Procedure For Corrective Action for Systems Not Currently Using Chlorine

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Table of Contents

INTRODUCTION

For all drinking-water systems operating under O. Reg. 170/03, made under the *Safe Drinking Water Act, 2002*, treatment is currently required or is required to be installed by July 1, 2006, (non-municipal year-round residential systems), unless relief has been granted or certain exemptions apply.

This document provides procedures for corrective action related to adverse microbiological test results from drinking-water samples taken from systems not currently using chlorine. These procedures should be used only when regulatory requirements allow for their use. All other regulatory requirements remain unchanged.

These procedures outline several options for corrective action for owners of drinking-water systems, depending on a number of factors.

I: **SYSTEMS THAT OBTAIN WATER FROM A GROUND WATER SUPPLY– CORRECTIVE ACTION FOR ADVERSE MICROBIOLOGICAL TEST RESULTS FROM DRINKING-WATER SAMPLES TAKEN**

The owner of the drinking-water system must ensure that the following corrective action is taken.

Escherichia coli (E. coli)

Procedure

Immediately take all reasonable steps to notify all users of water from the system to use an alternate source of drinking water or, if no alternate source is available, to bring water to a rapid rolling boil for at least one minute before use.

Immediately report the adverse test result to the medical officer of health and the Spills Action Centre of the Ministry of the Environment, and to any other parties as required.

Immediately resample and test. Report any adverse resample test results as required.

Conduct an inspection of the wellhead and surrounding property, distribution system, and any plumbing that is owned by the system owner to ensure that the system has been properly constructed and maintained to prevent entry of contaminants (see Appendix A – Well System Checklist). Correct any problems identified before continuing with corrective action steps.

Ensure that microbiological contamination is eliminated from the system through temporary disinfection, flushing of the lines, and by continuing to resample and test (see below). Continue these corrective actions until *Escherichia coli* (E. coli) is not detected in two consecutive sets of samples taken 24 to 48 hours apart or as otherwise directed by the medical officer of health.

Take such other steps as are directed by the medical officer of health.

If adverse microbiological test results can not be eliminated following temporary system disinfection, consult a trained professional. Consultation should include a site visit and consideration of the following factors (also, see Appendix B – List of Questions for Use in On-site Investigation):

- Potential sources of contamination
- Most effective means of delivering safe drinking water for the long-term
- Health protection of the users who are served by the system

The owner of the drinking-water system has the following options:

- Continued use of the existing system following successful temporary system disinfection;
- Continued use of the existing system following the installation and operation of treatment equipment (if not already installed) in accordance with the regulatory requirements;
- Disconnection from any existing source well that is suspected of being associated with the adverse results and connection to a new source well that has been constructed to meet the requirements of Regulation 903;
- Disconnection from all existing source wells and connection to a municipal residential drinking-water system that is currently providing primary and secondary disinfection in accordance with sections 1-2 to 1-5 of Schedule 1 of O. Reg. 170/03, subject to approval by the Ministry; or
- Disconnection from all existing source wells and connection to a regulated non-municipal drinking-water system or municipal non-residential drinking-water system that is currently providing primary and secondary disinfection in accordance with sections 2-2 to 2-5 of Schedule 2 of O. Reg. 170/03, and has the operational capacity to handle the additional demand, subject to confirmation in an engineering evaluation report prepared by a professional engineer.

NOTE: The owner must ensure that all abandoned wells are plugged and sealed according to the requirements of Regulation 903 made under the Ontario Water Resources Act.

Resample and Test

For the purposes of this procedure, "resample and test" means, with respect to corrective action that arises from the test of a water sample for a microbiological parameter,

i)   to take a set of water samples, at approximately the same time, with,
      a)   at least one sample from the same location as the sample that gave rise to the corrective action,
      b)   at least one sample from a location that is a significant distance upstream from the location described in a), if that is reasonably possible, and

c)   at least one sample from a location that is a significant distance downstream from the location described in a), if that is reasonably possible, and

ii)   conduct, on the samples taken, the same test that gave rise to the corrective action

Temporary System Disinfection

For the purposes of temporary disinfection, drinking-water systems to which this procedure applies that supply more than one building should have functional stand-by chlorination equipment, including a pump, solution tank, a fresh supply of chemical disinfectant, and a means to detect chlorine residual. If the owner of such a drinking-water system does not have functional stand-by chlorination equipment and that owner intends to continue the use of the existing system without installing and operating treatment equipment in accordance with regulatory requirements, then installation of basic stand-by chlorination equipment is advised.

If necessary, temporary system disinfection can be effectively carried out without stand-by chlorination equipment. In all cases, ensure that temporary system disinfection involves the following steps (see Appendix C – Procedure for Temporary Disinfection):

- Use a fresh supply of chemical disinfectant
- Disinfect the system such that a free chlorine residual of 50 mg/L can be detected at all points in the affected part(s) of the distribution system and in the plumbing that is connected to the system for at least 12 hours
- Flush the water lines with water to ensure the chlorine is removed from the system
- Resample and test 24 to 48 hours after flushing

Total coliforms

Procedure

Immediately report the adverse test result to the medical officer of health and the Spills Action Centre of the Ministry of the Environment, and to any other parties as required.

Resample and test as soon as reasonably possible. Report any adverse resample test results as required.

If adverse test results are received from any of these resample tests, take the following actions:

Conduct an inspection of the well-head and surrounding property, distribution system, and any plumbing that is owned by the system owner to ensure that the system has been properly constructed and maintained to prevent entry of contaminants (see Appendix A – Well System Checklist). Correct any problems identified before continuing with corrective action steps.

Ensure that microbiological contamination is eliminated from the system through temporary disinfection, flushing of the lines, and by continuing to resample and test (see below). Continue these corrective actions until total coliforms are not detected in two consecutive sets of samples taken 24 to 48 hours apart or as otherwise directed by the medical officer of health.

Take such other steps as are directed by the medical officer of health.

If adverse microbiological test results can not be eliminated following temporary system disinfection, consult a trained professional. Consultation should include a site visit and consideration of the following factors (also, see Appendix B – List of Questions for Use in On-site Investigation):

- Potential sources of contamination
- Most effective means of delivering safe drinking water for the long-term
- Health protection of the users who are served by the system

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- Disconnection from all existing source wells and connection to a municipal residential drinking-water system that is currently providing primary and secondary disinfection in accordance with sections 1-2 to 1-5 of Schedule 1 of O. Reg. 170/03, subject to approval by the Ministry; or
- Disconnection from all existing source wells and connection to a regulated non-municipal drinking-water system or municipal non-residential drinking-water system that is currently providing primary and secondary disinfection in accordance with sections 2-2 to 2-5 of Schedule 2 of O. Reg. 170/03, and has the operational capacity to handle the additional demand, subject to confirmation in an engineering evaluation report prepared by a professional engineer.

NOTE: The owner must ensure that all abandoned wells are plugged and sealed according to the requirements of Regulation 903 made under the Ontario Water Resources Act.

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For the purposes of this procedure, "resample and test" means, with respect to corrective action that arises from the test of a water sample for a microbiological parameter,

i)   to take a set of water samples, at approximately the same time, with,

     a)   at least one sample from the same location as the sample that gave rise to the corrective action,

     b)   at least one sample from a location that is a significant distance upstream from the location described in a), if that is reasonably possible, and

     c)   at least one sample from a location that is a significant distance downstream from the location described in a), if that is reasonably possible, and

ii)   conduct, on the samples taken, the same test that gave rise to the corrective action.

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If necessary, temporary system disinfection can be effectively carried out without stand-by chlorination equipment. In all cases, ensure that temporary system disinfection involves the following steps (see Appendix C – Procedure for Temporary Disinfection):

- Use a fresh supply of chemical disinfectant
- Disinfect the system such that a free chlorine residual of 50 mg/L can be detected at all points in the affected part(s) of the distribution system and in the plumbing that is connected to the system for at least 12 hours
- Flush the water lines with water to ensure the chlorine is removed from the system
- Resample and test 24 to 48 hours after flushing

Aeromonas spp., etc.

Procedure

Immediately report the adverse test result to the medical officer of health and the Spills Action Centre of the Ministry of the Environment, and to any other parties as required.

Resample and test as soon as reasonably possible. Report any adverse resample test results as required.

If adverse test results are received from any of these resample tests, take the following actions:

Conduct an inspection of the well-head and surrounding property, distribution system, and any plumbing that is owned by the system owner to ensure that the system has been properly constructed and maintained to prevent entry of contaminants (see Appendix A – Well System Checklist). Correct any problems identified before continuing with corrective action steps.

Ensure that microbiological contamination is eliminated from the system through temporary disinfection, flushing of the lines, and by continuing to resample and test (see below). Continue these corrective actions until *Aeromonas* spp., *Pseudomonas aeruginosa, Staphylococcus aureus, Clostridium* spp., or fecal streptococci (Group D streptococci) are not detected in two consecutive sets of samples taken 24 to 48 hours apart or as otherwise directed by the medical officer of health.

Take such other steps as are directed by the medical officer of health.

If adverse microbiological test results can not be eliminated following temporary system disinfection, consult a trained professional. Consultation should include a site visit and consideration of the following factors (also, see Appendix B – List of Questions for Use in On-site Investigation):

- Potential sources of contamination
- Most effective means of delivering safe drinking water for the long-term
- Health protection of the users who are served by the system

The owner of the drinking-water system has the following options:

- Continued use of the existing system following successful temporary system disinfection;
- Continued use of the existing system following the installation and operation of treatment equipment (if not already installed) in accordance with the regulatory requirements;
- Disconnection from any existing source well that is suspected of being associated with the adverse results and connection to a new source well that has been constructed to meet the requirements of Regulation 903;
- Disconnection from all existing source wells and connection to a municipal residential drinking-water system that is currently providing primary and secondary disinfection in accordance with sections 1-2 to 1-5 of Schedule 1 of O. Reg. 170/03, subject to approval by the Ministry; or
- Disconnection from all existing source wells and connection to a regulated non-municipal drinking-water system or municipal non-residential drinking-water system that is currently providing primary and secondary disinfection in accordance with sections 2-2 to 2-5 of Schedule 2 of O. Reg. 170/03, and has the operational capacity to handle the additional demand, subject to confirmation in an engineering evaluation report prepared by a professional engineer.

NOTE: The owner must ensure that all abandoned wells are plugged and sealed according to the requirements of Regulation 903 made under the Ontario Water Resources Act.

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For the purposes of this procedure, "resample and test" means, with respect to corrective action that arises from the test of a water sample for a microbiological parameter,

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      a)   at least one sample from the same location as the sample that gave rise to the corrective action,
      b)   at least one sample from a location that is a significant distance upstream from the location described in a), if that is reasonably possible, and
      c)   at least one sample from a location that is a significant distance downstream from the location described in a), if that is reasonably possible, and

ii)   conduct, on the samples taken, the same test that gave rise to the corrective action

Temporary System Disinfection

For the purposes of temporary disinfection, drinking-water systems to which this procedure applies that supply more than one building should have functional stand-by chlorination equipment, including a pump, solution tank, a fresh supply of chemical disinfectant, and a means to detect chlorine residual. If the owner of such a drinking-water system does not have functional stand-by chlorination equipment and that owner intends to continue the use of the existing system without installing and operating treatment equipment in accordance with regulatory requirements, then installation of basic stand-by chlorination equipment is advised.

If necessary, temporary system disinfection can be effectively carried out without stand-by chlorination equipment. In all cases, ensure that temporary system disinfection involves the following steps (see Appendix C – Procedure for Temporary Disinfection):

- Use a fresh supply of chemical disinfectant
- Disinfect the system such that a free chlorine residual of 50 mg/L can be detected at all points in the affected part(s) of the distribution system and in the plumbing that is connected to the system for at least 12 hours
- Flush the water lines with water to ensure the chlorine is removed from the system
- Resample and test 24 to 48 hours after flushing

II: **SYSTEMS THAT OBTAIN WATER FROM A SURFACE WATER SUPPLY – CORRECTIVE ACTION FOR ADVERSE MICROBIOLOGICAL TEST RESULTS FROM DRINKING-WATER SAMPLES TAKEN**

NOTE: It is not safe to drink untreated surface water. Under O. Reg. 170/03, Drinking Water Systems, the installation and operation of treatment equipment including filtration and disinfection is required on all surface water systems, unless certain exemptions apply or relief is granted.

Ground Water Under the Direct Influence of Surface Water

Systems that obtain water from a raw water supply which is ground water under the direct influence of surface water must follow the corrective action for surface water systems that are outlined here.

The following drinking-water systems are deemed to be systems that obtain water from a raw water supply which is ground water under the direct influence of surface water, unless a written report prepared after August 1, 2000 by a professional engineer or professional hydrogeologist concludes that the raw water supply is not ground water under the direct influence of surface water and the report includes a statement of his or here reasons for reaching that conclusion:

1. A drinking-water system that obtains water from a well that is not a drilled well or that does not have a watertight casing that extends to a depth of more than six metres below ground level.

2. A drinking-water system that obtains water from an infiltration gallery.

3. A drinking-water system that is not capable of producing water at a rate of 0.58 litres per second and that obtains water from a well, any part of which is within 15 metres of surface water.

4. A drinking-water system that is capable of producing water at a rate greater than 0.58 litres per second and that obtains water from an overburden well, any part of which is within 100 metres of surface water.

5. A drinking-water system that is capable of producing water at a rate greater than 0.58 litres per second and that obtains water from a bedrock well, any part of which is within 500 metres of surface water.

6. A drinking-water system that exhibits evidence of contamination by surface water.

7. A drinking-water system in respect of which a written report has been prepared by a professional engineer or professional hydrogeologist that concludes that the system's raw water supply is ground water under the direct influence of surface water and that includes a statement of his or her reasons for reaching that conclusion.

Escherichia coli (E. coli)

Procedure

Immediately take all reasonable steps to notify all users of water from the system to use an alternate source of drinking water or, if no alternate source is available, to bring water to a rapid rolling boil for at least one minute before use.

Immediately report the adverse test result to the medical officer of health and the Spills Action Centre of the Ministry of the Environment, and to any other parties as required.

Immediately resample and test. Report any adverse resample test results as required.

Ensure that microbiological contamination is eliminated from the system through temporary disinfection, flushing of the lines, and by continuing to resample and test (see below). Continue these corrective actions until _Escherichia coli_ (E. coli) are not detected in two consecutive sets of samples taken 24 to 48 hours apart or as otherwise directed by the medical officer of health.

Take such other steps as are directed by the medical officer of health.

If adverse microbiological test results can not be eliminated following temporary system disinfection, consult a trained professional. Consultation should include a site visit and consideration of the following factors (also, see Appendix B – List of Questions for Use in On-site Investigation):

- Potential sources of contamination
- Most effective means of delivering safe drinking water for the long-term
- Health protection of the users who are served by the system

The owner of the drinking-water system has the following options:

- Continued use of the existing system following the installation and operation of treatment equipment (if not already installed) in accordance with the regulatory requirements, including filtration and disinfection;
- Disconnection from all existing source intakes and connection to a new source well that has been constructed to meet the requirements of Regulation 903;
- Disconnection from all existing source intakes and connection to a municipal residential drinking-water system that is currently providing primary and secondary disinfection in accordance with sections 1-2 to 1-5 of Schedule 1 of O. Reg. 170/03, subject to approval by the Ministry; or
- Disconnection from all existing source intakes and connection to a regulated non-municipal drinking-water system or municipal non-residential drinking-water system that is currently providing primary and secondary disinfection in accordance with sections 2-2 to 2-5 of Schedule 2 of O. Reg. 170/03,, and has the operational capacity to handle the additional demand, subject to confirmation in an engineering evaluation report prepared by a professional engineer.

Resample and Test

For the purposes of this procedure, "resample and test" means, with respect to corrective action that arises from the test of a water sample for a microbiological parameter,

i)   to take a set of water samples, at approximately the same time, with,
    a)   at least one sample from the same location as the sample that gave rise to the corrective action,
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    c)   at least one sample from a location that is a significant distance downstream from the location described in a), if that is reasonably possible, and

ii)   conduct, on the samples taken, the same test that gave rise to the corrective action

Temporary System Disinfection

For the purposes of temporary disinfection, drinking-water systems to which this procedure applies that supply more than one building should have functional stand-by chlorination equipment, including a pump, solution tank, a fresh supply of chemical disinfectant, and a means to detect chlorine residual. If the owner of such a drinking-water system does not have functional stand-by chlorination equipment and that owner intends to continue the use of the existing system without installing and operating treatment equipment in accordance with regulatory requirements, then installation of basic stand-by chlorination equipment is advised.

If necessary, temporary system disinfection can be effectively carried out without stand-by chlorination equipment. In all cases, ensure that temporary system disinfection involves the following steps (see Appendix C – Procedure for Temporary Disinfection):

- Use a fresh supply of chemical disinfectant
- Disinfect the system such that a free chlorine residual of 50 mg/L can be detected at all points in the affected part(s) of the distribution system and in the plumbing that is connected to the system for at least 12 hours
- Flush the water lines with water to ensure the chlorine is removed from the system
- Resample and test 24 to 48 hours after flushing

Total coliforms

Procedure

Immediately report the adverse test result to the medical officer of health and the Spills Action Centre of the Ministry of the Environment, and to any other parties as required.

Resample and test as soon as reasonably possible. Report any adverse resample test results as required.

If adverse test results are received from any of these resample tests, take the following actions:

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The owner of the drinking-water system has the following options:

- Continued use of the existing system following the installation and operation of treatment equipment (if not already installed) in accordance with the regulatory requirements, including filtration and disinfection;
- Disconnection from all existing source intakes and connection to a new source well that has been constructed to meet the requirements of Regulation 903;
- Disconnection from all existing source intakes and connection to a municipal residential drinking-water system that is currently providing primary and secondary disinfection in accordance with sections 1-2 to 1-5 of Schedule 1 of O. Reg. 170/03, subject to approval by the Ministry; or
- Disconnection from all existing source intakes and connection to a regulated non-municipal drinking-water system or municipal non-residential drinking-water system that is currently providing primary and secondary disinfection in accordance with sections 2-2 to 2-5 of Schedule 2 of O. Reg. 170/03, and has the operational capacity to handle the additional demand, subject to confirmation in an engineering evaluation report prepared by a professional engineer.

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- Use a fresh supply of chemical disinfectant
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Aeromonas spp., etc.

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Immediately report the adverse test result to the medical officer of health and the Spills Action Centre of the Ministry of the Environment, and to any other parties as required.

Resample and test as soon as reasonably possible. Report any adverse resample test results as required.

If adverse test results are received from any of these resample tests, take the following actions:

Ensure that microbiological contamination is eliminated from the system through temporary disinfection, flushing of the lines, and by continuing to resample and test (see below). Continue these corrective actions until *Aeromonas* spp., *Pseudomonas aeruginosa, Staphylococcus aureus, Clostridium* spp., or fecal streptococci (Group D streptococci) are not detected in two consecutive sets of samples taken 24 to 48 hours apart or as otherwise directed by the medical officer of health.

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- Resample and test 24 to 48 hours after flushing

APPENDIX A
WELL SYSTEM CHECKLIST
Refer to Water Treatment Requirements of O. Reg. 170/03

Well Location

☐ Wells should be located at a site where the elevation is higher than the immediate surrounding area;

☐ Wells should be located at a site where the well is accessible for cleaning, treatment, repair, testing, inspection, and visual examination;

☐ Wells should not be located inside well pits or in other locations that are prone to flooding or surface water contamination;

☐ Wells that are not drilled wells with watertight casings extending to a depth of more than six metres below ground level should be located at least 30 metres from septic systems and other pollution sources;

☐ Wells that are drilled wells with watertight casings extending to a depth of more than six metres below ground level should be located at least 15 metres from septic systems and other pollution sources.

Extend Buried Casing

☐ The casing of a properly constructed new well should extend a minimum of 40 cm above grade.

Inspect Covers Or Sanitary Seals For Cracks And Holes

☐ All seals should be watertight and in good condition;

☐ The cover should be commercially manufactured, vermin-proof, and should be able to prevent the entry of surface water and foreign materials.

Contact Licensed Well Contractor To Inspect The Inside Of The Well

☐ The casing should be clean, free of contamination and watertight – look for signs of surface water seeping or running freely into the well, and look for seepage through cracks or stains on the inside of the casing;

☐ Check the seal around the plumbing inlets – replace the sealing material if it is in poor condition or if water is seeping in from outside the well;

☐ Remove any debris floating in the well and prevent further debris from entering the well;

☐ Compare your well construction to diagrams that show proper design and maintenance techniques – correct any problems you discover.

Check The Condition Of Air Vents

☐ Air vents should extend above the land surface to a height that would prevent the entry of flood water from any anticipated flooding in the area;

☐ The open end of the air vent should be shielded and screened to prevent the entry of foreign materials into the well;

☐ The air vent should be kept free of obstructions and blocks at all times.

Inspect The Area Around The Well

☐ Make sure this area is in a neat and sanitary condition;

☐ Ensure all potential contamination sources, such as animals, fuel, and equipment, are away from the top of the well;

☐ Look for settling of the ground around the outside of the well casing;

☐ If there is no slope or if some of the area has settled, mound the earth around the outside of the well casing so that it is tight, and so that water runs away from the well;

☐ Maintain a permanent buffer of grass or other vegetation extending at least 150 centimetres from the well casing in all directions.

Wells No Longer In Use Must Be Properly Plugged and Sealed By A Licensed Contractor

☐ All legal requirements under Regulation 903 made under the Ontario Water Resources Act must be adhered to, including the use of a suitable sealant that precludes the vertical movement of any water, contaminant, or other material between aquifers or between an aquifer and the ground surface.

Check Your Distribution And Plumbing Lines

☐ Monitor for leaks, corrosion and scaling in pipes, decreases in water pressure, dead-ends, and unexplained increases in water usage;

☐ Look for wet areas, greener vegetation, or melted snow along distribution lines to locate potential leaks;

☐ Ensure that any leaks, dead-ends, or other mechanical difficulties and equipment failures have been fixed;

☐ Eliminate any cross-connections through the use of gaps, breakers or other backflow prevention strategies or devices.

APPENDIX B
List of Questions for Use in On-site Investigation
Refer to Water Treatment Requirements of O. Reg. 170/03

Water Source

☐ Is the water source vulnerable to contamination?

☐ Where is the raw water source located?

☐ Is the wellhead located near a body of surface water?

☐ Do you suspect that the groundwater supply may be subject to the influence of surface water?

☐ Is the watershed or water recharge area subject to possible contamination from:

    livestock operations   sewage or sanitary discharges   heavy recreational use?

☐ Is it a drilled well with a watertight casing of more than 6 metres depth?

☐ Is it a dug or bored well or other shallow well without a watertight casing of more than 6 metres depth?

Sampling Technique

☐ Was a proper sampling procedure followed?

☐ What sample collection locations were utilized? Were they appropriate? Are they representative of the whole system?

☐ Was the faucet free of screen or other attachments?

☐ Did sampler wash hands prior to taking sample?

☐ Was the cold water run for at least 2 - 3 minutes prior to sampling?

☐ Was the correct sampling container used?

☐ Were bottle and cap handled appropriately during procedure to ensure that the sample was not contaminated?

☐ Was the sample volume adequate for the test to be performed?

☐ Was the sample properly refrigerated?

☐ Was sample transported to laboratory within 48 hours?

Sample History

☐ Is there a history of adverse microbiological water sample results?

☐ Is there any history of adverse results from the distribution system?

☐ For the previous period of 24 consecutive months:

☐ How many samples were taken?

☐ When were samples taken?

☐ Where were samples taken?

☐ What are the results of all of the samples (including both positive and negative results)?

Water Source History

☐ Have there been any recent major changes to the source water quality (i.e. in the last month)?

☐ Have there been any recent sewage or manure spills?

☐ Have there been any recent heavy rains or flooding?

☐ Has the watershed been experiencing any drought conditions?

☐ Has there been any nearby intensification of recreational water use such as boating?

☐ Has there been any undue demand on the source water?

☐ Have there been any other circumstances noted that could cause deterioration in source water quality?

Operational History

☐ Have there been any changes/problems with operation of the distribution system?

☐ Have any mechanical difficulties or equipment failures occurred?

☐ Have there been any operational deficiencies?

☐ Has there been any period where testing of the system was not carried out according to requirements?

☐ Have there been any recent disruptions in the system?

    low pressure or main breaks   cross-connections   recent construction
    stagnant water (dead ends)   inadequate flushing   age and condition of pipes
    bio-film presence

☐ What corrective actions have been initiated?

☐ Has the system been temporarily disinfected according to correct procedures?

☐ Have distribution pipes been flushed thoroughly in the affected area?

☐ Have water resamples been taken as required (a minimum of three samples per initial adverse test)?

Appendix C
Procedure for Temporary Disinfection

Temporary disinfection of a drinking-water system is required when adverse microbiological test results occur, when contamination is suspected (e.g. after a flood), and at the beginning of each operating season. Temporary disinfection is carried out by creating a concentration of at least **50 mg/L** of chlorine throughout the system and maintaining it over a contact time of **12 hours**. Manual disinfection may be necessary where systems do not have stand-by chlorine disinfection equipment installed.

Temporary disinfection must be done in accordance with the provisions of the AWWA Standard for Disinfecting Water Mains (C651-99), AWWA Standard for Disinfection of Water Storage Facilities (C652-92), AWWA Standard for Disinfection of Water Treatment Plants (C653-97) and AWWA Standard for Disinfection of Wells (C654-97) or an equivalent procedure.

The following summary is provided of an equivalent procedure for the manual disinfection of a household-sized system that obtains water from a well.

Manual Disinfection of a Household-sized System

Manual disinfection of very small systems is most commonly done using ordinary household bleach (see "Method for Calculating Amount of Bleach Needed" below). Use a fresh unscented liquid bleach product containing 5% to 5.25% sodium hypochlorite.

Before disinfecting the water distribution system and plumbing, remove or isolate any carbon filter from the system since carbon will tend to remove the chlorine. In addition, water heaters and storage tanks should be turned off, completely drained, and allowed to fill with chlorinated water. It is not necessary to drain and disinfect tanks and pipes that are connected to a furnace as part of a water or steam-based heating system.

Once the required amount of bleach has been added to the well, start feeding the chlorine solution through the distribution system and plumbing. Open all the taps until you can smell chlorine and then turn the taps off. This will thoroughly chlorinate the plumbing fixtures. If there are any taps on the system where chlorine smell can not be detected add more bleach into the well until a chlorine smell is present and then turn the taps off. Allow the high chlorine solution to sit in the system for about 12 hours.

After 12 hours, discharge the water which has been sitting in the water lines. Flush all the taps in the system with new water until the smell of chlorine disappears. None of the water being flushed should be allowed to enter the septic tank and the tile field. Entry of this water into the septic system may damage or cause the complete failure of the system. Although some chlorine may still be present in the system after flushing is completed, this will not be harmful.

After 24 to 48 hours, resample and test the distribution system or plumbing for microbiological parameters. This procedure for manual disinfection should be repeated until adverse microbiological test results are no longer received from two consecutive sets of samples taken 24 to 48 hours apart or as otherwise directed by the medical officer of health. Take such other steps as are directed by the medical officer of health.

Appendix C

Chlorination can effectively disinfect a well and water system. However, unless the source of the problem is found and corrected the problem will likely continue to recur. In some cases, a new well may have to be constructed to correct the problem.

Method for Calculating Amount of Bleach Needed

The **depth of water** in the well will be somewhat less than the **total depth** of the well. For the following calculation, use the depth of water, if known; otherwise use the total depth of the well. The total depth may be found on the well record.

Using Table 1, estimate the volume of water in the well, and the amount of bleach required.

Table 1: Volume of Bleach Required Per Metre of Water Depth at 50 mg/L Chlorine Dosage

Well Diameter (inside diameter of casing)	Volume of Water per metre of Water Depth	Volume of Bleach Needed to Disinfect **Each Metre** of Water Depth
5 cm (2")	2 L	2 mL
10 cm (4")	8 L	8 mL
12.5 cm (5")	12 L	12 mL
15 cm (6")	18 L	18 mL
17.5 cm (7")	24 L	24 mL
20 cm (8")	32 L	32 mL
60 cm (2')	300 L	300 mL
75 cm (2.5')	450 L	450 mL
90 cm (3')	650 L	650 mL

Appendix C

Note: A normal household measuring cup holds about 250 mL.

To obtain the final quantity of bleach to be added to the well, multiply the value in the final column by the **number** of **metres** of water depth:

Appendix C

Examples:

A drilled well with 15 cm diameter and water depth of 50 m would use 900 mL of bleach for manual disinfection.

(18 mL x 50 = 900 mL).

A dug well with diameter of 90 cm and water depth of 12 m would use 7.8 L of bleach for manual disinfection.

(650 mL x 12 = 7800 mL or 7.8 L).

Instead of using Table 1, you can also use the direct formula, if desired:

1.   A simple formula for estimating the approximate volume of household bleach to be added to well water to obtain 50 mg/L available chlorine is given below:

$V = 0.08 \times D^2 \times H$

where:

D   = inside diameter of the well casing in <u>centimetres</u>
H   = depth of water in <u>metres</u>
V   = volume of bleach that must be added in <u>millilitres</u>
0.08 = constant factor

2.   Knowing the diameter of the inside of the well casing and depth of water in the well, calculate the number of millilitres of bleach to be added to the well water for achieving a dosage of 50 mg/L.

Examples:

A drilled well with 15 cm diameter and water depth of 50 m would use 900 mL of bleach for manual disinfection.

$(V = 0.08 \times 15^2 \times 50 = 900$ mL$)$

A dug well with diameter of 90 cm and water depth of 12 m would use 7.8 L of bleach for manual disinfection.

$(V = 0.08 \times 90^2 \times 12 = 7776$ mL or 7.8 L$)$.