification data support using a multiplier other than 1.0. The predicted baseline BAF shall be used as the wildlife BAF for that substance.

Note: Copies of 40 CFR Part 132, Appendix B are available for inspection in the offices of the department of natural resources, secretary of state and the revisor of statutes, Madison, WI or may be purchased from the superintendent of documents, US government printing office, Washington, D.C. 20402.

History: Cr. Register, February, 1989, No. 398, eff. 3–1–89; **r. and recr., Register, August, 1997, No. 500, eff. 9–1–97.**

NR 105.11 Final plant values. (1) A Final Plant Value (FPV) is the lowest plant value that was obtained with an important aquatic plant species in an acceptable toxicity test for which the concentrations of the test substance were measured and the adverse effect was biologically important. Appropriate measures of the toxicity of the substance to aquatic plants are used to compare the relative sensitivities of aquatic plants and animals.

(2) A plant value is the result of a 96–hour test conducted with an algae or a chronic test conducted with an aquatic vascular plant. A test of the toxicity of a metal to a plant may not be used if the medium contained an excessive amount of a complexing agent, such as EDTA, that might affect the toxicity of the metal. Concentrations of EDTA above 200 µg/L should be considered excessive.

(3) The FPV shall be established by selecting the lowest result from a test with an important aquatic plant species in which the concentrations of test material are measured and the endpoint is biologically important.

Note: Although procedures for conducting and interpreting the results of toxicity tests with plants are not well advanced, results of tests with plants usually indicate that criteria which adequately protect aquatic animals and their uses will, in most cases, also protect aquatic plants and their uses.

History: Cr. Register, August, 1997, No. 500, eff. 9–1–97.

Chapter NR 106

PROCEDURES FOR CALCULATING WATER QUALITY BASED EFFLUENT LIMITATIONS FOR TOXIC AND ORGANOLEPTIC SUBSTANCES DISCHARGED TO SURFACE WATERS

Note: Corrections made under s. 13.93 (2m) (b) 7., Stats., Register, August, 1997, No. 500.

NR 106.01 Purpose. One purpose of this chapter is to specify how the department will calculate water quality based effluent limitations under s. 283.13 (5), Stats., for toxic and organoleptic substances and whole effluent toxicity. The other purpose of this chapter is to specify how the department will decide if and how these limitations will be included in Wisconsin pollution discharge elimination system (WPDES) permits. Water quality based effluent limitations for toxic and organoleptic substances are needed to assure attainment and maintenance of surface water quality standards as established in accordance with s. 281.15 (1) (b), Stats., and as set forth in chs. NR 102 to 105.

History: Cr. Register, February, 1989, No. 398, eff. 3–1–89.

NR 106.02 Applicability. The provisions of this chapter are applicable to point sources which discharge wastewater containing toxic or organoleptic substances to surface waters of the state.

History: Cr. Register, February, 1989, No. 398, eff. 3–1–89.

NR 106.03 Definitions. The following definitions are applicable to terms used in this chapter.

(1) "Bioaccumulative chemical of concern" or "BCC" means any substance that has the potential to cause adverse effects which, upon entering the surface waters, accumulates in aquatic organisms by a human health or wildlife bioaccumulation factor greater than 1000.

(2) "Biologically based design flow" means a receiving water design flow to protect fish and aquatic life for which both the duration of exposure is expressed in days and the allowable frequency of excursion is expressed in years. An example of a biologically based design flow is a 4–day 3–year design flow which corresponds to the lowest 4–day average flow that will limit excursions from any water quality criteria or secondary values to no more than once in 3 years.

(3) "Dynamic models" means computer simulation models which use real or derived time series data to predict a time series of observed or derived receiving water concentrations. Methods include continuous simulation, Monte Carlo simulations, or other similar statistical or deterministic techniques.

(4) "EC_{50}" means the point estimate of the concentration of a toxic substance, wastewater effluent or other aqueous mixture which causes an adverse effect including mortality to 50% of the exposed organisms in a given time period, when compared to an appropriate control.

(5) "IC25" means the point estimate of the concentration of a toxic substance, wastewater effluent or other aqueous mixture that would cause a 25% reduction in a nonlethal biological measurement, such as reproduction or growth, of the exposed test organisms in a given time period.

(6) "IWC" or "instream waste concentration" means the concentration of a toxicant or the parameter toxicity in the receiving water after mixing.

(7) "LC_{50}" means the point estimate of the concentration of a toxic substance, wastewater effluent or other aqueous mixture which is lethal to 50% of the exposed organisms in a given time period, when compared to an appropriate control.

(8) "Limit of detection" or "LOD" means the lowest concentration level that can be determined to be significantly different from a blank for that analytical test method and sample matrix.

(9) "Limit of quantitation" or "LOQ" means the concentration of an analyte at which one can state with a degree of confidence for that analytical test method and sample matrix that an analyte is present at a specific concentration on the sample tested.

(10) "NOEC" means the highest tested concentration of a toxic substance, wastewater effluent or other aqueous mixture at which no adverse effects are observed on the aquatic test organisms at a specific time of observation. The NOEC is determined using hypothesis testing.

(11) "rTU_c" or "relative toxic unit chronic" means the IWC divided by the IC25.

(12) "Toxicity test" means a test which determines the toxicity of a chemical substance, wastewater effluent or other aqueous mixture using living organisms. A toxicity test measures the degree of response of exposed test organisms to a chemical substance, wastewater effluent or other aqueous mixture.

(13) "TU_a" or "toxic unit acute" means 100 divided by the LC_{50}.

(14) "Whole effluent toxicity" means the aggregate toxic effect of an effluent as measured directly by a toxicity test.

History: Cr. Register, February, 1989, No. 398, eff. 3–1–89; **r. (7),** renum. (1) to (6), (8) and (9) to be (4), (7) to (9), (12) and (14) and am. (2), (4), (7) and (12), cr. (1), (5), (6), (10), (11) and (13), Register, August, 1997, No. 500, eff. 9–1–97.

NR 106.04 General. (1) Water quality based effluent limitations shall be established whenever categorical effluent limits required under s. 283.13, Stats., are less stringent than necessary to achieve applicable water quality standards specified in chs. NR 102 to 105. Water quality based effluent limitations for a point source shall be specified in the WPDES permit for that point source.

(2) In no case may the water quality based effluent limitations be less stringent than applicable categorical effluent limitations.

(3) The department shall establish limitations for toxic and organoleptic substances if any of the conditions specified in s. NR 106.05 are met. Limitations shall be established according to the

methods provided in s. NR 106.06 and included in WPDES permits according to the conditions provided in s. NR 106.07. The department shall establish limitations for whole effluent toxicity if any of the conditions specified in s. NR 106.08 are met. Whole effluent limitations shall be established and included in WPDES permits according to the methods provided in ss. NR 106.08 and 106.09.

(4) Water quality based effluent limitations or monitoring requirements for toxic or organoleptic substances or whole effluent toxicity may be removed from a permit, subject to public notice and opportunity for hearing under ch. NR 203, if the limitation is determined to be unnecessary based on the procedures presented in this chapter or based on other information available to the department.

(5) For purposes of this chapter, a cost–effective pollutant minimization program is an activity which has as its goal the reduction of all potential sources of the pollutant for the purpose of maintaining the effluent at or below the water quality based effluent limitation. The pollutant minimization programs specified in ss. NR 106.05 (8), 106.06(6) (d) and 106.07(6) (f) shall include investigation of treatment technologies and efficiencies, process changes, wastewater reuse or other pollution prevention techniques that are appropriate for that facility, taking account of the permittee's overall treatment strategies, facilities plans and operational circumstances. Past documented pollution prevention or treatment efforts may be used to satisfy all or part of a pollution minimization program requirement. The permittee shall submit to the department an annual status report on the progress of a pollutant minimization program.

History: Cr. Register, February, 1989, No. 398, eff. 3–1–89; am. (3), cr. (5), Register, August, 1997, No. 500, eff. 9–1–97.

NR 106.05 Determination of the necessity for water quality based effluent limitations for toxic and organoleptic substances. (1) (a) *General.* The department shall establish water quality based effluent limitations for point source dischargers whenever the discharges from those point sources contain(s) toxic or organoleptic substances at concentrations or loadings which do not, as determined by any method in this section, meet applicable water quality standards specified in chs. NR 102 to 105.

(b) *Determining necessity for limitations based on secondary values.* The department may establish water quality based effluent limitations for point source discharges based on secondary values calculated according to ch. NR 105. The department shall calculate secondary values and establish limitations for toxic and organoleptic substances in permits based on secondary values when, in the judgment of the department, one or more of the following factors support the necessity for the values, in conjunction with the procedures in subs. (2) to (8).

1. Whole effluent toxicity or other biomonitoring or bioassay test results indicate toxicity to test or other species.

2. The use designation of the receiving water is or may be impaired.

3. There is other information that the industrial category or subcategory of the point source or the industrial or other sources discharging to a publicly owned treatment works discharges the substance.

4. The substance in the wastewater will not be adequately removed or reduced by the type of wastewater treatment provided.

5. The ecological or environmental risk from the substance may be significant when discharged to surface waters.

6. Other relevant factors which may cause an adverse effect on surface waters as specified in s. NR 105.04(1).

(c) If the department determines that a limitation based on an aquatic life acute or chronic secondary value should be established in a permit according to the provisions in this section, a permittee may request an alternative wet limit in accordance with s. NR 106.07 (7).

Note: A toxic or organoleptic substance includes, but is not limited to, those substances in Table 6 of 40 CFR part 132.

(2) When considering the necessity for water quality based effluent limitations, the department shall consider in–stream biosurvey data and data from ambient toxicity analyses whenever such data are available.

(3) If representative discharge data are available for a toxic or organoleptic substance being discharged from a point source, limitations shall be established in accordance with any one of the following conditions:

(a) The discharge concentration of the substance for any day exceeds the limit of detection and exceeds the limitations based on either the acute toxicity criterion or secondary acute value for the substance as determined in s. NR 106.06 (3) where appropriate,

(b) The arithmetic average discharge concentration of the substance for any 4 consecutive days calculated as described in sub. (7) exceeds the limit of detection and exceeds the limitations based on either the chronic toxicity criterion or secondary chronic value for the substance as determined in s. NR 106.06 (4).

(c) The arithmetic average discharge concentration of the substance for any 30 consecutive days calculated as described in sub. (7) exceeds the limit of detection and exceeds any limitation based on the wildlife, human threshold, or human cancer criteria or secondary values, or taste and odor criteria for the substance as determined in s. NR 106.06 (4).

(4) If at least 11 daily discharge concentrations of the substance are greater than the limit of detection and the requirements of sub. (3) do not result in the need for an effluent limitation, water quality based effluent limitations are necessary for a substance in a point source discharge if the upper 99th percentile of available discharge concentrations as calculated in sub. (5) meets any of the conditions specified in pars. (a) to (c).

(a) The upper 99th percentile of daily discharge concentrations of the substance exceeds the limitation based on either the acute toxicity criterion or the secondary acute value for the substance as determined in s. NR 106.06 (3).

(b) The upper 99th percentile of 4–day average discharge concentration of the substance exceeds the limitation based on either the chronic toxicity criterion or the secondary chronic value for the substance as determined in s. NR 106.06 (4), or

(c) The upper 99th percentile of 30–day average discharge concentration of the substance exceeds any limitation based on the wildlife, human threshold, or human cancer criteria or secondary value, or taste and odor criteria for the substance as determined in s. NR 106.06 (4).

(5) This subsection shall be used to calculate upper 99th percentile values unless a probability distribution other than log normal is determined to be more appropriate and alternate methods to calculate the upper 99th percentile are available.

(a) When available daily discharge concentrations of the substance are not serially correlated and at least 11 concentrations are greater than the limit of detection, the upper 99th percentile of the daily average, the 4–day average and the 30–day average discharge concentrations may be calculated as follows:

$P_{99} = \exp(mu_{dn} + Z_p sigma_{dn})$

Where:

P_{99} = Upper 99th percentile of n–day average discharge concentrations.

d = Ratio of the number of daily discharge concentrations less than the limit of detection to the total number of discharge concentrations.

n = Number of discharge concentrations used to calculate an average over a specified monitoring period (n=1 for daily concentrations,4 for 4–day averages and 30 for 30–day averages).

exp = Base e (or approximately 2.718) raised to the power shown between the parentheses in the original equation.

Z_p = Z value corresponding to the upper p^{th} percentile of the standard normal distribution.

P = $(0.99–d^n)/(1–d^n)$.

mu_{dn} = $mu_d+[(sigma_d)^2–(sigma_{dn})^2]+ln[(1–d)/(1–d^n)]$ 0]= estimated log mean of n–day average discharge concentrations greater than the limit of detection. (Note: $mu_{dn} = mu_d$ if n = 1).

$(sigma_{dn})^2$ = $1n [(1–d^n) ([1+(s/m)^2]/[n(1–d)]+ (n–1)/n)]$ = estimated log variance of n–day average discharge concentrations greater than the limit of detection. (Note:$(sigma_{dn})^2= (sigma_d)^2$ if n = 1.)

mu_d = 1n m – 0 5 $(sigma_d)^2$ = estimated log mean of discharge concentrations greater than the limit of detection.

$(sigma_d)^2$ = $1n [1 + (s/m)^2]$ = estimated log from variance of discharge concentrations greater than the limit of detection.

1n = Natural logarithm.

m = Mean of discharge concentrations greater than the limit of detection.

s = Standard deviation of discharge concentrations greater than the limit of detection.

(b) When the daily discharge concentrations of any substance are serially correlated, the serially correlated data may be adjusted using appropriate methods such as that presented in Appendix E of "Technical Support Document for Water Quality–based Toxics Control", U.S. environmental protection agency, March 1991 (EPA/505/2–90–001). The equation presented in par. (a) may be used after adjustment of the serially correlated data.

(6) If less than 11 daily discharge concentrations of the substance are greater than the limit of detection, and the requirements in sub. (3) do not result in an effluent limitation, water quality based effluent limitations are necessary for a substance in a point source discharge if the arithmetic average of available discharge concentrations as calculated in sub. (7) exceeds any value determined in par. (a) or (b):

(a) One fifth of the limitation based on the acute toxicity criterion or secondary acute value for the substance, as determined in s. NR 106.06 (3) where appropriate, or

(b) One fifth of any limitation based on chronic toxicity criteria or secondary chronic values or long–term impacts as determined in s. NR 106.06 (4).

(7) The arithmetic average discharge concentration as used in subs. (3) and (6) shall be calculated using all available discharge data treated according to this subsection.

(a) If, in the judgment of the department, the analytical methods used to test for the substance represent acceptable methods, all values reported as less than the limit of detection shall be set equal to zero for calculation of the average concentration.

(b) If, in the judgment of the department, the analytical methods used to test for the substance do not represent the best acceptable methods, all values reported as less than the limit of detection shall be discarded from the data.

(8) When the provisions of this section cannot be invoked because representative discharge data are not available for a substance, water quality based effluent limitations may be established if, in the judgment of the department, water quality standards will be exceeded if the discharge from the point source is not limited. If, in the judgment of the department, the discharge from a point source may exceed the water quality standards, but the collection of representative discharge data is not possible due to the inability of the most sensitive approved method to quantify discharge levels and, in the judgment of the department the application numeric effluent limitations in a permit is infeasible or impractical, then the permittee may request an alternative to a numerical effluent limitation. The alternative shall consist of a permit requirement to conduct a cost–effective pollutant minimization program as specified in s. NR 106.04 (5). Approved methods are those specified in ch. NR 219 or 40 CFR part 136.

Note: A department guidance document finalized in May 1996, entitled "Wisconsin Strategy for Regulating Mercury in Wastewater", describes how the department evaluates whether an effluent limitation or a pollutant minimization program for mercury is appropriate.

(9) Regardless of the results of the analysis conducted under this section, the department may, whenever determined necessary, require monitoring for any toxic or organoleptic substance.

History: Cr. Register, February, 1989, No. 398, eff. 3–1–89; renum. (1) to be (1) (a), cr. (1) (b) and (c), am. (3) (a) to (c), (4) (a) to (c), (5) (b), (6) (a) and (b) and (8), Register, August, 1997, No. 500, eff. 9–1–97.

NR 106.06 Calculation of water quality based effluent limitations for toxic and organoleptic substances.

(1) BASIS FOR LIMITATIONS. (a) The department shall establish water quality based effluent limitations for point source dischargers whenever such limitations are necessary, as determined by any method in this section, to meet the applicable water quality standards, criteria and secondary values as determined in chs. NR 102 to 105.

(b) 1. Water quality based effluent limitations for toxic and organoleptic substances shall be determined to attain and maintain water quality standards and criteria or secondary values, specified in or determined according to procedures in ch. NR 105, at the point of discharge. Effluent limitations shall be established to protect downstream waters whenever the department has information to make the determinations.

2. For discharges to Green Bay that are north of 44° 32' 30" north latitude, the cold water community criteria shall apply in effluent limit calculations. For discharges to Green Bay that are south of 44° 32' 30" north latitude, effluent limitations shall be established in accordance with subd. 1.

(2) LIMITATIONS FOR BIOACCUMULATIVE CHEMICALS OF CONCERN (BCCS). (a) Notwithstanding any other provisions in chs. NR 102 and 106, beginning on March 23, 1997, effluent limitations for new or expanded discharges of BCCs into waters of the Great Lakes system as defined in s. NR 102.12 may not exceed the most stringent applicable water quality criteria or secondary values for BCCs. Effluent limitations for expanded discharges of BCCs with permit limitations shall be determined by means of a mass balance where the limitation for the existing portion of a permitted discharge shall be determined using the requirements of sub. (4) and the limitation for the expanded portion of the discharge may not exceed the most stringent criteria or value for that BCC.

(b) For the purposes of par. (a), "expanded discharge" means any change in concentration, level or loading of a substance which would exceed a limitation specified in a current WPDES permit, or which, according to the procedures in s. NR 106.05 would result in the establishment of a new limitation in a reissued or modified WPDES permit. "New discharge" means any point source which has not received a WPDES permit from the department prior to September 1, 1997.

Note: The Great Lakes Water Quality Initiative requires that for existing discharges of BCCs in waters of the Great Lakes system, effluent limitations may not exceed the most stringent criteria or secondary value beginning March 23, 2007, with two exceptions. Prior to that date, DNR will develop additional rules to implement this requirement for existing discharges.

(c) Effluent limitations for discharges of BCCs into waters of the Great Lakes system as defined in s. NR 102.12 that are based on human health criteria or secondary values calculated according to procedures in ch. NR 105, shall be also based on the most protective designated use: cold water, public water supply.

(3) LIMITATIONS BASED ON ACUTE TOXICITY. (a) The department shall establish water quality based effluent limitations to ensure that substances are not present in amounts which are acutely harmful to animals, plants or aquatic life in all surface

waters including those portions of the mixing zone normally habitable by aquatic life and effluent channels as required by s. NR 102.04 (1).

(b) To assure compliance with par. (a) and except as provided in par. (c), water quality based effluent limitations shall equal the final acute value as determined in s. NR 105.05 or the secondary acute value as determined in s. NR 105.05 (4) for the respective fish and aquatic life subcategory for which the receiving water is classified. Effluent limitations for substances for which criteria may be expressed as dissolved concentrations may be established according to sub. (7).

(c) Except as provided in par. (d), water quality based effluent limitations may exceed the final acute value or the secondary acute value within a zone of initial dilution provided that the acute toxicity criteria or secondary acute values are met within a short distance from the point of discharge. A zone of initial dilution shall only be provided if the discharger demonstrates to the department that mixing of the effluent with the receiving water in the zone of initial dilution is rapid and all the following conditions are met:

1. The discharge is not at the water surface or at the shoreline.

2. The discharge does not constitute a significant portion of the streamflow or otherwise dominate the receiving water.

3. The discharge velocity is not less than 3 meters per second (10 feet per second) unless an alternative discharge velocity, which similarly minimizes organism exposure time, is determined appropriate for the specific site.

4. The acute toxicity criteria or secondary acute values must be met within 10% of the distance from the edge of the outfall structure to the edge of a mixing zone which may be determined in accordance with s. NR 102.05 (3).

5. The acute toxicity criteria or secondary acute values shall be met within a distance of 50 times the discharge length scale in any direction. The discharge length scale is defined as the square root of the cross–sectional area of any discharge outlet. If a multiport diffuser is used, this requirement must be met for each port using the appropriate discharge length scale for that port.

6. The acute toxicity criteria or secondary acute values shall be met within a distance of 5 times the local water depth in any horizontal direction from any discharge outlet. The local water depth is defined as the natural water depth (existing prior to the installation of the discharge outlet) prevailing under the mixing zone design conditions for the site.

(d) For toxic substances with water quality criteria related to one or more other water quality parameters, effluent limitations shall be calculated using the effluent value for the water quality parameter. Water quality parameters include, but are not limited to, pH, temperature and hardness.

(4) LIMITATIONS BASED ON CHRONIC TOXICITY OR LONG–TERM IMPACTS. (a) *Water quality criteria and secondary values.* The department shall calculate water quality based effluent limitations to ensure that the chronic toxicity criteria (CTC), the wildlife criteria (WC), the taste and odor criteria (TOC), the human threshold criteria (HTC), and human cancer criteria (HCC) appropriate for the receiving water as specified in chs. NR 102 to 105 and the secondary chronic values determined according to ch. NR 105 will be met after dilution with an appropriate allowable quantity of receiving water flow as specified in this subsection, subs. (5) to (11) and s. NR 106.11. The available dilution shall be determined according to par. (c) unless the conditions specified in s. NR 102.05 (3) or sub. (2) require less dilution or no dilution be allowed. Effluent limitations for substances for which criteria may be expressed as dissolved concentrations may be established according to sub. (7).

(b) *Calculation of limits.* Water quality based effluent limitations to meet the requirements of this subsection shall be calculated using the procedure specified in subd. 1. or 2., except as provided in sub. (2) or (6).

1. For discharges of toxic or organoleptic substances to flowing receiving waters, the water quality based effluent limitation for a substance shall be calculated using the following conservation of mass equation whenever the background concentration is less than the water quality criterion or secondary value:

$$\text{Limitation} = \frac{(WQC)(Q_s + (1-f)Q_e) - (Q_s - fQ_e)(C_s)}{Q_e}$$

Where:

Limitation	=	Water quality based effluent limitation (in units of mass per unit of volume),
WQC	=	The water quality criterion or secondary value concentration (in units of mass per unit volume) as referenced in sub. (1) or par. (a)
Q_s	=	Receiving water design flow (in units of volume per unit time) as specified in par. (c),
Q_e	=	Effluent flow (in units of volume per unit time) as specified in par. (d).
f	=	Fraction of the effluent flow that is withdrawn from the receiving water, and
C_s	=	Background concentration of the substance (in units of mass per unit volume) as specified in par. (e).

Note: In applying this equation, all units for the flow and concentration parameters respectively, shall be consistent.

2. For discharges of toxic or organoleptic substances to receiving waters which do not exhibit a unidirectional flow at the point of discharge, such as lakes or impoundments, the department may calculate, in the absence of specific data, water quality based effluent limitations using the following equation whenever the background concentration is less than the water quality criterion or secondary value:

$$\text{Limitation} = 11\,(WQC) - 10C_s$$

Where:

Limitation	=	Water quality based effluent limitation (in units of mass per unit of volume)
WQC	=	The water quality criterion concentration or secondary value (in units of mass per unit volume) as referenced in sub. (1) or par. (a)
Cs	=	Background concentration of the substance (in units of mass per unit volume) as specified in par. (e).

On a case–by–case basis other dilutional factors may be used, but in no case may the dilution allowed exceed an area greater than the area where discharge induced mixing occurs. The discharge is also subject to the conditions specified in s. NR 102.05 (3). The discharger may be required to determine the size of the mixing zone using acceptable models or dye studies.

3. The limitation calculated in subd. 1. or 2. may be converted to a maximum load limitation by multiplying the calculated concentration limitation by the rate of effluent flow as determined in par. (d) and appropriate conversion factors.

(c) *Receiving water design flow (Qs).* The value of Q_s to be used in calculating the effluent limitation for discharges to flowing waters shall be determined as follows:

1. The department shall make reasonable efforts to determine the area of the zone of passage and the dilution characteristics of discharges.

2. The department may require that the discharger provide information on the discharge mixing and dilution characteristics of discharges.

3. The discharger shall be allowed to demonstrate, through appropriate and reasonable methods that an adequate zone of free

passage exists in the cross–section of the receiving water or that dilution is accomplished rapidly such that the extent of the mixing zone is minimized. In complex situations, the department may require that the demonstration under this subdivision include water quality modeling or field dispersion studies.

4. Following the determinations under subds. 1. to 3., the value of Q_s of the receiving water for calculating effluent limitations based upon the chronic toxicity criteria specified in s. NR 105.06 or secondary chronic values shall be determined on a case–by–case basis. In no case may Q_s exceed the larger of the average minimum 7–day flow which occurs once in 10 years (7–day Q_{10}) or, if sufficient information is available to calculate a biologically based receiving water design flow, the flow which prevents an excursion from the criterion or secondary value using a duration of 4 days and a frequency of less than once every 3 years (4–day, 3–year biological flow).

5. If the requirements of subds. 2. and 3. are not satisfied, the department shall notify the permittee and identify the deficiencies and allow additional time, if necessary, to complete the demonstration. If the demonstration cannot be completed satisfactorily, the value of Q_s of the receiving water for calculating effluent limitations based upon the chronic toxicity criteria specified in s. NR 105.06 or secondary chronic values shall equal 1/4 of the 7–day Q_{10} or $^1/_4$ of the 4–day, 3 year biological flow. In no case may the value of Q_s, of the receiving water, for calculating effluent limitations based upon the chronic toxicity criteria or secondary chronic values developed according to ch. NR 105, exceed 1/4 of the 7–day Q_{10} or 1/4 of the 4–day, 3–year biological flow if the department determines that the discharge has a potential to jeopardize the continued existence of any endangered or threatened species listed under ch. NR 27 and conforming to section 7 of the endangered species act, 16 USC 1536.

6. Q_s may be reduced from those values calculated in subds. 3. to 5. where natural receiving water flow is significantly altered by flow regulation.

7. Following the determinations under subds. 1. to 3., the value of Q_s of the receiving water for calculating effluent limitations based upon the wildlife criteria or secondary values developed according to ch. NR 105 shall be determined on a case–by–case basis. In no case may the Q_s exceed the average minimum 90–day flow which occurs once in 10 years (90–day Q_{10}) or if the 90–day Q_{10} flow is not available, the average minimum 30–day flow which occurs once in 5 years (30–day Q_5) or 85% of the average minimum 7–day flow which occurs once in 2 years (7–day Q_2).

8. If the requirements of subds. 2. and 3. are not satisfied, the department shall notify the permittee and identify the deficiencies and allow additional time, if necessary, to complete the demonstration. Except as provided in subd. 12., if the demonstration cannot be completed satisfactorily, the value of Q_s of the receiving water for calculating effluent limitations based upon the wildlife criteria specified in s. NR 105.07 shall equal ¼ of the 90–day Q_{10} or $ of the 30–day Q_5 or ¼ of 85% of the 7–day Q_2. In no case may the value of Q_5 of the receiving water, for calculating effluent limitations based upon the wildlife criteria or secondary values developed according to ch. NR 105, exceed ¼ of the 90–day Q_{10} or ¼ of the 30–day Q_5 or ¼ of 85% of the 7–day Q_2 if the department determines that the discharge has a potential to jeopardize the continued existence of any endangered or threatened species listed under ch. NR 27 and conforming to section 7 of the endangered species act, 16 USC 1536.

9. Except as provided in subd. 12., following the determinations under subds. 1. to 3., the value of Q_s of the receiving water for calculating effluent limitations based upon the human cancer criteria, human threshold criteria or secondary values developed according to ch. NR 105 shall be determined on a case–by–case basis. In no case may Q_s exceed the harmonic mean flow.

10. If the requirements of subds. 2. and 3. are not satisfied, the department shall notify the permittee and identify the deficiencies and allow additional time, if necessary, to complete the demonstration. Subject to subd. 12, if the demonstration cannot be completed satisfactorily, the value of Q_s of the receiving water for calculating effluent limitations based upon the human cancer criteria or secondary values or the human threshold criteria or secondary values specified in ch. NR 105 shall equal ¼ of the harmonic mean flow.

11. Except as provided in subd. 12., the value of Q_s shall equal the mean annual flow of the receiving water for calculating effluent limitations based upon the taste and odor criteria as specified in ch. NR 102.

12. Q_s may be reduced from those values calculated in subd. 9., 10., and 11., whenever the department determines such discharges may directly affect public drinking water supplies.

(d) *Effluent flows (Q_e).* 1. For dischargers subject to ch. NR 210 and which discharge for 24 hours per day on a year–round basis, Q_e shall equal the maximum effluent flow, expressed as a daily average, that is anticipated to occur for 12 continuous months during the design life of the treatment facility unless it is demonstrated to the department that such a design flow rate is not representative of projected flows at the facility.

2. For all other dischargers not subject to ch. NR 210, Q_e shall equal either subd. 2.a. or b. for effluent limitations based on aquatic life chronic criteria or chronic secondary values, and shall equal either subd. 2.a. or c. for effluent limitations based on wildlife, human threshold, human cancer or taste and odor criteria or secondary values. Whenever calculating Q_e, the department may consider a projected increase in effluent flow that will occur when production is increased or modified, or another wastewater source, including stormwater, is added to an existing wastewater treatment facility. This subdivision does not waive the requirements of ch. NR 207.

a. The maximum effluent flow, expressed as a daily average, that has occurred for 12 continuous months and represents normal operations; or

b. The maximum effluent flow, expressed as a daily average, that has occurred for 7 continuous days and represents normal operations; or

c. The maximum effluent flow, expressed as a daily average, that has occurred for 30 continuous days and represents normal operations.

3. For seasonal discharges, discharges proportional to stream flow, or other unusual discharge situations, Q_e shall be determined on a case by case basis.

(e) *Background concentrations of toxicant or organoleptic substances* (Cs). The representative background concentration of a toxic or organoleptic substance shall be used in deriving chemical specific water quality based effluent limitations. Except as provided elsewhere in this paragraph, the representative background concentration shall equal the geometric mean of the acceptable available data for a substance. Background concentrations may not be measured at a location within the direct influence of a point source discharge.

1. The department shall determine representative background concentrations of toxic substances on a case–by–case basis using available data on the receiving water or similar waterbodies in the state, including acceptable and available caged or resident fish tissue data, available or projected pollutant loading data, and best professional judgment.

2. The department may utilize representative seasonal concentrations and may consider other information on background concentrations submitted to the department.

3. When evaluating background concentration data, commonly accepted statistical techniques shall be used to evaluate

data sets consisting of values both above and below the level of detection. When all of the acceptable available data in a data set category, such as water column, caged or resident fish tissue, are below the level of detection for a pollutant, then all the data for that pollutant in that data set shall be assumed to be zero.

(5) VALUES FOR PARAMETERS WHICH AFFECT THE LIMIT. For toxic substances with water quality criteria related to one or more other water quality parameters, the department may calculate effluent limitations in consideration of those other water quality parameters. Water quality parameters include but are not limited to pH, temperature and hardness. The department shall determine the value of the water quality parameters on a case–by–case basis as follows:

(a) *Receiving water.* 1. The geometric mean of available data for the receiving water shall be used, except the arithmetic mean for pH shall be used.

2. Representative seasonal values may be used.

3. If information on the water quality parameters is not available, then information on the quality of similar water bodies in the area and best professional judgment may be used.

4. The receiving water value of the water quality parameter shall be used to determine the effluent limitation. The receiving water value may be modified to account for the mixture of the receiving and effluent flows when any of the following conditions occur:

a. When the value of the water quality parameter in the effluent is significantly greater than or less than the value in the receiving water;

b. When the effluent flow is relatively large in comparison to the receiving water flow used in the calculation of the effluent; or

c. When, as a result of demonstrated or measured physical, chemical or biological reactions, the value of the water quality parameter, after mixing of the receiving water and the effluent, is significantly different than the background value of the water quality parameter in the receiving water.

(b) *Effluent.* 1. The geometric mean of available data for the effluent shall be used, except the arithmetic mean for pH shall be used.

2. If information on the water quality parameters is not available, then values representative of similar effluents may be used.

(6) ALTERNATIVE EFFLUENT LIMITATIONS BASED UPON BACKGROUND CONCENTRATIONS. (a) Whenever the representative background concentration for a toxic or organoleptic substance in the receiving water is determined to be greater than any applicable water quality standard or criterion or secondary value for that substance and the source of at least 90% of the wastewater is from groundwater or a public drinking water supply, the effluent limitation for that substance without dilution shall be equal to the lowest applicable water quality standard or criterion or secondary value except as provided by par. (b).

(b) The department may establish limitations greater than the applicable water quality standard or criterion or secondary value for the substance as required by par. (a) up to the representative background concentration of the substance in the receiving water, or an alternate limitation or requirement may be determined according to par. (d). The limitation, or alternate limitation or requirement determined according to par. (d), shall only be increased above the standard or criterion if it is demonstrated to the department that the concentration of the substance in the groundwater or public drinking water supply or other source water at the point of intake exceeds the applicable standard or criterion for that substance and that reasonable, practical or otherwise required methods are implemented to minimize the addition of the toxic or organoleptic substance to the wastewater. This subdivision shall not apply where groundwater is withdrawn from a location because of noncompliance with the standards contained in ch. NR 140.

(c) 1. Whenever the representative background concentration for a toxic or organoleptic substance in the receiving water is determined to be greater than any applicable water quality standard or criteria for that substance and the source of more than 10% of the wastewater for any discharger is from the same receiving water, the effluent limitation for that substance shall, except as provided in subd. 2., equal the representative background toxicant concentration of that substance in the receiving water as determined by the department, or an alternate limitation or requirement may be determined according to par. (d).

2. The department may establish an effluent limitation more stringent than the representative background concentration when the existing treatment system has a demonstrated and cost–effective ability to achieve regular and consistent compliance with a limitation more stringent than the representative background concentration.

(d) Where appropriate, for effluent limitations determined under pars. (b) and (c), the department may conduct an analysis for a toxic or organoleptic substance which accounts for all sources of the pollutant impacting a waterbody or stream segment. In the event the discharger's relative contribution to the mass of the toxic or organoleptic substance impacting the waterbody or stream segment is negligible in the best professional judgment of the department, and the concentration of the substance in the discharge exceeds the representative background concentration of the substance, the department shall establish an alternative effluent limitation for the discharger. In determining whether the discharger's relative contribution to the mass of the substance is negligible, consideration shall be given to the type of substance being limited, the uses of the receiving water potentially affected and other relevant factors. The alternative effluent limitation or other requirement shall represent in the judgment of the department, application of the best demonstrated treatment technology reasonably achievable. An alternative effluent limitation or other requirement may include one or more of the following permit conditions:

1. A numerical limitation for the substance;

2. A monitoring requirement for the substance; or

3. A cost–effective pollutant minimization program for the substance as defined in s. NR 106.04(5).

Note: The analysis which may be conducted to determine the relative contributions of various sources of pollutants discharged to surface waters is functionally equivalent to the type of analysis described in 40 CFR 130.7.

(e) The determination of representative background concentrations for toxic or organoleptic substances in pars. (b) and (c) shall be statistically ($P \leq 0.01$) or otherwise appropriately determined as the reasonably expected maximum background concentration for that substance.

(7) APPLICABILITY OF WATER QUALITY CRITERIA EXPRESSED AS DISSOLVED CONCENTRATIONS. Effluent limitations may be established in a permit under this subsection based upon the acute and chronic aquatic life toxicity criteria expressed as dissolved concentrations which are determined using the procedures specified in ss. NR 105.05(5) and 105.06(8).

(a) Determine the effluent limitations according to the procedures specified in this chapter using the water quality criteria expressed as total recoverable from tables 1 to 6 in ch. NR 105. Determine the necessity for water quality based effluent limitations according to s. NR 106.05. If the procedures in s. NR 106.05 do not result in the need for effluent limitations based upon the total recoverable criteria, then no limitations shall be established in the permit and there is no further review. If the procedures in s. NR 106.05 do result in the need for effluent limitations based upon the total recoverable criteria, then the limitations shall be established in the permit or the permittee may request that effluent limitations be established based on criteria expressed as dissolved concentrations according to par. (b).

(b) If, following the procedures in par. (a), the permittee requests that effluent limitations be established based on criteria expressed as dissolved concentrations, the department shall determine the effluent limitations according to the procedures specified in this chapter using WQ_{TRAN}, the water quality criterion expressed as a dissolved concentration, and shall determine the necessity for water quality based effluent limitations according to s. NR 106.05. If the procedures in s. NR 106.05 do not result in the need for effluent limitations based upon the criteria expressed as dissolved concentrations, WQ_{TRAN}, then no limitations shall be established in the permit and the monitoring conditions in par. (c)1. shall be included in the permit. If the procedures in s. NR 106.05 do result in the need for effluent limitations based upon the criteria expressed as dissolved concentrations, then the limitation is established in the permit and the requirements in par. (c) apply.

(c) If, following the procedures in par. (b), effluent limitations are established based upon water quality criteria expressed as dissolved concentrations, then the following shall also be included in the permit:

1. Monitoring requirements which may include, but are not limited to, effluent monitoring, monitoring of effluent toxicity, in–stream monitoring for unfiltered and filtered substances which may be limited in the permit, or other monitoring. Testing methods which allow appropriately sensitive detection limits may also be specified.

2. Conditions which require the permittee to document that reasonable steps have been taken to minimize or eliminate the sources of the substances for which effluent limitations expressed as dissolved concentrations have been established in the permit. The documentation may consist of implementation of a formal pre–treatment program, pollution reduction activities, and other documented efforts which are reasonably likely to reduce or eliminate sources of the substance. The documentation shall be submitted as specified in the permit, unless, prior to issuance of the permit, documented source elimination or reduction efforts have occurred. If reasonable steps have not been taken as specified in the permit, the department may establish effluent limitations based upon a water quality criterion expressed as total recoverable concentrations.

(d) The procedures in pars. (a) to (c) may also be used to establish effluent limits based on aquatic life secondary values.

(8) CUMULATIVE RISK FOR HUMAN CARCINOGENS. (a) If an effluent for a particular discharger contains more than one substance for which a human cancer criterion (HCC) exists at levels which warrant water quality based effluent limits, the incremental risk of each carcinogen should be assumed to be additive. Except as provided in par. (b), the water quality based limitation for each carcinogen shall be established in a permit to protect against additive or synergistic effects possibly associated with simultaneous multiple chemical human exposure such that the following condition is met:

$$\frac{C_1}{\text{Limit 1}} + \frac{C_2}{\text{Limit 2}} + \ldots \frac{C_n}{\text{Limit n}} \leq 1$$

Where:

$C_{1 \ldots n}$ = the monthly average concentration of each separate carcinogen in the effluent (assumed equal to zero if effluent concentration is not detected)

$\text{Limit}_{1 \ldots n}$ = the effluent limitation concentration based on the human cancer criterion for each respective carcinogen

Note: This additional condition is equivalent to a total incremental risk of cancer due to multiple chemicals not exceeding 10^{-5}.

(b) If information is provided to the department that the carcinogenic risk is not additive, the limitations for each carcinogen will be determined based on that information.

(9) SEDIMENT DEPOSITION. The limitations calculated according to the procedures in this section may be reduced to prevent contamination of sediment with toxic substances or to prevent accumulation of the substance in sediments if determined necessary to protect water quality.

(10) ENVIRONMENTAL FATE. The limitations calculated pursuant to this section may be modified to account for degradation of the substance based on information available to the department provided that:

(a) The rate of degradation is documented by field studies supplied by the discharger, and

(b) The field studies demonstrate rapid and significant loss of the substance inside the mixing zone under the full range of critical conditions expected to be encountered; and

(c) The field studies are reviewed and approved by the department.

(11) OTHER METHODS OF CALCULATION. In lieu of sub. (4), scientifically defensible technical approaches such as calibrated and verified mathematical water quality models developed or adapted for a particular stream, simplified modeling approaches as outlined in "WATER QUALITY ASSESSMENT" (EPA–600/6–82–004), or dynamic methods may be utilized in developing water quality based effluent limitations such that applicable water quality standards specified in chs. NR 102 to 105 are maintained.

History: Cr. Register, February, 1989, No. 398, eff. 3–1–89; am. (1) (a), (4) (c) 12., (d) 1., (4) (e) 1.,(6) (e), cr. (1) (b) 2., (2), (3) (d), (4) (c) 7. to 11., (d) 2., (e) 3., (5) (a) 4., (6) (c) 2., (d), (7), renum. (1) (b), (2) (a) to (c), (3) (a) to (c) 6., 9., (d) 1. and 3., (e) 1. to 6., (4) to (8) to be (8) to (11) and am. (3) (b), (c) (intro.), 4. to 6., (4) (a), (b) (intro.) 1., 2.,, (c) 4. and 5., (6) (a) to (c), (11) (d) 2., (4) (e) 3., (5) (a) 4., (6) (c) 2. and (d) 5. and (7), r. (2) (d), (3) (c) 7. and 8., (d) 2., (e) 7., Register, August, 1997, No. 500, eff. 9–1–97.

NR 106.07 Application of and compliance with water quality based effluent limitations in permits. **(1)** The department shall determine on a case–by–case basis the monitoring frequency to be required for each water quality based effluent limitation in a permit.

(2) A chemical specific water quality based effluent limitation that is established according to this chapter shall be expressed in the permit as both a concentration limitation (in units of mg/L or equivalent units) and a mass limitation (in units of kg/day or equivalent units).

(a) For dischargers subject to ch. NR 210, an acute toxicity based concentration limitation that is derived by the procedure in s. NR 106.06 shall be converted to a mass limitation by using the discharger's maximum effluent flow, expressed as a daily average, that is anticipated to occur for 24 continuous hours during the design life of the treatment facility.

(b) For all other dischargers not subject to ch. NR 210, an acute toxicity based concentration limitation that is derived by the procedures in s. NR 106.06 shall be converted to a mass limitation by using the discharger's maximum effluent flow, expressed as a daily average, that has occurred for 24 continuous hours and represents normal operations. When calculating a mass limitation, the department may consider a projected increase in effluent flow that will occur when production is increased or modified, or another wastewater source, including stormwater, is added to an existing wastewater treatment facility. This paragraph does not waive the requirements of ch. NR 207.

(c) An aquatic life chronic, human health or wildlife–based concentration limitation that is determined by the procedures in s. NR 106.06 shall be converted to a mass limitation by using the same effluent flow rate that was used in s. NR 106.06 (4)(d) to calculate the chronic toxicity concentration limitation. Also, see sub. (9) for alternate wet weather limitations.

(d) A chronic toxicity based mass limitation that is determined by the procedures in s. NR 106.11 shall be converted to a con-

centration limitation by using an effluent flow rate from s. NR 106.06 (4)(d).

Note: The method of allocating the combined allowable load in to s. NR 106.11 does not have to be based on the effluent flow rates specified in s. NR 106.06 (4)(d).

(3) Except as provided in sub. (4), effluent limitations based on acute toxicity criteria or secondary acute values shall be expressed in permits as daily maximum limitations; effluent limitations based on aquatic life chronic toxicity criteria or secondary chronic values shall be expressed in permits as weekly average limitations; and effluent limitations based on wildlife, human threshold or human cancer criteria, or secondary values shall be expressed in permits as monthly average limitations.

(4) If, for a substance, the monitoring frequency determined according to sub. (1) is insufficient to allow calculation of a weekly average, then the water quality based effluent limitation for that substance based on aquatic life chronic toxicity criteria or secondary chronic values may be established in a permit as a daily maximum limitation. If, for a substance, the monitoring frequency determined according to sub. (1) is insufficient to allow calculation of a monthly average, then the water quality based effluent limitation for that substance may be established in a permit as a daily maximum limitation.

(5) If application of sub. (4) results in multiple daily maximum limitations for a substance, the most stringent of the daily maximum, limitations for that substance shall be established in the permit as the limitation.

(6) When the water quality based effluent limitation for any substance in a permit is less than the limit of detection or the limit of quantitation, the following conditions shall apply:

(a) The permittee shall perform monitoring required in the permit using an acceptable analytical methodology for that substance in the effluent which produces the lowest limit of detection and limit of quantitation.

(b) The permittee shall determine the limit of detection and limit of quantitation using a method specified by the department.

(c) Compliance with concentration and mass limitations shall be determined as follows:

1. When the water quality based effluent limitation is less than the limit of detection, effluent levels less than the limit of detection are in compliance with the effluent limitation.

2. When the water quality based effluent limitation is less than the limit of detection, effluent levels greater than the limit of detection, but less than the limit of quantitation are in compliance with the effluent limitation except when analytically confirmed and statistically confirmed by a sufficient number of analyses of multiple samples and use of appropriate statistical techniques. The department may require in a permit additional monitoring when effluent levels are between the limit of detection and the limit of quantitation.

3. When the water quality based effluent limitation is greater than the limit of detection, but less than the limit of quantitation effluent levels less than the limit of detection or less than the limit of quantitation are in compliance with the effluent limitation.

(d) When the water quality based effluent limitation is expressed in the permit as a daily maximum or average mass limitation, compliance is determined according to par. (c) after converting the limit of detection and limit of quantitation to mass values using appropriate conversion factors and the actual daily effluent flow, or actual average effluent flow for the averaging period.

(e) Except as provided in this paragraph, when calculating an average or mass discharge level for determining compliance with an effluent limitation according to the provisions of par. (c), a monitoring result less than the limit of detection may be assigned a value of zero. If the effluent limitation is less than the limit of detection, the department may substitute a value other than zero for results less than the limit of detection, after considering the number of monitoring results that are greater than the limit of detection and if warranted when applying appropriate statistical techniques.

(f) Unless the permittee can demonstrate continuous compliance with the limit, the department shall include a condition in the permit requiring the permittee to develop and implement or update and implement a cost–effective pollutant minimization program as specified in s. NR 106.04(5).

(7) The department may establish a whole effluent toxicity limitation according to s. NR 106.09 as an alternative to a chemical specific water quality–based effluent limitation based on a fish and aquatic life secondary acute or secondary chronic value determined according to ss. NR 105.05(4) and 105.06(6). The alternative whole effluent toxicity limitation shall meet all the following conditions:

(a) The fathead minnow *(Pimephales promelas)* or the cladoceran *Ceridaphnia dubia* were represented in the toxicological database used to generate the secondary value:

(b) The permittee has requested the alternative whole effluent toxicity limitation; and

(c) Whole effluent toxicity testing required in the permit shall be conducted at a frequency to be determined by the department, but at least once every 3 months during the entire term of the permit.

(8) If the effluent limitation based on a secondary value is established in a permit, the permittee may request that additional time be added to the compliance schedule, according to s. NR 106.17(2), for the permittee to conduct studies, other than studies for site–specific criteria pursuant to s. NR 105.02 (1), that are needed to propose a revision to the secondary value upon which the effluent limitation is based. During this time, the permittee may provide additional data necessary to either refine the secondary value or calculate a water quality criterion.

(9) In addition to the mass limitation calculated under sub. (2)(c), for a discharger subject to ch. NR 210 and which discharges on a year–around basis, the department shall include in the permit an alternative wet weather mass limitation. For purposes of compliance, this alternative wet weather mass limitation shall apply when the mass discharge level exceeds the mass limitation calculated under sub. (2)(c) and when the permittee demonstrates to the satisfaction of the department that the discharge exceedance is caused by and occurs during a wet weather event. For purposes of this subsection, a wet weather event occurs during and immediately following periods of precipitation or snowmelt, including but not limited to rain, sleet, snow, hail or melting snow, during which water from the precipitation, snowmelt or elevated groundwater enters the sewerage system through infiltration or inflow, or both. In calculating this alternative wet weather mass limitation, the department shall use the concentration limit determined by the procedures in s. NR 106.06, the appropriate conversion factor and the appropriate effluent flow given in either par. (a) or (b).

(a) For effluent limitations based on aquatic life chronic toxicity criteria or secondary chronic values, the maximum effluent flow, expressed as a daily average, that is anticipated to occur for 7 continuous days during the design life of the treatment facility.

(b) For effluent limitations based on wildlife, human threshold or human cancer criteria or secondary values, or taste and odor criteria, the maximum effluent flow, expressed as a daily average, that is anticipated to occur for 30 continuous days during the design life of the treatment facility.

History: Cr. Register, February, 1989, No. 398, eff. 3–1–89; renum. (2) to (5) to be (3) to (6) and am., cr. (2), (6) (d) to (f) and (7) to (9), Register, August, 1997, No. 500, eff. 9–1–97; **correction in (7) made under s. 13.93 (2m) (b) 1., Stats., Register, October, 1999, No. 526.**

NR 106.08 Determination of the necessity for whole effluent toxicity testing requirements and limitations.

(1) GENERAL. The department shall establish whole effluent toxicity testing requirements and limitations whenever necessary to meet applicable water quality standards as specified in chs. NR

102 to 105 as measured by exposure of aquatic organisms to an effluent and specified effluent dilutions. When considering the necessity for whole effluent toxicity testing requirements and limitations, the department shall consider in–stream biosurvey data and data from ambient toxicity analyses, whenever such data are available.

(2) DETERMINATION OF NECESSITY. If representative discharge data are available for an effluent being discharged from a point source, whole effluent toxicity testing requirements are necessary when:

(a) Existing aquatic life toxicity test data generated according to standard test protocols indicate a potential for an effluent from a point source discharge to adversely impact the receiving water aquatic life community.

(b) A water quality based effluent limitation for a toxic substance is determined necessary in s. NR 106.05.

(3) NO REPRESENTATIVE DATA. If no representative discharge data are available for an effluent being discharged from a point source, whole effluent toxicity testing requirements are necessary if, in the judgment of the department, water quality standards may be exceeded. In such cases, the following factors shall be considered.

(a) Any relevant information which is available that indicates a potential for an effluent to impact the receiving water aquatic life community.

(b) Available dilution in the receiving water.

(c) Discharge category and predicted effluent quality.

(d) Proximity to other point source dischargers.

(4) OTHER CONSIDERATIONS. Regardless of the results of the analysis conducted under this section, the department may, whenever determined necessary, require whole effluent toxicity testing for a point source discharge. The department may use information submitted under s. 166.20 (5) (a) 3. and 4., Stats., together with other information, in determining when whole effluent toxicity testing is necessary.

(5) REASONABLE POTENTIAL TO RECEIVE AN ACUTE OR CHRONIC WHOLE EFFLUENT TOXICITY LIMIT. (a)*General.* Whole effluent toxicity limits are established in a permit according to s. NR 106.09 whenever representative, facility–specific whole effluent toxicity data demonstrate that the effluent is or may be discharged at a level that will cause, have the potential to cause, or contribute to an excursion of a water quality standard. In evaluating the potential of a water quality standard to be exceeded, a reasonable potential factor (RPF) shall be calculated for a discharger with 5 or more representative toxicity tests according to par. (b). Whole effluent toxicity limits shall be imposed in a WPDES permit whenever the RPF calculated according to par. (b) exceeds 0.3. Whole effluent toxicity limits may be imposed, on a case–by–case basis, whenever facility–specific whole effluent toxicity test data indicate toxicity to aquatic life as determined in s. NR 106.09. Whole effluent toxicity limits may also be imposed in the absence of facility–specific whole effluent toxicity test data, on a case–by–case basis, whenever facility–specific or site–specific data or conditions indicate toxicity to aquatic life that is attributable to the discharger.

(b) *Reasonable potential factor.* The percentage of failures and the severity of those failures for the most sensitive species shall be used to determine when a whole effluent toxicity limit is established in a permit.

1. When a zone of initial dilution has not been approved by the department, a RPF for acute toxicity shall be calculated as follows for toxicity test data with a calculated LC_{50}:

RPF = Geometric Mean TU_a x Failure Rate

Where: Failure Rate = (Representative Tests Failed/ Representative Tests Conducted)

2. When a zone of initial dilution has not been approved by the department, a RPF for acute toxicity shall be calculated as follows for toxicity test data without a calculated LC_{50}:

RPF = Geometric Mean S x Failure Rate

Where: $S = (50 \div X)^{1/2}$

Where: X = 50 if the percent survival in 100% effluent is greater than or equal to 50%,
X =5 if the percent survival in 100% effluent is less than or equal to 5%,
X = the percent survival in 100% effluent when the percent survival is less than 50% and greater than 5%.

Failure Rate = (Representative Tests Failed/ Representative Tests Conducted)

3. When a zone of initial dilution has been approved by the department, according to s. NR 106.06(3)(c), a RPF for acute toxicity shall be calculated as follows:

RPF = Failure Rate

Where: Failure Rate = (Representative Tests Failed/ Representative Tests Conducted)

4. The RPF for chronic toxicity shall be calculated as follows:

RPF = Geometric Mean of rTU_c values x Failure Rate

Where: $rTU_c = IWC/IC_{25}$

If an IC_{25} is not available for a given toxicity test, a NOEC value may be used.

Failure Rate = (Representative Tests Failed/ Representative Tests Conducted)

(c) *Representative data.* Toxicity test data available to the department shall be considered representative when those data meet the following conditions:

1. Data are representative of normal discharge conditions;

2. Data were produced by a lab certified or registered under ch. NR 149;

3. Data were produced from toxicity test procedures specified in the WPDES permit;

4. Data were produced from toxicity tests that met all applicable quality assurance/quality control requirements specified in the WPDES permit; and

5. Data represent the geometric mean of all whole effluent toxicity test failures for the most sensitive species.

(d) *Use of other data when determining reasonable potential.* Data from toxicity tests not required in a WPDES permit and other empirical data may be considered when making judgments regarding reasonable potential. This may include data from split samples, toxicity testing evaluations, screening tests, single species tests and other information.

History: Cr. Register, February, 1989, No. 398, eff. 3–1–89; am. (1), r. and recr. (5), Register, August, 1997, No. 500, eff. 9–1–97.

NR 106.09 Whole effluent toxicity data evaluation and limitations. (1) DATA EVALUATION. Data evaluation procedures are specified in the "State of Wisconsin Aquatic Life Toxicity Testing Methods Manual, 1st Edition", Wisconsin Department of Natural Resources, 1996. The "Aquatic Life Testing Methods Manual, 1st Edition" (1996) is incorporated by reference. In the event of a WET test failure, facility specific requirements shall be

established in the WPDES permit which specify required follow–up actions.

Note: This publication is available at the office of the department of natural resources, the secretary of state and the revisor of statutes. Copies are available from the Department of Natural Resources, Bureau of Integrated Science Services, P.O. Box 7921, Madison, WI 53707

(2) ACUTE WHOLE EFFLUENT TOXICITY. (a) Except as provided in par. (c), the department shall establish acute whole effluent toxicity limitations to ensure that substances shall not be present in amounts which are acutely harmful to aquatic life in all surface waters including the mixing zone and effluent channel as required by s. NR 102.04(1).

(b) To assure compliance with par. (a), a whole effluent toxicity test, may not produce a statistically valid LC_{50} less than 100% with the following taxa–specific exposure periods:

1. 48 hours for aquatic invertebrate organisms (including *Ceriodaphnia dubia)*;

2. 96 hours for aquatic vertebrate organisms (including fathead minnows (*Pimephales promelas*));

3. Any other exposure period deemed appropriate by the department for a specific test organism.

(c) If a zone of initial dilution is determined appropriate in accordance with the provisions of s. NR 106.06(3)(c), whole effluent acute toxicity limitations determined by this subsection shall be adjusted such that the effluent meets the following condition. The adjustment shall insure that after dilution of the effluent with the receiving water at a concentration equal to 3.3 times the percent dilution value calculated through application of the zone of initial dilution, the test solution of effluent and receiving water shall not produce a statistically valid LC_{50} less than 3.3 times the percent dilution value determined through application of the zone of initial dilution with the exposure periods as provided in par. (b).

(d) If, in the judgment of the department, the statistical interpretation methods used to test for LC_{50} are not appropriate for a specific data set, empirical interpretation methods may be used to determine the significance of an effect.

(e) Compliance with an acute whole effluent toxicity water quality based limitation shall be determined as follows:

1. For dischargers without an approved zone of initial dilution, a TU_a of 1.0 may not be exceeded.

2. For dischargers with an approved zone of initial dilution determined according to s. NR 106.06(3)(c), a TU_a of X may not be exceeded.

Where: $X = 100 \div (3.3 \times \text{Dilution Factor})$

Dilution Factor = The Approved Zone of Initial Dilution Concentration

(3) CHRONIC WHOLE EFFLUENT TOXICITY. (a) The department shall establish chronic whole effluent toxicity limitations to ensure that concentrations of substances are not discharged from a point source that alone or in combination with other materials present are toxic to fish or other aquatic life as required by s. NR 102.04 (4) (d).

(b) To assure compliance with par. (a), an effluent, after dilution with an appropriate allowable quantity of receiving water flow equivalent to that provided by receiving water flows specified in s. NR 106.06 (4) (c) or implied in s. NR 106.06 (4) (b) 2., may not cause a significant adverse effect, as determined by subds. 1. and 2., to a test organism population when compared to an appropriate control.

1. Using statistical interpretation methods appropriate to the toxicity test protocol, an adverse effect will be determined to be significant if the statistically derived IC_{25}, from the whole effluent toxicity test, is less than the calculated IWC.

2. If, in the judgment of the department, the statistical interpretation methods used to test for significance are not appropriate for a specific data set, empirical interpretation methods may be used to determine the significance of an effect.

(c) Compliance with a chronic whole effluent toxicity water quality based limitation shall be determined as a calculated rTU_c less than or equal to 1.0.

History: Cr. Register, February, 1989, No. 398, eff. 3–1–89; renum. (1) (a), (b), (c) (intro.) and 2. and (2) to be (2) (a) to (c) and (3) and am. (2) (b), (c), (3) (a), (b) (intro.) and 1., r. (1) (c) 1., cr. (1), Register, August, 1997, No. 500, eff. 9–1–96.

NR 106.10 Exclusions. (1) NONCONTACT COOLING WATER. Except as provided in sub. (2), the department may not impose water quality based effluent limitations for toxic and organoleptic substances for discharges of uncontaminated stormwater runoff not defined as point sources by s. 283.01 (12), Stats., noncontact cooling waters which do not contain additives or combined discharges consisting solely of uncontaminated stormwater runoff and noncontact cooling water without additives. Only the additives to noncontact cooling waters shall be examined under this chapter for the establishment of water quality based effluent limitations. For purposes of this exclusion, the term "additives" are those compounds intentionally introduced by the discharger, but do not include the addition of compounds at a rate and quantity necessary to provide a safe drinking water supply, or the addition of substances in similar type and amount to those substances typically added to a public drinking water supply. The following may be used to establish water quality based effluent limitations for noncontact cooling waters:

(a) If at least one 48–hour LC_{50} or EC_{50} value is available for *Daphnia magna* or *Certodaphnia dubia* and at least one 96–hour LC_{50} or EC_{50} value is available for either fathead minnow, rainbow trout or bluegill, the geometric mean LC_{50} or EC_{50} for each of these species shall be divided by 5 if rainbow trout are represented in the data base or divided by 10 if rainbow trout are not represented in the data base. The limitation for purposes of this section shall be equal to the lowest resultant value. A limitation can be calculated for an additive only if both LC_{50} and EC_{50} data for at least one of the invertebrate species and at least one of the fish species listed above are available.

(b) Effluent limitations based on chronic toxicity to aquatic life shall be established using the procedures described in this paragraph for additives whenever chronic toxicity criteria are not available from s. NR 105.06. The calculation of limitations shall be in accordance with the requirements of s. NR 106.06 (4) (b). In this calculation, the water quality criterion concentration shall be equal to the final acute value for that additive as provided in s. NR 105.05, or the effluent limitation as determined in par. (a), divided by the geometric mean of all the vertebrate and invertebrate species mean acute–chronic ratios determined in accordance with s. NR 105.06 (5) for that additive. A water quality criterion concentration may be calculated for an additive only if a final acute value, as provided in s. NR 105.05 or an effluent limitation as determined in par. (a), and an acute–chronic ratio for a vertebrate species and an acute–chronic ratio for an invertebrate species are available.

(c) Groundwater which is withdrawn from a location because of noncompliance with the standards contained in ch. NR 140 and which is used as noncontact cooling water shall not be subject to this exclusion.

(d) Regardless of the results of the analysis conducted under this section, the department may, whenever determined necessary, require whole effluent toxicity testing for a point source discharge.

(2) INTERMITTENT DISCHARGES. Effluent limitations derived as specified in s. NR 106.06 (3) and (4) for substances which rapidly degrade and which are discharged for less than 24 hours per day shall be calculated as specified in those subsections, unless the discharger demonstrates to the department that, as a result of the

duration and frequency of the discharge, adverse effects will not occur when limitations are increased.

History: Cr. Register, February, 1989, No. 398, eff. 3–1–89; am. (1) (a), (b) and (2), cr. (1) (d), August, 1997, No. 500, eff. 9–1–97.

NR 106.11 Multiple discharges. Whenever the department determines that more than one discharge may be affecting the water quality of the same receiving water for one or more substances, the provisions of this chapter shall be used to calculate the combined allowable load from the discharges necessary to meet the water quality criteria for the substances. The resultant combined allowable load shall be divided among the various discharges using an allocation method based on site–specific considerations. Whenever the department makes a determination under this section, the department shall notify all permittees who may be affecting the water quality of the same receiving water of the determination and any limitations developed under this section. Permittees shall be given the opportunity to comment to the department on any determination made under this section.

History: Cr. Register, February, 1989, No. 398, eff. 3–1–89; am. Register, August, 1997, No. 500, eff. 9–1–97.

NR 106.12 Limitations for ammonia nitrogen. Regardless of any other requirement of this chapter, the department shall establish, on a case–by–case basis, water quality based effluent limitations for discharges of ammonia nitrogen. The criteria and limitations established in s. NR 104.02(3)(a) 2. b. and 3. a. for discharges to surface waters not supporting a balanced aquatic community shall apply.

History: Cr. Register, February, 1989, No. 398, eff. 3–1–89

NR 106.13 Leachate in publicly owned treatment works. Publicly owned treatment works subject to ch. NR 210 may demonstrate to the department that leachate from a licensed solid waste facility materially affects the quality of effluent from that treatment works and affects the capability of the treatment works to meet the effluent limitations established under this chapter. If the department determines that a proper demonstration has been made, the department shall, within its capabilities, provide reasonable assistance to the owner of the treatment works and establish an appropriate schedule of compliance.

History: Cr. Register, February, 1989, No. 398, eff. 3–1–89.

NR 106.14 Analytical methods and laboratory requirements. (1) Methods used for analysis of samples shall be those specified in ch. NR 219 unless alternative methods are specified in the WPDES discharge permits. Where more than one approved analytical method for a pollutant exists, the department may specify in the permit which method shall be used.

(2) The permittee shall submit, with all monitoring results, appropriate quality control information, as specified by the department.

(3) The permittee shall report numerical values for all monitoring results greater than the limit of detection, as determined by a method specified by the department, unless analyte–specific instructions in the WPDES permit specify otherwise. The permittee shall appropriately identify all results greater than the limit of detection but less than the limit of quantitation.

History: Cr. Register, February, 1989, No. 398, eff. 3–1–89; renum. NR 106.14 to be (1), cr. (2) and (3), Register, August, 1997, No. 500, eff. 9–1–97.

NR 106.15 Limitations for mercury. Regardless of the effluent limitations determined under this chapter, the discharge of organic mercury compounds, inorganic mercury compounds, and metallic mercury shall not exceed the requirements in s. 281.17 (7), Stats., and ch. NR 100.

History: Cr. Register, February, 1989, No. 398, eff. 3–1–89.

NR 106.16 Additivity of dioxins and furans. The 2,3,7,8–TCDD toxicity equivalence concentration in effluent shall be used when developing waste load allocations and for purposes of establishing water quality based effluent limits.

(1) For the chlorinated dibenzo–p–dioxins (CDDs) listed in Tables 7, 8 and 9 in ch. NR 105, the potential adverse additive effects of all dioxin (CDD) and chlorinated dibenzofuran (CDF) congeners in effluents shall be accounted for as specified in this section.

(2) The Toxicity Equivalency Factors (TEFs) in Table 1 and Bioaccumulation Equivalency Factors (BEFs) in Table 2 shall be used when calculating a 2,3,7,8–TCDD toxicity equivalence concentration in effluent to be used when implementing both human health noncancer and cancer criteria. The chemical concentration of each CDD and CDF in effluent shall be converted to a 2,3,7,8–TCDD toxicity equivalence concentration in effluent by using the following equation:

$$(TEC)_{tcdd} = \Sigma\, (C)_x\, (TEF)_x\, (BEF)_x$$

where:

$(TEC)_{tcdd}$ = ,3,7,8–TCDD toxicity equivalence concentration in effluent

$(C)_x$ = concentration of total chemical x in effluent

$(TEF)_x$ = TCDD toxicity equivalency factor for x from table 1

$(BEF)_x$ = TCDD bioaccumulation equivalency factor for x from table 2

Table 1

Toxicity Equivalency Factors for CDDS and CDFs

Congener	TEF
2,3,7,8–TCDD	1.0
1,2,3,7,8–PeCDD	0.5
1,2,3,4,7,8–HxCDD	0.1
1,2,3,6,7,8–HxCDD	0.1
1,2,3,7,8,9–HxCDD	0.1
1,2,3,4,6,7,8–HpCDD	0.01
OCDD	0.001
2,3,7,8–TCDF	0.1
1,2,3,7,8–PeCDF	0.05
2,3,4,7,8–PeCDF	0.5
1,2,3,4,7,8–HxCDF	0.1
1,2,3,6,7,8–HxCDF	0.1
2,3,4,6,7,8–HxCDF	0.1
1,2,3,7,8,9–HxCDF	0.1
1,2,3,4,6,7,8–HpCDF	0.01
1,2,3,4,7,8,9–HpCDF	0.01
OCDF	0.001

Table 2

Bioaccumulation Equivalency Factors for CDDs and CDFs

Congener	BEF
2,3,7,8–TCDD	1.0
1,2,3,7,8–PeCDD	0.9
1,2,3,4,7,8–HxCDD	0.3
1,2,3,6,7,8–HxCDD	0.1
1,2,3,7,8,9–HxCDD	0.1
1,2,3,4,6,7,8–HpCDD	0.05
OCDD	0.01

2,3,7,8–TCDF	0.8
1,2,3,7,8–PeCDF	0.2
2,3,4,7,8–PeCDF	1.6
1,2,3,4,7,8–HxCDF	0.08
1,2,3,6,7,8–HxCDF	0.2
2,3,4,6,7,8–HxCDF	0.7
1,2,3,7,8,9–HxCDF	0.6
1,2,3,4,6,7,8–HpCDF	0.01
1,2,3,4,7,8,9–HpCDF	0.4
OCDF	0.02

History: Cr., Register, August, 1997, No. 500, eff. 9–1–97.

NR 106.17 Schedules for compliance. (1) Any point source which has not received a WPDES permit from the department prior to March 23, 1997 or which commenced construction after that date may not receive a schedule for compliance to meet an effluent limitation that is established under the provisions of this chapter. The department may allow a brief period, not to exceed 90 days from the beginning of discharge, for the discharger to correct pollution control equipment start–up problems.

(2) A reissued or modified permit may include a schedule for compliance with new or more stringent effluent limitations that are established by this chapter. The schedule for compliance shall meet the following conditions:

(a) Be as short as reasonably possible;

(b) May not extend beyond 5 years from the date that the permit is reissued or modified to include the new or more stringent effluent limitation, except as provided in par. (c);

(c) If the effluent limitation is based on a secondary value, the compliance schedule may allow the permittee additional time to conduct studies, other than those for site–specific criteria developed under s. NR 105.02 (1), that are needed to propose a revision to the secondary value upon which the effluent limitation is based. In no case may the compliance schedule for an effluent limitation that is based on a secondary value extend beyond 7 years from the date that the permit is reissued or modified to include the effluent limitation;

(d) May not allow more than one year between interim compliance dates;

(e) May require the permittee to evaluate pollution and waste minimization measures as a means for complying with the effluent limitation; and

(f) May extend beyond the expiration date of the permit if an interim permit limit which is effective upon the permit's expiration date is included in the permit.

Note: An interim permit limit is not necessarily a numerical effluent limitation.
History: Cr., Register, August, 1997, No. 500, eff. 9–1–97.