Substance	V	ln CCI	50	100	200
Total Recoverable Copper:					
Great Lakes	0.9422	-1.8956	5.99	11.51	22.12
Cold Water	0.9422	-1.8956	5.99	11.51	22.12
Warm Water Sportfish	0.9422	-1.8956	5.99	11.51	22.12
All Others	0.9422	-1.8956	5.99	11.51	22.12
Total Recoverable Lead:					
Great Lakes	1.273	-3.5511	4.17	10.09	24.38
Cold Water	1.273	-3.5511	4.17	10.09	24.38
Warm Water Sportfish	1.273	-3.5511	4.17	10.09	24.38
All Others	1.273	-3.5511	4.17	10.09	24.38
Total Recoverable Nickel:					
Great Lakes	0.846	0.2956	36.79	66.13	118.9
Cold Water	0.846	0.2956	36.79	66.13	118.9
Warm Water Sportfish	0.846	0.2956	36.79	66.13	118.9
All Others	0.846	0.2956	36.79	66.13	118.9
Total Recoverable Silver:					
Great Lakes	1.169	-4.6949	0.885	1.99	4.48
Cold Water	1.169	-4.6949	0.885	1.99	4.48
Warm Water Sportfish	1.169	-4.6949	0.885	1.99	4.48
All Others	1.169	-4.6949	0.885	1.99	4.48
Total Recoverable Zinc:					
Great Lakes	0.8473	0.0019	27.57	49.59	89.23
Cold Water	0.8473	0.0019	27.57	49.59	89.23
Warm Water Sportfish	0.8473	0.0019	27.57	49.59	89.23
All Others	0.8473	0.0019	27.57	49.59	89.23

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:					
Great Lakes	1.005	-4.9779	4.73	17.48	47.8
Cold Water	1.005	-4.9779	4.73	17.48	47.8
Warm Water Sportfish	1.005	-4.9779	4.73	17.48	47.8
All Others	1.005	-4.9779	4.73	17.48	47.8

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

NR 105.07 Wild and domestic animal criterion. (1) The wild and domestic animal criterion is the concentration of a substance which if not exceeded protects Wisconsin's wild and domestic animals 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 wild and domestic animal criterion (WDAC) is the lowest species wild and domestic animal value (WDAV) calculated pursuant to sub. (2).

(b) Table 7 contains the wild and domestic animal criteria calculated according to the procedures of this chapter.

Table 7
Wild and Domestic Animal Criteria

Substance	Criteria (all in ng/L)
DDT & Metabolites	0.15
Mercury	2.0
Polychlorinated Biphenyls	3.0*

*For purposes of regulating the discharge of PCB under ch. NR 106 the WDAC shall apply according to the specific Aroclor criteria given below.

Aroclor 1248, 1254, 1260	3.0 ng/L
Aroclor 1221, 1232, 1242	47.0 ng/L
Aroclor 1016	233.0 ng/L

If a discharge contains more than one Aroclor mixture or if the Aroclor mixture in the discharge is unknown, the discharge will be regulated based on the most toxic Aroclor mixture. In determining for a discharge the Aroclor mixture present or the predominant Aroclor mixture, when more than one Aroclor is present, the department may take into account factors such as: source of the PCB Aroclor or Aroclor mixture, historical information, amount of quantitative chemical information, quality of available data, and variability of the data.

(2) (a) The species wild and domestic animal value 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:

$$WDAV = \frac{NOAEL \times Wt_A \times SSF}{W_A + [F_A \times BAF]}$$

Where:

$WDAV$ = Wild and domestic animal 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 mammalian or avian studies or as specified in subs. (3) to (5).

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

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

SSF = An uncertainty factor ranging between 0.01 and 1 to account for differences in species sensitivity.

F_A = Average daily amount of food consumed by the test animals in kilograms (kg/d) or as specified in sub. (6).

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

(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 in question.

(c) A species WDAV is calculated as the geometric mean of the WDAVs if more than one WDAV is available for a species.

(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 wild and domestic animal 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) For those substances for which a NOAEL or LOAEL is not available for any species but an LD_{50} has been derived from studies of animal species exposed to the substance via oral routes including gavage, a NOAEL may be estimated using and LD_{50} value and an appropriate ratio relating acute to chronic effects considering the physicochemical and toxicokinetic properties of the substance.

(6) If drinking or feeding rates are not given in the study or studies from which a WDAV is being calculated, drinking (W_A) and feeding rates (F_A) shall be calculated for laboratory rodents as specified in par. (a) and for other mammalian or avian species by using the allometric equations given in pars. (b) and (c).

(a) For studies done with laboratory rats or mice the following reference shall be consulted: National Institute for Occupational Safety and Health, 1980, Registry of Toxic Effects of Chemical Substances.

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

1. $F_A = 0.0687 \times (Wt_A)^{0.82}$

Where: F_A = Feeding rate of mammalian species in kilograms per day (kg/d).

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

2. $W_A = 0.099 \times (Wt_A)^{0.90}$

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

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

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

1. $F_A = 0.0582\ (Wt_A)^{0.65}$

Where: F_A = Feeding rate of avian species in kilograms per day (kg/d).

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

2. $W_A = 0.059 \times (Wt_A)^{0.67}$

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

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

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

NR 105.08 Human threshold criterion. (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) Human threshold criteria are listed in Table 8.

(3) 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:

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

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

ADI = Acceptable daily intake in milligrams toxicant per kilogram body weight per day (mg/kg-d) as specified in sub. (4).

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

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

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

2. When deriving an acceptable daily intake 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 intakes derived from studies using alternate exposure routes, such as inhalation, may be used.

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

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

NR 105.09 Human cancer criterion. (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 (7).

(2) For any single carcinogen or any mixture of carcinogens the incrmental 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.

(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:

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

Substance	Public Water Supply			Non-public Water Supply		
	Warm Water Sport Fish Communities	Cold Water Communities	Great Lakes Communities	Warm Water Sport Fish Communities	Cold Water Communities	Warm Water Forage and Limited Forage Fish Communities and Limited Aquatic Life
Acrylonitrile	0.56	0.44	0.44	4.7	1.4	130
Aldrin (ng/L)	0.54	0.17	0.17	0.57	0.17	6100
Arsenic[2]	50	50	50	50	50	50
alpha-BHC	0.07	0.033	0.034	0.15	0.045	26
beta-BHC	0.12	0.059	0.06	0.27	0.079	46
gamma-BHC (lindane)	0.14	0.067	0.068	0.3	0.09	53
BHC, technical grade	0.094	0.044	0.045	0.2	0.06	35
Benzene[3]	5	5	5	140	45	1300
Benzidine (ng/L)	1.1	0.64	0.65	3.8	1.1	300
Benzo(a)pyrene	0.023	0.023	0.023	0.1	0.1	6.1
Beryllium	0.033	0.033	0.033	0.2	0.2	7.9
Bis(2-chloroethyl) ether	0.3	0.28	0.28	8.8	2.9	61
Bis(chloromethyl) ether (ng/L)	0.037	0.037	0.037	3.4	1.5	7.5
Carbon tetrachloride	2.5	2.1	2.1	31	10	540
Chlordane (ng/L)	4.3	1.3	1.3	4.4	1.3	54000
Chloroethene (vinyl chloride)	0.15	0.15	0.15	10	3.7	30
Chloroform(trichloromethane)	1.9	1.8	1.8	87	31	380
4,4'-DDT (ng/L)	0.14	0.042	0.043	0.14	0.042	8300
1,4-Dichlorobenzene	15	11	11	100	30	3500
3,3'-Dichlorobenzidine	0.09	0.038	0.039	0.16	0.047	41
1,2-Dichloroethane	3.8	3.7	3.7	370	170	760
1,1-Dichloroethene	2.3	2.1	2.1	48	15	480
Dichloromethane (methylene chloride)	48	47	47	3600	1400	9600
Dieldrin (ng/L)	0.54	0.17	0.17	0.57	0.17	2300
2,4-Dinitrotoluene	9.2	8.6	8.6	260	85	1900
1,2-Diphenylhydrazine	0.39	0.28	0.28	2.4	0.74	91
Halomethanes[4]	1.9	1.8	1.8	87	31	380
Heptachlor (ng/L)	1.4	0.41	0.42	1.4	0.42	16000
Hexachlorobenzene (ng/L)	5.3	1.6	1.6	5.5	1.6	41000
Hexachlorobutadiene	4.4	4.2	4.2	160	53	900
Hexachloroethane	18	11	11	65	19	4900
N-Nitrosodiethylamine (ng/L)	8	8	8	1100	670	1600
N-Nitrosodimethylamine	0.013	0.013	0.013	1.8	1	2.7
N-Nitrosodi-n-butylamine	0.063	0.059	0.059	1.9	0.64	13
N-Nitrosodiphenylamine	45	24	24	120	36	14000
N-Nitrosopyrrolidine	0.16	0.16	0.16	29	23	33
Polychlorinated biphenyls (ng/L)[5]	0.49	0.14	0.15	0.49	0.15	16000
Polynuclear Aromatic Hydrocarbons[6]	0.023	0.023	0.023	0.1	0.1	6.1
2,3,7,8-Tetrachloro-dibenzo-p-dioxin (pg/L)	0.097	0.03	0.03	0.1	0.03	450
1,1,2,2-Tetrachloroethane	1.7	1.6	1.6	64	22	350
Tetrachloroethene	5.8	4.6	4.6	49	15	1300
Toxaphene (ng/L)	5.6	1.7	1.7	5.7	1.7	62000
1,1,2-Trichloroethane	5.8	5.3	5.3	140	46	1200
Trichloroethene[3]	5	5	5	360	110	3600
2,4,6-Trichlorophenol	9	4.1	4.2	18	5.4	3600

[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] Human cancer criteria for arsenic equal the maximum contaminant level.

[3] 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).

[4] 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).

[5] For purposes of regulating the discharge of polychlorinated biphenyls (PCB) under ch. NR 106, the human cancer criteria for PCB shall apply only to Aroclors 1254 and 1260. In determining for a discharge the Aroclor mixture present or the predominant Aroclor mixture, when more than one Aroclor is present, the department may take into account factors such as: source of the PCB Aroclor or Aroclor mixture, historical information, amount of quantitative chemical information, quality of available data, and variability of the data. If a discharge contains more than one Aroclor mixture or if the Aroclor mixture in the discharge is unknown, the discharge will be regulated based on the most toxic Aroclor mixture.

[6] Human cancer criteria for polynuclear aromatic hydrocarbons are applicable to any combination of the following chemicals: benzo(a)anthracene (1,2-benzanthracene), benzo(b)fluoranthene (3,4-benzofluoranthene), benzo(g,h,i)perylene (1,12-benzoperylene), benzo(k)fluoranthene (11,12-benzofluoranthene), chrysene, dibenzo(a,h)anthracene (1,2,5,6-dibenzanthracene), indeno(1,2,3-cd)pyrene, phenanthrene and pyrene.

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

Where:

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

RAI = Risk associated intake 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 109 or the July 8, 1987 Federal Register (52 FR 25690), the MCL shall be used as the human cancer criterion.

(5) The risk associated intake (RAI) 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 intake 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 intake 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 intake 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 intake derived from the studies is generally used to calculate the human cancer criterion. If the risk associated intake 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 intake shall be derived from available studies which use mammalian test species and which are judged acceptable. Methods for deriving the risk associated intake 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 percent 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 intake shall be calculated using the following equation:

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

Where:

RAI = Risk associated intake 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.

(6) For informational purposes, the department shall maintain a comprehensive list of known or suspected human carcinogens. This list shall be updated at least yearly. Whenever the National Toxicology Program or the International Agency for Research on Cancer determines that Aroclors of PCB other than those in footnote 5 of Table 9 are carcinogens, the department shall enact amendments to this section under s. 227.24, Stats., (emergency rule) to regulate those additional Aroclors as human carcinogens under this section.

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

NR 105.10 Bioaccumulation factor. (1) The bioaccumulation factor used to derive wild and domestic animal, human threshold, human cancer and taste and odor criteria is determined as specified in pars. (a) to (d):

(a) Bioaccumulation factors shall be calculated from field data if the following conditions are met:

1. Data are available to show that the concentration of the substance in the water to which the aquatic organism was exposed remained reasonably constant over the range of territory inhabited by the organism long enough for the concentration of the substance in the aquatic organism to reach a steady state.

2. Competing mechanisms for removal of the substance from solution did not markedly affect the bioavailability of the substance.

3. The concentration of the substance to which the organism was exposed is less than the lowest concentration causing any adverse effects on the organism.

(b) Bioaccumulation factors shall be derived from laboratory tests by setting the bioaccumulation factor equal to the bioconcentration factor if the following conditions are met:

1. The bioconcentration factor was calculated from measured concentrations of the substance in the test solution and of the substance and its metabolites in the test organism.

2. The laboratory test was of sufficient duration for the concentration of the substance in the aquatic organism to have reached a steady state. In the absence of a laboratory test of sufficient duration, the bioconcentration factor may be calculated from a laboratory test with a duration equal to or greater than 28 days or from the laboratory test with the longest duration greater than 28 days if more than one test is available for the same species.

3. The concentration of the substance to which the test organism was exposed was less than the lowest concentration causing any adverse effects in the organism.

4. If more than one bioconcentration factor for the same aquatic species is available, the geometric mean of the bioconcentration factors is used.

5. The bioconcentration factor was calculated on the basis of wet tissue weights. If bioconcentration factors based on wet tissue weights are not available, a bioconcentration factor calculated using dry tissue weights may be converted to a wet tissue weight basis by multiplying the dry weight bioconcentration factor by 0.1 for plankton and by 0.2 for individual species of fishes and invertebrates.

(c) In absence of any bioaccumulation factors derived from field data as specified in par. (a) or laboratory tests as specified in par. (b), the bioaccumulation factor for lipid-soluble substances shall equal the bioconcentration factor calculated as follows:

$$\log_{10} BCF = (0.79 \log_{10} K_{ow}) - 0.4$$

Where: $\log_{10}$ = Logarithm base 10.

BCF = Bioconcentration factor at approximately 6% lipids.

K_{ow} = The octanol/water partition coefficient which if not available from laboratory testing may be calculated from structure-activity relationships or available regression equations.

Note: The above equation may be inappropriate for a chemical with a molecular weight greater than 600 or a log K_{ow} greater than 6.5, or which is readily metabolized by fish.

(d) For lipid-soluble substances, bioaccumulation factors are assumed to be directly proportional to the percent lipids from one tissue to another and from one aquatic species to another.

(2) The bioaccumulation factors derived in sub. (1) shall be used to calculate water quality criteria for a substance as specified in pars. (a) and (b):

(a) To derive a wild and domestic animal criterion as described in s. NR 105.07, the geometric mean of all available whole body bioaccumulation factors (BAF) derived according to sub. (1) (a) or (b) for aquatic species shall be used. In addition, the geometric mean for all available plant bioaccumulation factors derived according to sub. (1) (a) or (b) for aquatic plants shall be calculated and compared to the geometric mean BAF derived for vertebrates and multicellular invertebrates. If the BAF calculated for plants is greater than the BAF calculated for vertebrates and multicellular invertebrates, the plant BAF shall be used. In the absence of any bioaccumulation factor measured from field studies as described in sub. (1) (a) or lab studies as specified in sub. (1) (b), the bioaccumulation factor for lipid-soluble substances may be calculated as specified in sub. (1) (c). Additional considerations in deriving bioaccumulation factors include:

1. For lipid-soluble substances, an edible portion bioaccumulation factor may be converted to a whole body bioaccumulation factor for a fish or shellfish species by multiplying the edible-portion bioaccumulation factor by the ratio of the percent lipid in the whole body to the percent lipid in the edible portion of the same species.

2. For lipid-soluble substances, a bioaccumulation factor calculated as described in sub. (1) (c) is assumed to be proportional to 6% lipids and may be converted to a whole body bioaccumulation factor by multiplying the calculated bioconcentration factor by the ratio of the percent lipid in the whole body to 6.

3. For inorganic substances, the bioaccumulation factor is set equal to the geometric mean of all available aquatic species whole body bioaccumulation factors.

(b) To derive a human threshold criterion or a human cancer criterion as described in ss. NR 105.08 and 105.09, respectively, or a taste and odor criterion as described in s. NR 102.14, the bioaccumulation factor is calculated as follows:

1. Preference shall be given to bioaccumulation factors derived from field data as specified in sub. (1) (a) over those derived from laboratory tests as specified in sub. (1) (b). Bioaccumulation factors derived from octanol/water partition coefficients as specified in sub. (1) (c) shall be used only if bioaccumulation factors derived from field data or laboratory tests are not available.

2. For lipid-soluble substances the bioaccumulation factor is calculated by multiplying the geometric mean of all available aquatic species bioaccumulation factors adjusted for percent lipids by either 1.3 for warm water sport fish communities, 4.4 for cold water communities, or 4.3 for great lakes communities. Bioaccumulation factors are adjusted for percent lipids by dividing the whole body or edible portion bioaccumulation factor of an aquatic species by the percent lipids in the whole or edible portion of the same species. A bioaccumulation factor calcu-

lated as described in sub. (1) (c) is adjusted for percent lipids by dividing the bioconcentration factor by 6.

3. For inorganic substances, the bioaccumulation factor is set equal to the geometric mean of all available aquatic species edible portion bioaccumulation factors. If edible portion bioaccumulation factors are not available, whole body bioaccumulation factors may be used.

4. For warm water forage, limited forage and limited aquatic life communities the bioaccumulation factor is set equal to zero.

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