

Parameters and Testing Frequency for Private Wells

The following excerpt is an update to the *Parameters and Testing Frequency Section* of the Massachusetts Department of Environmental Protection (MassDEP) Drinking Water Program's *Private Well Guidelines*. These guidelines can be found online at <http://www.mass.gov/eea/docs/dep/water/laws/i-thru-z/prwellgd.pdf>. This update is necessary in order to include new parameters that now require monitoring in Public Drinking Water Systems. The Commonwealth of Massachusetts does not have any statutes that specifically regulate the quality of private water supply systems. MassDEP has carefully evaluated all parameters currently regulated and recommends that monitoring be performed on all private wells at various times. These recommendations take into account the cost of monitoring while ensuring protection of the drinking water through periodic testing. This excerpt provides guidance to the Local Boards of Health (BOH) and other interested individuals regarding the selection of appropriate chemical, biological and radiological pollutants for monitoring in private drinking water wells. It also makes recommendations for the sampling frequency and offers Recommended Concentration Limits for pollutants that have been identified by EPA or MassDEP as of potential concern for public health.

In Massachusetts over 400,000 people rely on private water systems to provide drinking water. A private water supply consists of a system that has less than fifteen service connections and either (1) serves less than 25 individuals or (2) serves an average of 25 or more individuals daily for less than 60 days of the year.

A range of adverse outcomes can result from exposure to pollutants in drinking water including compromised public health; unacceptable taste and odor; and, aesthetic concerns. MassDEP has developed the following tables to provide individuals with groups of potential contaminants and associated reference limits.

The recommended concentration limits in Tables 8, 9, 10, and 11 are subject to change based on new research and updated reviews. The MassDEP Office of Research and Standards (ORS) document *Standards and Guidelines for Contaminants in Massachusetts Drinking Waters* should be checked for updated concentration limits, and general decision-making. This document can be found at <http://www.mass.gov/eea/agencies/massdep/water/drinking/standards/standards-and-guidelines-for-drinking-water-contaminants.html>. For information on the derivation of the recommended concentration limits, and general information on the health effects of drinking water contaminants, please contact ORS at 617-556-1158, or visit <http://www.mass.gov/eea/agencies/massdep/water/drinking/standards/office-of-research-standards-drinking-water-guidelines.html>.

For additional information regarding the potential health risks associated with a specific contaminant see the following:

- Guidelines and Policies for Public Water Systems; **Appendix M**, Attachment C, available on-line at <http://www.mass.gov/eea/docs/dep/water/ccrguide.pdf>.
- Internet based information from the U.S. Environmental Protection Agency (EPA), available at <http://water.epa.gov/drink/index.cfm> and <http://water.epa.gov/drink/contaminants/index.cfm>.

Table 8 is provided to assist local Boards of Health in evaluating the quality of private drinking water supplies and to provide guidance regarding testing frequencies for various parameters. The limits in Table 8 (with the exception of the Office of Research and Standards Guidelines (ORSGs)) are the Primary Standards that have been adopted by MassDEP for Public Water Systems (PWS). For establishing ORSGs for drinking water, MassDEP uses methodology similar to that used by the EPA's Office of Groundwater and Drinking Water for establishing Primary Standards. These limits have been determined by either the U.S. Environmental Protection Agency or the MassDEP Office of Research and Standards (ORS) to be protective of human health.

Table 9 is a list of chemicals that are generally not recommended for routine private well monitoring. However, these chemicals may be specifically recommended for testing when a contamination problem has been identified by the Board of Health, the Department of Public Health, or MassDEP. Table 9 does not include all contaminants for which the MassDEP/ORS has established drinking water guidelines. For a complete list of ORS guidelines visit <http://www.mass.gov/eea/agencies/massdep/water/drinking/standards/standards-and-guidelines-for-drinking-water-contaminants.html>. For information on the derivation of the recommended concentration limits, and general information on the health effects of water contaminants, please contact ORS at 617-556-1158.

Table 10 parameters are not based on health considerations, but rather on the effect they may have on taste, color and/or odor of drinking water. The limits listed in Table 10 are the Secondary Standards that have been adopted by MassDEP for PWS.

Table 11 presents parameters that along with sodium are good indicators of pollutants that might also contain the types of compounds and chemicals noted in Tables 8 and 9. For example, high concentrations of nitrate, chloride, and ammonia in drinking water might indicate that the well is drawing in septic effluent. Since septic effluent frequently contains volatile organic compounds, it would be advisable to have the source of drinking water analyzed for volatile organics. High concentrations of iron, manganese, total dissolved solids, nitrogen (as ammonia or nitrate) and extreme hardness are typical indicators of landfill leachate. High concentrations of these parameters in domestic drinking water should trigger an expanded analysis to include all of the parameters in Tables 8, and 9 because many of them are also found in landfill leachate.

Boards of Health should consider potential threats to groundwater quality when deciding what testing program is most appropriate for their town. Naturally occurring contaminants and past and present land uses are of primary importance. Land uses that have a potential to adversely impact water quality include:

- storage, use or disposal of
 - herbicides
 - pesticides
 - fertilizers
 - hazardous materials
- subsurface waste disposal.

Table 8
Recommended Analytes, Concentration Limits, and Monitoring Frequency
for Private Wells

Concentrations are in milligrams per liter (mg/l); to convert to micrograms per liter (ug/l) multiply concentration in mg/l by 1000.

Parameter	Recommended Concentration Limit	Recommended Sampling Frequency
Inorganic Compounds		Monitor initially for all compounds and then once every ten years if no detects, or as otherwise determined by the local Board of Health. Note: Nitrate and Nitrite should be monitored once every year.
Antimony	0.006 mg/l	
Arsenic	0.010 mg/l	
Asbestos	7 million fibers/l	
Barium	2 mg/l	
Beryllium	0.004 mg/l	
Cadmium	0.005 mg/l	
Chromium (total)	0.1 mg/l	
Cyanide (as free cyanide)	0.2 mg/l	
Fluoride	4 mg/l	
Lead (action level)	0.015 mg/l	
Copper (action level)	1.3 mg/l	
Manganese ¹	0.3 mg/l	
Mercury	0.002 mg/l	
Nitrate (N)	10 mg/l	
Nitrite (N)	1 mg/l	
Total Nitrate & Nitrite (N)	10 mg/l	
Perchlorate	0.002 mg/l	
Selenium	0.05 mg/l	
Sodium ²	20 mg/l ³	
Thallium	0.002 mg/l	
Turbidity		As determined by the local Board of Health.
Turbidity ⁴	1 NTU ⁵	

Table 8 Continued on next two pages

¹ EPA has set a lifetime Health Advisory value of 0.3 mg/l for Manganese to protect against concerns of potential neurological effects. This advisory is based on the health risks posed to children under the age of 1 and infants on formula by the ingestion of Manganese.

² Sodium guideline is based on an eight (8) ounce serving. This guideline was established to protect persons on sodium restricted diets. If the sodium concentration is above the guideline and a person using the water is on a sodium-restricted diet, that person's physician should be consulted as to whether the water should be consumed.

³ **ORSG:** Office of Research and Standards Guideline.

⁴ See the table and associated footnotes provided by EPA at <http://water.epa.gov/drink/contaminants/index.cfm> for a discussion of the concern for turbidity in drinking water and the recommended concentration limit.

⁵ NTU = Nephelometric turbidity unit.

Table 8 Continued:

Parameter	Recommended Concentration Limit	Recommended Sampling Frequency
Synthetic Organic Compounds (SOC) ⁵		<p>To reduce cost it is best to perform a monitoring screen initially using analytical method 505 or 508 and then once every ten years if no detects or as specified by the local Board of Health. The recommended monitoring screen won't provide analytical results for all of the SOC listed in Table 8. Monitoring for the remaining SOC should be considered if contaminants are detected in the monitoring screen. This approach is consistent with what MassDEP requires for SOC monitoring at public water supplies. Owners of wells in agricultural areas are encouraged to conduct more frequent testing.</p> <p>If private well owners decide to request laboratory analysis of all of the SOC listed in Table 8, MassDEP encourages them to request that the laboratory include analytical results for other synthetic organic compounds that the laboratory may normally include with the analysis of the synthetic organic compounds listed in this table at no additional cost.</p>
Alachlor	0.002 mg/l	
Atrazine	0.003 mg/l	
Benzo(a)pyrene	0.0002 mg/l	
Carbofuran	0.04 mg/l	
Chlordane	0.002 mg/l	
Dalapon	0.2 mg/l	
Di(2-ethylhexyl)adipate	0.4 mg/l	
Di(2-ethylhexyl) phthalate	0.006 mg/l	
Dinoseb	0.007 mg/l	
Diquat ⁶	0.02 mg/l	
1,2-Dibromo-3-chloropropane (DBCP)	0.0002 mg/l	
2,4-D (2,4-Dichlorophenoxyacetic acid)	0.07 mg/l	
Endothall ⁶	0.1 mg/l	
Endrin	0.002 mg/l	
Ethylene Dibromide (EDB)	0.00002 mg/l	
Glyphosate ⁶	0.7 mg/l	
Heptachlor	0.0004 mg/l	
Heptachlor epoxide	0.0002 mg/l	
Hexachlorocyclopentadiene	0.001 mg/l	
Lindane	0.002 mg/l	
Methoxychlor	0.04 mg/l	
Oxamyl(Vydate)	0.2 mg/l	
Polychlorinated biphenyls (PCBs)	0.0005 mg/l	
Pentachlorophenol	0.001 mg/l	
Picloram	0.5 mg/l	
Simazine	0.004 mg/l	
2,3,7,8-TCDD (Dioxin)	3 x 10 ⁻⁸ mg/l	
Toxaphene	0.003 mg/l	
2,4,5-TP (Silvex)	0.05 mg/l	

⁵ The SOC monitoring requirements for public water supply wells typically only involve screening by analytical method 505 or 508. The screening analysis does not test for all SOC listed in this table.

Table 8 Continued:

Parameter		Recommended Concentration Limit	Recommended Sampling Frequency
Bacteria			
Total Coliform Bacteria		Positive sample	Monitor once every year, or as otherwise specified by the local Board of Health.
Enterococci		Positive sample	
<i>Cryptosporidium</i>		Positive sample	Initial monitoring for <i>Cryptosporidium</i> and <i>Giardia lamblia</i> is only recommended if the source is surface water (e.g. spring) or a well located within 100 feet of a surface water body or is prone to flooding. It is recommended that additional monitoring occur after any flooding event in which the flood waters reach the well location, or as otherwise specified by the local Board of Health.
<i>Giardia lamblia</i>		Positive sample	
Radionuclides			
Gross Alpha Activity		15 pCi/l	Monitor for radionuclides initially and determine future sampling frequency based upon the results. If the gross alpha result is greater than 15 pCi/l then uranium testing should be performed. If the gross alpha result is greater than 5 pCi/l then Radium-226 and Radium-228 testing should be performed.
Radium –226 & 228		5 pCi/l	
Uranium		0.03 mg/l	
Beta particle and photon radioactivity		4 mrem/year	
Radon 222 ⁶		10,000 pci/L	
Volatile Organic Compounds (VOC)			
Benzene		0.005 mg/l	Monitor initially for VOC and then once every 10 years if no detects, or as otherwise determined by the local Board of Health. Owners of wells in industrial or densely developed residential areas are encouraged to conduct more frequent testing.
Carbon Tetrachloride		0.005 mg/l	
Dichloromethane (methylene chloride)		0.005 mg/l	MassDEP encourages private well owners to request that the laboratory include analytical results for other volatile organic compounds that the laboratory may normally include with the analysis of the volatile organic compounds listed in this table at no additional cost.
1,2-Dichlorobenzene (o-DCB)		0.6 mg/l	
1,4-Dichlorobenzene (p-DCB)		0.005 mg/l	
1,2-Dichloroethane		0.005 mg/l	
1,2-Dichloroethylene (cis)		0.07 mg/l	
1,2-Dichloroethylene (trans)		0.1 mg/l	
1,1-Dichloroethylene		0.007 mg/l	
1,2-Dichloropropane		0.005 mg/l	
Ethylbenzene		0.7 mg/l	
Methyl Tertiary Butyl Ether (MTBE)		0.07 mg/l ⁷	
Monochlorobenzene (chlorobenzene)		0.1 mg/l	
Styrene		0.1 mg/l	
Tetrachloroethylene (PCE)		0.005 mg/l	
Toluene		1 mg/l	
Trichloroethylene (TCE)		0.005 mg/l	
1,1,1-Trichloroethane (1,1,1-TCA)		0.2 mg/l	
1,2,4-Trichlorobenzene		0.07 mg/l	
1,1,2-Trichloroethane		0.005 mg/l	
Vinyl Chloride (VC)		0.002 mg/l	
Xylenes (total)		10 mg/l	

⁶ Exceedance of this guideline indicates that air sampling for Radon-222 should be done and you should contact your local Board of Health for more information. EPA proposed new guidelines for radon (64 FR

211; Tuesday, November 2, 1999). Radon is commonly found in Massachusetts' groundwaters as a decay product of uranium in the underlying soil or bedrock.

⁷ **ORSG**: Office of Research and Standards Guideline.

**Table 9
Additional Recommended Analytes, Concentration Limits, and Monitoring
Frequency for Private Wells If Contamination is Suspected**

Parameter	Recommended Concentration Limit ¹	Recommended Sampling Frequency
Acetone	6.3 mg/l	These parameters are generally not recommended for private well monitoring, unless a problem has been identified by the Board of Health, the Department of Public Health, or MassDEP.
Bromomethane	0.01 mg/l	
Chloroform	0.07 mg/l	
Dichlorodifluoromethane	1.4 mg/l	
1,1-Dichloroethane	0.07 mg/l	
1,3-Dichloropropene	0.0004 mg/l	
1,4-Dioxane	0.003 mg/l	
Ethylene Glycol	14 mg/l	
Methyl Ethyl Ketone	4.0 mg/l	
Methyl Isobutyl Ketone	0.35 mg/l	
Metolachlor	0.1 mg/l	
Naphthalene	0.140 mg/l	
Nickel	0.1 mg/l	
n-Nitrosodimethylamine (NDMA)	0.00001 mg/l	
Tertiary-Amyl Methyl Ether (TAME)	0.09 mg/l	
Tertiary Butyl Alcohol (TBA)	0.12 mg/l	
Tetrahydrofuran	1.3 mg/l	
Trichlorotrifluoroethane (Freon113)	210 mg/l	

¹ All Recommended Concentration Limits in Table 9 are Office of Research and Standards Guidelines (ORSGs). MassDEP uses methodology similar to that used by the EPA's Office of Groundwater and Drinking Water for establishing primary drinking water standards, when setting guidelines for chemicals in drinking water.

Table 10
Recommended Analytes, Concentration Limits, and Monitoring Frequency
for Private Wells – Secondary Standards

Parameter	Recommended Concentration Limit	Recommended Sampling Frequency
Aluminum	0.05 to 0.2mg/l	These parameters are generally recommended for initial monitoring and then once every 10 years or as otherwise determined by the Local Board of Health. TON: Threshold Odor Number
Chloride	250 mg/l	
Color	15 color units	
Copper	1 mg/l	
Fluoride	2 mg/l	
Foaming Agents	0.5 mg/l	
Iron	0.3 mg/l	
Manganese ¹	0.05 mg/l	
Odor	3 TON	
pH	6.5-8.5	
Silver	0.10 mg/l	
Sulfate	250 mg/l	
Total Dissolved Solids	500 mg/l	
Zinc	5 mg/l	

¹The EPA Secondary Standard of 0.05 mg/l is based solely on taste and odor considerations. EPA has also set a lifetime Health Advisory of 0.3 mg/l for Manganese(see Table 8).

Table 11
Indicator Parameters

Parameter	Recommended Upper Limit	Recommended Lower Limit
Alkalinity	100 mg/l	30 mg/l
Calcium	150 mg/l	50 mg/l
Chloride	250 mg/l	N/A
Color	15 color units	N/A
Copper	1 mg/l	N/A
Hardness	200 mg/l	50 mg/l
Iron	0.3 mg/l	N/A
Magnesium	Relative scale	N/A
Manganese	0.05 mg/l	N/A
Nitrogen (as ammonia)	0.1 mg/l	0.015 mg/l
Nitrate	1 mg/l	N/A
Odor	3 TON	TON: Threshold Odor Number
pH	8.5	6.5
Potassium	Relative scale	N/A
Sediment	visual observation	N/A
Sulfate	250 mg/l	N/A
Total Dissolved Solids	500 mg/l	N/A

Additional Comments on Recommended Sampling Frequency

Although, private well contamination is often identified through detection of an unpleasant or unnatural taste or odor, consumers should keep in mind that harmful concentrations of several contaminants do not impart a noticeable taste or odor to the water. It is prudent to have the well water sampled periodically and tested by a certified laboratory. The following sampling scheme is suggested:

- (1) For newly constructed wells or persons intending to purchase a home served by a private well:

Water samples should be collected from private drinking water wells and analyzed for all of the parameters listed in Table 8 at least once to assess the suitability of the well as a source of drinking water and to establish a base-line of water chemistry. These base-line results can be compared to subsequent water quality analyses to determine whether any changing trends are occurring that may indicate a contaminant threat. Samples taken from wells completed in crystalline bedrock should also be analyzed for radon. Persons intending to purchase a home served by a private well should request the results of available water quality analyses and/or have the well sampled and tested as recommended to establish a water chemistry base-line.

- (2) For existing wells:

Once a base-line has been established, each year, preferably in the spring, all private wells should have their water analyzed for coliform bacteria.

Every three years, homeowners with wells located proximal to land uses and/or intensive residential developments that are potentially impacting groundwater quality should have their water analyzed for nitrate, turbidity, the volatile organic compounds listed in Table 8, sodium, and all of the parameters listed in Table 10. These results should be compared to previously collected base-line water chemistry.

- (3) Every three years, homeowners who are located in relatively rural areas and who have had their water analyzed for the parameters indicated in (1), above, should have their water analyzed for nitrate, and all of the parameters listed in Table 10. In areas where current or historical land use includes agriculture, analysis for Synthetic Organic Compounds and arsenic is also recommended. These results should be compared to previously collected base-line water chemistry.

If any of the limits noted in Tables 8, 9, and 11 are exceeded, a second water quality test should be conducted to confirm the results of the first analysis. If the limit is exceeded in the second analysis, treatment may be necessary and the local Board of Health should be notified.

Exceedence of the recommended limit for sodium noted in Table 8 is primarily of concern to persons on low sodium diets. If road salt is suspected as the source of high sodium levels, the well owner or Board of Health should contact the Massachusetts Department of Transportation Highway Division (Environmental Section) if the road is maintained by the state, or the local Department of Public Works (DPW) if it is maintained by the town.

Recommended Use of Approved Methods and Certified Laboratories

All water quality analyses should be conducted utilizing methods approved by the U. S. Environmental Protection Agency for analyzing drinking water (<http://water.epa.gov/scitech/drinkingwater/labcert/analyticalmethods.cfm>) and **not** methods used for analyzing wastewater.

All water quality analyses should be conducted by a laboratory that is certified by the Commonwealth of Massachusetts for the specific analysis required. The Commonwealth of Massachusetts has an ongoing laboratory certification program administered by the Wall Experiment Station. Through this program laboratories are certified to perform specific analyses. It is important to note, however, that a laboratory that is certified for one type of analysis may not be certified for another type of analysis. In addition, since the certification process is ongoing, a laboratory may, at any time, lose its certification for a particular analysis. Thus, prior to contracting a laboratory for a particular analysis, it should be verified that the laboratory has current certification by the state to perform such an analysis. A list of laboratories that are certified for specific analyses can be obtained at the following MassDEP web page: <http://public.dep.state.ma.us/Labcert/Labcert.aspx>.

Recommended Water Quality Report

It is recommended that the local Board of Health require the well owner to submit to the Board a Water Quality Report anytime a private water supply is tested. The report should include:

- (1) Name, address and phone number or other contact information for the individual who performed the sampling (i.e., BOH member, BOH agent, lab personnel, well owner, well owner's agent);
- (2) where in the system the sample was obtained (point-of-use or point-of-entry) and, if sampled, at the point-of-use, whether or not the system was flushed prior to sampling;
- (3) type of water treatment used (chemical or special device e.g., disinfection, reverse osmosis unit, filter, etc.), if applicable;
- (4) date and time of sample collection;
- (5) date and time sample received by the laboratory;
- (6) a copy of the laboratory's test results; and,
- (7) a copy of the Chain of Custody.

Results that indicate no contamination are as important as those that indicate water quality problems because these results provide background data in case of future contamination. A complete record of all testing results is also useful when designing local water quality testing programs.