

Chapter NR 109

SAFE DRINKING WATER

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NR 109.01 Purpose. The purpose of this chapter is to establish minimum standards and procedures for the protection of the public health, safety and welfare in the obtaining of safe drinking water. This chapter is adopted under the authority granted in chs. 144 and 162, Stats.

Note: See chs. NR 108, 111, 112 and 114 for other requirements pertaining to public and private drinking water systems.

History: Cr. Register, February, 1978, No. 266, eff. 3-1-78; am. Register, April, 1982, No. 316, eff. 5-1-82.

NR 109.03 Applicability. The provisions of this chapter shall apply to all new and existing public water systems as defined in this chapter.

History: Cr. Register, February, 1978, No. 266, eff. 3-1-78.

NR 109.04 Definitions. (1) "Best available technology" or "BAT" means the best technology treatment techniques, or other means which the U.S. environmental protection agency finds, after examination for efficacy under field conditions and not solely under laboratory conditions, are available, taking cost into consideration.

(2) "Coagulation" means a process using coagulant chemicals and mixing by which colloidal and suspended materials are destabilized and agglomerated into flocs.

(3) "Community water system" means a public water system which serves at least 15 service connections used by year-round residents or regularly serves at least 25 year-round residents. Any public water system serving 7 or more homes, 10 or more mobile homes, 10 or more apartment units, or 10 or more condominium units shall be considered a community water system unless information is available to indicate that 25 year-round residents will not be served.

(4) "Confirmed presence" means the presence of coliform bacteria in a water sample confirmed by a total coliform-positive repeat sample.

(5) "Confluent growth" means a continuous bacterial growth covering the entire filtration area of a membrane filter, or a portion thereof, in which bacterial colonies are not discrete.

(7) "Conventional filtration treatment" means a series of processes including coagulation, flocculation, sedimentation, and filtration resulting in substantial particulate removal.

(8) "CT" or "CTcalc" is the product of "residual disinfectant concentration" (C) in mg/l determined before or at the first customer, and the corresponding "disinfectant contact time" (T) in minutes, i.e., "C" x "T". If a public water system applies disinfectants at more than one point prior to the first customer, it shall determine the CT of each disinfectant sequence before or at the first customer, to determine the total percent inactivation or "total inactivation ratio." The inactivation ratio for a single disinfectant sequence is:

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$$\frac{CT_{\text{calc}}}{CT_{99.9}}$$

where "CT_{99.9}" is the CT value required for 99.9% (3 log) inactivation of *Giardia lamblia* cysts. The sum of the inactivation ratios, or total inactivation ratio for a series of disinfection sequences is:

$$\sum \frac{(CT_{\text{calc}})}{CT_{99.9}}$$

and is calculated by adding together the inactivation ratio for each disinfection sequence. A total inactivation ratio equal to or greater than 1.0 is assumed to provide a 3 log inactivation of *Giardia lamblia* cysts.

(9) "Contaminant" means any physical, chemical, biological, or radiological substance or matter in water.

(10) "Diatomaceous earth filtration" means a process resulting in substantial particulate removal in which:

(a) A precoat cake of diatomaceous earth filter media is deposited on a support membrane (septum); and

(b) While the water is filtered by passing through the cake on the septum, additional filter media known as body feed is continuously added to the feed water to maintain the permeability of the filter cake.

(11) "Direct filtration" means a series of processes including coagulation and filtration but excluding sedimentation resulting in substantial particulate removal.

(12) "Disinfectant contact time" ("T" in CT calculations) means the time in minutes that it takes for water to move from the point of disinfectant application or the previous point of disinfectant residual measurement to a point before or at the point where residual disinfectant concentration ("C") is measured. Where only one "C" is measured, "T" is the time in minutes that it takes for water to move from the point of disinfectant application to a point before or where residual disinfectant concentration ("C") is measured. Where more than one "C" is measured, "T" is:

(a) For the first measurement of "C", the time in minutes that it takes for water to move from the first or only point of disinfectant application to a point before or at the point where the first "C" is measured; and

(b) For subsequent measurements of "C", the time in minutes that it takes for water to move from the previous "C" measurement point to the "C" measurement point for which the particular "T" is being calculated.

(13) "Disinfection" means a process which inactivates pathogenic organisms in water by chemical oxidants or equivalent agents.

(14) "Domestic or other non-distribution system plumbing problem" means a coliform contamination problem in a public water system with

more than one service connection that is limited to the specific service connection from which the coliform-positive sample was taken.

(15) "Dose equivalent" means the product of the absorbed dose for ionizing radiation and such factors as account for differences in biological effectiveness due to the type of radiation and its distribution in the body as specified by the international commission on radiological units and measurements (ICRU).

(16) "Filtration" means a process for removing particulate matter from water by passage through porous media.

(17) "Flocculation" means a process to enhance agglomeration or collection of smaller floc particles into larger, more easily settleable particles through gentle stirring by hydraulic or mechanical means.

(18) "Department" means the department of natural resources.

(19) "Gross alpha particle activity" means the total radioactivity due to alpha particle emission as inferred from measurements on a dry sample.

(20) "Ground water under the direct influence of surface water" means any water beneath the surface of the ground with:

(a) Occurrence of insects or other macroorganisms, algae or large diameter pathogens such as *Giardia lamblia*, in greater than or equal to 10% of representative source water samples collected over a period of 6 months, immediately prior to the first or only point of disinfectant application, or

(b) Evidence of relatively rapid shifts in water characteristics such as turbidity, temperature, conductivity, or pH which closely correlate to climatological or surface water conditions.

(21) "*Legionella*" means a genus of bacteria, some species of which have caused a type of pneumonia called Legionnaires disease.

(22) "Gross beta particle activity" means the total radioactivity due to beta particle emission as inferred from measurements on a dry sample.

(23) "Man-made beta particle and photon emitters" means all radionuclides emitting beta particles and/or photons listed in Maximum Permissible Body Burdens and Maximum Permissible Concentration of Radionuclides in Air or Water for Occupational Exposure, NBS Handbook 69, except the daughter products of thorium-232, uranium-235 and uranium-238.

(24) "Maximum contaminant level" or "MCL" means the maximum permissible level of a contaminant in water which is delivered to the consumer service outlet of the ultimate user of a public water system, except in the case of turbidity where the maximum permissible level is measured at the point of entry to the distribution system. Contaminants added to the water under circumstances controlled by the user, except those resulting from corrosion of piping and plumbing caused by water quality, are excluded from this definition.

(25) "Near the first service connection" means at one of the 20% of all service connections in the entire system that are nearest the water supply

treatment facility or water supply source, as measured by water transport time within the distribution system.

(26) "Maximum contaminant level goal" or "MCLG" means the maximum level of a contaminant in drinking water at which no known or anticipated adverse affect on the health of persons would occur, and which allows an adequate margin of safety. Maximum contaminant level goals are non-enforceable health goals.

(27) "Non-community water system" means a public water system that serves fewer than 25 year-round residents.

Note: Examples of non-community water systems include those serving schools, motels, restaurants, churches, campgrounds and parks.

(28) "Non-transient non-community water system" means a non-community water system that regularly serves at least 25 of the same persons over 6 months per year.

(29) "Person" means an individual, corporation, company, association, cooperative, trust, institution, partnership, state, municipality, or federal agency.

(30) "Picocurie (pCi)" means that quantity of radioactive material producing 2.22 nuclear transformations per minute.

(31) "Point-of-disinfectant application" is the point where the disinfectant is applied and water downstream of that point is not subject to recontamination by surface runoff.

(32) "Plant" means any facility for the obtainment of potable water, whether from surface water or groundwater sources, for a community water system.

(33) "Point-of-entry treatment device" is a water treatment device applied to the drinking water entering a house or building for the purpose of reducing contaminants in the drinking water distributed throughout the house or building.

(34) "Point-of-use treatment device" is water treatment device applied to a single tap used for the purpose of reducing contaminants in drinking water at that one tap.

(35) "Primary maximum contaminant levels" means those maximum contaminant levels which represent minimum public health standards.

(36) "Public water system" means a system for the provision to the public of piped water for human consumption, if such system has at least 15 service connections or regularly serves an average of at least 25 individuals daily at least 60 days out of the year. A public water system is either a "community water system" or a "non-community water system". Such system includes:

(a) Any collection, treatment, storage, and distribution facilities under control of the operator of such system and used primarily in connection with such system, and

(b) Any collection or pretreatment storage facilities not under such control which are used primarily in connection with such system.

Note: The definition of public water system as regulated by this chapter is broader and includes more water systems than those governed by the public service commission under its definition of a public utility in ch. 196, Stats.

(37) "Residual disinfectant concentration" ("C" in CT calculations) means the concentration of disinfectant measured in mg/l in a representative sample of water.

(38) "Rem" means the unit of dose equivalent from ionizing radiation to the total body or any internal organ or organ system. A "millirem" (mrem) is 1/1000 of a rem.

(39) "Sanitary survey" means an onsite inspection of the water source, facilities, equipment, operation and maintenance of a public water system for the purpose of evaluating the adequacy of such source, facilities, equipment, operation and maintenance for producing and distributing safe drinking water.

(39m) "Secondary drinking water standards" means those standards for aesthetic parameters which represent minimum public welfare concerns but do not represent health standards.

(40) "Sedimentation" means a process for removal of solids before filtration by gravity or separation.

(41) "Slow sand filtration" means a process involving passage of raw water through a bed of sand at low velocity (generally less than 0.4 m/h) resulting in substantial particulate removal by physical and biological mechanisms.

(42) "Surface water" means all water which is open to the atmosphere and subject to surface runoff.

(43) "System with a single service connection" means a system which supplies drinking water to consumers via a single line.

(44m) "Supplier of water" means any person who owns or operates a public water system.

(45) "Too numerous to count" means that the total number bacterial colonies exceeds 200 on a 47-mm diameter membrane filter used for coliform detection.

(46) "Waterborne disease outbreak" means the significant occurrence of acute infectious illness, epidemiologically associated with the ingestion of water from a public water system which is deficient in treatment or is supplied from a contaminated source, as determined by the department or other local or state agency.

(47) "Virus" means a virus of fecal origin which is infectious to humans by waterborne transmission.

History: Cr. Register, February, 1978, No. 266, eff. 3-1-78; am. (1) and (9), renum. (12) to (17) to be (13) to (18) and am. (13), cr. (12), Register, April, 1982, No. 316, eff. 5-1-82; renum. (1) to (18) to be (2) to (9), (11), (13) to (15), (18) to (23) and am. (9) and (11), cr. (1), (10), (12), (16) and (17), Register, August, 1989, No. 404, eff. 9-1-89; renum. (1) to (23) to be (3), (6), (9), (15), (18), (19), (22) to (24), (26) to (30), (32) to (36), (38), (39), (44) and (44m), cr. (2), (4), (5), (7), (8), (10) to (14), (16), (17), (20), (21), (25), (31), (37), (40) to (43) and (45) to (47), Register, March, 1991, No. 423, eff. 4-1-91.

NR 109.05 Coverage. This chapter shall apply to each public water system, unless the public water system meets all of the following conditions:

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- (1) Consists only of distribution and storage facilities (and does not have any collection or treatment facilities); and
- (2) Obtains all of its water from, but is not owned or operated by, a public water system to which such regulations apply; and
- (3) Does not sell water to any person; and
- (4) Is not a carrier which conveys passengers in interstate commerce.

History: Cr. Register, February, 1978, No. 266, eff. 3-1-78; am. (1), Register, March, 1991, No. 423, eff. 4-1-91.

Subchapter I — Maximum Contaminant Levels, Monitoring and Analytical Requirements

NR 109.09 Maximum contaminant levels goals for primary contaminants.

- (1) Maximum contaminant level goals (MCLGs) are zero for the following contaminants:

Benzene
Carbon tetrachloride
1,2-dichloroethane
Giardia lamblia
Legionella
Trichloroethylene
Total coliforms (including fecal coliforms and *Escherichia coli*)
Vinyl chloride
Viruses

- (2) MCLGs for the following contaminants are as indicated:

Contaminants	MCLG in mg/l
1,1-Dichloroethylene	0.007
1,1,1-Trichloroethane	0.20
para-Dichlorobenzene	0.075

History: Cr. Register, August, 1989, No. 404, eff. 9-1-89; am. (1), Register, March, 1991, No. 423, eff. 4-1-91.

NR 109.10 Applicability of primary maximum contaminant levels to new or reconstructed water sources. No new or reconstructed water source exceeding any primary maximum contaminant level in this chapter may be connected to a public water system unless blending or treatment is provided such that the primary maximum contaminant level is not exceeded upon entry to the distribution system.

History: Cr. Register, August, 1989, No. 404, eff. 9-1-89.

NR 109.11 Maximum contaminant levels for inorganic chemicals. (1) The maximum contaminant level for nitrate is applicable to both community water systems and non-community water systems, except as provided in sub. (3). The maximum contaminant levels for the other inorganic chemicals apply only to community water systems. Compliance with maximum contaminant levels for inorganic chemicals is calculated under s. NR 109.12.

- (2) The following are the maximum contaminant levels for inorganic chemicals:

Contaminant	Level, milligrams per liter
Arsenic	0.05
Barium	1.
Cadmium	0.010
Chromium	0.05
Fluoride	4.0
Lead	0.05
Mercury	0.002
Nitrate (as N)	10.
Selenium	0.01
Silver	0.05

(3) At the discretion of the department, nitrate as nitrogen levels not to exceed 20 mg/l may be allowed in a non-community water system if the supplier of water demonstrates to the satisfaction of the department that:

(a) Such water will not be available to children under 6 months of age; and

(b) There will be continuous posting of the fact that nitrate as nitrogen levels exceed 10 mg/l and the potential health effects of exposure; and

(c) Local and state public health authorities will be notified annually of nitrate as nitrogen levels that exceed 10 mg/l;

(d) A supply of low nitrate (contains less than 10 mg/l nitrate as nitrogen), bacteriologically safe drinking water shall be provided for infants under 6 months of age.

(e) No adverse health effects will result.

History: Cr. Register, February, 1978, No. 266, eff. 3-1-78; am. Register, April, 1982, No. 316, eff. 5-1-82; am. (1) and (2), Register, August, 1989, No. 404, eff. 9-1-89.

NR 109.12 Inorganic chemical sampling and analytical requirements. (1) Samples collected for the purpose of determining compliance with s. NR 109.11 shall be collected at a point on the distribution system representative of water quality at the customer tap.

(2) Analyses for the purpose of determining compliance with s. NR 109.11 are required as follows:

(a) Analyses for all community water systems utilizing surface water sources shall be completed before system operation begins. These analyses shall be repeated at intervals determined by the department, but not less than once per year.

(b) Analyses for all community water systems utilizing only ground-water sources shall be completed within 90 days after system operation begins. These analyses shall be repeated at intervals determined by the department, but not less than 3-year intervals.

(c) For non-community water systems, analysis for nitrate concentration shall be completed within 90 days after system operation begins. These analyses shall be repeated at intervals determined by the department.

(d) In addition to complying with pars. (a) and (b), suppliers of water monitoring for natural fluoride shall sample each entry point to the distribution system. If water from more than one source is combined before entry to the distribution system, the entry point shall be sampled during periods representative of the maximum natural fluoride levels occurring under normal operating conditions.

(e) 1. The department may decrease the frequencies for natural fluoride monitoring if the department determines that the system is unlikely to exceed the MCL, considering the following factors:

a. Reported concentrations from previously required monitoring,

b. The degree of variation in reported concentrations, and

c. Other factors which may affect natural fluoride concentrations such as changes in pumping rates in groundwater supplies or significant changes in the system's configuration, operating procedures, source of water, and changes in stream flows.

2. In no case may monitoring be reduced to less than one sample every 10 years. For systems monitoring once every 10 years, the department shall review the monitoring frequency every 10 years to determine whether more frequent monitoring is necessary.

(3) If the result of an analysis made under sub. (2) indicates that the level of any contaminant listed in s. NR 109.11 exceeds the maximum contaminant level, the supplier of water shall report to the department within 7 days and initiate 3 additional analyses at the same sampling point within one month.

(4) When the average of 4 analyses made under sub. (3), rounded to the same number of significant figures as the maximum contaminant level for the substance in question, exceeds the maximum contaminant level, the supplier of water shall notify the department under s. NR 109.80 and give notice to the public under s. NR 109.81. Monitoring after the maximum contaminant level is exceeded shall be at a frequency designated by the department and shall continue until the maximum contaminant level has not been exceeded in 2 successive samples collected 30 to 60 days apart, or until a monitoring schedule as a condition to a variance under s. NR 109.91, conditional waiver under s. NR 109.90 or enforcement action shall become effective. Special monitoring thereafter shall be at a frequency designated by the department.

(5) The provisions of subs. (3) and (4) notwithstanding, compliance with the maximum contaminant level for nitrate as nitrogen shall be determined on the basis of the mean of 2 analyses. When a level exceeding the maximum contaminant level for nitrate as nitrogen is found, a second analysis shall be initiated within 24 hours, and if the average of the 2 analyses exceeds the maximum contaminant level the supplier of water shall report findings to the department under s. NR 109.80 and shall notify the public under s. NR 109.81.

(6) Analyses conducted to determine compliance with s. NR 109.11 shall be made in accordance with methods listed in s. NR 109.725, Table A.

(7) Analysis for fluoride under this section may only be conducted by laboratories that have analyzed performance evaluation samples provided by U.S. EPA environmental monitoring and support laboratory to within plus or minus 10% of the reference value at fluoride concentrations from 1.0 mg/l to 10.0 mg/l within the past 12 months.

History: Cr. Register, February, 1978, No. 266, eff. 3-1-78; am. Register, April, 1982, No. 316, eff. 5-1-82; am. (3) and (4), cr. (7), Register, August, 1989, No. 404, eff. 9-1-89; am. (6), Register, March, 1991, No. 423, eff. 4-1-91.

NR 109.13 Sodium monitoring, reporting and notification requirements.

(1) The supplier of water for a community water system shall collect and analyze one sample per plant at a representative point on the distribution system for the determination of sodium concentration; samples will be collected and analyzed annually for systems utilizing surface water sources in whole or in part, and at least every 3 years for systems utilizing solely groundwater sources. The minimum number of samples required to be taken by the system shall be based on the number of plants used by the system, except that multiple wells drawing raw water from a single aquifer may, with department approval, be considered one plant for determining the minimum number of samples. The supplier of water may be required by the department to collect and analyze water samples for sodium more frequently in locations where the sodium content is variable.

(2) The supplier of water shall report to the department the results of the analyses for sodium concentration within the first 10 days of the month following the month in which the sample results were received or within the first 10 days following the end of the required monitoring period as stipulated by the department, whichever is first. If more than annual sampling is required, the supplier shall report the average sodium concentration within 10 days of the month following the month in which the analytical results of the last sample used for the annual average was received.

(3) The supplier of water shall notify appropriate local health officials of the sodium concentration by written notice by direct mail within 3 months of receipt of sample results. A copy of each notice required to be provided by this subsection and a list of health officials notified shall be sent to the department within 10 days of its issuance.

(4) Analyses for sodium shall be performed as prescribed in s. NR 109.725, Table E.

Note: A primary maximum contaminant level has not been established for sodium.

History: Cr. Register, April, 1982, No. 316, eff. 5-1-82; r. and recr. (4), Register, March, 1991, No. 423, eff. 4-1-91.

NR 109.14 Special monitoring for corrosivity characteristics. (1) The supplier of water for a community water system shall collect samples from a representative entry point to the water distribution system for the purpose of analysis to determine the corrosivity characteristics of the water.

(a) The supplier shall collect 2 samples per plant for analysis for each plant using surface water sources wholly or in part or more if required by the department; one sample shall be collected during mid-winter and one

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during mid-summer. The supplier of the water shall collect one sample per plant for analysis for each plant using groundwater sources or more if required by the department. The minimum number of samples required to be taken by the system shall be based on the number of plants used by the system, except that multiple wells drawing raw water from a single aquifer may, with department approval, be considered one plant for determining the minimum number of samples.

(b) Determination of the corrosivity characteristics of the water shall include measurement of field pH, calcium hardness, alkalinity, temperature, total dissolved solids (total filterable residue), and calculation of the Langelier Index in accordance with sub. (3). The determination of corrosivity characteristics shall only include one round of sampling (2 samples per plant for surface water and one sample per plant for groundwater sources). However, the department may require more frequent monitoring as appropriate. In addition, the department may require monitoring for additional parameters which may indicate corrosivity characteristics, such as sulfates and chlorides. In certain cases, the Aggressive Index may be used instead of the Langelier Index; any request to use the Aggressive Index shall be made in writing to the department, and the department shall make this determination.

(2) The supplier of water shall report to the department the results of the analysis for the corrosivity characteristics within the first 10 days of the month following the month in which the sample results were received. If more frequent sampling is required by the department, the supplier may accumulate the data and shall report each value within the first 10 days of the month following the month in which analytical results of the last sample were received.

(3) Analyses conducted to determine the corrosivity of the water shall be made in accordance with methods listed in s. NR 109.725, Table E.

(4) Suppliers of water for community water supply systems shall identify whether the following construction materials are present in their distribution system and report their findings to the department:

(a) Lead from piping, solder, caulking, interior lining of distribution mains, alloys and home plumbing.

(b) Copper from piping and alloys, service lines and home plumbing.

(c) Galvanized piping, service lines and home plumbing.

(d) Ferrous piping materials such as cast iron and steel.

(e) Asbestos cement pipe.

(f) Vinyl lined asbestos cement pipe.

(g) Coal tar lined pipes and tanks.

(5) When the water of a community water system is determined to have a Langelier Index value more corrosive than -1.0 , the supplier of water shall sample the distribution system to determine the presence of corrosion products. Parameters to be evaluated shall be determined by the department and will vary with piping materials used in the distribution system.

(6) If sampling required in sub. (5) indicates the presence of corrosion products, or if the water of a community water system is determined to have a Langelier Index value more corrosive than -2.0 , the department may require the supplier of water to implement corrosion-control measures.

History: Cr. Register, April, 1982, No. 316, eff. 5-1-82; am. (3), Register, March, 1991, No. 423, eff. 4-1-91.

NR 109.20 Maximum contaminant levels for nonvolatile organochlorine pesticides and chlorophenoxy acid herbicides. The following are the maximum contaminant levels for nonvolatile organochlorine pesticides and chlorophenoxy acid herbicides. They apply only to community water systems. Compliance with maximum contaminant levels for these organic chemicals shall be calculated pursuant to s. NR 109.21.

	Level, milligrams per liter
(1) Chlorinated hydrocarbons:	
Endrin (1,2,3,4,10, 10-hexachloro- 6,7-epoxy-1,4, 4a,5,6,7,8,8a-octahydro-1,4-endo, endo-5,8 - dimethano naphthalene).	0.0002
Lindane (1,2,3,4,5,6-hexachloro-cyclohexane, gamma isomer).	0.004
Methoxychlor (1,1,1-Trichloro- 2, 2 - bis (p-methoxyphenyl) ethane).	0.1
Toxaphene (C ¹⁰ H ¹⁰ C1 ⁸ -Technical chlorinated camphene, 67-69 percent chlorine).	0.005
(2) Chlorophenoxy acids:	
2,4 - D (2,4-Dichlorophenoxyacetic acid).	0.1
2,4,5 - TP Silvex (2,4,5-Trichlorophenoxypropionic acid).	0.01

History: Cr. Register, February, 1978, No. 266, eff. 3-1-78; cr. (3), Register, April, 1982, No. 316, eff. 5-1-82; am. title and (1) (intro.), r. (3), Register, August, 1989, No. 404, eff. 9-1-89.

NR 109.21 Nonvolatile organochlorine pesticides and chlorophenoxy acid herbicides—sampling and analytical requirements. (1) An analysis of substances for the purpose of determining compliance with s. NR 109.20 (1) and (2) shall be made as follows:

(a) For all community water systems utilizing surface water sources, analyses shall be completed before system operation begins. Subsequent analyses shall be repeated at intervals specified by the department, but not less than at 3-year intervals. Samples analyzed shall be collected during the period of the year designated by the department as the period when contamination by pesticides is most likely to occur.

(b) For community water systems utilizing only ground water sources, analyses shall be completed for those systems specified by the department.

(2) If the result of an analysis made under sub. (1) indicates that the level of any contaminant listed in s. NR 109.20 exceeds the maximum contaminant level, the supplier of water shall report to the department within 7 days and initiate 3 additional analyses within one month.

(3) When the average of 4 analyses made under sub. (2), rounded to the same number of significant figures as the maximum contaminant

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level for the substance in question, exceeds the maximum contaminant level, the supplier of water shall report to the department under s. NR 109.80 and give notice to the public under s. NR 109.81. Monitoring after the maximum contaminant level is exceeded shall be at a frequency designated by the department and shall continue until the maximum contaminant level has not been exceeded in 2 successive samples (special monitoring thereafter shall be at a frequency designated by the department) or until a monitoring schedule as a condition to a variance, under s. NR 109.91, conditional waiver under s. NR 109.90 or enforcement action shall become effective.

(4) Analysis made to determine compliance with s. NR 109.20 (1) and (2) shall be conducted in accordance with requirements in s. NR 109.725, Table B.

History: Cr. Register, February, 1978, No. 266, eff. 3-1-78; am., Register, April, 1982, No. 316, eff. 5-1-82; am. (4) and (5), Register, December, 1982, No. 324, eff. 1-1-83; am. title, (3) and (5), Register, August, 1989, No. 404, eff. 9-1-89; am. (4), r. (5) and (6), Register, March, 1991, No. 423, eff. 4-1-91.

NR 109.22 Maximum contaminant level for total trihalomethanes. The maximum contaminant level for total trihalomethanes (the sum of the concentrations of bromodichloromethane, dibromochloromethane, tribromomethane (bromoform), and trichloromethane (chloroform)) shall be 0.1 milligrams per liter. This maximum contaminant level applies to community water systems which add a disinfectant (oxidant) to the water in any part of the drinking water treatment process. Compliance with the maximum contaminant level for total trihalomethanes shall be calculated pursuant to s. NR 109.23.

History: Cr. Register, August, 1989, No. 404, eff. 9-1-89.

NR 109.23 Total trihalomethanes — sampling and analytical requirements. (1) The supplier of water for a community water system which serves a population of 10,000 or more individuals and which adds a disinfectant (oxidant) to the water shall analyze for total trihalomethanes (TTHMs) in accordance with this section. For systems serving 75,000 or more individuals, sampling and analyses shall begin not later than March 31, 1981. For systems serving 10,000 to 74,999 individuals, sampling and analyses shall begin not later than March 31, 1983. For the purpose of this section, the minimum number of samples required to be taken by the system shall be based on the number of plants used by the system except that multiple wells drawing raw water from a single aquifer may, with department approval, be considered one plant for determining the minimum number of samples. All samples required during an established monitoring period shall be collected within a 24-hour period.

(2) (a) For all community water systems utilizing surface water sources in whole or in part, and for all community water systems utilizing only groundwater sources that have not been determined by the department to qualify for the monitoring requirements of sub. (3), analyses for TTHMs shall be performed at quarterly intervals on at least 4 water samples for each plant used by the system. At least 25% of the samples shall be taken at locations within the distribution system reflecting the maximum residence time of the water in the system. The remaining 75% shall be taken at representative locations in the distribution system, taking into account the number of persons served, different sources of water and different treatment methods employed. The results of all analyses per quarter shall be arithmetically averaged and reported to the depart-

ment within 30 days of the system's receipt of such results. All samples collected shall be used in the computation of the average, unless the analytical results are invalidated for technical reasons. Sampling and analyses shall be conducted in accordance with the methods listed in sub. (5).

(b) The monitoring frequency required by par. (a) may be reduced by the department to a minimum of one sample analyzed for TTHMs per quarter taken at a point in the distribution system reflecting the maximum residence time of the water in the system, upon a determination by the department that the data from at least one year of monitoring in accordance with par. (a) and local conditions demonstrate that TTHM concentrations will be consistently below the maximum contaminant level. If at any time during which the reduced monitoring frequency prescribed under this paragraph applies, the results from any analysis exceed 0.10 mg/l of TTHMs and such results are confirmed by at least one check sample taken promptly after such results are received, or if the system makes any significant change to its source of water or treatment program, the supplier of water shall immediately begin monitoring in accordance with the requirements of par. (a), which monitoring shall continue for at least one year before the frequency may be reduced again. At the option of the department, a system's monitoring frequency may be increased above the minimum in those cases where it is necessary to detect variations of TTHM levels within the distribution system.

(3) (a) The supplier of water for a community water system utilizing only groundwater sources may seek to have the monitoring frequency required by sub. (2) (a) reduced to a minimum of one sample for maximum TTHM potential per year for each plant used by the system, taken at a point in the distribution system reflecting maximum residence time of the water in the system. The supplier of water shall submit to the department the results of at least one sample analyzed for maximum TTHM potential for each plant used by the system, taken at a point in the distribution system reflecting the maximum residence time of the water in the system, taken at a point in the distribution system reflecting the maximum residence time of the water in the system. The system's monitoring frequency may only be reduced upon a determination by the department that, based upon the data submitted by the system, the system has a maximum TTHM potential of less than 0.10 mg/l and that, based upon an assessment of the local conditions of the system, the system is not likely to approach or exceed the maximum contaminant level for total TTHMs. The results of all analyses shall be reported to the department within 30 days of the system's receipt of such results. All samples collected shall be used for determining whether the system must comply with the monitoring requirements of sub. (2), unless the analytical results are invalidated for technical reasons. Sampling and analyses shall be conducted in accordance with the methods listed in sub. (5).

(b) If at any time during which the reduced monitoring frequency prescribed under par. (a) applies, the results from any analysis taken by the supplier of water for maximum TTHM potential are equal to or greater than 0.10 mg/l and such results are confirmed by at least one check sample taken promptly after such results are received, the system shall immediately begin monitoring in accordance with the requirements of sub. (2) and such monitoring shall continue for at least one year before the frequency may be reduced again. In the event of any significant change to the system's raw water or treatment program, the supplier of water shall immediately analyze an additional sample for maximum TTHM

potential taken at a point in the distribution system reflecting maximum residence time of the water in the system for the purpose of determining whether the system must comply with the monitoring requirements of sub. (2). At the option of the department, monitoring frequencies may be increased above the minimum in those cases where this is necessary to detect variation of TTHM levels within the distribution system.

(4) Compliance with s. NR 109.22 shall be determined based on a running annual average of quarterly samples collected by the system as prescribed in sub. (2) (a) or (b). If the average of samples covering any 12 month period exceeds the maximum contaminant level, the supplier of water shall report to the department under s. NR 109.80 and notify the public under s. NR 109.81. Monitoring after the maximum contaminant level is exceeded shall be at a frequency designated by the department and shall continue until a monitoring schedule as a condition to a variance under s. 109.91, conditional waiver under s. NR 109.90 or enforcement action becomes effective.

(5) Sampling and analyses made under this section shall be conducted as prescribed in s. NR 109.725, Table B.

(6) Before the supplier of water for a community water system makes any significant modifications to its existing treatment process for the purposes of achieving compliance with s. NR 109.22, such supplier shall submit and obtain department approval of a detailed plan setting forth its proposed modification and those safeguards that it will implement to ensure that the bacteriological quality of the drinking water provided by such system will not be adversely affected by such modification. Each system shall comply with the provisions set forth in the department approved plan. At a minimum, a department approved plan shall require the supplier of water for a system modifying its disinfection practice to:

(a) Evaluate the water system for sanitary defects and evaluate the source water for biological quality;

(b) Evaluate its existing treatment practices and consider improvements that will minimize disinfectant demand and optimize finished water quality throughout the distribution system;

(c) Provide baseline water quality survey data of the distribution system. Such data shall include the results from monitoring for coliform and fecal coliform bacteria, fecal streptococci, standard plate counts at 35°C and 20°C, phosphate, ammonia nitrogen and total organic carbon. Virus studies may be required where source waters are heavily contaminated with sewage effluent;

(d) Conduct additional monitoring to assure continued maintenance of optimal biological quality in finished water (example: when chloramines are introduced as disinfectants or when pre-chlorination is being discontinued). Additional monitoring may also be required by the department for chlorate, chlorite and chlorine dioxide if chlorine dioxide is approved as a disinfectant. Standard plate count analyses may also be required by the department as appropriate before and after any modifications; and

(e) Include in the plan provisions to maintain an active disinfectant residual throughout the distribution system at all times during and after the modification.

History: Cr. Register, April, 1982, No. 316, eff. 5-1-82; renum. to be NR 109.23 and am. (4), Register, August, 1989, No. 404, 9-1-89; r. and recr. (5), am. (6) (intro.), Register, March, 1991, No. 423, eff. 4-1-91.

NR 109.24 Maximum contaminant levels for volatile organic contaminants. (1) The following maximum contaminant levels for volatile organic contaminants apply to community water systems and non-transient non-community water systems.

Contaminant	Maximum contaminant level in mg/l
Benzene	0.005
Vinyl chloride	0.0002
Carbon tetrachloride	0.005
1,2-Dichloroethane	0.005
Trichloroethylene	0.005
1,1-Dichloroethylene	0.007
1,1,1-Trichloroethane	0.20
para-Dichlorobenzene	0.075

(2) The following are the BATs available for achieving compliance with the maximum contaminant level for the volatile organic chemicals listed in sub. (1):

- (a) Central treatment using packed tower aeration, and
- (b) Central treatment using granular activated carbon, except for vinyl chloride.

History: Cr. Register, August, 1989, No. 404, eff. 9-1-89.

NR 109.25 Volatile organic contaminants—sampling and analytical requirements. Analysis of the contaminants listed in s. NR 109.24 for purposes of determining compliance with the maximum contaminant levels shall be conducted as follows:

(1) (a) Suppliers of water having groundwater systems shall sample at points of entry to the distribution system representative of each well. Sampling shall be conducted at the same location or a more representative location each quarter. Each entry point to the distribution system shall be sampled every 3 months except as provided in sub. (7) (a).

(b) To ensure that average contaminant levels are not understated for entry points which have shown variable contaminant levels, the supplier of water shall sample such entry points to represent the highest contaminant levels which occur under normal (non-emergency) operating conditions. Exceptions to this may be approved by the department on a case-by-case basis if the supplier of water adequately demonstrates that another monitoring program is more representative of average contaminant levels at that entry point.

(2) Suppliers of water having surface water systems shall sample at points in the distribution system representative of each source or at entry points to the distribution system after any application of treatment.

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Sampling shall be conducted at the same location or a more representative location each quarter. Each source shall be sampled every 3 months except as provided in sub. (7) (b).

(3) If the system draws water from more than one source and sources are combined before distribution, the supplier of water shall sample at an entry point to the distribution system during periods of normal operating conditions.

(4) All suppliers of water having community water systems or non-transient non-community water systems serving more than 10,000 individuals shall analyze all distribution or entry-point samples representing all source waters beginning no later than January 1, 1988. All suppliers of water having community water systems or non-transient non-community water systems serving from 3,300 to 10,000 individuals shall analyze all distribution or entry-point samples, as required in this section, representing all source waters beginning no later than January 1, 1989. Suppliers of water having community and non-transient non-community water systems serving less than 3,300 individuals shall analyze all distribution or entry-point samples, as required in this section, representing all source waters beginning no later than January 1, 1991.

(5) The department may require confirmation for any positive or negative results. The department may delete results of sampling errors from any compliance calculation.

(6) Analysis for vinyl chloride is required only for groundwater systems that have detected one or more of the following 2-carbon organic compounds: Trichloroethylene, tetrachloroethylene, 1,2-dichloroethane, 1,1,1-trichloroethane, cis-1,2-dichloroethylene, trans-1,2-dichloroethylene, or 1,1-dichloroethylene. The analysis for vinyl chloride is required at each distribution or entry point at which one or more of the 2-carbon organic compounds were found. If the first analysis does not detect vinyl chloride, the department may reduce the frequency of vinyl chloride monitoring to once every 3 years for that sample location or other sample locations which are more representative of the same source. Suppliers of water having surface water systems may be required to analyze for vinyl chloride at the discretion of the department.

(7) The department may reduce the monitoring frequency specified in subs. (1) and (2) as follows:

(a) For groundwater systems:

1. When VOCs are not detected in the first sample, or any subsequent samples that may be taken, and the system is not vulnerable as determined under par. (d) or (e), monitoring shall be repeated every 5 years.

2. When VOCs are not detected in the first sample, or any subsequent sample that may be taken, and the system is vulnerable as determined under par. (d) or (e):

a. Monitoring shall be repeated every 3 years for systems serving more than 500 connections.

b. Monitoring shall be repeated every 5 years for systems serving less than 500 connections.

3. When VOCs are detected in any sample, the supplier of water shall report to the department within 7 days and monitor quarterly thereafter as required in sub. (1).

(b) For surface water systems:

1. When VOCs are not detected in the first year of quarterly sampling, or any other subsequent sample that may be taken, and the system is not vulnerable as determined under par. (d) or (e), monitoring shall be performed at a frequency determined by the department.

2. When VOCs are not detected in the first year of quarterly sampling, or any other subsequent sample that may be taken, and the system is vulnerable as determined under par. (d) or (e):

a. Monitoring shall be repeated every 3 years for systems serving more than 500 connections.

b. Monitoring shall be repeated every 5 years for systems serving less than 500 connections.

3. When VOCs are detected in any sample, the supplier of water shall report to the department within 7 days and monitor quarterly thereafter as required in sub. (2).

(c) The department may reduce the frequency of monitoring to once per year for a groundwater system or surface water system having VOCs at levels consistently less than the MCL for 3 consecutive years.

(d) Vulnerability of each public water system shall be determined by the department based upon an assessment of the following factors:

1. Previous monitoring results,
2. Number of persons served by public water system,
3. Proximity of a smaller system to a larger system,
4. Proximity to commercial or industrial use, disposal, or storage of volatile synthetic organic chemicals, and
5. Protection of the water source.

(e) A public water system is deemed to be vulnerable for a period of 3 years after any positive measurement of one or more contaminants either listed in s. NR 109.24 or referenced in s. NR 109.26 except for trihalomethanes or other demonstrated disinfection by-products.

(8) Initial compliance with s. NR 109.24 (1) shall be determined based on the results of a running annual average of up to 4 quarterly samples for each sampling location. When any result is reported as detected, but less than the limit of quantitation, the limit of detection for that compound shall be used in the calculation of the average. If one location's average is greater than the MCL, the system shall be deemed to be out of compliance. If the result of any one or more samples would cause the running annual average to be exceeded, then the system shall be deemed to be out of compliance immediately. For systems required to take only one sample per location because no VOCs were detected, compliance shall be based on that one sample.

(9) Analysis under this section shall be conducted as prescribed in s. NR 109.725, Table B.

(10) The department may increase monitoring requirements when necessary to detect contaminant variations within a system.

History: Cr. Register, August, 1989, No. 404, eff. 9-1-89; am. (7) (a) 3. and (b) 3., (c), (8), r. and recr. (9), Register, March, 1991, No. 423, eff. 4-1-91.

NR 109.26 Special monitoring, reporting, and public notification for selected organic chemicals. (1) (a) Suppliers of water having community or non-transient, non-community water systems shall monitor for the contaminants listed in par. (e) by the date specified in Table 1:

Table 1 - Monitoring Schedule by System Size

Number of persons served	Monitoring to begin no later than-
Over 10,000	Jan. 1, 1988
3,300 to 10,000	Jan. 1, 1989
Less than 3,300	Jan. 1, 1991

(b) Surface water systems shall be sampled at points in the distribution system representative of each water system source or at entry points to the distribution system after any application of treatment. The minimum number of samples is one year of quarterly samples per water source.

(c) Groundwater systems shall be sampled at points of entry to the distribution system representative of each well after any application of treatment. The minimum number of samples is one sample per entry point to the distribution system.

(d) The department may require confirmation and follow-up samples for positive or negative results.

(e) Suppliers of water having community water systems or non-transient, non-community water systems shall monitor for the following contaminants except as provided in par. (f):

1. Chloroform
2. Bromodichloromethane
3. Chlorodibromomethane
4. Bromoform
5. trans-1,2-Dichloroethylene
6. Chlorobenzene
7. m-Dichlorobenzene
8. Dichloromethane
9. cis-1,2-Dichloroethylene

10. o-Dichlorobenzene
11. Dibromomethane
12. 1,1-Dichloropropene
13. Tetrachloroethylene
14. Toluene
15. p-Xylene
16. o-Xylene
17. m-Xylene
18. 1,1-Dichloroethane
19. 1,2-Dichloropropane
20. 1,1,2,2-Tetrachloroethane
21. Ethylbenzene
22. 1,3-Dichloropropane
23. Styrene
24. Chloromethane
25. Bromomethane
26. 1,2,3-Trichloropropane
27. 1,1,1,2-Tetrachloroethane
28. Chloroethane
29. 1,1,2-Trichloroethane
30. 2,2-Dichloropropane
31. o-Chlorotoluene
32. p-Chlorotoluene
33. Bromobenzene
34. 1,3-Dichloropropene
35. Ethylene dibromide (EDB)
36. 1,2-Dibromo-3-chloropropane (DBCP)

(f) Suppliers of water having community water systems or non-transient, non-community water systems shall monitor for EDB and DBCP only if the department determines they are vulnerable to contamination by either or both of these substances. For the purpose of this paragraph, a vulnerable system is defined as a system which is potentially contaminated by EDB and DBCP, including surface water systems where these 2 compounds are applied, manufactured, stored, disposed of, or shipped upstream, and for groundwater systems in areas where the compounds are applied, manufactured, stored, disposed of, or shipped in the groundwater recharge basin, or for groundwater systems that are in proximity to underground storage tanks that contain leaded gasoline.

(g) Analysis under this section shall be conducted using the methods prescribed in s. NR 109.725, Table B.

(h) Analysis under this section shall only be conducted by laboratories approved under 40 Code of Federal Regulations 141.24 (g) (11). In addition, each laboratory analyzing for EDB and DBCP shall achieve a method detection limit for EDB and DBCP of 0.00002 mg/l, according to the procedures in Appendix B of Part 136, 40 Code of Federal Regulations.

(i) Public water systems may use monitoring data collected any time after January 1, 1983 to meet the requirements for unregulated monitoring, provided that the monitoring program was consistent with the requirements of this section.

(j) Monitoring for the following compounds is required at the discretion of the department:

1. 1,2,4-Trimethylbenzene
2. 1,2,4-Trichlorobenzene
3. 1,2,3-Trichlorobenzene
4. n-Propylbenzene
5. n-Butylbenzene
6. Napthalene
7. Hexachlorobutadiene
8. 1,3,5-Trimethylbenzene
9. p-Isopropyltoluene
10. Isopropylbenzene
11. Tert-butylbenzene
12. Sec-butylbenzene
13. Fluorotrichloromethane
14. Dichlorodifluoromethane
15. Bromochloromethane

(k) Suppliers of water having a non-transient, non-community water system shall repeat the monitoring required in this subsection no less frequently than every 5 years.

(2) (a) The requirements of this subsection only apply to the contaminants listed in sub. (1).

(b) Any supplier of water having a community water system or non-transient, non-community water system who is required to monitor under sub. (1) shall send a copy of the results of such monitoring within 30 days of receipt and any public notice under par. (c) to the department.

(c) The supplier of water shall notify persons served by the system of the availability of the results of sampling under sub. (1) by including a notice in the first set of water bills issued by the system after the receipt

of the results or written notice within 3 months. The notice shall identify a person and supply the telephone number to contact for information on the monitoring results.

History: Cr. Register, August, 1989, No. 404, eff. 9-1-89; r. and recr. (1) (g), Register, March, 1991, No. 423, eff. 4-1-91.

NR 109.30 Maximum microbiological contaminant levels. The following are the maximum contaminant levels for coliform bacteria applicable to public water systems.

(1) The maximum contaminant level (MCL) for coliform bacteria is based on the presence or absence of total coliforms in a sample.

(a) For a system which collects at least 40 samples per month, if no more than 5.0% of the samples collected during a month are total coliform-positive, the system is in compliance with the MCL for total coliforms.

(b) For a system which collects fewer than 40 samples per month, if no more than one sample collected during a sampling period is total coliform-positive, the system is in compliance with the MCL for total coliforms.

(2) Any fecal coliform-positive repeat sample or E. Coli-positive repeat sample, or any total coliform-positive repeat sample following a fecal coliform-positive or E. Coli-positive routine sample constitutes a violation of the MCL for total coliforms. For purposes of the public notification requirements in s. NR 109.81, this is a violation that may pose an acute risk to health.

(3) The water supplier for a public water system shall determine compliance with the MCL for total coliforms in subs. (1) and (2) for each period in which the system is required to monitor for total coliforms.

(4) The supplier of water shall initiate definitive action to identify the cause of the positive bacteriological sample results and to eliminate potential health hazards which may exist in the system when monitoring pursuant to s. NR 109.31 (1) or (2) shows the presence of any coliform organisms.

(5) If heterotrophic bacterial plate counts on water distributed to the consumer exceed 500 organisms per milliliter the department shall determine if the bacterial count is of public health or nuisance significance and may require appropriate action.

(6) The following are best technology, treatment techniques, or other means available for achieving compliance with the maximum contaminant level for total coliforms in subs. (1) and (2):

(a) Protection of wells from coliform contamination by appropriate placement and construction;

(b) Maintenance of a disinfectant residual throughout the distribution system;

(c) Proper maintenance of the distribution system including appropriate pipe replacement and repair procedures, main flushing programs, proper operation and maintenance of storage tanks and reservoirs, and continual maintenance of positive water pressure in all parts of the distribution system;

(d) Filtration and disinfection of surface water, or disinfection of ground water using strong oxidants such as chlorine, chlorine dioxide or ozone; or

(e) The development and implementation of a department approved wellhead protection program.

Note: The basic purpose of a wellhead protection program is to restrict potentially polluting activities near wells and well fields and within recharge areas of aquifers supplying water to these wells. In general, activities are more restricted close to the well and less so farther away.

History: Cr. Register, February, 1978, No. 266, eff. 3-1-78; am. (2) and (4), Register, April, 1982, No. 316, eff. 5-1-82; correction in (intro.) made under s. 13.93 (2m) (b) 7, Stats., Register, October, 1985, No. 358; am. (intro.) and (4), Register, August, 1989, No. 404, eff. 9-1-89; r. and recr. Register, March, 1991, No. 423, eff. 4-1-91.

NR 109.31 Microbiological contaminant sampling and analytical requirements. (1) **ROUTINE MONITORING.** (a) Suppliers of water for public water systems shall collect total coliform samples at sites which are representative of water throughout the distribution system according to a written sample siting plan. These plans are subject to department review and revision.

(b) 1. Water suppliers for community water systems shall take water samples for coliform determination at regular intervals, and in a number proportionate to the population served by the system. Suppliers required to collect multiple samples each month shall sample at geographically representative locations and on dates evenly spaced during the month. Except as specified in subd. 2., the minimum sampling frequency shall be as set forth in the following:

Population served:	Minimum number of samples per month
25 to 1,000 (Not serving a municipality)	1
25 to 1,000 (Serving a municipality)	2
1,001 to 2,500	2
2,501 to 3,300	3
3,301 to 4,100	4
4,101 to 4,900	5
4,901 to 5,800	6
5,801 to 6,700	7
6,701 to 7,600	8
7,601 to 8,500	9
8,501 to 12,900	10
12,901 to 17,200	15
17,201 to 21,500	20
21,501 to 25,000	25
25,001 to 33,000	30
33,001 to 41,000	40
41,001 to 50,000	50
50,001 to 59,000	60
59,001 to 70,000	70
70,001 to 83,000	80
83,001 to 96,000	90
96,001 to 130,000	100
130,001 to 220,000	120
220,001 to 320,000	150
320,001 to 450,000	180

450,001 to 600,000	210
600,001 to 780,000	240
780,001 to 970,000	270
970,001 to 1,230,000	300
1,230,001 to 1,520,000	330
1,520,001 to 1,850,000	360
1,850,001 to 2,270,000	390
2,270,001 to 3,020,000	420
3,020,001 to 3,960,000	450
3,960,000 or more	480

2. Based on a history of no coliform bacterial contamination and on a sanitary survey by the department showing the water system to be supplied solely by a protected ground water source and free of sanitary defects, a non-municipal community water system serving 25 to 1,000 persons may, with written permission from the department, reduce this sampling frequency, except that in no case shall it be reduced to less than one per calendar quarter.

(c) The supplier of water for a non-community school or a non-transient non-community water system shall sample for coliform bacteria in each calendar quarter during which the system provides water to the public, unless the department, on the basis of a sanitary survey or other factors, determines that some other frequency is more appropriate.

(d) The monitoring frequency for total coliforms for non-community water systems, notwithstanding par. (c), is as follows:

1. On or after June 29, 1994, a non-community water system using only ground water and serving 1,000 persons per day or fewer shall monitor each calendar quarter that the system provides water to the public, except that the department may reduce the monitoring frequency, in writing, if a sanitary survey shows that the system is free of sanitary defects. In no case may the monitoring frequency be reduced to less than once per year.

2. On or after December 31, 1990, a non-community water system using only ground water and serving on average more than 1,000 persons per day for any month shall monitor at the same frequency as a like-sized community water system, as specified in par. (b) 1., except that the department may reduce the monitoring frequency, in writing, for any month the average daily population served is less than 1,000 persons per day.

3. A non-community water system using ground water under the direct influence of surface water as defined in s. NR 109.04, in total or in part, shall monitor at the same frequency as a like-sized community municipal system, as specified in par. (b) 1. The system shall begin monitoring at this frequency beginning 6 months after the department determines that the ground water source is under the direct influence of surface water.

(e) Public water systems shall collect samples at regular time intervals throughout the month, except that a system which uses ground water and serves 1,000 persons or fewer, may collect all required samples on a single day if they are taken from different sites.

(f) Special purpose samples such as those taken to determine whether disinfection practices are sufficient following pipe placement, replace-
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ment or repair, may not be used to determine compliance with the MCL for total coliforms in s. NR 109.30. Repeat samples taken pursuant to sub. (2) are not considered special purpose samples, and shall be used to determine compliance with the MCL for total coliforms in s. NR 109.30.

(2) REPEAT MONITORING. (a) If a routine sample is total coliform-positive, the water supplier of a public water system shall collect a set of repeat samples within 24 hours of being notified of the positive result. A system which is required to collect more than one routine sample/month shall collect no fewer than 3 repeat samples for each total coliform-positive sample found. A system which is required to collect one routine sample/month or fewer shall collect no fewer than 4 repeat samples for each total coliform-positive sample found. The department may extend the 24-hour limit on a case-by-case basis if the system has a logistical problem in collecting the repeat samples within 24 hours that is beyond its control. In the case of an extension, the department will specify how much time the water supplier has to collect repeat samples.

(b) The water supplier shall collect at least one repeat sample from the sampling tap where the original total coliform-positive sample was taken, and at least one repeat sample at a tap within 5 service connections upstream and at least one repeat sample at a tap within 5 service connections downstream of the original sampling site. If a total coliform-positive sample is at the end of the distribution system, or one away from the end of the distribution system, the department may waive the requirement to collect at least one repeat sample upstream or downstream of the original sampling site.

(c) The water supplier shall collect all repeat samples on the same day, except that the department may allow a system with a single service connection to collect the required set of repeat samples over a 4 day period or to collect a larger volume repeat sample in one or more sample containers of any size, as long as the total volume collected is at least 400 ml (300 ml for systems which collect more than one routine sample/month.)

(d) If one or more repeat samples in the set is total coliform-positive, the public water supplier shall collect an additional set of repeat samples in the manner specified in pars. (a) to (c). The additional set of samples shall be collected within 24 hours of being notified of the positive result, unless the department extends the limit as provided in par. (a). The water supplier shall repeat this process until either total coliforms are not detected in one complete set of repeat samples or the system determines that the MCL for total coliforms in s. NR 109.30 has been exceeded and notifies the department.

(e) If a water supplier collecting fewer than 5 routine samples/month has one or more total coliform-positive samples and the department does not invalidate the samples under sub. (3), the supplier shall collect at least 5 routine samples during the next month the system provides water to the public, except that the department may waive this requirement if the conditions of subd. 1. or 2. are met. The requirement for a water supplier to collect repeat samples in pars. (a) to (d) is not waiveable.

1. The department may waive the requirement to collect 5 routine samples the next month the system provides water to the public if the department performs a site visit before the end of the next month the system provides water to the public. Although a sanitary survey need not be performed, the site visit shall be sufficiently detailed to allow the

department to determine whether additional monitoring or any corrective action is needed.

2. The department may waive the requirement to collect 5 routine samples the next month the system provides water to the public if the department has determined why the sample was total coliform-positive and establishes that the water supplier has corrected the problem or will correct the problem before the end of the next month the system serves water to the public. In this case, the decision to waive the following month's additional monitoring requirement will be documented in writing, signed by a qualified department official, and made available to the public. The written documentation shall describe the specific cause of the total coliform-positive sample and what action the water supplier has taken or will take to correct this problem. The requirement to collect 5 routine samples the next month the system provides water to the public is not waivable solely on the grounds that all repeat samples are total coliform-negative.

(f) After a water supplier collects a routine sample and before learning the results of the analysis of that sample, if the water supplier collects another routine sample from within 5 adjacent service connections of the initial sample, and the initial sample after analysis is found to contain total coliforms, then the system may count the subsequent sample as a repeat sample instead of as a routine sample.

(g) Results of all routine and repeat samples not invalidated by the department shall be included in determining compliance with the MCL for total coliforms in s. NR 109.30.

(3) INVALIDATION OF TOTAL COLIFORM SAMPLES. (a) A total coliform-positive sample invalidated under this subsection does not count towards meeting the minimum monitoring requirements of this section.

(b) The department may invalidate a total coliform-positive sample only if the conditions of subd. 1., 2. or 3. are met.

1. The laboratory establishes that improper sample analysis caused the total coliform-positive result.

2. The department, on the basis of the results of repeat samples collected as required by sub. (2) (a) to (d), determines that the total coliform-positive sample resulted from a domestic or other non-distribution system plumbing problem. No sample may be invalidated by the department on the basis of repeat sample results unless all repeat samples collected at the same tap as the original total coliform-positive sample are also total coliform-positive, and all repeat samples collected within 5 service connections of the original tap are total coliform-negative (e.g., the department will not invalidate a total coliform-positive sample on the basis of repeat samples if all the repeat samples are total coliform-negative, or if the public water system has only one service connection.)

3. The department has substantial grounds to believe that a total coliform-positive result is due to a circumstance or condition which does not reflect water quality in the distribution system. In this case, the system owner or operator shall still collect all repeat samples required under sub. (2) (a) to (d), and use them to determine compliance with the MCL for total coliforms in s. NR 109.30. To invalidate a total coliform-positive sample under this paragraph, the decision with the rationale for the

decision shall be documented in writing, approved by a qualified department official and available to the public for inspection. The document shall state the specific cause of the total coliform-positive sample, and what action the system owner or operator has taken or will take, to correct this problem. The department may not invalidate a total coliform-positive sample solely on the grounds that all repeat samples are total coliform-negative.

(c) A laboratory shall invalidate a total coliform sample (unless total coliforms are detected) if the sample produces a turbid culture in the absence of gas production using an analytical method where gas formation is examined (e.g., the Multiple Tube Fermentation Technique), produces a turbid culture in the absence of an acid reaction in the Presence-Absence Coliform Test, or exhibits confluent growth or produces colonies too numerous to count with an analytical method using a membrane filter (e.g., Membrane Filter Technique). If a laboratory invalidates a sample because of such interference, the system owner or operator shall collect another sample from the same location as the original sample within 24 hours of being notified of the interference problem, and have it analyzed for the presence of total coliforms. The system owner or operator shall continue to re-sample within 24 hours and have the samples analyzed until it obtains a valid result. The department may waive the 24 hour time limit on a case-by-case basis.

(4) **FECAL COLIFORMS/ESCHERICHIA COLI (E. COLI) TESTING.** (a) If any routine or repeat sample is total coliform-positive, the system owner or operator shall analyze that total coliform-positive culture medium to determine if fecal coliforms are present, except that the system may test for E. Coli in lieu of fecal coliforms. If fecal coliforms or E. Coli are present, the system owner or operator shall notify the department by the end of the day when the system is notified of the test result, unless the system is notified of the result after normal department business hours, in which case the system owner or operator shall notify the department before the end of the next business day.

(b) The department may allow a public water system, on a case-by-case basis, to forgo fecal coliform or E. Coli testing on a total coliform-positive sample if that system owner or operator assumes that the total coliform-positive sample is fecal coliform-positive or E. Coli-positive. Accordingly, the system owner or operator shall notify the department as specified in par. (a) and the provisions of s. NR 109.30 (2) apply.

(5) **ANALYTICAL METHODOLOGY.** (a) The standard sample volume required for total coliform analysis, regardless of analytical method used, is 100 ml.

(b) Public water system owners or operators need only determine the presence or absence of total coliforms; a determination of total coliform density is not required.

Note: The coliform density may, however, be helpful in selecting a remedial option.

(c) Samples collected in compliance with requirements of s. NR 109.30 shall be analyzed as prescribed in s. NR 109.725, Table C.

(6) **SANITARY SURVEYS.** (a) Public water systems which do not collect 5 or more routine samples/month shall undergo an initial sanitary survey by June 29, 1994 for community water systems and June 29, 1999 for non-community water systems. Thereafter, systems shall undergo an

other sanitary survey every 5 years, except that non-community water systems using only protected and disinfected ground water, as determined on a case-by-case basis by the department, shall undergo subsequent sanitary surveys at least every 10 years after the initial sanitary survey. The department will review the results of each sanitary survey to determine whether the existing monitoring frequency is adequate and what additional measures, if any, the system needs to undertake to improve drinking water quality.

(b) Sanitary surveys shall be performed by the department or an agent approved by the department. If the department requests a system owner to have a sanitary survey performed, the system owner is responsible for ensuring the survey is completed.

(7) (a) When a sample collected under subs. (1) to (4) exceeds a maximum contaminant level in s. NR 109.30 (1) or (2), the supplier of water shall report the violation to the department no later than the end of the next business day after it learns of the violation, and shall provide public notice of the violation in accordance with s. NR 109.81.

(b) A public water supplier who has failed to comply with a coliform monitoring requirement, shall report the monitoring violation to the department within 10 days after discovering the violation, and notify the public as specified in s. NR 109.81.

(8) In addition to sampling from the distribution system, each supplier of water for a system providing disinfection shall obtain at least one sample every 3 months from each well prior to the point of any chemical addition. For waterworks which have more than one well in the same location and utilizing the same aquifer, only one of the wells may be sampled each time on an alternating basis. If a well has a high potential for contamination, the department may, in individual cases, require more frequent sampling.

(9) At surface water facilities, the microbiological quality of the water shall be monitored sufficiently to maintain quality control of the treatment process. Each plant shall establish a schedule which will be subject to review and modification by the department.

Note: Generally, membrane filter or 5 tube fermentation tests and heterotrophic plate counts of the raw, settled and finished water on an established schedule will be necessary to meet this requirement.

(10) At all waterworks which have a potential for high total bacteria levels because of the water quality, the method of treatment, chemical addition or other cause, the department may require heterotrophic plate counts pursuant to an established schedule. Analyses shall be conducted in accordance with the analytical requirements in s. NR 109.725, Table C.

History: Cr. Register, February, 1978, No. 266, eff. 3-1-78; am. (2) (a) (intro.) and (b) and (3), renum. (4) to (9) to be (5) to (10) and am. (5) to (9), cr. (4), Register, April, 1982, No. 316, eff. 5-1-82; am. (7), Register, December, 1982, No. 324, eff. 1-1-83; am. (5) (a), (b) (intro.) and 2., (c) and (10), Register, August, 1989, No. 404, eff. 9-1-89; r. and recr. Register, March, 1991, No. 423, eff. 4-1-91.

NR 109.40 Maximum contaminant levels for turbidity. The requirements in this section apply to filtered systems prior to June 29, 1993. The requirements in this section apply to unfiltered systems that the department has determined, in writing, shall install filtration, prior to June 29, 1993, or until filtration is installed, whichever is later. Turbidity require-
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ments on or after June 29, 1993 are stated in s. NR 109.760. The maximum contaminant levels for turbidity are applicable to both community water systems and non-community water systems using surface water sources and ground water sources under the direct influence of surface water, in whole or in part. The maximum contaminant levels for turbidity in drinking water, measured at a representative entry point to the distribution system, are:

(1) One nephelometric turbidity unit (NTU), as determined by a monthly average under s. NR 109.41, except that 5 or fewer turbidity units may be allowed if the supplier of water can demonstrate to the department that the higher turbidity does not do any of the following:

- (a) Interfere with disinfection;
- (b) Prevent maintenance of an effective disinfectant agent throughout the distribution system; or
- (c) Interfere with microbiological determinations.

(2) Five nephelometric turbidity units (NTU) based on an average for 2 consecutive days pursuant to NR 109.41.

History: Cr. Register, February, 1978, No. 266, eff. 3-1-78; am. (1) (intro.), Register, April, 1982, No. 316, eff. 5-1-82; am. (intro.) Register, March, 1991, No. 423, eff. 4-1-91.

NR 109.41 Turbidity sampling and analytical requirements. (1) The requirements of this section apply to filtered public water systems prior to June 29, 1993. The requirements of this section apply to unfiltered public water systems that the department has determined, in writing, shall install filtration, prior to June 29, 1993, or until filtration is installed whichever is later. Turbidity requirements on or after June 29, 1993 are stated in s. NR 109.760.

(2) Samples shall be taken by suppliers of water for both community water systems and non-community water systems at representative entry points to the water distribution system at least once per day, for the purpose of making turbidity measurements to determine compliance with s. NR 109.40. The department may reduce the required sampling frequency at a non-community water system if it determines in writing that a reduced sampling frequency will not pose a risk to public health. The measurement shall be made by the Nephelometric Method as specified in s. NR 109.725, Table E.

(3) If the result of a turbidity analysis exceeds the maximum contaminant level, the sampling and measurement shall be confirmed by resampling as soon as practicable and preferably within one hour. If the repeat sample confirms that the maximum contaminant level has been exceeded, the supplier of water shall report to the department within 48 hours. The repeat sample shall be the sample used for the purpose of calculating the monthly average. If the monthly average of the daily samples exceeds the maximum contaminant level, or if the average of 2 samples taken on consecutive days exceeds 5 NTU, the supplier of water shall report to the department and notify the public as directed in ss. NR 109.80 and 109.81.

History: Cr. Register, February, 1978, No. 266, eff. 3-1-78; am. (2) and (3), r. (4), Register, April, 1982, No. 316, eff. 5-1-82; am. (2), Register, December, 1982, No. 324, eff. 1-1-83; r. and recr. Register, March, 1991, No. 423, eff. 4-1-91.

NR 109.50 Maximum contaminant levels for radium-226, radium-228, and gross alpha particle radioactivity in community water systems. The following are the maximum contaminant levels for radium-226, radium-228, and gross alpha particle radioactivity:

- (1) Combined radium-226 and radium-228 — 5 pCi/l.
- (2) Gross alpha particle activity (including radium-226 but excluding radon and uranium) — 15 pCi/l.

Note: Sections NR 109.50 through NR 109.52 are identical to the radioactivity standards of the department of health and social services in ch. HSS 157, Wis. Adm. Code, and to the National Interim Primary Drinking Water Regulations, 40 Code of Federal Regulations 141. These sections are adopted pursuant to s. 140.56(2), Stats.

History: Cr. Register, February, 1978, No. 266, eff. 3-1-78.

NR 109.51 Maximum contaminant levels for beta particle and photon radioactivity from man-made radionuclides in community water systems. (1) The average annual concentration of beta particle and photon radioactivity from man-made radionuclides in drinking water shall not produce an annual dose equivalent to the total body or any internal organ greater than 4 millirem/year.

(2) Except for the radionuclides listed in Table A, the concentration of man-made radionuclides causing 4 mrem total body or organ dose equivalents shall be calculated on the basis of a 2 liter per day drinking water intake using the 168 hour data listed in "Maximum Permissible Body Burdens and Maximum Permissible Concentrations of Radionuclides in Air or Water for Occupational Exposure", NBS Handbook 69 as amended August, 1963, U.S. Department of Commerce. Copies of this document are available for inspection at the office of the department of natural resources, the secretary of state's office and the office of the revisor of statutes, and may be obtained for personal use from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402. If 2 or more radionuclides are present, the sum of their annual dose equivalent to the total body or to any organ shall not exceed 4 millirem/year.

Table A. — Average annual concentrations assumed to produce a total body or organ dose of 4 mrem/yr.

Radionuclide	Critical Organ	pCi per liter
Tritium	Total body	20,000
Strontium-90	Bone marrow	8

Note: Sections NR 109.50 through 109.52 are identical to the radioactivity standards of the department of health and social services in ch. HSS 157, Wis. Adm. Code, and to the National Interim Primary Drinking Water Regulations, 40 CFR 141. These sections are adopted pursuant to s. 140.56 (2), Stats.

History: Cr. Register, February, 1978, No. 266, eff. 3-1-78.

NR 109.52 Analytical methods for radioactivity. (1) Analyses conducted to determine compliance with ss. NR 109.50 and 109.51 shall be made in accordance with approved methods listed in s. NR 109.725, Table D.

Note: Sections NR 109.50 to 109.52 are identical to the radioactivity standards of the department of health and social services in ch. HSS 157, Wis. Adm. Code, and to the National Register, March, 1991, No. 423

Interim Primary Drinking Water Regulations, 40 CFR 141. These sections are adopted pursuant to s. 140.56 (2), Stats.

History: Cr. Register, February, 1978, No. 266, eff. 3-1-78; r. and recr. Register, March, 1991, No. 423, eff. 4-1-91.

NR 109.53 Monitoring frequency for radioactivity in community water systems. (1) **MONITORING REQUIREMENTS FOR GROSS ALPHA PARTICLE ACTIVITY, RADIUM-226 AND RADIUM-228.** (a) Initial sampling to determine compliance with s. NR 109.50 shall begin within 90 days after system operation begins. Compliance shall be based on the analysis of an annual composite of 4 consecutive quarterly samples or the average of the analyses of 4 samples obtained at quarterly intervals.

1. A gross alpha particle activity measurement may be substituted for the required radium-226 and radium-228 analysis, provided that the measured gross alpha particle activity does not exceed 5 pCi/l at a confidence level of 95% (1.65σ where σ is the standard deviation of the net counting rate of the sample). In localities where radium-228 may be present in drinking water, the department may require radium-226 and/or radium-228 analyses when the gross alpha particle activity exceeds 2 pCi/l.

2. When the gross alpha particle activity exceeds 5 pCi/l, the same or an equivalent sample shall be analyzed for radium-226. If the concentration of radium-226 exceeds 3 pCi/l the same or an equivalent sample shall be analyzed for radium-228.

(b) Suppliers of water shall monitor at least once every 4 years following the procedure required by sub. (1) (a). At the discretion of the department, when an annual record taken in conformance with sub. (1) (a) has established that the average annual concentration is less than half the maximum contaminant levels established by NR 109.50, analysis of a single sample may be substituted for the quarterly sampling procedure required by sub. (1) (a).

1. More frequent monitoring shall be conducted when ordered by the department in the vicinity of mining or other operation which may contribute alpha particle radioactivity to either surface or ground water sources of drinking water.

2. A supplier of water shall monitor in conformance with sub. (1) (a) within one year of the introduction of new water source for a community water system. More frequent monitoring shall be conducted when ordered by the department in the event of possible contamination or when changes in the distribution system or treatment processing occur which may increase the concentration of radioactivity in finished water.

3. A community water system using 2 or more sources having different concentrations of radioactivity shall monitor source water, in addition to water from the consumer service outlet, when required by the department.

4. Monitoring for compliance with NR 109.50 after the initial period need not include radium-228 except when required by the department, provided, that the average annual concentration of radium-228 has been assayed at least once using the quarterly sampling procedure required by sub. (1) (a).

5. Suppliers of water shall conduct annual monitoring of any community water system in which the radium-226 concentration exceeds 3 pCi/1, when required by the department.

(c) If the average annual maximum contaminant level for gross alpha particle activity or total radium as set forth in s. NR 109.50 is exceeded, the supplier of water having a community water system shall give notice to the department pursuant to s. NR 109.80 and notify the public as required by s. NR 109.81. Monitoring at quarterly intervals shall be continued until the annual average concentration no longer exceeds the maximum contaminant level or until a monitoring schedule as a condition to a variance under s. NR 109.91, conditional waiver under s. NR 109.90 or enforcement action shall become effective. Special monitoring thereafter shall be at a frequency designated by the department.

(2) MONITORING REQUIREMENTS FOR MAN-MADE RADIOACTIVITY IN COMMUNITY WATER SYSTEMS. (a) Systems using surface water sources and serving more than 100,000 persons and such other community water systems as are designated by the department shall be monitored for initial compliance with s. NR 109.51 by analysis of a composite of 4 consecutive quarterly samples or analysis of 4 quarterly samples. Compliance with s. NR 109.51 may be assumed without further analysis if the average annual concentration of gross beta particle activity is less than 50 pCi/1 and if the average annual concentrations of tritium and strontium-90 are less than those listed in Table A, provided that, if both radionuclides are present, the sum of their annual dose equivalents to bone marrow may not exceed 4 millirem/year.

1. If the gross beta particle activity exceeds 50 pCi/1, an analysis of the sample must be performed to identify the major radioactive constituents present and the appropriate organ and total body doses shall be calculated to determine compliance with NR 109.51.

2. Suppliers of water shall conduct additional monitoring, as required by the department to determine the concentration of man-made radioactivity in principal watersheds designated by the department.

3. At the discretion of the department, suppliers of water utilizing only ground waters may be required to monitor for man-made radioactivity.

(b) After the initial analysis required by par. (a) suppliers of water shall monitor at least every 4 years following the procedure given in par. (a).

(c) The supplier of any community water system designated by the department as utilizing waters subject to contamination by effluents from nuclear facilities shall initiate quarterly monitoring for gross beta particle and iodine-131 radioactivity and annual monitoring for strontium-90 and tritium.

1. Quarterly monitoring for gross beta particle activity shall be based on the analysis of monthly samples or the analysis of a composite of 3 monthly samples. The former is recommended. If the gross beta particle activity in a sample exceeds 15 pCi/1, the same or an equivalent sample shall be analyzed for strontium-89 and cesium-134. If the gross beta particle activity exceeds 50 pCi/1, an analysis of the sample must be performed to identify the major radioactive constituents present and the appropriate organ and total body doses shall be calculated to determine compliance with NR 109.51.

2. For iodine-131, a composite of 5 consecutive daily samples shall be analyzed once each quarter. As required by the department, more frequent monitoring shall be conducted when iodine-131 is identified in the finished water.

3. Annual monitoring for strontium-90 and tritium shall be conducted by means of a composite of 4 consecutive quarterly samples or analysis of 4 quarterly samples.

4. The department may allow the substitution of environmental surveillance data taken in conjunction with a nuclear facility for direct monitoring of man-made radioactivity by the supplier of water where the department determines such data is applicable to a particular community water system.

(d) If the average annual maximum contaminant level for man-made radioactivity set forth in s. NR 109.16 is exceeded, the operator of a community water system shall give notice to the department under s. NR 109.80 and to the public as required by s. NR 109.81. Monitoring at monthly intervals shall be continued until the concentration no longer exceeds the maximum contaminant level or until a monitoring schedule as a condition to a variance, exemption or enforcement action shall become effective.

History: Cr. Register, February, 1978, No. 266, eff. 3-1-78; am. (1) (a) (intro.) and (2) (a) (intro.), r. (1) (a) 2.a., renum. (1) (a) 2.b. and c. to be (1) (b) and (c), r. (2) (b), renum. (2) (c), (d), (intro.) and (e) to be (2) (b), (c), (intro.) and (d) and am., Register, April, 1982, No. 316, eff. 5-1-82; am. (1) (c), Register, August, 1989, No. 404, eff. 9-1-89.

Subchapter II — Secondary Chemical and Physical Standards and Monitoring Requirements

NR 109.60 Secondary inorganic chemical and physical standards. (1) Waters containing inorganic chemicals in quantities above the limits contained in this section are not hazardous to health but may be objectionable to an appreciable number of persons.

(2) The following are the secondary standards for inorganic chemicals:

Standard	Milligrams per liter
Chloride	250
Color	15 units
Copper	1.0
Corrosivity	Noncorrosive
Fluoride*	2.0
Foaming agents	
MBAS (Methylene-Blue Active Substances)0.5	
Hydrogen Sulfide.....	not detectable
Iron	0.3
Manganese	0.05
Odor	3 (Threshold No.)
Sulfate.....	250
Total Residue.....	500
Zinc	5

* Note: The primary maximum contaminant level for fluoride is contained in s. NR 109.11.

(3) The secondary standards contained in this section apply to all public water systems. Compliance with these standards shall be calculated in accordance with s. NR 109.61.

(4) **COMPLIANCE WITH THE SECONDARY DRINKING WATER STANDARD AND PUBLIC NOTIFICATION FOR FLUORIDE.** Suppliers of water having community water systems that exceed the secondary maximum contaminant level for fluoride as determined by the last single sample taken in accordance with the requirement of s. NR 109.12, but do not exceed the maximum contaminant level for fluoride as specified in s. NR 109.11, shall provide the notice prescribed in s. NR 109.81 (5) (i) to all billing units annually, all new billing units at the time service begins and annually to the department and the department of health and social services.

History: Cr. Register, February, 1978, No. 266, eff. 3-1-78; am. (2), Register, April, 1982, No. 316, eff. 3-1-82; am. (2), cr. (4), Register, August, 1989, No. 404, eff. 9-1-89.

NR 109.61 Sampling and analytical requirements for secondary standards. (1) If the department receives complaints regarding the aesthetic quality of the water the supplier of water may be required to implement a monitoring program to determine compliance with s. NR 109.60.

(2) If it is determined by the department that physical or chemical substances or both in excess of those standards contained in s. NR 109.60 are objectionable to an appreciable number of persons and are detrimental to the public welfare the department may, on its own motion, require remedial action by the supplier of water to insure that the public receives the highest quality water practicably obtainable.

(3) The department may require that laboratory test results submitted to the department under this section be performed by a laboratory certified or registered under subchs. I, II, and IV of ch. NR 149.

History: Cr. Register, February, 1978, No. 266, eff. 3-1-78; am. (2), Register, April, 1982, No. 316, eff. 4-1-82; cr. (3), Register, April, 1986, No. 364, eff. 8-28-86.

Subchapter III — Miscellaneous Chemical Monitoring Requirements, Raw Surface Water Standards, Approved Laboratories and Approved Methods for Safe Drinking Water Analysis.

NR 109.70 General requirements. Public water systems shall meet applicable minimum monitoring requirements stated in this chapter. The department may increase monitoring requirements of any section of this chapter, if the department deems such an increase is necessary to protect public health, safety and welfare. The department may decrease the monitoring requirements of any section of this chapter, if the department determines that such a decrease will not adversely affect protection of public health, safety or welfare.

History: Cr. Register, March, 1991, No. 423, eff. 4-1-91.

NR 109.705 Additional requirements for systems which chlorinate or fluoridate water. (1) **FLUORIDE.** (a) The supplier of water for a community water system artificially fluoridating the water shall establish a monitoring program in order to maintain the fluoride concentration within the range of 1.0 to 1.5 milligrams per liter as recommended by the dental health section of the department of health and social services for optimum dental benefits.

(b) The monitoring program shall include:

1. Submission of the results of daily fluoride tests of samples from the distribution system, and

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2. One sample per month taken from a representative location in the distribution system and submitted to the state laboratory of hygiene.

Note: For waterworks with large distribution systems and multiple sources, more than one fluoride test per day may be necessary to assure proper feed rates. See NR 111.54 (5) for testing equipment requirements. Exceptions to the daily fluoride test requirement may be approved by the department if it is demonstrated that the optimum fluoride concentration in par. (a) will be maintained by a reduced monitoring program.

(c) The sample submitted to the state laboratory of hygiene shall be a portion of a split sample so that the operator can determine the fluoride concentration with the operator's equipment and compare it to the state laboratory results. The fluoride concentration obtained by the operator shall be noted on the data sheet prior to submission to the state laboratory.

(2) **CHLORINE.** The suppliers of water for all waterworks which chlorinate water shall test chlorine residuals at locations and intervals necessary to control the chlorination process. At ground water supplies, the chlorine residual of a sample from a representative location in the distribution system shall be checked at least twice per week. Waterworks having surface water treatment plants shall determine the chlorine residual in the plant effluent at least every 2 hours and in the distribution system at least daily in representative locations. Where water quality changes rapidly, residuals shall be tested at more frequent intervals as specified by the department and in those individual cases, continuous monitoring equipment may be required if the department determines it is necessary to protect public health. Chlorine residual testing is required when bacteriological samples are taken.

History: Cr. Register, February, 1978, No. 266, eff. 3-1-78; am. (1) (b)1., Register, April, 1982, No. 316, eff. 5-1-82; renum. from NR 109.70 and am. (2), Register, March, 1991, No. 423, eff. 4-1-91.

NR 109.71 Raw surface water standards. The intake water shall be the highest quality reasonably available and which, with appropriate treatment and adequate safeguards, will meet the drinking water standards in this chapter.

History: Cr. Register, February, 1978, No. 266, eff. 3-1-78; am. Register, March, 1991, No. 423, eff. 4-1-91.

NR 109.72 Laboratories. (1) For the purpose of compliance with ss. NR 109.12, 109.13, 109.14, 109.21, 109.23, 109.25 and 109.26, samples shall be analyzed at the state laboratory of hygiene, at a laboratory facility acceptable to the U.S. environmental protection agency, or at a laboratory certified for the safe drinking water test category under ch. NR 149. For the purpose of compliance with ss. NR 109.31, 109.52 and 109.78, bacteriological and radiological samples shall be analyzed at a laboratory facility certified or approved by the department of health and social services, or at a laboratory facility acceptable to the U.S. environmental protection agency.

(2) All community water systems utilizing surface water sources shall analyze bacteriological samples for in-plant operational control at a laboratory facility approved by the department of health and social services.

History: Cr. Register, February, 1978, No. 266, eff. 3-1-78; renum. to be (1), cr. (2), Register, April, 1982, No. 316, eff. 5-1-82; am. (1), Register, April, 1986, No. 364, eff. 8-28-86; am. (1), Register, August, 1989, No. 404, eff. 9-1-89; am. (1), Register, March, 1991, No. 423, eff. 4-1-91.

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NR 109.725 Approved analytical methods for safe drinking water analyses. Only the following analytical methods are approved for analyses required by this chapter:

TABLE A
Approved Methodology for Primary Inorganic Contaminants

Contaminant	Methodology	EPA ¹	Reference (Method Number)		Other
			ASTM ²	SM ³	
Arsenic	Atomic absorption; furnace technique	206.2	-	-	-
	Atomic absorption; gaseous hydride	206.3	D2972-78B	301A-VII	I-1062-78 ⁹
	Spectrophotometric, silver diethyldithiocarbamate	206.4	D2972-78A	404A after B(4)	-
	Inductively Coupled Plasma (ICP)	200.7 ¹⁰	-	-	-
Barium	Atomic absorption; direct aspiration	208.1	-	301A-IV	-
	Atomic absorption; furnace technique	208.2	-	-	-
	ICP	200.7 ¹⁰	-	-	-
Cadmium	Atomic absorption; direct aspiration	213.1	D3557-78A or B	301A-II or III	-
	Atomic absorption; furnace technique	213.2	-	-	-
	ICP	200.7 ¹⁰	-	-	-
Chromium	Atomic absorption; direct aspiration	218.1	D1687-77D	301A-II or III	-
	Atomic absorption; furnace technique	218.2	-	-	-
	ICP	200.7 ¹⁰	-	-	-
Fluoride	Colorimetric SPADNS; with distillation	340.1	D1179-72A	-	413A and C ⁴
	Potentiometric ion selective electrode	340.2	D1179-72B	-	413B ⁴
	Automated Alizarin fluoride blue; with distillation	340.3	-	-	413E ⁴
					129-71W ⁵
Lead	Automated ion selective electrode	-	-	-	380-75WE ⁶
	Atomic absorption; direct aspiration	239.1	D3559-78A or B	301A-II or III	-
	Atomic absorption; furnace technique	239.2	-	-	-
	ICP	200.7 ¹⁰	-	-	-
Mercury	Manual cold vapor technique	245.1	D3223-79	301A-VI	-
	Automated cold vapor technique	245.2	-	-	-
Nitrate	Colorimetric brucine	352.1	D992-71	419D	-
	Spectrometric; cadmium reduction	353.3	D3867-79B	419C	-
	Automated hydrazine reduction	353.1	-	-	-
	Automated cadmium reduction	353.2	D3867-79A	605	-
	Ion selective electrode	-	-	-	93MM-79 ⁷
	Ion Chromatography ⁸	300.0	-	-	-
Selenium	Atomic absorption; furnace technique	270.2	-	-	-
	Atomic absorption; gaseous hydride	270.3	D3859-79	301A-VII	I-1667-78 ⁹
Silver	Atomic absorption; direct aspiration	272.1	-	301A-II	-
	Atomic absorption; furnace technique	272.2	-	-	-
	ICP	200.7 ¹⁰	-	-	-
Turbidity	Nephelometric	180.1	-	214A	-

¹ "Methods for Chemical Analysis of Water and Wastes", EPA Environmental Monitoring and Support Laboratory, Cincinnati, Ohio, 45268 (EPA-600/4-79-020), March 1983. Available from ORD Publications, CERL, EPA, 26 W. St. Claire, Cincinnati, Ohio, 45268. For approved analytical procedures for metals, the technique applicable to total metals shall be used.

- ² Annual Book of ASTM Standards, Part 31 Water, 1979. Available from the American Society for Testing and Materials, 1916 Race Street, Philadelphia, Pennsylvania, 19103.
- ³ "Standard Methods for the Examination of Water and Wastewater", 14th Edition, American Public Health Association, American Water Works Association, Water Pollution Control Federation, 1975. American Public Health Association, 1015 Fifteenth Street, N.W., Washington, D.C., 20005 (14th Edition is available on inter-library loan.)
- ⁴ "Standard Methods for the Examination of Water and Wastewater", 16th Edition, American Public Health Association, American Water Works Association, Water Pollution Control Federation, 1985. American Public Health Association, 1015 Fifteenth Street, N.W., Washington, D.C. 20005.
- ⁵ "Fluoride in Water and Wastewater Industrial Method #129-71W". December 1972. Available from Brant Luebbe Analyzing Technologies, Inc., 103 Fairview Park Drive, Elmsford, New York 10523-1500.
- ⁶ "Fluoride in Water and Wastewater", February 1976. Available from Technicon Industrial Systems, Benedict Avenue, Tarrytown, New York, 10591.
- ⁷ "Methods Manual 93 Series Electrodes". Form 93 MM/9790, pp. 2-5, 1979. Available from Orion Research Incorporated, 840 Memorial Drive, Cambridge, Mass. 02138.
- ⁸ Method 300.0 has been incorporated into "Methods for Chemical Analysis of Water and Wastes" (EPA/600/4-79/020) by Technical Addition (EPA/600/4-84/017) and is available from the EMSL-Cincinnati, 26 W. St. Claire Street, Cincinnati, Ohio 45268.
- ⁹ Techniques of Water Resources Investigation of the United States Geological Survey, Chapter A-1, "Methods for Determination of Inorganic Substances in Water and Fluvial Sediments, Book 5 (1979, Stock #024, 001-03177-9). Available from Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.
- ¹⁰ Method 200.7 with appendix entitled "Inductively Coupled Plasma-Atomic Emission Analysis of Drinking Water", March 1987. Available from the EMSL-Cincinnati, 26 W. St. Claire Street, Cincinnati, Ohio 45268.

TABLE B
Approved Methodology for Organic Contaminants

Contaminant	Methodology	Reference (Method Number)			USGS ⁴	Other
		EPA ¹	ASTM ²	SM ³		
Chlorinated hydrocarbons: endrin lindane methoxychlor toxaphene	Solvent extraction, gas chromatography	pp.1-19	D3086-79	509A	pp. 24-39	SPE-500 ¹⁶
Chlorophenoxy 2,4-D 2,4,5-TP	Solvent extraction, derivatization, gas chromatography	pp. 20-35	D3478-79	509B	pp. 24-39	SPE-500 ¹⁶
Total Trihalomethanes (TTHM) ⁵	Purge and trap, gas chromatography	(⁵)	-	-	-	
	Solvent extraction, gas chromatography	(⁶)	-	-	-	
	Gas chromatography/mass spectrometry (GC/MS)	(⁷)(⁸)	-	-	-	
Volatile Organic Chemicals other than TTHM	Purge and trap, gas chromatography	(¹⁰)(¹¹)(¹²)				
	purge and trap, GC/MS	(¹³)(¹⁴)				
1,2-Dibromoethane (EDB) & 1,2-Dibromo-3-chloropropane (DBCP)	Microextraction, gas chromatography	(¹⁵)				

- ¹ "Methods for Organochlorine Pesticides and Chlorophenoxy Acid Herbicides in Drinking Water and Raw Source Water", Available from ORD Publications, CERL, EPA, 20 W. St. Claire, Cincinnati, Ohio 45268.
- ² Annual Book of ASTM Standards, Part 31 Water, 1979. Available from the American Society for Testing and Materials, 1916 Race Street, Philadelphia, Pennsylvania 19103.
- ³ "Standard Methods for the Examination of Water and Wastewater." 14th Edition, 1975, American Public Health Association, American Water Works Association, Water Pollution Control Federation, 1015 Fifteenth Street, N.W., Washington, D.C. 20036 (14th Edition no longer available).
- ⁴ Techniques of Water-Resources Investigation of the United States Geological Survey, "Methods for Analysis of Organic Substances in Water", Book 5, Chapter A-3, 1972. Available from Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.
- ⁵ "The Analysis of Trihalomethanes in Finished Waters by the Purge and Trap Method", Method 501.1. Available from the EMSL, EPA, 26 W. St. Claire, Cincinnati, Ohio 45268.
- ⁶ "The Analysis of Trihalomethanes in Drinking Water by Liquid/Liquid Extraction", Method 501.2. Available from the EMSL, EPA, 26 W. St. Claire, Cincinnati, Ohio 45268.
- ⁷ "Measurement of Trihalomethanes in Drinking Water by Gas Chromatography/Mass Spectrometry and Selection Monitoring", Method 501.3. Available from the EMSL, EPA, 26 W. St. Claire, Cincinnati, Ohio 45268.

- ⁸ EPA Method 524 - "Measurement of Purgeable Organic Compounds in Drinking Water by GC/MS". Available from the EMSL, EPA, 26 W. St. Claire, Cincinnati, Ohio 45268.
- ⁹ 40 CFR 141.30 Appendix C, Federal Register, October 26, 1984. Available from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.
- ¹⁰ Method 502.1, "Volatile Halogenated Organic Chemicals in Water by Purge and Trap Gas Chromatography," Available from ORD Publications, CERL, EPA 20 W. St. Claire, Cincinnati, OH 45268.
- ¹¹ Method 503.1, "Volatile Aromatic and Unsaturated Organic Compounds in Water by Purge and Trap Gas Chromatography", Available from ORD Publications, CERL, EPA, 20 W. St. Claire, Cincinnati, OH 45268.
- ¹² Method 502.2, "Volatile Organic Compounds in Water by Purge and Trap Capillary Gas Chromatography with Photoionization and Electrolytic Conductivity Detectors in Series", Available from ORD Publications, CERL, EPA, 20 W. St. Claire, Cincinnati, OH 45268.
- ¹³ Method 524.1, "Volatile Organic Compounds in Water by Purge and Trap Gas Chromatography/Mass Spectrometry," available from ORD Publications, CERL, EPA, 20 W. St. Claire, Cincinnati, OH 45268.
- ¹⁴ Method 524.2, "Volatile Organic Compounds in Water by Purge and Trap Capillary Column Gas Chromatography/Mass Spectrometry," available from ORD Publications, CERL, EPA, 20 W. St. Claire, Cincinnati, OH 45288.
- ¹⁵ "Measurement of 1,2-Dibromoethane (EDB) and 1,2-Dibromo-3-Chloropropane (DBCP) in Drinking Water by Microextraction and Gas Chromatography", Available from ORD Publications, CERL, EPA, 20 W. St. Claire, Cincinnati, Ohio 45268.
- ¹⁶ "Solid Phase Extraction (SPE) test method number SPE-500 for EPA's "Methods for Organochlorine Pesticides and Chlorophenoxy Acid in Herbicides in Drinking Water and Raw Source Water". Available from J. T. Baker Chemical Company, 22 Red School Lane, Phillipsburg, NJ 08865.

TABLE C
Approved Methodology for Microbiological Measurements

	Methodology	EPA ¹	Standard Methods (16th Edition ²)
Total Coliform Bacteria	Multiple tube fermentation ³ (preferred for turbid or high noncoliform populations)	Part III, Section B, 4.1 thru 4.6.4(c) (pp. 114-118)	908, 908A, and 908B (pp. 870-878)
	Membrane filter ⁴ (preferred because large volumes of samples analyzed in much shorter time)	Part III, Section B, 2.1 thru 2.6 (pp. 108-112)	909, 909A, and 909B (pp. 886-896)
	Minimal Media ONPG-MUG(MMO-MUG) Test ⁵		
	Presence - Absence (P-A) Coliform Test		908E (pp. 882-886)
Total Coliform, Concentration	Standard Total Coliform Multiple Tube (MPN) Tests		908A, 908B, and 908D
	Standard Total Coliform Membrane Filter (MF) Procedure		909A or 909B
	Minimal Medium ONPG-MUG Test ⁷		
Fecal Coliform, follow up for positive total coliform test ⁶	See note ⁶		
Fecal Coliform Concentration	Fecal Coliform MPN Procedures		908C or 908D, (pp. 878-882)
	Fecal Coliform MF Procedures		909C (pp. 896-898)
Heterotrophic Plate Count	Pour Plate Method		907A (pp. 864-866)

TABLE C (continued)

- ¹ "Microbiological Methods for Monitoring the Environment, Water and Wastes", EPA-600/8-78-017, December 1978. Available from the U.S. EPA, Environmental Monitoring and Support Laboratory, 26 W. St. Claire Street, Cincinnati, Ohio, 54268.
- ² "Standard Methods for the Examination of Water and Wastewater", 16th Edition, American Public Health Association, American Water Works Association, Water Pollution Control Federation, 1985.
- ³ The standard sample size for MPN procedure shall be 10 times the standard portion of 10 ml.
- ⁴ A standard sample size of 100 ml shall be used for the membrane filter.
- ⁵ Analyses shall be conducted in accordance with the analytical recommendations set forth in "National Field Evaluation of a Defined Substrate Method for the Simultaneous Detection of Total Coliforms and Escherichia Coli from Drinking Water: Comparison with Presence - Absence Techniques", (Edberg et al.), Applied and Environmental Microbiology, 55, pp. 1003-1008, April 1989. Available from the American Water Works Association Research Foundation, 6666 West Quincy Ave., Denver, CO 80235.
- ⁶ Analyses shall be conducted in accordance with the analytical procedure described in Federal Register, Vol 54, No. 124, Thursday, June 29, 1989, Rules and Regulations, p. 27565, 40 CFR 141.21(f)(5).
- ⁷ Analyses shall be conducted in accordance with the analytical recommendations set forth in "National Field Evaluation of a Defined Substrate Method for the Simultaneous Enumeration of Total Coliforms and Escherichia Coli from Drinking Water: Comparison with the Standard Multiple Tube Fermentation Method", (Edberg et al.), pp. 1595-1601, June 1988 (as amended under Erratum, Volume 54, p. 3197, December, 1988). Available from the American Water Works Association Research Foundation, 6666 West Quincy Ave., Denver, CO 80235.

TABLE D
SDWA Approved Methodology for Radiological Measurements

Parameter	Method	EPA ¹	Standard Methods ²	ASTM ³ (1975)	Others
1) Gross alpha & beta	Total, suspended and dissolved	p. 1	302		
2) Total radium	Precipitation	p. 24	304		
3) Radium 226	Soluble, suspended and total	p. 16	305		
4) Strontium - 89, 90	Total	p. 29	303		
5) Tritium		p. 34	306		
6) Cesium - 134	Gamma spectrometry	p. 4		D-2459	
7) Uranium	Fluorometry			D-2907	
8) Others					(4)(5)

¹ "Interim Radiochemical Methodology for Drinking Water", EPA-600/4-75-008. Available from the EMSL, U.S. EPA, 26 W. St. Claire, Cincinnati, Ohio, 45268.

² "Standard Methods for the Examination of Water and Wastewater", 13th Edition, (1971), APHA, 1015 Fifteenth Street, N.W., Washington, D.C. 20005 (13th Edition no longer available).

³ "1975 Annual Book of ASTM Standards, Water and Atmospheric Analysis", Part 31, (1975). Available from the ASTM, 1916 Race Street, Philadelphia, PA, 19103.

⁴ "Procedures for Radiochemical Analysis of Nuclear Reactor Aqueous Solutions", May 1973, H. L. Krieger and S. Gold, EPA-R4-73-014. Available from U.S. EPA, 26 W. St. Claire Street, Cincinnati, Ohio, 45268.

⁵ "HASL Procedures Manual", Edited by John H. Hasley (1972), U.S., DOE, HASL-300. Available from the Environmental Measurements Laboratory, 376 Hudson Street, New York, NY, 10014.

TABLE E
Approved Methodology for Physical Parameters, Residual Chlorine, Sodium, Corrosivity and Secondary Contaminants

A. Inorganic					
Parameter and Method	EPA 1979 ¹	Standard Methods ²	ASTM ³	USGS ⁴	Other
1. Alkalinity, Methyl orange titrimetric or potentiometric	310.1	403 ^a	D1067-82B	-	-
2. Calcium					
EDTA titrimetric ¹¹	215.2	306C ^a	D511-82(B)	-	-
Atomic absorption; direct aspiration	215.1	301A-II ^a	D511-82(C)	-	-
Inductively Coupled Plasma	200.7 ⁵	-	-	-	-
3. Chloride					
Potentiometric ¹¹	-	408C ^a	-	-	-
Colorimetric (ferricyanide) manual or Automated	325.1, 325.2	407D ^b	D512-67(C)	I-1187-78 I-2187-78	-
Titrimetric, Mercuric Nitrate	325.3	407B ^b	D512-67(A)	I-1184-78	p. 554 ⁷
Ion Chromatography	300.0 ¹⁰	-	-	-	-
4. Chlorine dioxide residual					
Amperometric	-	410B ^c	-	-	-
DPD	-	410C ^c	-	-	-
5. Color					
Colorimetric Pt-Co	110.2	204A ^b	-	I-1250-78	-
Spectrophotometric	110.3	204B ^b	-	-	-
6. Copper - Total ⁶ , Digestion ⁶ , followed by:					
AA direct aspiration	220.1	303A ^b or 303B ^b	D1688-77 (D or E)	I-3271-78 or I-3270-78	p. 557 ⁷
AA furnace	220.2	304 ^b	-	-	-
Inductively Coupled Plasma	200.7 ⁵	-	-	-	-
7. Corrosivity:					
Langelier Index	-	203 ^a	-	-	-
Aggressive Index	-	-	-	-	C400-77 ⁸

TABLE E (Cont.)

Parameter and Method	EPA 1979 ¹	Standard Methods ²	ASTM ³	USGS ⁴	Other
8. Foaming Agents (MBAS)					
Colorimetric	425.1	512A ^b	-	-	-
9. Free chlorine residual ¹²					
Colorimetric or titrimetric DPD	-	408E ^c or 408F ^c	-	-	-
Lueco Crystal Violet Method	-	408F ^c	-	-	-
Amperometric	330.1	-	408C	D1253-76(A)	-
10. Iron - Total ⁶ , Digestion ⁶ , followed by:					
AA direct aspiration	236.1	303A ^b or 303B ^b	D1068-77 (C or D)	I-3381-78	p. 557 ⁷
AA furnace	236.2	304 ^b	-	-	-
Inductively Coupled Plasma	200.7 ⁵	-	-	-	-
11. Manganese Total ⁶ , Digestion ⁶ , followed by:					
AA direct aspiration	243.1	303A ^b or 303B ^b	D858-77 (B or C)	I-3454-78	p. 557 ⁷
AA furnace	243.2	304 ^b	-	-	-
Inductively Coupled Plasma	200.7 ⁵	-	-	-	-
Colorimetric (Persulfate)	-	319B ^b	D858-77 (A)	-	p. 564 ⁷
12. Odor - Threshold Odor	140.1	207 ^b			
13. Ozone					
Indigo Method	-	-	-	-	pp. 169-176 ¹³
14. pH					
Potentiometric	150.1	423 ^c	D1293-78 (A or B)	-	-
15. Sodium					
Atomic absorption; direct aspiration	273.1	-	-	-	-
Atomic absorption; furnace technique	273.2	-	-	-	-
Flame photometric	-	320A ^a	D1428-64A	-	-
Inductively Coupled Plasma	200.7 ⁵	-	-	-	-

TABLE E (Cont.)

Parameter and Method	EPA 1979 ¹	Standard Methods ²	ASTM ³	USGS ⁴	Other
16. Sulfate - Colorimetric, Automated, Chloranilate,	375.1	-	-	-	-
Automated, Methylthymol Blue	375.2	-	-	I-2822-78	-
Ion Chromatography	300.0 ¹⁰	-	-	-	-
Gravimetric	375.3	426A ^b or 426B ^b	D516-68 (A)	-	pp. 562-63 ⁷
Turbidimetric ¹¹	375.4	427C ^a	D516-68 (B)	-	-
17. Sulfide (as S)					
Titrimetric (iodine)	376.1	427D ^b	-	I-3840-78	-
Colorimetric (methylene blue)	372.2	427C ^b	-	-	-
18. Temperature					
Thermometric	-	212 ^c	-	-	-
19. Total Filterable Residue, gravimetric	160.1	208B ^a	-	-	-
20. Total Residue, gravimetric	160.3	209A ^b	-	I3750-78	-
21. Turbidity, nephelometric method	-	214A ^c	-	-	-
22. Zinc - Total ⁶ , Digestion ⁶ followed by:					
AA direct aspiration	289.1	303A ^b or 303B ^b	D1691-77 (D)I-3900-78	p. 557 ⁷	-
AA furnace	289.2	-	D1691-77 (C)	-	-
Inductively Coupled Plasma	200.7 ⁵	-	-	-	-
Colorimetric (Dithizone)	-	328B ^b	-	-	-
Zincon	-	-	-	-	(⁸)

¹ "Methods for Chemical Analysis of Water and Wastes", (EPA-600/4-79-020), March 1979, EPA Environmental Monitoring and Support Laboratory, Cincinnati, Ohio, 45268. Available from ORD Publications, CERL, EPA, 26 W. St. Claire Street, Cincinnati, Ohio 45268. For approved analytical procedures for metals, the technique applicable to total metals shall be used.

² "Standard Methods for the Examination of Water and Wastewater", American Public Health Association, American Water Works Association, Water Pollution Control Federation, 1015 Fifteenth Street, N.W., Washington, D.C. 20005. ^a 14th edition, 1975; ^b 15th edition 1980, and; ^c 16th edition, 1985.

TABLE E (Cont.)

- 3 "Annual Book of ASTM Standards, Part 31, Water", 1980. Available from the American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103. The same method in the current edition may be used if the date of method revision is the same as the 1980 edition.
- 4 "Methods for Analysis of Inorganic Substances in Water and Fluvial Sediments", U.S. Department of the Interior, U.S. Geological Survey, Open-File Report 78-679, or "Methods for Determination of Inorganic Substances in Water and Fluvial Sediments," N.W. Skongstad, et al; U.S. Geological Survey, TWRI, Book 5, Chapter A1, 1979. Available from U.S. Geological Survey, 604 S. Pickett Street, Alexandria, VA 22304.
- 5 Method 200.7 with appendix titled "Inductively Coupled Plasma Atomic Emission Analysis of Drinking Water", March 1987. Available from the EMSL - Cincinnati, 26 W. St. Claire Street, Cincinnati, Ohio 45268.
- 6 For the determination of total metals the sample is not filtered before processing. A digestion procedure is required to solubilize suspended material and to destroy possible organic-metal complexes. Two digestion procedures are given in "Methods for Chemical Analysis of Water and Wastes, 1979." One (§ 4.1.3), is a vigorous digestion using nitric acid. A less vigorous digestion using nitric and hydrochloric acids (§ 4.1.4) is preferred; however the analyst should be cautioned that this mild digestion may not suffice for all sample types. Particularly, if a colorimetric procedure is to be employed, it is necessary to ensure that all organo-metallic bonds be broken so that the metal is in a reactive state. In those situations, the vigorous digestion is to be preferred making certain that at no time does the sample to dryness. Samples containing large amount of organic materials would also benefit by this vigorous digestion. Use of the graphite furnace technique, inductively coupled plasma, as well as determination for certain elements such as arsenic, the noble metals, mercury, selenium, and titanium require a modified digestion and in all cases the method write up should be consulted for specific instruction or cautions.
- 7 "Official Methods of Analysis of the AOAC" methods manual, 13th ed. (1980). Current edition available from the Association of Official Analytical Chemists, 1111 N. 19th Street, Suite 210, Arlington, VA 22209. (The method in the current edition may be used if the date of method revision is the same as the 13th edition.)
- 8 "AWWA Standards for Asbestos - Cement Pipe, 4 in. through 16 in. for Water and Other Liquids", AWWA C400-77, Revision of C400-75. Available from the AWWA, 6666 West Quincy Avenue, Denver Colorado, 80235.
- 9 Zinc, Zincon Method, Method 8009, Hach Handbook of Water Analysis, 1979, pages 2-231 and 2-333. Available from the Hach Chemical Company, P.O. Box 389, Loveland, Colorado 80537.
- 10 Method 300.0 has been incorporated into "Methods for Chemical Analysis of Water and Wastes", (EPA 600/4-79/020) by Technical Addition (EPA 600/4-84/017), and is available from the EMSL-Cincinnati, 26 W. St. Claire Street, Cincinnati, Ohio 45268.
- 11 This is the method to use for corrosivity determination.
- 12 Residual disinfectant concentrations for free chlorine and combined chlorine may also be measured by using DPD colorimetric test kits if approved by the department.
- 13 "Determination of Ozone in Water by the Indigo Method; A Submitted Standard Method"; Ozone Science and Engineering, Vol. 4, ppl 169-176, Pergamon Press Ltd., 1982, or automated methods which are calibrated in reference to the results obtained by the Indigo Method on a regular basis, if approved by the department.

History: Cr. Register, March, 1991, No. 423, eff. 4-1-91.

NR 109.73 Monitoring of consecutive public water systems. When a public water system supplies water to one or more other public water systems, the department may modify the monitoring requirements imposed by this chapter to the extent that the interconnection of the systems justifies treating them as a single system for monitoring purposes. Any modified monitoring shall be conducted pursuant to a schedule specified by the department and concurred in by the administrator of the U.S. environmental protection agency.

History: Cr. Register, February, 1978, No. 266, eff. 3-1-78.

NR 109.74 Sampling and analytical requirements for other chemicals. (1) If the department determines that the public health, safety or welfare requires testing for chemical or physical constituents in water which are not contained in this chapter the department may order such testing as it deems necessary.

(a) The department shall provide public notice and an opportunity for public hearing within 90 days after any order under this subsection.

(b) Hearings under this subsection shall be class 1 hearings and shall be held in accordance with ch. 227, Stats.

(c) Such testing shall be done at a laboratory certified or registered under ch. NR 149 as the department may require on a case-by-case basis.

(2) Testing for other constituents shall be performed at water systems as determined necessary by the department for design and control of treatment processes for contaminants which may affect public health or welfare. Such testing shall be done at a laboratory certified or registered under ch. NR 149 as the department may require on a case-by-case basis.

History: Cr. Register, February, 1978, No. 266, eff. 3-1-78; cr. (1) (c), am. (2), Register, April, 1986.

Subchapter IV — Filtration and Disinfection

NR 109.75 General requirements. (1) These regulations establish criteria under which filtration is required as a treatment technique for public water systems supplied by a surface water source or a groundwater source under the direct influence of surface water. Direct influence shall be determined for individual sources by the department. The department determination of direct influence may be based on site-specific measurements of water quality characteristics such as those stated in s. NR 109.04 (20) or documentation of well construction characteristics and geology with field evaluation. These regulations also establish requirements for treatment techniques in lieu of maximum contaminant levels for *Giardia lamblia*, viruses, heterotrophic plate count bacteria, *Legionella* and turbidity. Treatment technique requirements apply to every public water system which utilizes surface water or ground water under the direct influence of surface water and the requirements consist of installing and properly operating water treatment processes which reliably achieve:

(a) At least 99.9% (3 log) removal or inactivation of *Giardia lamblia* cysts between a point where the raw water is not subject to recontamination by surface water runoff and a point downstream before or at the first customer; and

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(b) At least 99.9% (4 log) removal or inactivation of viruses between a point where the raw water is not subject to recontamination by surface water runoff and a point downstream before or at the first customer.

(2) A public water system using a surface water source or a ground water under the direct influence of surface water is considered to be in compliance with the requirements of sub. (1) if it meets the filtration requirements in s. NR 109.76 and the disinfection requirements in s. NR 109.77.

(3) Each public water system using a surface water source or a ground water under the direct influence of surface water shall be operated by qualified personnel who meet the requirements specified by the department.

History: Cr. Register, March, 1991, No. 423, eff. 4-1-91.

NR 109.755 Criteria for avoiding filtration. A public water system that uses ground water under the direct influence of surface water as a water supply source shall meet all of the conditions of subs. (1) and (2), and is subject to sub. (3), on or after December 30, 1991, unless the department has determined, in writing, that filtration is required. If the department determines in writing, before December 30, 1991, that filtration is required, the system owner shall install filtration and shall meet the criteria for filtered systems specified in ss. NR 109.77 and 109.78 by June 29, 1993. Within 18 months of the failure of a public water system using a ground water source under the direct influence of surface water to meet any one of the requirements of subs. (1) and (2) or after June 29, 1993, whichever is later, the system owner shall install filtration and shall meet the criteria for filtered systems specified in ss. NR 109.77 and 109.78.

(1) **SOURCE WATER QUALITY CONDITIONS.** (a) The fecal coliform concentration shall be equal to or less than 20/100ml, or the total coliform concentration shall be equal to or less than 100/100 ml, measured as specified in s. NR 109.725 Table C, in representative samples of the source water immediately prior to the first or only point of disinfectant application in at least 90% of the measurements made for the 6 previous months that the system served water to the public on an ongoing basis. If a system measures both fecal and total coliforms, the fecal coliform criterion, but not the total coliform criterion, in this paragraph shall be met.

(b) The turbidity level may not exceed 5 NTU, measured as specified in s. NR 109.725 Table A, in representative samples of the source water immediately prior to the first or only point of disinfectant application unless:

1. The department determines that any such event was caused by circumstances that were unusual and unpredictable; and

2. There have not been more than 2 events in the past 12 months the system served water to the public, or more than 5 events in the past 120 months the system served water to the public, in which the turbidity level exceeded 5 NTU. An "event" is a series of consecutive days during which at least one turbidity measurement each day exceeds 5 NTU.

(2) **SITE-SPECIFIC CONDITIONS.** (a) 1. The public water system shall meet the disinfection requirements of s. NR 109.77 (1) (a) at least 11 of the 12 previous months that the system served water to the public, on an ongoing basis, unless the system fails to meet the requirements during 2

of the 12 previous months that the system served water to the public, and the department determines that at least one of these failures was caused by circumstances that were unusual and unpredictable.

2. The public water system shall meet the requirements of s. NR 109.77 (1) (b) at all times the system serves water to the public.

3. The public water system shall meet the requirements of s. NR 109.77 (1) (c) at all times the system serves water to the public unless the department determines that any such failure was caused by circumstances that were unusual and unpredictable.

4. The public water system shall meet the requirements of s. NR 109.77 (1) (d) on an ongoing basis unless the department determines that failure to meet these requirements was not caused by a deficiency in treatment of the source water.

(b) The public water system shall maintain a department approved well head protection program which minimizes the potential for contamination by *Giardia lamblia* cysts and viruses in the source water. The department shall determine whether the well head protection program is adequate to meet this goal. At a minimum, the program shall:

1. Characterize the watershed hydrology, hydrogeology and land ownership;

2. Identify watershed characteristics and activities which may have an adverse effect on source water quality; and

3. Monitor the occurrence of activities which may have an adverse effect on source water quality.

(c) The public water system is subject to an annual on-site inspection to assess the well head protection program and disinfection treatment process. Either the department or a party approved by the department shall conduct the on-site inspection. The inspection shall be conducted by competent individuals and shall include:

1. A review of the effectiveness of the watershed control program;

2. A review of the physical condition of the source intake and how well it is protected;

3. A review of the system's equipment maintenance program to ensure there is low probability for failure of the disinfection process;

4. An inspection of the disinfection equipment for physical deterioration;

5. A review of operating procedures;

6. A review of data records to ensure that all required tests are being conducted and recorded and disinfection is effectively practiced; and

7. Identification of any improvements which are needed in the equipment, system maintenance and operation, or data collection.

(d) The public water system may not have been identified as a source of a waterborne disease outbreak, or if it has been so identified, the system shall be modified sufficiently to prevent another such occurrence, as determined by the department.

(e) The public water system shall comply with the maximum contaminant level (MCL) for total coliforms in s. NR 109.30 at least 11 months of the previous 12 months that the system served water to the public, on an ongoing basis, unless the department determines that failure to meet this requirement was not caused by a deficiency in treatment of the source water.

(f) The public water system shall comply with the requirements for trihalomethanes in s. NR 109.23.

(3) TREATMENT TECHNIQUE VIOLATIONS. (a) A system that fails to meet any one of the criteria in subs. (1) and (2), and which the department has determined in writing that filtration is required, and fails to install filtration by June 29, 1993, is in violation of a treatment technique requirement.

(b) A system that has not installed filtration is in violation of a treatment technique if:

1. The turbidity level in a representative sample of the source water immediately prior to the first or only point of disinfection application exceeds 5 NTU; or

2. The system is identified as a source of a waterborne disease outbreak.

(4) ADDITIONAL CIRCUMSTANCES WHEN FILTRATION WOULD BE REQUIRED. The department may require a public water system to install filtration even when the system meets the requirements of subs. (1) and (2) if other water quality characteristics or site specific conditions present a threat to public health which could not be eliminated by disinfection alone.

History: Cr. Register, March, 1991, No. 423, eff. 4-1-91.

NR 109.76 Filtration requirements. Public water systems that use a surface water source shall provide filtration which complies with the requirements of sub. (1) and meets the disinfection criteria for filtered systems specified in s. NR 109.77 (1) by June 29, 1993. Public water systems that use a ground water source under the direct influence of surface water shall provide filtration which complies with the specifications of sub. (1), (2), (3), (4) or (5) and meets the disinfection criteria for filtered systems specified in s. NR 109.77 by June 29, 1993 or within 18 months of the date that a source is determined to be under the direct influence of surface water, whichever is later.

(1) CONVENTIONAL FILTRATION TREATMENT. (a) For systems using conventional filtration, the turbidity level of representative samples of a system's filtered water shall be less than or equal to 0.5 NTU in at least 95% of the measurements taken each month, measured as specified in s. NR 109.725, Table E. The department may approve a turbidity limit up to 1 NTU if the water supplier provides the department with documentation which reliably indicates the system achieves at least 99.9% removal or inactivation of *Giardia lamblia* cysts at a turbidity level above 0.5 NTU at least 95% of the time that the system delivers water to the public.

(b) The turbidity level of representative samples of a system's filtered water may not exceed 5 NTU, measured as specified in s. NR 109.725, Table E.

(2) **DIRECT FILTRATION.** (a) For systems using direct filtration, the turbidity level of representative samples of a system's filtered water shall be less than or equal to 0.5 NTU in at least 95% of the measurements taken each month, measured as specified in s. NR 109.725, Table E. The department may approve a turbidity limit up to 1 NTU if the water supplier provides the department with documentation which reliably indicates the system achieves at least 99.9% removal or inactivation of *Giardia lamblia* cysts at a turbidity level above 0.5 NTU at least 95% of the time that the system delivers water to the public.

(b) The turbidity level of representative samples of a system's filtered water may not exceed 5 NTU, measured as specified in s. NR 109.725, Table E.

(3) **SLOW SAND FILTRATION.** (a) For systems using slow sand filtration, the turbidity level of representative samples of a system's filtered water shall be less than or equal to 1 NTU in at least 95% of the measurements taken each month, measured as specified in s. NR 109.725, Table E.

(b) The turbidity level of representative samples of a system's filtered water may not exceed 5 NTU, measured as specified in s. NR 109.725, Table E.

(4) **DIATOMACEOUS EARTH FILTRATION.** (a) For systems using diatomaceous earth filtration, the turbidity level of representative samples of a system's filtered water shall be less than or equal to 1 NTU in at least 95% of the measurements taken each month, measured as specified in s. NR 109.725, Table E.

(b) The turbidity level of representative samples of a system's filtered water may not exceed 5 NTU, measured as specified in s. NR 109.725, Table E.

(5) **OTHER FILTRATION TECHNOLOGIES.** A public water system supplier may use a filtration technology not listed in subs. (1) to (4) if the supplier demonstrates to the department, using pilot studies or other means, that the alternative filtration technology, in combination with disinfection treatment that meets the requirements of s. NR 109.78, consistently achieves 99.9% removal or inactivation of *Giardia lamblia* cysts and 99.9% removal or inactivation of viruses. For a system that makes this demonstration, the requirements of sub. (3) apply.

History: Cr. Register, March, 1991, No. 423, eff. 4-1-91.

NR 109.77 Disinfection requirements. A system which uses ground water under the direct influence of surface water and does not provide filtration treatment shall provide disinfection treatment specified in sub. (1) on or after December 31, 1991, or 18 months after the department determines that the ground water source is under the influence of surface water, whichever is later. A system which filters and uses surface water or ground water under the direct influence of surface water as a source, shall provide the disinfection treatment specified in sub. (2) on or after June 29, 1993, or when filtration is installed, whichever is later. Failure to meet any requirement of this section after June 29, 1993 is a treatment technique violation.

Register, March, 1991, No. 423

(1) DISINFECTATION REQUIREMENTS FOR PUBLIC WATER SYSTEMS THAT DO NOT PROVIDE FILTRATION. (a) The disinfection treatment shall be sufficient to ensure at least 99.9% (3 log) inactivation of *Giardia lamblia* cysts and 99.99% (4 log) inactivation of viruses, every day the system serves water to the public, except any one day each month. Each day a system serves water to the public, the water supplier shall calculate the CT value from the system's treatment parameters using the procedure specified in s. NR 109.78 (2), and determine whether this value is sufficient to achieve the specified inactivation rates for *Giardia lamblia* cysts and viruses. Systems using a disinfectant other than chlorine shall demonstrate to the department through on-site challenge studies or other information that the system is achieving required minimum inactivation rates.

(b) The disinfection system shall have either redundant components, including an auxiliary power supply with automatic start-up and alarm to ensure that disinfectant application is maintained continuously while water is being delivered to the distribution system, or automatic shut-off of water delivery to the distribution system whenever there is less than 0.2 mg/l of residual disinfectant concentration in the water. If the department determines that automatic shut-off of delivery of water to the distribution system would cause an unreasonable risk to health or property, the system shall have redundant components.

(c) The residual disinfectant concentration in the water entering the distribution system, measured as specified in s. NR 109.725, Table E, may not be less than 0.2 mg/l for more than 4 hours.

(d) 1. The residual disinfectant concentration in the distribution system, measured as total chlorine, combined chlorine, or chlorine dioxide, as specified in s. NR 109.725 Table E, may not be undetectable in more than 5% of the samples each month, for any 2 consecutive months that the system serves water to the public. Water in the distribution system with a heterotrophic bacteria concentration less than or equal to 500/ml, measured as heterotrophic plate count (HPC) as specified in s. NR 109.725, Table C, is deemed to have a detectable disinfectant residual for purposes of determining compliance with this requirement. Thus, the value "V" in the following formula cannot exceed 5% in one month for any 2 consecutive months.

$$V = c + d + e/a + b \times 100$$

where:

a = number of instances where the residual disinfectant concentration is measured;

b = number of instances where the residual disinfectant concentration is not measured but heterotrophic bacteria plate count (HPC) is measured;

c = number of instances where the residual disinfectant concentration is measured but not detected and no HPC is measured;

d = number of instances where no residual disinfectant concentration is detected and where the HPC is > 500/ml; and

e = number of instances where the residual disinfectant concentration is not measured and HPC is > 500/ml.

2. If the department determines, based on site specific considerations, that a system has no means for having a sample transported and analyzed for HPC by a certified laboratory under the requisite time and temperature conditions required in s. NR 109.725, Table C, and that the system is providing adequate disinfection in the distribution system, the requirements of subd. 1. do not apply.

(2) **DISINFECTION REQUIREMENTS FOR PUBLIC WATER SYSTEMS WHICH PROVIDE FILTRATION.** Each public water system that provides filtration treatment shall provide disinfection treatment as follows:

(a) Disinfection treatment shall be sufficient to ensure that the total treatment processes of that system achieve at least 99.9% (3 log) inactivation or removal of *Giardia lamblia* cysts and at least 99.99% (4 log) inactivation or removal of viruses, as determined by the department.

(b) The residual disinfectant concentration in the water entering the distribution system, measured as specified in s. NR 109.725, Table E, may not be less than 0.2 mg/l for more than 4 hours.

(c) 1. The residual disinfectant concentration in the distribution system, measured as total chlorine, combined chlorine or chlorine dioxide, as specified in s. NR 109.725, Table E, may not be undetectable in more than 5% of the samples each month, for any 2 consecutive months that the system serves water to the public. Water in the distribution system with a heterotrophic bacteria concentration less than or equal to 500/ml, measured as heterotrophic plate count (HPC) as specified in s. NR 109.725, Table C, is deemed to have a detectable disinfectant residual for purposes of determining compliance with this requirement. Thus, the value "V" in the following formula may not exceed 5% in one month, for any 2 consecutive months.

$$V = c + d + e/a + b \times 100$$

where:

a = number of instances where the residual disinfectant concentration is measured;

b = number of instances where the residual disinfectant concentration is not measured but heterotrophic bacteria plate count (HPC) is measured;

c = number of instances where the residual disinfectant concentration is measured but not detected and no HPC is measured;

d = number of instances where no residual disinfectant concentration is detected and where the HPC is > 500/ml; and

e = number of instances where the residual disinfectant concentration is not measured and HPC is > 500/ml.

2. If the department determines, based on site specific considerations, that a system has no means for having a sample transported and analyzed for HPC by a certified laboratory under the requisite time and temperature conditions required in s. NR 109.725, Table C, and that the system is providing adequate disinfection in the distribution system, the requirements of subd. 1. do not apply.

(3) The department may require continuous disinfection of public water systems using ground water not under the direct influence of surface water if it determines that an existing or potential public health threat to the water system warrants such a requirement. Additional treatment including disinfectant contact time may be required by the department on a case-by-case basis.

(a) The following conditions, as well as other conditions, are considered by the department to be existing or potential water system public health threats:

1. A public water system history of microbiological contamination in the water source or distribution system by either coliform or noncoliform bacteria.

2. The presence of color in raw water from a well serving a public system.

3. Inadequate construction, i.e. construction which does not meet current requirements of ch. NR 111 or 112, of a well which serves a public water system.

(b) Disinfectant treatment required under this section shall meet the requirements of sub. (1).

History: Cr. Register, March, 1991, No. 423, eff. 4-1-91.

NR 109.78 Monitoring requirements. (1) **MONITORING REQUIREMENTS FOR GROUND WATER SYSTEMS UNDER THE DIRECT INFLUENCE OF SURFACE WATER THAT DO NOT PROVIDE FILTRATION.** A public water system that uses a ground water source under the direct influence of surface water and does not provide filtration treatment shall begin monitoring as specified in sub. (2) December 31, 1990, or 6 months after the department determines that the ground water source is under the direct influence of surface water, whichever is later.

(a) Fecal coliform or total coliform density measurements as required by s. NR 109.755 (1) (a) shall be performed on representative source water samples immediately prior to the first or only point of disinfectant application. The system owner or operator shall sample for fecal or total coliforms at the following minimum frequency each week the system serves water to the public:

System Size (persons served)	Samples/week ¹
< or = 500	1
501 to 3,300	2
3,301 to 10,000	3
10,001 to 25,000	4
> 25,000	5

¹ Shall be taken on separate days

In addition, one fecal or total coliform density measurement shall be performed every day the system serves water to the public and the turbidity of the source water exceeds 1 NTU (these samples count toward the weekly coliform sampling requirement).

(b) Turbidity measurements as required by s. NR 109.755 (1) (b) shall be performed on representative grab samples of source water immediately prior to the first or only point of disinfectant application every 4

hours (or more frequently) that the system serves water to the public. A public water system may substitute continuous turbidity monitoring for grab sample monitoring if it validates the continuous measurement for accuracy on a regular basis using a protocol approved by the department.

(c) The total inactivation ratio for each day that the system is in operation shall be determined based on the $CT_{99.9}$ values in Tables 1 to 8 of subd. 6., as appropriate. The parameters necessary to determine the total inactivation ratio shall be monitored as follows:

1. Temperature of the disinfected water shall be measured at least once per day at each residual disinfectant concentration sampling point.

2. If the system uses chlorine, the pH of the disinfected water shall be measured at least once per day at each chlorine residual disinfectant concentration sampling point.

3. The disinfectant contact time ("T") shall be determined for each day during peak hourly flow.

4. The residual disinfectant concentration ("C") of the water before or at the first customer shall be measured each day during peak hourly flow.

5. If a system uses a disinfectant other than chlorine, the system may demonstrate to the department, through the use of a department approved protocol for on-site disinfection challenge studies or other information satisfactory to the department, that $CT_{99.9}$ values other than those specified in tables 7 and 8, and other operational parameters, are adequate to demonstrate that the system is achieving the minimum inactivation rates specified in s. NR 109.77 (1) (a).

6. CT Tables.

Table 1 — CT Values ($CT_{99.9}$) for 99.9 Percent Inactivation of *Giardia Lamblia* Cysts by Free Chlorine at 0.5 °C or Lower¹

RESIDUAL (mg/l)	pH						
	< = 6.0	6.5	7.0	7.5	8.0	8.5	< = 9.0
< or = 0.4	137	163	195	237	277	329	390
0.6	141	168	200	239	286	342	407
0.8	145	172	205	246	295	354	422
1.0	148	176	210	253	304	365	437
1.2	152	180	215	259	313	376	451
1.4	155	184	221	266	321	387	464
1.6	157	189	226	273	329	397	477
1.8	162	193	231	279	338	407	489
2.0	165	197	236	286	346	417	500
2.2	169	201	242	297	353	426	511
2.4	172	205	247	298	361	435	522
2.6	175	209	252	304	368	444	533
2.8	178	213	257	310	375	452	543
3.0	181	217	261	316	382	460	552

¹ These CT values achieve greater than a 99.9 percent inactivation of viruses. CT values between the indicated pH values may be determined by linear interpolation. CT values between the indicated temperatures of different tables may be determined by linear interpolation. If no interpolation is used, use the $CT_{99.9}$ value at the lower temperature and at the higher pH.

Table 2 — CT Values ($CT_{99.9}$) for 99.9 Percent Inactivation of *Giardia Lamblia* Cysts by Free Chlorine at 0.5 °C¹

RESIDUAL (mg/l)	pH						
	< = 6.0	6.5	7.0	7.5	8.0	8.5	< = 9.0
< or = 0.4	97	117	139	166	198	239	279
0.6	100	120	143	171	204	244	291
0.8	103	122	146	175	210	252	301
1.0	105	125	149	179	216	260	312
1.2	107	127	152	183	221	267	320
1.4	109	130	155	187	227	274	329
1.6	111	132	158	192	232	281	337
1.8	114	135	162	196	238	287	345
2.0	116	138	165	200	243	294	353
2.2	118	140	169	204	248	300	361
2.4	120	143	172	209	253	306	368
2.6	122	146	175	213	258	312	375
2.8	124	148	178	217	263	318	382
3.0	126	151	182	221	268	324	389

¹ These CT values achieve greater than a 99.9 percent inactivation of viruses. CT values between the indicated pH values may be determined by linear interpolation. CT values between the indicated temperatures of different tables may be determined by linear interpolation. If no interpolation is used, use the $CT_{99.9}$ value at the lower temperature and at the higher pH.

Table 3 — CT Values (CT_{99.9}) for 99.9 Percent Inactivation of *Giardia Lamblia* Cysts by Free Chlorine at 10.0 °C¹

RESIDUAL (mg/l)	pH						
	< = 6.0	6.5	7.0	7.5	8.0	8.5	< = 9.0
< or = 0.4	73	88	104	125	149	177	209
0.6	75	90	107	128	153	183	218
0.8	78	92	110	131	158	189	226
1.0	79	94	112	134	162	195	234
1.2	80	95	114	137	166	200	240
1.4	82	98	116	140	170	206	247
1.6	83	99	119	144	174	211	253
1.8	86	101	122	147	179	215	259
2.0	87	104	124	150	182	221	265
2.2	89	105	127	153	186	225	271
2.4	90	107	129	157	190	230	276
2.6	92	110	131	160	194	234	281
2.8	93	111	134	163	197	239	287
3.0	95	113	137	166	201	243	292

¹ These CT values achieve greater than a 99.9 percent inactivation of viruses. CT values between the indicated pH values may be determined by linear interpolation. CT values between the indicated temperatures of different tables may be determined by linear interpolation. If no interpolation is used, use the CT_{99.9} value at the lower temperature and at the higher pH.

Table 4 — CT Values (CT_{99.9}) for 99.9 Percent Inactivation of *Giardia Lamblia* Cysts by Free Chlorine at 15.0 °C¹

RESIDUAL (mg/l)	pH						
	< = 6.0	6.5	7.0	7.5	8.0	8.5	< = 9.0
< or = 0.4	49	59	70	83	99	118	140
0.6	50	60	72	86	102	122	146
0.8	52	61	73	88	105	126	151
1.0	53	63	75	90	108	130	156
1.2	54	63	75	92	111	134	160
1.4	55	65	78	94	114	137	165
1.6	56	66	79	96	116	141	169
1.8	57	68	81	98	119	144	173
2.0	58	69	83	100	122	147	177
2.2	59	70	85	102	124	150	181
2.4	60	72	86	105	127	153	184
2.6	61	73	88	107	129	156	188
2.8	62	74	89	109	132	159	191
3.0	63	76	91	111	134	162	195

¹ These CT values achieve greater than a 99.9 percent inactivation of viruses. CT values between the indicated pH values may be determined by linear interpolation. CT values between the indicated temperatures of different tables may be determined by linear interpolation. If no interpolation is used, use the CT_{99.9} value at the lower temperature and at the higher pH.

Table 5 — CT Values (CT_{99.9}) for 99.9 Percent Inactivation of *Giardia*
Lamblia Cysts by Free Chlorine at 20.0 °C¹

RESIDUAL (mg/l)	pH						
	< = 6.0	6.5	7.0	7.5	8.0	8.5	< = 9.0
< or = 0.4	36	44	52	62	74	89	105
0.6	38	45	54	64	77	92	109
0.8	39	46	55	66	79	95	113
1.0	39	47	56	67	81	98	117
1.2	40	48	57	69	83	100	120
1.4	41	49	58	70	85	103	123
1.6	42	50	59	72	87	105	126
1.8	43	51	61	74	89	108	129
2.0	44	52	62	75	91	110	132
2.2	44	53	63	77	93	113	135
2.4	45	54	65	78	95	115	138
2.6	46	55	66	80	97	117	141
2.8	47	56	67	81	99	119	143
3.0	47	57	68	83	101	122	146

¹ These CT values achieve greater than a 99.9 percent inactivation of viruses. CT values between the indicated pH values may be determined by linear interpolation. CT values between the indicated temperatures of different tables may be determined by linear interpolation. If no interpolation is used, use the CT_{99.9} value at the lower temperature and at the higher pH.

Table 6 — CT Values (CT_{99.9}) for 99.9 Percent Inactivation of *Giardia*
Lamblia Cysts by Free Chlorine at 25.0 °C or Higher¹

RESIDUAL (mg/l)	pH						
	< = 6.0	6.5	7.0	7.5	8.0	8.5	< = 9.0
< or = 0.4	24	29	35	42	50	59	70
0.6	25	30	36	43	51	61	73
0.8	26	31	37	44	53	63	75
1.0	26	31	37	45	54	65	78
1.2	27	32	38	46	55	67	80
1.4	27	33	39	47	57	69	82
1.6	28	33	40	48	58	70	84
1.8	29	34	41	49	60	72	86
2.0	29	35	41	50	61	74	88
2.2	30	35	42	51	62	75	90
2.4	30	36	43	52	63	77	92
2.6	31	37	44	53	65	78	94
2.8	31	37	45	54	66	80	96
3.0	32	38	46	55	67	81	97

¹ These CT values achieve greater than a 99.9 percent inactivation of viruses. CT values between the indicated pH values may be determined by linear interpolation. CT values between the indicated temperatures of different tables may be determined by linear interpolation. If no interpolation is used, use the CT_{99.9} value at the lower temperature and at the higher pH.

Table 7 — Values (CT_{99.9}) for 99.9 Percent Inactivation of *Giardia Lamblia* Cysts by Chlorine Dioxide and Ozone¹

DISINFECTANT	TEMPERATURE					
	<= 1°C	5°C	10°C	15°C	20°C	>= 25°C
Chlorine Dioxide	63	26	23	19	15	11
Ozone	2.9	1.9	1.4	0.95	0.72	0.48

¹ These CT values achieve greater than 99.9 percent inactivation of viruses. CT values between the indicated temperatures may be determined by linear interpolation. If no interpolation is used, use the CT_{99.9} value at the lower temperature for determining the CT_{99.9} values between indicated temperatures.

Table 8 — CT Values (CT_{99.9}) for 99.9 Percent Inactivation of *Giardia Lamblia* Cysts by Chloramines¹

< 1°C	5°C	10°C	15°C	20°C	25°C
3,800	2,200	1,850	1,500	1,100	750

¹ These values are for pH values of 6 to 9. These CT values may be assumed to achieve greater than 99.99 percent inactivation of viruses only if chlorine is added and mixed in the water prior to the addition of ammonia. If this condition is not met, the system shall demonstrate, based on site studies or other information, as approved by the department, that the system is achieving at least 99.99 percent inactivation of viruses. CT values between the indicated temperatures may be determined by linear interpolation. If no interpolation is used, use the CT_{99.9} value at the lower temperature for determining CT_{99.9} values between indicated temperatures.

(d) The total inactivation ratio shall be calculated as follows:

1. If the system uses only one point of disinfectant application, the system owner or operator may determine the total inactivation ratio based on either of the following 2 methods:

a. One inactivation ratio (CT_{calc}/CT_{99.9}) is determined before or at the first customer during peak hourly flow and if the CT_{calc}/CT_{99.9} is greater than or equal to 1.0, the 99.9% *Giardia lamblia* inactivation requirement has been achieved; or

b. Successive CT_{calc}/CT_{99.9} values, representing sequential inactivation ratios, are determined between the point of disinfectant application and a point before or at the first customer during peak hourly flow. Under this alternative, the following method shall be used to calculate the total inactivation ratio:

1) Determine CT_{calc}/CT_{99.9} for each sequence,

2) Add the CT_{calc}/CT_{99.9} values together ($\sum(\text{CT}_{\text{calc}}/\text{CT}_{99.9})$)

3) If $\sum(\text{CT}_{\text{calc}}/\text{CT}_{99.9}) > \text{ or } = 1.0$, the 99.9% *Giardia lamblia* inactivation requirement has been achieved.

2. If the system uses more than one point of disinfectant application before or at the first customer, the system owner or operator shall determine the CT value of each disinfection sequence immediately prior to the next point of disinfectant application during peak flow. The CT_{calc}/CT_{99.9} value of each sequence and

$$\sum(\text{CT}_{\text{calc}}/\text{CT}_{99.9})$$

shall be calculated using the method in subd. 1.b. to determine if the system is in compliance with s. NR 109.77.

3. Although not required, the total percent inactivation for a system with one or more points of residual disinfectant concentration monitoring may be calculated by solving the following equation:

Percent inactivation = $100 - (100/10^z)$, where

$z = 3 \times$ summation of $(CT_{calc}/CT_{99.9})$

(e) The residual disinfectant concentration of the water entering the distribution system shall be monitored continuously, and the lowest value shall be recorded each day, except that if there is a failure in the continuous monitoring equipment, grab sampling every 4 hours may be conducted in lieu of continuous monitoring, but for no more than 5 working days following the failure of the equipment, and systems serving 3,300 or fewer persons may take grab samples in lieu of providing continuous monitoring on an ongoing basis at the following prescribed frequencies:

System Size by Population	Samples/day ¹
< or = 500	1
501 to 1,000	2
1,001 to 2,500	3
2,501 to 3,300	4

¹ The day's samples cannot be taken at the same time. The sampling intervals are subject to department review and approval.

If at any time the residual disinfectant concentration falls below 0.2 mg/l in a system using grab sampling in lieu of continuous monitoring, the system shall take a grab sample every 4 hours until the residual concentration is equal to or greater than 0.2 mg/l.

(f) 1. The residual disinfectant concentration shall be measured at least at the same points in the distribution system and at the same time as total coliforms are sampled, except that the department may allow a public water system which uses a ground water source, to take disinfectant residual samples at points other than the total coliform sampling points if the department determines that such points are more representative of treated (disinfected) water quality within the distribution system. Heterotrophic bacteria, measured as heterotrophic plate count (HPC) as specified in s. NR 109.725, Table C, may be measured in lieu of residual disinfectant concentration, when approved by the department.

2. If the department determines, based on site specific considerations, that a system has no means for having a sample transported and analyzed for HPC by a certified laboratory under the requisite time and temperature conditions specified by s. NR 109.725, Table C, and that the system is providing adequate disinfection in the distribution system, the requirements of subd. 1. do not apply to that system.

(2) MONITORING REQUIREMENTS FOR SYSTEMS USING FILTRATION TREATMENT. A public water system that uses a surface water source or a ground water source under the direct influence of surface water and provides filtration treatment shall monitor in accordance with this section on or after June 29, 1993 or when filtration is installed whichever is later.

(a) Turbidity measurements as specified in s. NR 109.76 shall be performed on representative samples of the system's filtered water every 4 hours (or more frequently) that the system serves water to the public. A public water system may substitute continuous turbidity monitoring for grab sample monitoring if it validates the continuous measurement for accuracy on a regular basis using a protocol approved by the department. For any systems using slow sand filtration or filtration treatment other than conventional treatment, direct filtration or diatomaceous earth filtration, the department may reduce the sampling frequency to once per day if it determines that less frequent monitoring is sufficient to indicate effective filtration performance. For systems serving 500 or fewer persons, the department may reduce the turbidity sampling frequency to once per day, regardless of the type of filtration treatment used, if the department determines that less frequent monitoring is sufficient to indicate effective filtration performance.

(b) The residual disinfectant concentration of the water entering the distribution system shall be monitored continuously, and the lowest value shall be recorded each day, except that if there is a failure in the continuous monitoring equipment, grab sampling every 4 hours may be conducted in lieu of continuous monitoring, but for no more than 5 working days following the failure of the equipment. Systems serving 3,300 or fewer persons may take grab samples in lieu of providing continuous monitoring on an ongoing basis at the frequencies each day prescribed as follows:

System Size by Population	Samples/day ¹
< or = 500	1
501 to 1,000	2
1,001 to 2,500	3
2,501 to 3,300	4

¹ The day's samples cannot be taken at the same time. The sampling intervals are subject to department review and approval.

If at any time the residual disinfectant concentration falls below 0.2 mg/l in a system using grab sampling in lieu of continuous monitoring, the system shall take a grab sample every 4 hours until the residual disinfectant concentration is equal to or greater than 0.2 mg/l.

(c) 1. The residual disinfectant concentration shall be measured at least at the same points in the distribution system and at the same time as total coliforms are sampled. The department may allow a public water system which uses both a surface water source or a ground water source under direct influence of surface water, and a ground water source to take disinfectant residual samples at points other than the total coliform sampling points if the department determines that such points are more representative of treated (disinfected) water quality within the distribution system. Heterotrophic bacteria, measured as heterotrophic plate count (HPC) as specified in s. NR 109.725, Table C, may be measured in lieu of residual disinfectant concentration, when approved by the department.

2. If the department determines, based on site specific considerations, that a system has no means for having a sample transported and analyzed for HPC by a certified laboratory under the requisite time and temperature conditions specified in s. NR 109.725, Table C, and that the

system is providing adequate disinfection in the distribution system, the requirements of subd 1. do not apply to that system.

History: Cr. Register, March, 1991, No. 423, eff. 4-1-91.

Subchapter V — Reporting, Public Notification and Record Keeping

NR 109.80 Reporting requirements. (1) Except where a shorter reporting period is specified in this chapter, the supplier of water shall report to the department the results of any test measurement or analysis required by this chapter within:

(a) The first 10 days following the month in which the result is received; or

(b) The first 10 days following the end of the required monitoring period as stipulated by the department, whichever of these is shortest.

(2) Except where some other period is specified in this chapter, the supplier of water shall report to the department within 48 hours the failure to comply with any maximum contaminant level or monitoring requirement set forth in this chapter.

(3) The supplier of water is not required to report analytical results to the department in cases where the state laboratory of hygiene performs the analysis and reports the results to the department.

(4) The supplier of water, within 10 days of completion of each public notification required under s. NR 109.81, shall submit to the department a representative copy of each type of notice distributed, published, posted, or made available to the persons served by the system or to the media, or both.

(5) A public water system that uses a ground water source under the direct influence of surface water and does not provide filtration treatment shall report monthly to the department the information specified in this subsection on or after December 31, 1990, or 6 months after the department has determined that filtration is required in writing.

(a) Source water quality information shall be reported to the department within 10 days after the end of each month the system serves water to the public. Information that shall be reported includes:

1. The cumulative number of months for which results are reported.
2. The number of fecal or total coliform samples, whichever are analyzed during the month (if a system monitors for both, only fecal coliforms shall be reported), the dates of sample collection, and the dates when the turbidity level exceeded 1 NTU.
3. The number of samples during the month that had equal to or less than 20/100 ml fecal coliforms or equal to or less than 100/100 ml total coliforms, whichever are analyzed.
4. The cumulative number of fecal or total coliform samples, whichever are analyzed, during the previous 6 months the system served water to the public.
5. The cumulative number of samples that had equal to or less than 20/100 ml fecal coliforms or equal to or less than 100/100 ml total coliforms,

whichever are analyzed, during the previous 6 months the system served water to the public.

6. The percentage of samples that had equal to or less than 20/100 ml fecal coliforms or equal to or less than 100/100 ml total coliforms, whichever are analyzed, during the previous 6 months the system served water to the public.

7. The maximum turbidity level measured during the month, the dates of occurrence for any measurements which exceeded 5 NTU, and the dates the occurrences were reported to the department.

8. For the first 12 months of record keeping, the dates and cumulative number of events during which the turbidity exceeded 5 NTU, and after one year of record keeping for turbidity measurements, the dates and cumulative number of events during which the turbidity exceeded 5 NTU in the previous 12 months the system served water to the public.

9. For the first 120 months of record keeping, the dates and cumulative number of events during which the turbidity exceeded 5 NTU, and after 10 years of record keeping for turbidity measurements, the dates and cumulative number of events during which the turbidity exceeded 5 NTU in the previous 120 months the system served water to the public.

(b) Disinfection information specified in s. NR 109.785 (1) shall be reported to the department within 10 days after the end of each month the system serves water to the public. Information that shall be reported includes:

1. For each day, the lowest measurement of residual disinfectant concentration in mg/l in water entering the distribution system.

2. The date and duration of each period when the residual disinfectant concentration in water entering the distribution system fell below 0.2 mg/l and when the department was notified of the occurrence.

3. The daily residual disinfectant concentrations (in mg/l) and disinfectant contact times (in minutes) used for calculating the CT values.

4. If chlorine is used, the daily measurements of pH of disinfected water following each point of chlorine disinfection.

5. The daily measurements of water temperature in °C following each point of disinfection.

6. The daily CT_{calc} and $CT_{calc}/CT_{99.9}$ values for each disinfectant measurement or sequence and the sum of all $CT_{calc}/CT_{99.9}$ values ($\sum (CT_{calc}/CT_{99.9})$) before or at the first customer.

7. The daily determination of whether disinfection achieves adequate *Giardia lamblia* cyst and virus inactivation, i.e., whether ($CT_{calc}/CT_{99.9}$) is at least 1.0, or where disinfectants other than chlorine are used, other indicator conditions that the department determines are appropriate, are met.

8. The following information on the samples taken in the distribution system in conjunction with total coliform monitoring pursuant to s. NR 190.77:

a. Number of instances where the residual disinfectant concentration is measured;

b. Number of instances where the residual disinfectant concentration is not measured but heterotrophic bacteria plate count (HPC) is measured;

c. Number of instances where the residual disinfectant concentration is measured but not detected and no HPC is measured;

d. Number of instances where no residual disinfectant concentration is detected and where HPC is $> 500/\text{ml}$;

e. Number of instances where the residual disinfectant concentration is not measured and HPC is $> 500/\text{ml}$;

f. For the current and previous month the system serves water to the public, the value of "V" in the following formula:

$$V = c + d + e/a + b \times 100$$

where:

a = the value in subpar. a.

b = the value in subpar. b.

c = the value in subpar. c.

d = the value in subpar. d.

e = the value in subpar. e.

g. If the department determines, based on site specific considerations, that a system has no means for having a sample transported and analyzed for HPC by a certified laboratory within the requisite time and temperature conditions specified by s. NR 109.78 and that the system is providing adequate disinfection in the distribution system, the requirements of subpars. a. to f. do not apply.

9. A public water system owner or operator need not report the data listed in subds. 1. to 3. if all data listed in par. (a) remain on file at the system and department determines that:

a. The system owner or operator has submitted to the department all the information required by subds. 1. to 8. for at least 12 months; and

b. The department has determined that the system is not required to provide filtration treatment.

(c) No later than 10 days after the end of each federal fiscal year (September 30), each water supplier shall provide a report which summarizes their water system compliance with all well head protection program requirements specified in s. NR 109.755 (2) (b).

(d) No later than 10 days after the end of each federal fiscal year (September 30), each water supplier shall provide to the department a report of the on-site inspection conducted during that year pursuant to s. NR 109.755 (2) (c), unless the on-site inspection was conducted by the department. If the inspection was conducted by the department, the department shall provide a copy of its report to the public water system.

(e) 1. Each water supplier, upon discovering that a waterborne disease outbreak potentially attributable to their water system has occurred,

shall report that occurrence to the department as soon as possible, but no later than by the end of the next business day.

2. If at any time the turbidity exceeds 5 NTU, the water supplier shall inform the department as soon as possible, but no later than the end of the next business day.

3. If at any time the disinfectant residual falls below 0.2 mg/l in the water entering the distribution system, the water supplier shall notify the department as soon as possible, but no later than by the end of the next business day. The water supplier also shall notify the department by the end of the next business day whether or not the residual was restored to at least 0.2 mg/l within 4 hours.

(6) A public water system that uses a surface water source or a ground water source under the direct influence of surface water and provides filtration treatment shall report monthly to the department the information specified in this subsection on or after June 29, 1993, or when filtration is installed, whichever is later.

(a) Turbidity measurements as required by s. NR 109.785 (2) (a) shall be reported within 10 days after the end of each month the system serves water to the public. Information that shall be reported includes:

1. The total number of filtered water turbidity measurements taken during the month.

2. The number and percentage of filtered water turbidity measurements taken during the month which are less than or equal to the turbidity limits specified in s. NR 109.78 for the filtration technology being used.

3. The date and value of any turbidity measurements taken during the month which exceed 5 NTU.

(b) Disinfection information specified in s. NR 109.76 shall be reported to the department. Information that shall be reported includes:

1. For each day, the lowest measurement of residual disinfectant concentration in mg/l in water entering the distribution system.

2. The date and duration of each period when the residual disinfectant concentration in water entering the distribution system fell below 0.2 mg/l and when the department was notified of the occurrence.

3. The following information on the samples taken in the distribution system in conjunction with total coliform monitoring pursuant to s. NR 109.770:

a. Number of instances where the residual disinfectant concentration is measured;

b. Number of instances where the residual disinfectant concentration is not measured but heterotrophic bacteria plate count (HPC) is measured;

c. Number of instances where the residual disinfectant concentration is measured but not detected and no HPC is measured;

d. Number of instances where no residual disinfectant concentration is detected and where HPC is > 500 /ml;

e. Number of instances where the residual disinfectant concentration is not measured and HPC is $> 500/\text{ml}$;

f. For the current and previous month the system serves water to the public, the value of "V" in the following formula:

$$V = c + d + e/a + b \times 100$$

where:

a = the value in subpar. a.

b = the value in subpar. b.

c = the value in subpar. c.

d = the value in subpar. d.

e = the value in subpar. e.

g. If the department determines, based on site specific considerations, that a system has no means for having a sample transported and analyzed for HPC by a certified laboratory within the requisite time and temperature conditions specified by s. NR 109.78 and that the system is providing adequate disinfection in the distribution system, the requirements of subpars. a. to f. do not apply.

4. A water supplier need not report the data listed in subd. 1. if all data listed in par. (b) remain on file at the system and the department determines that the water supplier has submitted all the information required by par. (b) for at least 12 months.

(c) 1. If at any time the turbidity exceeds 5 NTU, the water supplier shall inform the department as soon as possible, but no later than the end of the next business day.

2. If at any time the disinfectant residual falls below 0.2 mg/l in the water entering the distribution system, the water supplier shall notify the department as soon as possible, but no later than the end of the next business day. The water supplier also shall notify the department by the end of the next business day whether or not the residual was restored to at least 0.2 mg/l within 4 hours.

(7) Each water supplier, upon discovering that a waterborne disease outbreak potentially attributable to their water system has occurred, shall report that occurrence to the department as soon as possible, but no later than by the end of the next business day.

(8) Upon the request of the department, the supplier of water shall submit to the department copies of any records required to be maintained under s. NR 109.82 or copies of any documents then in existence which the department is entitled to inspect under the authority of s. 144.09, Stats.

History: Cr. Register, February, 1978, No. 266, eff. 3-1-78; am. (1), cr. (4) and (5), Register, April, 1982, No. 316, eff. 5-1-82; am. (3), Register, August, 1989, No. 404, eff. 9-1-89; am. (2), renum. (5) to be (8), cr. (5) to (7), Register, March, 1991, No. 423, eff. 4-1-91.

NR 109.81 Public notification. (1) MAXIMUM CONTAMINANT LEVEL (MCL), TREATMENT TECHNIQUE, VARIANCE, AND CONDITIONAL WAIVER VIOLATIONS. The owner or operator of a public water system which fails to comply with an applicable MCL or treatment technique established

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by this chapter or which fails to comply with the requirements of any variance under s. NR 109.91 or conditional waiver under s. NR 109.90 shall notify persons served by the system as follows:

(a) Except as provided in par. (c), the owner or operator of a community water system shall give notice:

1. By publication in a daily newspaper of general circulation in the area served by the system as soon as possible, but in no case later than 14 days after the violation or failure. If the area served by a community water system is not served by a daily newspaper of general circulation, notice shall instead be given by publication in a weekly newspaper of general circulation serving the area; and

2. By mail delivery, by direct mail or with the water bill, or by hand delivery, not later than 45 days after the violation or failure. The department may waive mail or hand delivery if it determines that the owner or operator of the community water system in violation has corrected the violation or failure within the 45-day period. The department shall make the determination in writing and within the 45-day period; and

3. For violation of the MCLs of contaminants that may pose an acute risk to human health, by furnishing a copy of the notice to the radio and television stations serving the area served by the community water system or by hand delivery to each customer as soon as possible but in no case later than 72 hours after the violation. The following violations are acute violations:

a. Any violation specified by the department as posing an acute risk to human health.

b. Any violation of the microbiological MCL which the department determines warrants a notification to boil water.

c. Violation of the MCL for nitrate as defined in s. NR 109.11 (2) and determined according to s. NR 109.12.

(b) Except as provided in par. (c), following the initial notice given under par. (a), the owner or operator of the community water system shall give notice at least once every 3 months by mail delivery (by direct mail or with the water bill) or by hand delivery, for as long as the violation or failure exists.

(c) In lieu of the requirements of par. (a) 1. or 2., the owner or operator of a community water system in an area that is not served by a daily or weekly newspaper of general circulation shall give notice within 14 days after the violation or failure by hand delivery or by continuous posting in conspicuous places within the area served by the system. Posting shall continue for as long as the violation or failure exists. Notice by hand delivery shall be repeated at least every 3 months for as long as the violation or failure exists.

(d) The owner or operator of a non-community water system shall give notice within 72 hours after the violation or failure by continuous posting in conspicuous places within the area served by the system. The owner or operator of a system such as a restaurant which is permitted to serve water exceeding a maximum contaminant level to customers away from water outlets shall provide a written public notice at each table. Posting shall continue for as long as the violation or failure exists.

(2) OTHER VIOLATIONS, VARIANCES, CONDITIONAL WAIVERS. The owner or operator of a public water system which fails to perform monitoring required by this chapter, fails to comply with a testing procedure established by this chapter, is subject to a variance granted under subch. VI of this chapter or is subject to a conditional waiver under subch. VI of this chapter shall notify persons served by the system as follows:

(a) Except as provided in par. (c) or (d), the owner or operator of a community water system shall give notice within 3 months of the violation or granting of a conditional waiver under s. NR 109.90 by publication in a daily newspaper of general circulation in the area served by the system. If the area served by a community water system is not served by a daily newspaper of general circulation, notice shall instead be given by publication in a weekly newspaper of general circulation serving the area.

(b) Except as provided in par. (c) or (d), following the initial notice given under par. (a), the owner or operator of the community water system shall give notice at least once every 3 months by mail delivery (by direct mail or with the water bill) or by hand delivery, for as long as the violation exists. Repeat notice of the existence of a conditional waiver under s. NR 109.90 shall be given every 3 months for as long as the conditional waiver remains in effect.

(c) In lieu of the requirements of par. (a) or (b), the owner or operator of a community water system in an area that is not served by a daily or weekly newspaper of general circulation shall give notice, within 3 months of the violation, or granting of a conditional waiver under s. NR 109.90, by hand delivery or by continuous posting in conspicuous places within the area served by the system. Posting shall continue for as long as the violation exists or the conditional waiver remains in effect. Notice by hand delivery shall be repeated at least every 3 months for as long as the violation exists or the conditional waiver remains in effect.

(d) The owner or operator of a non-community water system shall give notice, within 72 hours of the violation or the granting of the variance under s. NR 109.91 or conditional waiver under s. NR 109.90, by continuous posting at all drinking water outlets within the area served by the system. Posting shall continue for as long as the violation exists, or the variance or conditional waiver remains in effect.

(e) The owner or operator of a community water system serving an institution and granted a variance from the maximum contaminant level for nitrate as nitrogen under s. NR 109.91 (2) shall give notice, within 72 hours of the granting of the variance, by continuous posting at all drinking water outlets within the area served by the system. Posting shall continue for as long as the variance remains in effect.

(f) In lieu of the requirements of par. (a), (b), (c) or (d), the owner or operator of a public water system may provide a summary public notice for bacteriological monitoring violations totalling no more than 3 months in any calendar year. Such notice shall be provided no later than 90 days after the end of the calendar year in which the violations occurred.

(3) NOTICE TO NEW BILLING UNITS. The owner or operator of a community water system shall give a copy of the most recent public notice for any outstanding violation of any maximum contaminant level, treat-

ment technique requirement or conditional waiver under s. NR 109.90 to all new billing units or new hookups prior to or at the time service begins.

(4) **GENERAL CONTENT OF PUBLIC NOTICE.** Each notice required by this section shall provide a clear and readily understandable explanation of the violation, any potential adverse health effects, the population at risk, the steps that the supplier of water is taking to correct such violation, the necessity for seeking alternative water supplies, if any, and any preventive measures the consumer should take until the violation is corrected. Each notice shall be conspicuous and may not contain unduly technical language, unduly small print, or similar problems that frustrate the purpose of the notice. Each notice shall include the telephone number of the owner, operator, or designee of the public water system as a source of additional information concerning the notice. Where appropriate, the notice shall be multi-lingual.

(5) **MANDATORY HEALTH EFFECTS LANGUAGE.** When providing the information on potential adverse health effects required by sub. (4) in notices of violations of maximum contaminant levels or treatment technique requirements, notices of the granting or the continued existence of a conditional waiver under s. NR 109.90 or a variance under s. NR 109.91 or notices of failure to comply with a conditional waiver under s. NR 109.90 or a variance under s. NR 109.91, the owner or operator of a public water system shall include the following language specified for each contaminant.

Note: If language for a particular contaminant is not specified below at the time notice is required, this section does not apply.

(a) *Trichloroethylene.* The United States environmental protection agency (EPA) sets national drinking water standards and has determined that trichloroethylene is a health concern at certain levels of exposure. This chemical is a common metal cleaning and dry cleaning fluid. It generally gets into drinking water by improper waste disposal. This chemical has been shown to cause cancer in laboratory animals such as rats and mice when the animals are exposed at high levels over their lifetimes. Chemicals that cause cancer in laboratory animals also may increase the risk of cancer in humans who are exposed at lower levels over long periods of time. EPA has set forth the enforceable drinking water standard for trichloroethylene at 0.005 parts per million (ppm) to reduce the risk of cancer or other adverse health effects which have been observed in laboratory animals. Drinking water which meets this standard is associated with little to none of this risk and should be considered safe.

(b) *Carbon tetrachloride.* The United States environmental protection agency (EPA) sets national drinking water standards and has determined that carbon tetrachloride is a health concern at certain levels of exposure. This chemical was once a popular household cleaning fluid. It generally gets into drinking water by improper waste disposal. This chemical has been shown to cause cancer in laboratory animals such as rats and mice when the animals are exposed to high levels over their lifetimes. Chemicals that cause cancer in laboratory animals also may increase the risk of cancer in humans who are exposed at lower levels over long periods of time. EPA has set forth the enforceable drinking water standard for carbon tetrachloride at 0.005 parts per million (ppm) to reduce the risk of cancer or other adverse health effects which have been observed in laboratory animals. Drinking water which meets this stan-

ard is associated with little to none of this risk and should be considered safe.

(c) *1,2-Dichloroethane*. The United States environmental protection agency (EPA) sets national drinking water standards and has determined that 1,2-dichloroethane is a health concern at certain levels of exposure. This chemical is used as a cleaning fluid for fats, oils, waxes and resins. It generally gets into drinking water by improper waste disposal. This chemical has been shown to cause cancer in laboratory animals such as rats and mice when the animals are exposed at high levels over their lifetimes. Chemicals that cause cancer in laboratory animals also may increase the risk of cancer in humans who are exposed at lower levels over long periods of time. EPA has set forth the enforceable drinking water standard for 1,2-dichloroethane at 0.005 parts per million (ppm) to reduce the risk of cancer or other adverse health effects which have been observed in laboratory animals. Drinking water which meets this standard is associated with little to none of this risk and should be considered safe.

(d) *Vinyl chloride*. The United States environmental protection agency (EPA) and the Wisconsin Department of Natural Resources set drinking water standards and have determined that vinyl chloride is a health concern at certain levels of exposure. This chemical is used in industry and is found in drinking water as a result of the breakdown of related solvents. The solvents are used as cleaners and degreasers of metals and generally get into drinking water by improper disposal. This chemical has been associated with with significantly increased risks of cancer among certain industrial workers who were exposed to relatively large amounts of this chemical during their working careers. This chemical has also been shown to cause cancer in laboratory animals when the animals are exposed at high levels over their lifetimes. Chemicals that cause increased risk of cancer among exposed industrial workers and in laboratory animals also may increase the risk of cancer in humans who are exposed at lower levels over long periods of time. The Wisconsin Department of Natural Resources has set the enforceable drinking water standard for vinyl chloride at 0.0002 parts per million (ppm) to reduce the risk of cancer or other adverse health effects which have been observed in humans and laboratory animals. Drinking water which meets this standard is associated with little to none of this risk and should be considered safe.

(e) *Benzene*. The United States environmental protection agency (EPA) sets national drinking water standards and has determined that benzene is a health concern at certain levels of exposure. The chemical is used as a solvent and degreaser of metals. It is also a major component of gasoline. Drinking water contamination generally results from leaking underground gasoline and petroleum tanks or improper waste disposal. This chemical has been associated with significantly increased risks of leukemia among certain industrial workers who were exposed to relatively large amounts of this chemical during their working careers. This chemical has also been shown to cause cancer in laboratory animals when the animals are exposed at high levels over their lifetimes. Chemicals that cause increased risk of cancer among exposed industrial workers and laboratory animals also may increase the risk of cancer in humans who are exposed at lower levels over long periods of time. EPA has set the enforceable drinking water standard for benzene at 0.005 parts per million (ppm) to reduce the risk of cancer or other adverse health effects

which have been observed in humans and laboratory animals. Drinking water which meets this standard is associated with little to none of this risk and should be considered safe.

(f) *1,1-Dichloroethylene*. The United States environmental protection agency (EPA) sets national drinking water standards and has determined that 1,1-dichloroethylene is a health concern at certain levels of exposure. This chemical is used in industry and is found in drinking water as a result of the breakdown of related solvents. The solvents are used as cleaners and degreasers of metals and generally get into drinking water by improper waste disposal. This chemical has been shown to cause liver and kidney damage in laboratory animals such as rats and mice when the animals are exposed at high levels over their lifetimes. Chemicals which cause adverse effects in laboratory animals also may cause adverse health effects in humans who are exposed at lower levels over long periods of time. EPA has set the enforceable drinking water standard for 1,1-dichloroethylene at 0.007 parts per million (ppm) to reduce the risk of these adverse health effects which have been observed in laboratory animals. Drinking water which meets this standard is associated with little to none of this risk and should be considered safe.

(g) *Para-dichlorobenzene*. The United States environmental protection agency (EPA) sets national drinking water standards and has determined that para-dichlorobenzene is a health concern at certain levels of exposure. This chemical is a component of deodorizers, moth balls and pesticides. It generally gets into drinking water by improper waste disposal. This chemical has been shown to cause liver and kidney damage in laboratory animals such as rats and mice when the animals are exposed to high levels over their lifetimes. Chemicals that cause adverse effects in laboratory animals also may cause adverse health effects in humans who are exposed at lower levels over long periods of time. EPA has set the enforceable drinking water standard for para-dichlorobenzene at 0.075 parts per million (ppm) to reduce the risk of these adverse health effects which have been observed in laboratory animals. Drinking water which meets this standard is associated with little to none of this risk and should be considered safe.

(h) *1,1,1-Trichloroethane*. The United States environmental protection agency (EPA) sets national drinking water standards and has determined that 1,1,1-trichloroethane is a health concern at certain levels of exposure. This chemical is used as a cleaner and degreaser of metals. It generally gets into drinking water by improper waste disposal. This chemical has been shown to damage the liver, nervous system and circulatory system of laboratory animals such as rats and mice when the animals are exposed at high levels over their lifetimes. Some industrial workers who were exposed to relatively large amounts of this chemical during their working careers also suffered damage to the liver, nervous system and circulatory system. Chemicals which cause adverse effects among exposed industrial workers and in laboratory animals also may cause adverse health effects in humans who are exposed at lower levels over long periods of time. EPA has set the enforceable drinking water standard for 1,1,1-trichloroethane at 0.2 parts per million (ppm) to protect against the risk of these adverse health effects which have been observed in humans and laboratory animals. Drinking water which meets this standard is associated with little to none of this risk and should be considered safe.

(i) *Flouride*. The notice shall contain the following language:

Public Notice

Dear User,

The U.S. Environmental Protection Agency requires that we send you this notice on the level of fluoride in your drinking water. The drinking water in your community has a fluoride concentration of _____ (water supplier insert the compliance result which triggered the notification) milligrams per liter (mg/l).

Federal regulations require that fluoride, which occurs naturally in your water supply, not exceed a concentration of 4.0 mg/l in drinking water. This is an enforceable standard called a Maximum Contaminant Level (MCL), and it has been established to protect the public health. Exposure to drinking water levels above 4.0 mg/l for many years may result in some cases of crippling skeletal fluorosis, which is a serious bone disorder.

Federal law also requires that we notify you when monitoring indicates that the fluoride in your drinking water exceeds 2.0 mg/l. This is intended to alert families about dental problems that might affect children under 9 years of age. The fluoride concentration of your water exceeds this federal guideline.

Fluoride in children's drinking water at levels of approximately 1 mg/l reduces the number of dental cavities. However, some children exposed to levels of fluoride greater than about 2.0 mg/l may develop dental fluorosis. Dental fluorosis, in its moderate and severe forms, is a brown staining and/or pitting of the permanent teeth.

Because dental fluorosis occurs only when developing teeth (before they erupt from the gums) are exposed to elevated fluoride levels, households without children are not expected to be affected by this level of fluoride. Families with children under the age of 9 are encouraged to seek other sources of drinking water for their children to avoid the possibility of staining and pitting.

Your water supplier can lower the concentration of fluoride in your water so that you will still receive the benefits of cavity prevention while the possibility of stained and pitted teeth is minimized. Removal of fluoride may increase your water costs. Treatment systems are also commercially available for home use. Information on such systems is available at the address given below. Low fluoride bottled drinking water that would meet all standards is also commercially available.

For further information, contact _____ (water supplier insert the name, address, and telephone number of a contact person at the public water system) at your water system.

(j) *Total coliforms* (To be used when there is a violation of s. NR 109.30 (1) and not a violation of s. NR 109.30 (2)). The United States environmental protection agency (EPA) sets drinking water standards and has determined that the presence of total coliforms is a possible health concern. Total coliforms are common in the environment and are generally not harmful themselves. The presence of these bacteria in drinking water, however, generally is a result of a problem with water treatment or the pipes which distribute the water, and indicates that the water may be

contaminated with organisms that can cause disease. Disease symptoms may include diarrhea, cramps, nausea, and possibly jaundice, and any associated headaches and fatigue. These symptoms, however, are not just associated with disease-causing organisms in drinking water, but also may be caused by a number of factors other than your drinking water. EPA has set an enforceable drinking water standard for total coliforms to reduce the risk of these adverse health effects. Under this standard, no more than 5.0% of the samples collected during any month can contain these bacteria, except that systems collecting fewer than 40 samples/month that have one total coliform-positive sample per month are not violating the standard. Drinking water which meets this standard is usually not associated with a health risk from disease-causing bacteria and should be considered safe.

(k) *Fecal coliforms/e. coli* (To be used when there is a violation of s. NR 109.30 (2) or s. NR 109.30 (1) and (2)). The United States environmental protection agency (EPA) sets drinking water standards and has determined that the presence of fecal coliforms and *E. Coli* is a serious health concern. Fecal coliforms and *E. Coli* are generally not harmful themselves, but their presence in drinking water is serious because they usually are associated with sewage or animal wastes. The presence of these bacteria is generally a result of a problem with water treatment or the pipes which distribute the water, and indicates that the water may be contaminated with organisms that can cause disease. Disease symptoms may include diarrhea, cramps, nausea, and possibly jaundice, and any associated headaches and fatigue. These symptoms, however, are not just associated with disease-causing organisms in drinking water, but also may be caused by a number of factors other than your drinking water. EPA has set an enforceable drinking water standard for fecal coliforms and *E. Coli* to reduce the risk of these adverse health effects. Under this standard, all drinking water shall be free of these bacteria. Drinking water which meets this standard is usually not associated with a health risk from disease-causing bacteria and should be considered safe. State and local health authorities recommend that consumers take the following precautions: (To be inserted by the public water system owner or operator, according to instructions from the department)

(l) *Microbiological contaminants* (for use when there is a violation of the treatment technique requirements for filtration and disinfection in subch. IV). The United States environmental protection agency (EPA) sets drinking water standards and has determined that the presence of microbiological contaminants are a health concern at certain levels of exposure. If water is inadequately treated, microbiological contaminants in that water may cause disease. Disease symptoms may include diarrhea, cramps, nausea, and possibly jaundice, and any associated headaches and fatigue. These symptoms, however, are not just associated with disease causing organisms in drinking water, but also may be caused by a number of factors other than your drinking water. EPA has set enforceable requirements for treating drinking water to reduce the risk of these adverse health effects. Treatment such as filtering and disinfecting the water removes or destroys microbiological contaminants. Drinking water which is treated to meet EPA requirements is associated with little to none of this risk and should be considered safe.

(6) PUBLIC NOTICES FOR FLUORIDE. Notice of violation of the maximum contaminant level for fluoride, notice of a conditional waiver under s. NR 109.90 from the maximum contaminant level for fluoride, and no-Register, March, 1991, No. 423

tice of failure to comply with a conditional waiver under s. NR 109.90 for the maximum contaminant level for fluoride shall consist of the public notice prescribed in sub. (5) (i), plus a description of any steps which the system is taking to come into compliance.

(7) **FAILURE TO COMPLY** If a public water system fails to comply with the requirements of this section, the department may issue public notification directly.

History: Cr. Register, February, 1978, No. 266, eff. 3-1-78; am. (4) (a), Register, April, 1982, No. 316, eff. 5-1-82; r. and recr., Register, August, 1989, No. 404, eff. 9-1-89; am. (1) (a) 3. intro. and (2) (intro.), cr. (5) (j) to (l), Register, March, 1991, No. 423, eff. 4-1-91.

NR 109.82 Record maintenance. Any owner or operator of a public water system subject to the provisions of this chapter shall retain on the premises or at a convenient location near the premises the following records:

(1) Records of bacteriological analyses made pursuant to this part shall be kept for not less than 5 years. Records of chemical analyses made pursuant to this part shall be kept for not less than 10 years. Actual laboratory reports may be kept, or data may be transferred to tabular summaries, provided that the following information is included:

(a) The date, place, and time of sampling, and the name of the person who collected the sample;

(b) Identification of the sample as to whether it was a routine distribution system sample, check sample, raw or process water sample or other special purpose sample;

(c) Date of analysis;

(d) Laboratory and person responsible for performing analysis;

(e) The analytical technique/method used; and

(f) The results of the analysis.

(2) Records of action taken by the supplier of water to correct violations of this chapter shall be kept for a period not less than 3 years after the last action taken with respect to the particular violation involved.

(3) Copies of any written reports, summaries or communications relating to sanitary surveys of the system conducted by the supplier of water, by a private consultant, or by any local, state or federal agency, shall be kept for a period not less than 10 years after completion of the sanitary survey involved.

(4) Records concerning a variance or exemption granted to the system shall be kept for a period ending not less than 5 years following the expiration of such variance or exemption.

History: Cr. Register, February, 1978, No. 266, eff. 3-1-78; am. (intro.), Register, April, 1982, No. 316, eff. 5-1-82.

Subchapter VI — Conditional Waivers and Variances

NR 109.90 Conditional waivers. (1) A public system is eligible to apply to the department for a conditional waiver respecting compliance with a maximum contaminant level or treatment technique requirement if:

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(a) Because of the characteristics of the raw water sources which are reasonably available, the public water system cannot comply with a maximum contaminant level,

(b) Compelling factors indicate that the public water system cannot comply with a maximum contaminant level or treatment technique requirement for a limited period of time, and

(c) Granting of a conditional waiver will not result in an unreasonable risk to public health.

(2) The department may grant a conditional waiver with the following requirements if the supplier of water has established that the criteria of sub. (1) have been met:

(a) Compliance, including increments of progress, by the supplier of water with each maximum contaminant level or treatment technique requirement within the time frame specified by the department in the compliance schedule, and

(b) Implementation by the supplier of water of such control measures as the department deems necessary until compliance with the maximum contaminant level or treatment technique requirement is achieved.

(3) Before the department may grant a conditional waiver under this subsection a class 1 public notice under ch. 985, Stats., and opportunity for a public hearing on the proposed conditional waiver shall be provided by the department. A hearing held pursuant to a request under this paragraph is a class 1 hearing and shall be conducted in accordance with ch. 227, Stats.

(4) The department may extend a compliance deadline not to exceed 3 years after the date a conditional waiver is granted under sub. (2) if the supplier of water establishes that:

(a) The public water system cannot meet the maximum contaminant level or treatment technique requirement without capital improvements which cannot be completed within the period of such conditional waiver,

(b) The supplier of water has entered into an enforceable agreement to become part of a regional public water system or, if the supplier of water needs financial assistance for the necessary capital improvements, the supplier of water has entered into an agreement to obtain such financial assistance, and

(c) The supplier of water is taking all practicable steps to meet the standard.

(5) The department may renew an extension granted under sub. (4) if the supplier of water establishes that:

(a) The public water system does not serve more than 500 service connections,

(b) The public water system cannot meet a maximum contaminant level or treatment technique requirement without financial assistance for the necessary capital improvements, and

(c) The public water system is taking all practicable steps to achieve compliance with a maximum contaminant level or treatment technique requirement.

History: Cr. Register, August, 1989, No. 404, eff. 9-1-89.

NR 109.91 Nitrate variances. (1) A non-community water system is eligible for a variance from the nitrate as nitrogen maximum contaminant level if:

(a) The department determines that because of the characteristics of the raw water sources which are reasonably available, the non-community water system cannot comply with the maximum contaminant level for nitrate as nitrogen; and

(b) The non-community water system has not had a nitrate as nitrogen sample which exceeds 20 mg/l, confirmed by a check sample; and

(c) The supplier of water continuously posts a department approved notice at all water taps supplied with water by the non-community water system. The notice shall state that the nitrate as nitrogen level exceeds 10 mg/l and describe the potential health effects of exposure; and

(d) The supplier of water ensures that water from its system will not be available to children under 6 months of age and provides bottled water which complies with all maximum contaminant levels for such children; and

(e) No adverse health effects will result.

(2) A community water system serving a nursing home, prison or mental health care facility, is eligible for a variance from the nitrate as nitrogen maximum contaminant level if:

(a) The institution does not permit infants under 6 months of age as residents; and

(b) The community water system has not had a nitrate as nitrogen sample which exceeds 20 mg/l, confirmed by a check sample; and

(c) The institution continuously posts a department approved notice at all water taps supplied with water by the community water system. The notice shall state that the nitrate as nitrogen level exceeds 10 mg/l and describe the potential health effects of exposure; and

(d) The institution ensures that water from its system will not be available to children under 6 months of age and provides bottled water which complies with all maximum contaminant levels for such children; and

(e) No adverse health effects will result.

(3) The department may condition the issuance of a variance under this section on compliance with such control measures as it deems necessary. Failure to comply with any term or condition of a variance granted by the department under this section voids the variance.

History: Cr. Register, August, 1989, No. 404, eff. 9-1-89.