



Drinking Water Manual

Bacteriological Water Quality Public and Private Water Supplies

Department of Health and Community Services
Environmental Public Health Division
May 2012



Drinking Water Manual

Part 1

Bacteriological, Sampling & Disinfection Standard

Department of Health and Community Services
Public Health Division

2011



Standards for Bacteriological Quality of Drinking Water

Objective: To reduce the risk of enteric illnesses that may be attributed to public water supplies, the following standards are applicable in the Province of Newfoundland and Labrador. If any of the criteria are exceeded, corrective action should be taken in the affected area immediately.

STANDARDS - BACTERIOLOGICAL:

Bacteriological standards are based on *Guidelines for Canadian Drinking Water Quality* 6th Edition, 1996 as revised, and shall be considered generally applicable to the Province of Newfoundland and Labrador. The Guideline notes that the maximum acceptable concentration (MAC) for the bacteriological quality of public, semi-public and private drinking water systems is no coliforms detectable per 100 mL. However, because coliforms are not uniformly distributed in water and are subject to considerable variation in public health significance, drinking water that fulfils the following conditions is considered to conform to this MAC:

1. No sample should contain *Escherichia coli* (*E. coli*).
2. No consecutive samples from the same site or no more than 10% of the samples from each distribution system in a given sample set should show the presence of total coliforms.

STANDARDS - SAMPLING:

The number of bacteriological samples to be taken is based on the following:

| | |
|--|---|
| No distribution system, potable water dispensing unit or very small system serving less than 100 people | 1 sample per month |
| Distribution systems serving: | |
| Less than 5,000 population | 4 samples per month |
| 5,000 to 90,000 | 1 sample per 1,000 population per month |
| more than 90,000 | 90 plus one sample per additional 10,000 population per month |

STANDARDS - DISINFECTION:

Continuous disinfection is required for community and public facility water systems. Chlorine is the most common chemical used for disinfection, and where used:

- All water entering the distribution system or public facility, after a minimum 20 minute contact time, shall contain a residual disinfectant concentration of free chlorine of at least 0.3 mg/L, or equivalent CT value;
- A detectable free chlorine residual must be maintained in all areas in the distribution system. For potable water dispensing units (PWDUs) where the finished water is continuously disinfected immediately before being dispensed to the public using ultra-violet (UV) radiation or any other approved method for that unit, no disinfection residual is required.

Water systems which are primarily disinfected by means **other than chlorination**, must be provided with a sufficient residual disinfectant as determined to be appropriate for that system.

**Application of
Standards for Bacteriological Quality of Public Drinking Water Supplies**

- 1) If the required continuous disinfection is not being provided, an immediate boil water advisory is recommended.
- 2) Bacteriological samples shall be taken at representative locations in the distribution system and must include the beginning and the end of the system, in accordance with the recommended number of samples. Disinfection residuals must be checked and recorded for each sampling point.

Disinfection Residual

- 3) If no disinfectant residual is detected at the sampling location, the operator of the system shall be advised of the fact that no residual is detected, and in consultation with the appropriate authorities and in accordance with existing guidelines, remedial action shall be initiated. This may include the issuing of a boil water advisory for the area affected by the lack of disinfectant residual.

E. coli

- 4) If the bacteriological test reveals the presence of *E. coli*, re-sampling of the site, as well as up and downstream locations, should be carried out within 24 hours. However, a boil water advisory may be recommended before the re-sampling results are known depending upon the extent of *E. coli* contamination in the initial testing, combined with knowledge of other problems pertaining to the water system. Regardless, if the repeat test reveals the presence of *E. coli*, a boil water advisory is recommended.

Total Coliforms

- 5) If the bacteriological test reveals the presence of total coliforms, but no *E. coli*, re-sampling of the site, as well as up and downstream locations, should be carried out as soon as is practically possible. If the consecutive test confirms the presence of total coliforms, but no *E. coli*, a boil water advisory is recommended for water systems that have only disinfection but no additional water treatment (such as coagulation, sedimentation, filtration or equivalent technologies) or have no significant operational procedures and controls over the water system. Regardless, remedial action shall commence in consultation with the water system operator.

Rescinding Boil Water Advisories

6. a. A boil water advisory should be rescinded when:
 - i. The condition(s) which led to the boil advisory have been corrected; and
 - ii. Two consecutive sets of samples, collected 24 hours or more apart, meet the bacteriological and disinfection standards.
- b. However, when a boil water advisory is issued because *E. coli* was detected in a set of samples and re-sampling could not be carried out within 24 hours (reason code F2E), the boil water advisory can be rescinded when:
 - i. One set of satisfactory representative bacteriological samples, including samples collected at up and downstream locations, complies with the bacteriological standard;

- ii. The water supply complies with the disinfection standard; and
 - iii. Other factors indicate the water is safe to drink.
- c. However, when a boil water advisory is issued because the water distribution system is undergoing maintenance or repairs (reason code D1), the boil water advisory can be rescinded when:
- i. One set of satisfactory representative bacteriological samples complies with the bacteriological standard (for water main breaks, a minimum of two representative samples shall be collected: one sample upstream and one sample downstream of the break);
 - ii. The water supply complies with the disinfection standard; and
 - iii. Other factors indicate the water is safe to drink.

If unsatisfactory bacteriological levels are detected during the one day initial sampling event, the two consecutive days of satisfactory bacteriological sample results, not taken less than 24 hours apart are necessary before rescission of the boil water advisory.

- d. When a boil water advisory is rescinded after one set of satisfactory bacteriological sample results, a second day of confirmatory bacteriological samples must be collected as soon as practically possible following water distribution system repairs.
- e. All appropriate municipal, provincial government and health authority officials must be advised of the decision to rescind a boil water advisory

Results Reporting

- 7. The reporting of results pertaining to these standards shall be done in accordance with the provincial *"Guidelines for the Issuance of Boil Water Advisories"*.

Application of
Standards for Bacteriological Quality of Private Wells

1. Drinking water samples from private wells submitted to the Public Health Laboratory or Government Service Centres for bacteriological analysis will be tested for the presence of both total coliform bacteria and the fecal indicator *Escherichia coli* (*E.coli*). If neither are detected the sample fully meets the standard.
2. If the bacteriological test reveals the presence of total coliforms, but no *E.coli*, in a 100 mL sample, the drinking water is considered **substandard** but not to pose an immediate health risk. Disinfection of the water source should be recommended to the owner. Retesting should be carried out following disinfection of the water source. Until disinfection is carried out and retest results are known, the water may be boiled before being consumed or an alternative safe source of drinking water may be used.
3. If the bacteriological test reveals the presence of *E.coli*, the drinking water is considered **unsatisfactory** and unsafe for drinking. It is recommended that the drinking water be boiled and that corrective action be taken to deal with fecal contamination entering the well. Retesting should be carried out following appropriate corrective action.
4. Reporting of the results will be carried out in accordance with the provincial document "*Reporting of Bacteriological Results from Private Water Supplies*".



Standards for Chemical and Physical Monitoring of Drinking Water

Objective: To help ensure that consumers of water provided by a public drinking water supply have clean and safe drinking water. Chemical and physical guidelines as specified in the *Guidelines for Canadian Drinking Water Quality* 6th Edition, 1996, as revised, shall be considered as objectives which are applicable to the Province of Newfoundland and Labrador. The *Guidelines* note that the maximum acceptable concentration (MAC) can be achieved by available water treatment methods at reasonable cost and it must also be reliably measurable by available analytical methods. If it is determined that water quality criteria are exceeded, priority should be given to meeting the *Guideline* objectives taking into account costs, the degree of exceedance and local factors.

Standards - Chemical and Physical Parameters:

The following standards for routine chemical and physical water quality monitoring are applicable in the Province of Newfoundland and Labrador. The minimum parameters to be monitored are shown in the table below. This table does not include all parameters in the *Guidelines* rather only those included in standard chemical analysis and metal scan packages. Some parameters are without MAC but are required for normal operational evaluation. The collected samples are to be analysed by accredited laboratories. If there is reason to suspect the presence of certain substances in a water supply system, additional parameters may be added as required by the Department of Environment.

| Chemical Parameters | | | | |
|----------------------------|--------------|----------|------------------------|--------------------------|
| Aluminum | Boron | Copper | Magnesium | Sulphate |
| Ammonia | Cadmium | Fluoride | Nitrate | Total Organic Carbon/DOC |
| Antimony | Calcium | Hardness | Potassium | Trihalomethanes |
| Arsenic | Chloride | Iron | Selenium | Uranium |
| Barium | Chromium | Lead | Sodium | Zinc |
| Physical Parameters | | | | |
| Colour | Conductivity | pH | Total Dissolved Solids | Turbidity |

Standards - Sampling Location and Frequency

Samples for chemical and physical parameters shall be taken from the source water (lake, pond, river, reservoir, well or spring) and from the distribution system. The distribution system samples shall be taken at a point significantly beyond the point at which treated water enters the distribution system. Additional sampling locations may be identified if profiling/bench marking data is required for any of the parameters. All sampling shall be done by taking grab samples.

Samples are to be collected semi-annually with the exception of trihalomethane samples which are to be collected for each season of the year. Plant operators may be required to sample for operational parameters (aluminum, pH, fluoride, colour, residual chlorine, temperature and turbidity) on a weekly or bi-weekly basis.

It is essential that results of chemical and physical monitoring are provided to the operator of the water supply system and that the operator make those results available to the consumers. Where results show that the water exceeds the MAC or any aesthetic objectives, the water supply owner / operator shall develop an action plan in consultation with appropriate authorities for addressing non-compliance issues.



Drinking Water Manual

Part 2: SAMPLE SITE SELECTION SAMPLING PROCEDURES

Public Health Division
Department of Health and Community Services

(Revised April 02, 2003; Revised September 2009)

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PART A: SAMPLING SITES AND SAMPLE COLLECTION

1. RESPONSIBILITY

Environmental Health Officers (EHOs) and/or Environmental Technicians with the Government Service Centre, Department of Government Services are responsible for:

- The collection of water samples, for bacteriological testing, from public water supply distribution systems.
- The testing of chlorine residuals in public water supply distribution systems (e.g., at entry to distribution system and throughout distribution system).
- Coordination of testing with regional testing sites and/or the Public Health Laboratory

Environmental Health Officers are responsible for:

- The interpretation of test results and appropriate follow-up action, including advice and consultation.

Regional management of the Government Service Centre are responsible for ensuring that EHOs/Technicians carry out sampling in accordance with this protocol and the *Standards for Bacteriological Quality of Drinking Water* (Part 1 of the Drinking Water Manual).

2. SAMPLING SITES

It is important that the water samples collected from the distribution system reflect the quality of the water supplied to consumers. The quality can vary greatly from one point in the distribution system to another, depending on the layout of the distribution system.

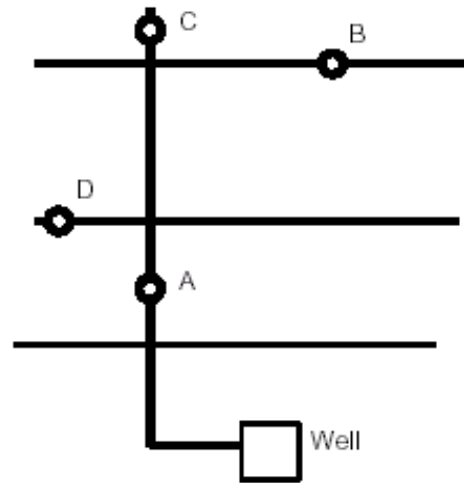
A map or sketch of the water distribution system should be used to locate general sampling locations that will give samples that are representative of the various characteristics of the distribution system. Samples must be collected from locations that are representative of:

- dead-end pipes;
- main lines;
- branch lines;
- loops;
- various water sources;
- storage tanks;
- pressure zones; and
- other distribution configurations.

In addition, factors such as population density and accessibility need to be considered when choosing sampling locations.

Let's consider the example of a branched distribution system as presented to the right (Distribution System 1). Water samples should be collected at the following locations for samples to be considered representative of the distribution system:

- 1) Location A: main line
- 2) Location B: branch line
- 3) Location C: dead end of main line
- 4) Location D: dead end of branch

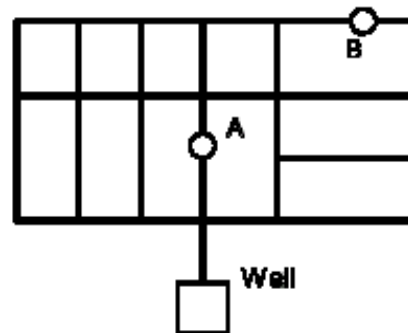


Distribution System 1: Branched water distribution system

For a looped water system as presented to the right (Distribution System 2), a minimum of two sample locations could be representative of the main loop (Location A) and branched loop (Location B) conditions.

Once general locations that will provide representative samples have been identified, specific sampling points from which the EHO/Technician will collect samples need to be selected. Sampling points should:

- be conventional-type water faucets, preferably in buildings in with consistent water use.
- be accessible during the time you normally collect samples,
- provide reliable results, and
- be free of conditions or equipment that could provide a sample that is not representative of the distribution system (see below).



Distribution System 2: looped water distribution system

- Sampling points can be located in residences or in public or commercial buildings. The sampling sites should be permanent.

Because of the re-sampling requirements outlined in Part 1 of the Drinking Water Manual, *Application of Standards for Bacteriological Quality of Public Drinking Water Supplies*, you should identify **three** sampling sites for each general location — two "backup" sites are needed on either side of the primary site at each location. Both "backup" sites, one upstream and one downstream, should be located within **five service connections** of the primary site.

When choosing a sampling site, **do not obtain the water sample from faucets** that:

- are outdoors
- are seldom used;
- drip or leak (e.g., leak around stem);
- are dusty, dirty or corroded;
- are swing/swivel faucets with a single valve;
- are too close to the sink basin
- are pointed upwards
- are located in janitorial closets and commercial sinks
- cannot deliver a smooth stream of water;
- contain an aerator or screen (remove screen or aerator if this type of faucet is chosen);
- are connected to home drinking water treatment units, including water softeners

Samples should not be collected from drinking water fountains, flexible hoses or garden hoses. In addition, where possible choose a smooth-end faucet over a treaded-end faucet.

3. SAMPLE COLLECTION PROCEDURE

To ensure that the samples are representative of the quality of water delivered to consumers, the sample collection procedures outlined below are to be followed. This will help to ensure that samples are not contaminated during sample collection.

1. Collect samples only in special sterile water collection bottles available from the Public Health Laboratory. These bottles contain the chlorine neutralizing reagent sodium thiosulphate.
2. Bottles must not be rinsed before collecting the water sample.
3. The sample bottle must be kept closed until the EHO/Technician is ready to collect the sample.
4. Make sure taps/faucet are in good condition and remove any aerator or screen

Note: flaming or disinfection of the faucet is not necessary if you have chosen the sampling site by considering the guidance provided on page 3.

5. Before collecting the sample, allow water to run to waste for 5 minutes to clear the water service line.
6. Adjust water flow so that a pencil width steady stream flows from the faucet. Do not adjust flow during sample collection.
7. Remove the screw cap from the bottle and hold on to it with the open end facing down. Do not:
 - lay the cap down
 - touch the inside of the cap
 - put the cap in your pocket

Note: the inside of the screw cap or the mouth of the bottle must not be touched when collecting a water sample. In addition, do not allow the screw cap or mouth of the bottle to come into contact with any surfaces that may introduce contamination.

8. Holding the sample bottle near the base, fill the bottle to the 200ml mark on the bottle. Do not overfill the bottle

9. Immediately replace the cap and ensure that it is on securely. Shake the bottle.
10. Complete the label on the sample bottle and complete the requisition enclosed with the sample bottle.
11. Samples are to be delivered to the regional testing site or the Newfoundland Public Health Laboratory for bacteriological testing. Routine samples are not typically accepted on Friday or any day preceding a public holiday.
12. Water samples that can not be delivered to a regional testing site or the Newfoundland Public Health Laboratory within two hours of collection must be kept refrigerated and delivered within 30 hours of collection. A cooler with ice packs should provide sufficient refrigeration.
13. Samples must be tested within 30 hours of collection. Samples older than 30 hours are not suitable for testing.

4. BACTERIOLOGICAL WATER TESTING

Bacteriological water sample testing is carried out at regional testing sites in:

- Happy Valley-Goose Bay
- St. Anthony
- Corner Brook
- Grand Falls - Windsor
- Gander
- Clarenville

and at the Public Health Laboratory in St. John's. Testing is carried out in accordance with the protocols developed by the Public Health Laboratory for the detection of coliform bacteria and *E. coli* (indicator organisms).

Where the GSC carries out non-routine sampling and the tests cannot be performed by a regional testing site or the Public Health Laboratory, a qualitative test method and field test kit should be utilized.

PART B: NUMBER OF SAMPLES

1. SAMPLING STANDARD

Bacteriological Sampling Standard:

The bacteriological water quality monitoring program requires monthly water samples to be collected from all public water supplies and the testing of the samples for total coliforms and *E. coli*. The number of samples to be collected monthly from public water is contained in the *Sampling Standard* of the *Standards for Bacteriological Quality of Drinking Water*. The *Sampling Standard* is provided in table 1 below.

Table1: Bacteriological Sampling Standard

| | |
|--|--|
| No distribution system or very small system serving less than 100 people: | 1 sample per month |
| Distribution systems serving: | |
| Less than 5,000 population | 4 samples per month |
| 5,000 to 90,000 | 1 sample per 1,000 population per month |
| more than 90,000 | 90 plus one additional sample per 10,000 population per month |

Distribution Systems:

The **bacteriological sampling standard applies to distribution systems** of public water supplies. The **number of samples to collect** is not based on the size of the community but rather is **based on the number of people serviced by a particular distribution system**. Water from drinking water source(s) is distributed to consumers by a series of water pipes commonly called a distribution system. The distribution system starts after appropriate water treatment (e.g., disinfection with adequate contact time) has taken place.

The number of samples collected from a community's public water supply system depends on the **number of distribution systems** (See Note #1 below) that make up the water and the **population served by each distribution system** (see page 10).

Note #1: You must know the number of distribution systems that make up a community's public water supply system to determine the number of samples to collect.

If a community has one water source feeding drinking water into common treatment plant for further distribution to consumers, then the community is considered to have only one distribution system (see figure 1).

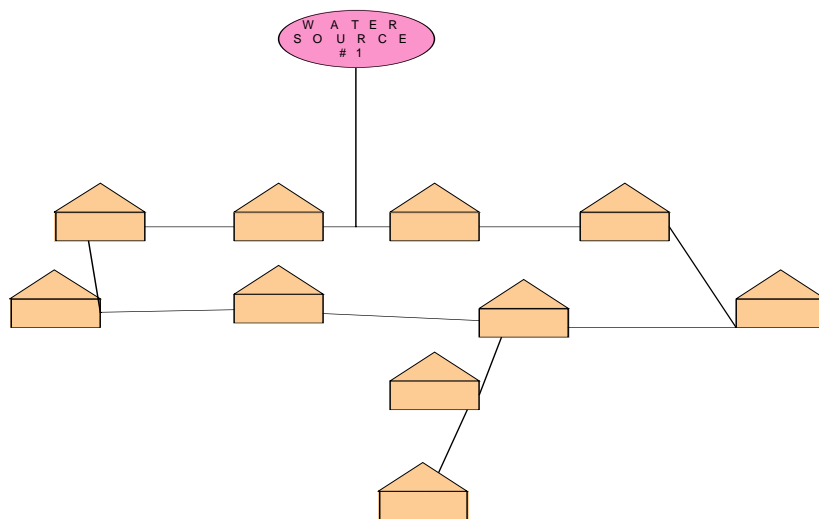


FIGURE 1 : ONE SOURCE , ONE DISTRIBUTION SYSTEM

Likewise, where a community with a number of water sources feeding drinking water into a common treatment plant for further distribution to consumers, the community is considered to have one distribution system (see figure 2).

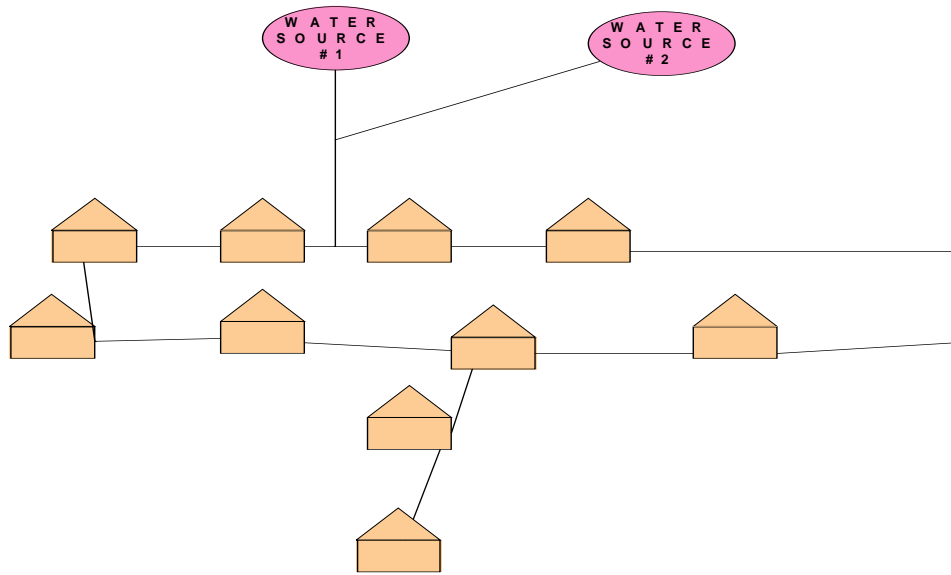


FIGURE 2 : T W O S O U R C E S O N E D I S T R I B U T I O N S Y S T E M

Where a community has two (or more) water sources and the water sources are individually treated and the water is distributed to consumers using separate piping systems, the community is considered to have two (or more) distribution systems (see figure 3).

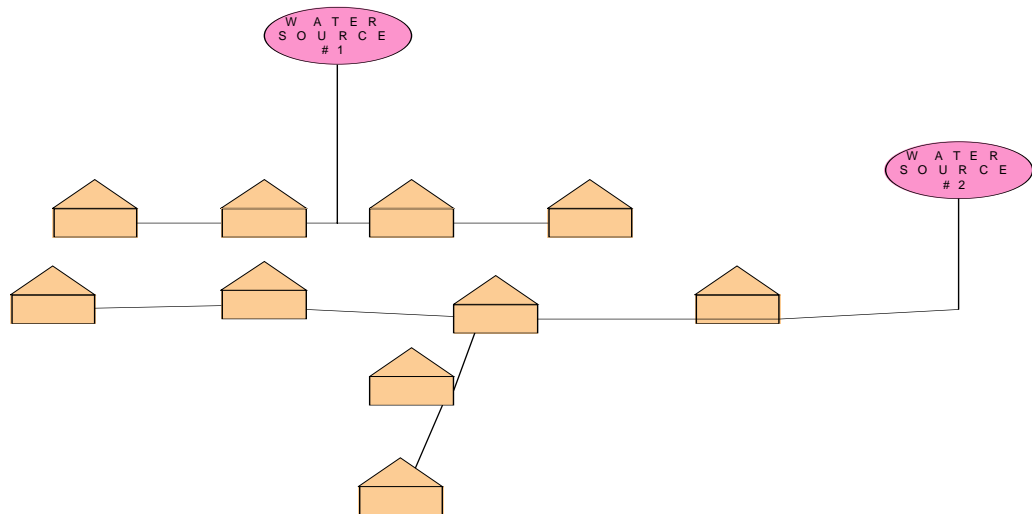


FIGURE 3 : T W O S O U R C E S T W O D I S T R I B U T I O N S Y S T E M S

Environmental Health Officers/Technicians are likely to encounter community water supplies where there is more than one water source and the distribution systems are not separated as in shown in figure 3 above. This is represented in figure 4.

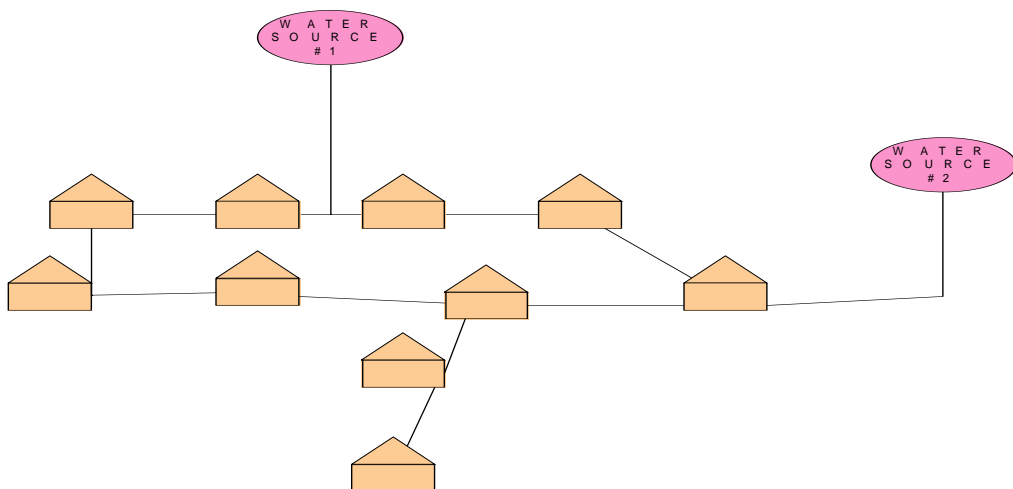


FIGURE 4: TWO SOURCES, INTERCONNECTED DISTRIBUTION SYSTEMS

For situations that are similar to figure 4, chlorine residual testing must be conducted where water enters the distribution system from each source. The number of samples for bacteriological testing shall be determined based on the combined population served by the two distribution systems and the sampling locations should be representative of the system as a whole. Care must be taken in choosing sampling sites to ensure that water from each source is sampled and tested.

Environmental Health Officers/Technicians should consult with authorities in their local area to obtain information on the design of the community water supply/distribution system(s). Authorities who may be able to provide the information are listed below.

1. regional staff with the Department of Municipal and Provincial Affairs
2. regional staff with the Department of Environment
3. community council officials

Population Served

Once the Environmental Health Officer determines the number of distribution systems that make up a community water supply, the next step is to determine the population served by the distribution system(s).

Note #2: You must know the size of the population served by each distribution system to determine the number of samples to collect from the community water supply.

The population served by a distribution system can be determined by viewing the interdepartmental water database (MIMS).

Sampling, based on population served, should adhere to the *Sampling Standard*. The *Sample Standard* sets the minimum number of samples that need to be collected for distribution systems. Additional sampling may be necessary when there is evidence of problems with the water source and/or distribution system (e.g., treatment problems, unsatisfactory bacteriological results, etc.).

2. EXAMPLES

Several examples are provided below to assist EHOs/Technicians with determining the correct number of samples to collect from community drinking water supplies.

Example 1: (see figure 3)

| | |
|---------------------------|--|
| Community Population: | 1300 |
| Water Supply Source: | two drilled wells, plus a number of private wells |
| Distribution System: | one well services 378 people second well services 370 people |
| Number of Samples: | Distribution system for well one: 4 per month Distribution system for well two: 4 per month |

Example 2: (see figure 1)

| | |
|---------------------------|---|
| Community Population: | 748 |
| Water Supply Source: | Fresh Water Lake |
| Distribution System: | All water from same source, one distribution system |
| Number of Samples: | 4 per month |

Example 3: (see figure 2)

| | |
|---------------------------|---|
| Community Population: | 1200 |
| Water Supply Source: | Fresh Water Lake & Drilled Well service 1200 people |
| Distribution System: | common treatment plant & distribution system for the two supplies |
| Number of Samples: | 4 per month |

Example 4: (see figure 3)

Community Population: 13,240

Water Supply Source: -Drilled Well Field (1 chlorinator) serving 8,500 people
-Lake (separate chlorination unit) serving 4740 people
-Two supplies are not interconnected in any way

Number of Samples: **Well fed distribution system:** **8 per month**
 Lake fed distribution system: **4 per month**

Example 5: (see figure 4)

Community Population: 4700

Water Supply Source: -Two surface water supplies (individually treated)
-Distribution systems are interconnected

Number of Samples **4 per month**

3. CHLORINE RESIDUAL TESTING

When samples are collected for bacteriological water analysis, a chlorine residual test must also be carried out. Chlorine residual testing is conducted to determine if a distribution system is in compliance with the *Disinfection Standard of the Standards for Bacteriological Quality of Drinking Water*. The *Disinfection Standard* states:

Continuous disinfection is required for community and public facility water systems. Chlorine is the most common chemical used for disinfection, and where used:

- All water entering the distribution system or public facility, after a minimum 20 minute contact time, shall contain a residual disinfectant concentration of free chlorine of at least 0.3 mg/L, or equivalent CT value.
- A detectable free chlorine residual must be maintained in all areas in the distribution system.

Water systems which are primarily disinfected by means **other than chlorination** must be provided with a sufficient residual disinfectant as determined to be appropriate for that system.

Note: The disinfection standard does not reflect the necessary CT value to inactivate protozoan cysts such as Giardia and Cryptosporidium. Treatment options such as filtration, in addition to disinfection, are often necessary to adequately protect against protozoan cysts.

Environmental Health Officers/Technicians are to use the Hach Pocket Colorimeter™ to test for chlorine residual. The Instruction Manual and the document "Instructions for Verifying the Repeatability of Results" (Part 2A of the Drinking Water Manual) are to be followed by EHOs/Technicians when using the instruments.

4. SEMI-PUBLIC WATER SUPPLIES

Semi-public water supplies include institutional water supplies and commercial water supplies. Currently, there is no requirement for routine bacteriological monitoring or continuous disinfection of these water supplies.

Where owners and operators of institutional and commercial water supplies have their supplies tested, Environmental Health Officers will be available to interpret results and provide appropriate advice.

During routine inspections of various public facilities (e.g., child care centres, food premises, schools, parks and campgrounds), EHOs/Technicians should collect bacteriological water samples as an audit of the water supply safety for the public facility.

REFERENCES

Alberta Health and Wellness. Environmental Health Field Manual for Private, Public and Commercial Drinking Water Systems in Alberta. September 2002

American Water Works Association. Routine Coliform Sampling for Water Utilities(Video). 2001

Virginia Department of Health. A Guide to Bacteriological Sampling of Public Water Supplies. January 1997

(Revised September 2009)

HACH
POCKET COLORIMETER™
for
CHLORINE RESIDUAL TESTING



PART 2A
INSTRUCTIONS FOR
VERIFYING THE
REPEATABILITY OF RESULTS

Government Service Centre

Revised: May 06, 2003

DRAFT

HACH Pocket Colorimeter™

Accuracy Check Using *Spec Secondary Standards*

The Pocket Colorimeter™ is factory-calibrated and ready for use.

However, before using the Pocket Colorimeter™, and on a regular basis thereafter, Environmental Health Officers with the GSC, or other operator of the unit, must:

1. Ensure that the factory calibrations are being applied when the instrument is operated. A check of the factory calibration must be carried out.
2. Verify the consistent operation of the Pocket Colorimeter™ by checking the unit using *Spec Secondary Standards*.

The procedures provided in Part 1 and Part 2 below must be strictly followed. As well, please note that all operational procedures outlined in the **Instruction Manual** pertaining to care and handling of the equipment are necessary if these procedures are to be effective.

Part 1: Retrieval of Factory Calibration

EHOs, and other users, should ensure that the Pocket Colorimeter™ is operating properly using the factory calibration.

Please note that it is not necessary for EHOs to calibrate the colorimeter. If adjustments are required, please forward the unit to the Public Health Laboratory.

To retrieve the factory calibration, please follow the steps outlined below.

1. Press both the **ZERO** and **READ** keys simultaneously and hold them for three seconds.

CAL will appear in the display, followed by a flashing **0**.

2. While the display is flashing, press and hold the **READ** key for two seconds.

The display will show **dFL** and the calibration mode is exited. **dFL** is displayed until the **ZERO** or **READ** key is pressed (which also performs the function of the pressed key) or until automatic shut-off occurs.

The instrument will use the factory calibration to determine chlorine concentrations of your samples.

- Notes:
- A. To retrieve a low range factory calibration, the instrument must be in the low range mode (0 to 2.00 mg/L). The low range mode display shows 0.01 mg/L Cl₂ resolution.
 - B. To retrieve a high range factory calibration, the instrument must be in the high range mode (0 to 4.5 mg/L total chlorine test). The high range mode display shows 0.1 mg/L Cl₂ resolution.
 - C. To change between high and low range modes, press both the **ZERO** and **READ** keys simultaneously. After one second, release the **ZERO** key and hold the **READ** key until **HI** or **LO** appears in the display.

Repeat until the instrument displays the desired mode. Release the key when the instrument is in the desired mode.

At anytime you believe the Pocket Colorimeter is not operating using the factory-calibration, the steps outlined above must be followed.

DRAFT

Part 2: Verifying the Repeatability of Results

Use *Spec Secondary Standards* to quickly verify/check the repeatability of results obtained with the Pocket Colorimeter™.

After initial readings for the *Spec Secondary Standards* are collected and recorded, they are to be re-checked **bi-weekly** to ensure the instrument is working consistently.

All results are to be recorded on the attached “*Record of Applying Secondary Standards*” data sheet.

Note: Before proceeding, make sure the instrument is in the low (LO) range mode.

1. Place the Spec blank into the cell holder with the alignment mark facing the keypad. Tightly cover the cell with the instrument cap.
2. Press **ZERO**. The display will show **0.00**.
3. Place the STD 1 cell into the cell holder. Tightly cover the cell with the instrument cap.
4. Press **READ**. Record the concentration reading.
5. Repeat steps 3 and 4 with cells labeled STD 2 and STD 3.
6. Compare these readings with previous readings to verify the instrument is returning consistent measurements.

If the displayed values are outside the acceptable error range, then contact the Public Health Laboratory. The expected variability or allowable error is provided with the *Spec Secondary Standards*.

The Expected Variability or Allowable Error for the ***Spec Secondary Standards*** should be recorded in the second row of the *Record of Applying Secondary Standards*.

Note: The standards do not ensure reagent quality nor do they ensure the accuracy of the test results. Analysis of real standard solutions using the kit reagents is required to verify the accuracy of the entire Pocket Colorimeter system. The Spec Standards should never be used to calibrate the instrument. The certificate of analysis lists the expected value and tolerance for each Spec Standard.

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RECORD OF APPLYING SECONDARY STANDARDS

HACH POCKET COLORIMETER

Operator's/EHO's Name: _____

| | Blank | Standard # 1 | Standard #2 | Standard #3 | EHO Signature |
|---|-------|--------------|-------------|-------------|---------------|
| Expected Variability or Allowable Error | | | | | |
| | | | | | |
| May__ /2003 | | | | | |
| June 3 | | | | | |
| June 17 | | | | | |
| July 2 | | | | | |
| July 15 | | | | | |
| July 29 | | | | | |
| August 29 | | | | | |
| August 12 | | | | | |
| August 26 | | | | | |
| September 9 | | | | | |
| September 23 | | | | | |
| October 7 | | | | | |
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| November 4 | | | | | |
| November 18 | | | | | |
| December 2 | | | | | |
| December 16 | | | | | |

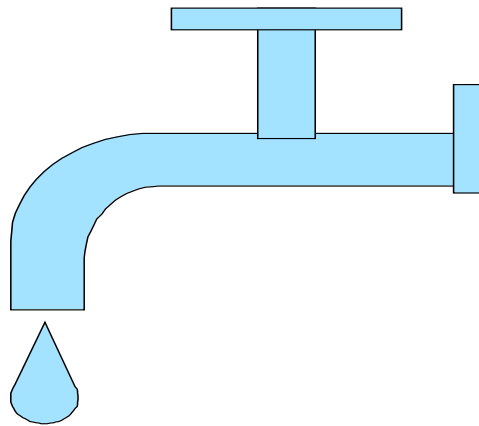
Upon completion, fax this data sheet to Mr. Terry Battcock, Environmental Health Coordinator with the Government Service Centre in St. John's, at 709-729-3980.

Revised: May 06, 2003

DRAFT

**BACTERIOLOGICAL WATER QUALITY
M O N I T O R I N G**

**BACTERIOLOGICAL WATER
QUALITY TESTING**



**PART 3: COLILERT & COLIBLUE
TEST METHODS**

Newfoundland Public Health Laboratory
DEPARTMENT OF HEALTH AND COMMUNITY SERVICES

DHCS-2001-W9

Revised: January 2003

(See Note in Introduction)

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NEWFOUNDLAND PUBLIC HEALTH LABORATORY

SANITARY ENVIRONMENTAL BACTERIOLOGY

1. INTRODUCTION

The Newfoundland Public Health Laboratory (PHL) is the provincial reference centre for sanitary and environmental microbiology services. The PHL serves a variety of governmental and non-governmental agencies, engineering/construction firms, real estate companies and private individuals. Microbiological water quality testing includes total and fecal coliform testing as well as special services such as tests for **Escherichia coli (E. coli)**, algae and parasitic agents such as **Cryptosporidium** and **Giardia**. The PHL also stocks and distributes water collection bottles, media, filters, petri dishes and pads for bacteriologic water testing and pillows for testing free and total chlorine to Government Service Centres (GSCs) across the province.

Based on consensus reached by the **Drinking Water Safety Technical Working Group**, the bacteriologic testing methodology and protocol for drinking water quality is being changed to enhance the overall testing approach. The **Colilert** method has been introduced as the standard test for determining bacteriological quality of water. This is a **qualitative** presence-absence method and is simpler than the currently used m-endo medium-based test for total coliforms. More importantly, the **Colilert** test simultaneously allows for testing both total coliforms, and **E. coli**, the most specific fecal coliform. The **Colilert** test is supplemented by another method called the **ColiBlue** test. The **ColiBlue** test uses a differential medium which allows for **quantitative** testing of both total coliform and **E. coli**. The details of the above methodologies are provided in the following pages.

As part of our ongoing review of our drinking water quality, the PHL has a new mandate and financial support from the Department of Health and Community Services. The PHL is responsible for providing all necessary equipment and supplies to GSCs for upgrading bacteriological water quality testing using the new methods. This includes counter-top and portable incubators, ultra-violet lights, temperature recorders, field testing kits, reagents and bottles. The reagents for the determination of free and total chlorine will continue to be provided. In addition, the PHL will provide equipment maintenance service.

The PHL will also offer training sessions for Environmental Health Officers (EHOs) in the new testing methodologies and in the use and maintenance of testing equipment. In addition, a quality assurance program will be introduced for GSCs. This will be comprised of a test panel of water organisms which will be distributed at least twice yearly to all GSCs. The details of this program are also described in the following pages.

Note:

In light of bacteriological water testing being performed at hospital testing sites, this part of the drinking water manual is retained for information purposes.

COLILERT

Colilert is a highly sensitive, qualitative, presence-absence test which simultaneously detects both total coliforms and **E. coli** in a single 100 mL sample of drinking water incubated overnight at 35°C. The test is based on two chemicals, ONPG (O-nitro-phenyl- β -D-galactopyranoside) and MUG (4-methyl-umbelliferyl- β -D-glucuronide). These are incorporated into the **Colilert** medium and serve as specific indicators of total coliforms and **E. coli**. After filling the **Colilert** bottle with test water sample, the powdered **Colilert** growth medium is added to the water and the bottle is incubated. When growth of coliform bacteria occurs, the coliform enzyme β -galactosidase hydrolyzes ONPG which results in a colour change of the water from colourless to yellow. If **E. coli** is present the **E. coli** enzyme β -glucuronidase hydrolyzes MUG, a non-fluorescent substrate, to yield methyl-umbelliferone, a fluorescent product. This is detected with a long-wave length (365 nm) ultraviolet light. A standardized "comparator" control is used to compare and interpret the colour changes observed with test samples.

- Colourless or no colour change: No coliforms or **E. coli** present
- Yellow colour: Total coliforms present
- Yellow colour and fluorescence: Coliforms and **E. coli** present

In performing the **Colilert** test, follow the test instructions carefully. The **Colilert** test is highly sensitive, and therefore, vulnerable for contamination. Exercise caution in performing steps #1 through #6 shown on the next page.

Colilert is a qualitative test where the magnitude of contamination can't be determined. Therefore, water sources yielding a positive test for coliforms and/or **E. coli** should have subsequent water samples tested quantitatively for total coliforms and **E. coli**. The quantitative procedure is to be done by using the **ColiBlue** test (see **ColiBlue**).

The **Colilert** test is recommended to test only treated water. This test is not recommended for private water samples mainly because if contaminated, the extent of contamination will not be readily known. Therefore, for private water, the **ColiBlue** test is recommended.

2.1 COLILERT TEST PROCEDURE (procedure shown diagrammatically next page)

1. Remove cap from **Colilert** plastic bottle. **Be careful not to touch the inside of the cap or bottle.** Fill with water sample to 100 mL line indicated on the bottle. Close cap.
2. Carefully separate a package of Colilert powdered reagent from a strip making sure not to accidentally open adjacent pack.
3. Tap the powder to the bottom of the reagent pack.
4. Carefully open the pack by snapping backwards the top at the shoreline. **Do not touch the opening of the pack.**
5. Remove cap from water bottle and aseptically add the powdered reagent to the water sample.
6. Replace cap on bottle. **Be sure the cap is tightly sealed.**
7. Shake sample until reagent has dissolved.
8. Incubate at $35 \pm 0.5^{\circ}\text{C}$ for 24 hours.
9. Read results comparing each bottle against the comparator in the identical container as the test.

2.2 RESULTS AND INTERPRETATION

- If no yellow colour (sample remains clear or colourless) is observed, the test is negative for total coliforms and **E. coli**.
- If the sample has a yellow colour equal to or greater than the comparator, the test is positive for total coliforms.
- If the sample is yellow but less than the comparator, re-incubate for an additional 4 hours (total incubation time not to exceed 28 hours). If the sample contains coliform, the colour will intensify after the additional incubation. If the intensity of colour remains the same, the sample is negative for total coliforms.
- Observe all yellow bottles under a 365 nm wavelength ultraviolet light source. Hold light source within 5 inches of the sample in a darken environment. **Do not look directly at UV light.** If fluorescence is equal to or greater than the comparator, the presence of **E. coli** is confirmed.

HOW TO USE COLILERT

Presence / Absence (P/A)

Step 1:

Presence/Absence (P/A) Procedure:

1. Add contents of one pack to a 100 ml sample (50ml for W050 and W050B) in a sterile, transparent, non-fluorescing vessel.
2. Cap vessel and shake.
3. Incubate at $35^{\circ} \pm 0.5^{\circ}\text{C}$ for 24 hours.
4. Read results according to Step 2 below.



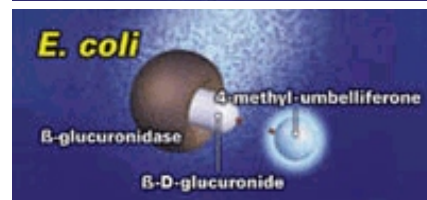
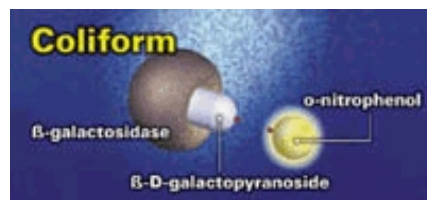
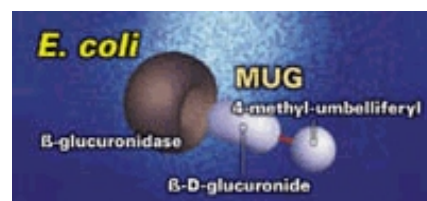
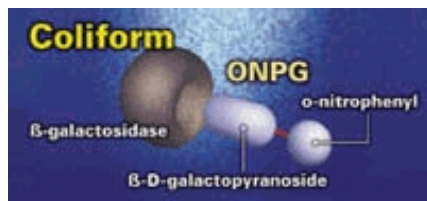
Step 2:

Read results:

- Colorless = negative
- Yellow = total coliforms
- Yellow/fluorescent = *E. coli*



Look for fluorescence with a 6-watt, 365 nm, UV light within 5 inches of the sample, in a dark environment. Face light away from your eyes and towards the sample.



3. COLIBLUE

The **ColiBlue** test is a quantitative membrane filtration method and it uses a differential medium called **ColiBlue 24** medium. The **ColiBlue** medium contains an enzymatic chromogenic indicator that differentiates total coliforms and **E. coli**. Special inhibitors are incorporated in the medium to inhibit the growth of non-coliform bacteria. The test thus allows the simultaneous detection of both total coliforms and **E. coli** on a single membrane in a single incubation step. This method uses 100 mL water sample, the standard membrane filtration technique and an incubation temperature of 35°C.

- Red colonies: coliforms
- Blue colonies: **E. coli**
- Both red and blue colonies: Total coliform

Note: Red colonies may vary in colour intensity; blue colonies may appear blue to purple.

3.1 M-COLIBLUE TEST PROCEDURE (procedure shown diagrammatically next page)

1. Collect sample in sterile water collection bottle containing sodium thiosulfate provided by PHL.
2. Label a sterile petri dish containing an absorbent pad.
3. Invert **m-ColiBlue24** ampule 2-3 times to mix broth. Twist off cap of ampule and pour contents evenly over the absorbent pad in the petri dish. Do not touch the pad or the inside of the petri dish.
4. Set-up membrane filter apparatus according to the recommend procedure for field testing or lab test analysis.
5. Shake water sample vigorously to mix. Pour sample into the sterile measuring cup up to the 100 mL mark inside the cup.
6. Apply vacuum (with the syringe or vacuum pump) and filter the 100 mL sample.
7. Keeping the membrane filter in place, rinse the funnel walls 3 times with 20 - 30 mL of sterile buffered water.
8. After the rinse has filtered through, lift of the funnel; using sterile forceps, transfer the filter to the prepared petri dish containing the **ColiBlue** medium.
9. Place the filter on the pad in the petri dish, grid side up, with a slight rolling motion so as not to trap air under the filter. Ensure that the filter touches the entire pad. Replace the petri dish lid.
10. Invert the petri dish and incubate at $35 \pm 0.5^{\circ}\text{C}$ for 24 ± 4 hours.
11. Remove the petri dish from the incubator and count the colonies.

3.2 RESULTS AND INTERPRETATION

Remove the petri dish from the incubator and count the colonies.

- Red colonies: coliform
- Blue colonies: **E. coli**
- Red colonies + blue colonies: Total coliforms

Report density of coliforms and/or **E. coli** as the number of colonies per 100 mL

Using m-ColiBlue24 Broth PourRite Ampules

The m-ColiBlue24 Broth can be used to analyze drinking water; bottled water; beverages; surface, ground and well water; wastewater; fresh and marine recreational waters; and process water for ultrapure, chemical processing and pharmaceutical applications.



1. Place a sterile absorbent pad in a sterile petri dish (use sterilized forceps). Replace petri dish lid.

Note: Do not touch the pad or the inside of the petri dish.

Note: To sterilize forceps, dip forceps in alcohol and flame in an alcohol or Bunsen burner. Let forceps cool before use.



2. Invert ampules 2 to 3 times to mix broth. Break open an ampule of m-ColiBlue24 Broth. Pour the contents evenly over the absorbent pad. Replace petri dish lid.



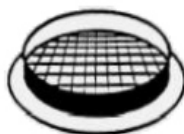
3. Set up the Membrane Filter Apparatus; see "Preparing Materials." With sterile forceps, place a membrane filter, grid side up, into the assembly.



4. Shake the sample vigorously to mix. Pour 100 mL of sample or dil sample into the funnel. Apply vacuum and filter sample. Rinse the funnel walls 3 times with 20 to 30 mL of sterile buffered dilution water.



5. Turn off the vacuum and lift off the funnel top. Using sterile forceps, transfer the filter to the previously prepared petri dish.



6. With a slight rolling motion, place the filter, grid side up, on the absorbent pad. Check for trapped air under the filter and make sure the filter touches the entire pad. Replace petri dish lid.



7. Invert the petri dish and incubate at 35 ± 0.5 °C for 24 ± 4 hours.

8. Remove the petri dish from the incubator and count the colonies.

Red and β colonies indicate total coliforms and blue color indicate *E. coli*.

*Note: Red colonies may vary color intensity. Count all β and blue colonies as total coliforms. Blue colonies may appear blue to purple. Count blue to purple colonies as *E.**

m-ColiBlue24[®] Broth

■ The best value in presence-absence coliform media



Detection and Identification Within 24 Hours

m-ColiBlue24 broth simultaneously detects and identifies total coliforms and *E. coli*, so there's no need for a confirmation step.

Easy to Read

m-ColiBlue24 broth makes it easy to differentiate between coliforms: *E. coli* are blue; other coliforms are red; total coliforms is the sum of the two. It's that simple.

Unambiguous

With m-ColiBlue24 broth, there are no color keys, no fluorescent lamps, and no ambiguity in the results — especially with turbid samples, which can be difficult to read with other presence-absence methods.



Enumerative

If you discover there are coliforms in the water, you want to know the extent of the problem. With m-ColiBlue24 broth, you can get a coliform and/or *E. coli* count and take the appropriate action.

Less Expensive

m-ColiBlue24 broth is considerably less expensive than other presence-absence media (or quantitative versions of those media). In addition, Millipore offers special discount packages on media, Petri dishes, membranes, and filtration apparatus.

Backed by Millipore Technical Support

The Millipore Technical Services department provides technical support and acts as a resource for regulatory information.

MILLIPORE

4. QUALITY ASSURANCE PROGRAM

4.1 INSTRUCTIONS

1. Six samples will be sent twice yearly. Three samples (A, B, C) to be tested for Presence-Absence by **Colilert** and three samples (D, E, F) to be tested by membrane filtration using **m-ColiBlue 24** broth.
2. Perform analysis as soon as possible upon receipt. Keep test samples refrigerated until tests are performed.
3. The test organisms are packaged in **silver pouches**, one organism per pouch. The pouches are labelled A, B, C, D, E, F. Inside the pouches, the test organisms are attached to the clear coloured cap on a vial. The microfilm of organisms can be seen through the clear cap as a black area inside the "O" ring of the cap
4. Rehydration fluid is contained in the vials with the blue caps.
5. In addition to the test organisms and rehydration fluid, the proficiency test kit contains a foam rack, three **Colilert** bottles containing 100 mL sterile water, 3 bottles buffer (99 mL) and opener. Please use the your own supply of **Colilert** reagent, membrane filters and **m-ColiBlue 24** broth medium for membrane filtration analysis.

4.2 PROCEDURE

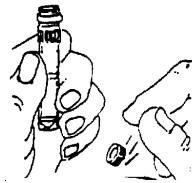
1. Remove pouches, rehydrating fluid and **Colilert** bottles from the refrigerator. Pre-warm rehydrating fluid and Colilert bottle at 35°C. Allow pouches to warm to room temperature.
2. Remove the vial with the clear cap from the silver pouch and label vial with the sample number indicated on the out side of the pouch, i.e. A, B, C, etc
3. Remove and **discard blue cap** from rehydrating fluid; remove the clear cap from test vial containing the microorganisms and transfer the rehydrating fluid to the vial. Tighten cap .

Repeat for the 6 test samples.

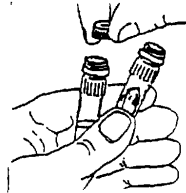
4. Insert the vials into the foam rack provided. Invert the rack and tap to be sure liquid is in contact with the inside of the cap. Place in the incubator at 35°C in the inverted position (the foam rack will be on top and the vial caps will be sitting on the shelf of the incubator) for 15 minutes.

5. After incubation, mix contents of each vial gently by inversion several times. **Do not shake.** The cap should contain no black particles if bacteria are in solution. If black particles are present, repeat incubation for 1-2 minutes more and mix again.
6. For Presence -Absence test, label the 3 **Colilert** bottles A, B, and C. Pour contents of the appropriately labelled rehydrated bacteria into the labelled bottles.
7. Add powdered **Colilert** reagent to the bottles taking care not to touch the bottle tops. Mix well and incubate bottles at 35°C for 24 hours. Read and report findings on the record sheet provided.
8. For test organisms D, E, F, test by membrane filtration using **m-ColiBlue 24** medium. Open caps of 3 bottles of buffer (99 mL) using opener provided. Decant the entire contents of vials D, E, F into the appropriately labelled buffer bottles. Carefully recap and mix well. Be careful re-opening the bottles because the buffer/bacteria tends to be trapped in the cap; gently tap cap to ensure all material is drained back into the dilution bottle.
9. Decant the 100 mL of buffer containing the organisms into membrane filter funnel with membrane filter in place and proceed with normal filtration procedure. Place each filter on appropriately labelled petri dishes containing m-ColiBlue 24 medium.
10. Invert petri dishes and incubate at 35°C for 24 hours.
11. Count colonies and report per 100 mL on the record sheet provided.

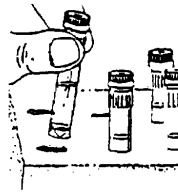
INSTRUCTIONS FOR USING
QUANTI-CULT®
 WATER / WASTEWATER



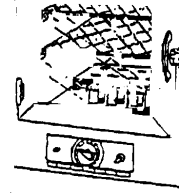
1. Discard blue cap from rehydration vial.



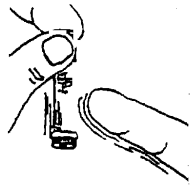
2. Transfer clear cap onto pre-warmed rehydration vial.



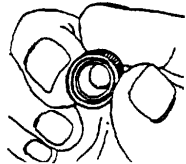
3. Insert vial into foam rack (Cap side up).



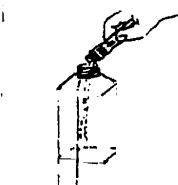
4. Invert foam rack and incubate 15 minutes at 35°C.



5. Remove vial from rack. Tap cap gently or invert to mix. Tap vial on the counter to ensure that all liquid is out of the cap prior to inspecting the cap.



* 6. Remove cap and look at inside surface to be certain that no undissolved black particles are present.



7. Decant entire contents into dilution blank for addition to



8. Membrane Filter Procedure (ColiBlue)

OR



9. Presence / Absence (ColiLert)

10. Incubate at 35°C for 24 hrs.

*11. Cell suspension should be used within 30 min of rehydration.

NEWFOUNDLAND PUBLIC HEALTH LABORATORY

Proficiency Test Report Form

Date Specimens Received: _____

Date Test Performed: _____

Test Performed by: _____

Location/Address: _____

RESULTS:

Colilert:

| Sample No. | Total Coliforms | | Escherichia coli | | Comments |
|------------|-----------------|--------|------------------|-----------------|----------|
| | Present | Absent | Fluorescent | Non-fluorescent | |
| A | | | | | |
| B | | | | | |
| C | | | | | |

m-ColiBlue 24:

| Sample No. | Coliforms 100 mL | Escherichia coli 100 mL | Total Coliform 100 mL | Comments |
|------------|---------------------|----------------------------|--------------------------|----------|
| D | | | | |
| E | | | | |
| F | | | | |

Colilert Bottles and ColiBlue Plates DISINFECTION AND DISPOSAL

Care and precaution must be taken when disposing of Colilert bottles and ColiBlue plates that show the presence of any growth, including coliform and/or *E. coli* bacteria.

Prior to disposal it is recommended that a few drops of chlorine solution be added to each bottle and plate to decontaminate the lab-ware.

1. Disinfection:

Chlorine should be added in the following manner:

Colilert Bottles:

1. Remove screw cap from the bottle.
2. Add 5 drops of liquid chlorine (bleach) to each Colilert bottle.
3. Tightly screw the cap on the bottle and let stand for 10 minutes before discarding.
4. Wash hands thoroughly.

ColiBlue Plates:

1. Remove cover from the plate.
2. Add 4-5 drops of liquid chlorine (bleach) to each ColiBlue plate.
3. Replace cover on plate and let stand for 10 minutes before discarding.
4. Wash hands thoroughly.

2. Disposal

Bottles and Plates, following disinfection, can be disposed of in the regular waste stream.

3. Alternate Disposal Plan

Place all bottles and plates in bio-hazard bag and forward it to your nearby hospital for incineration, if this service is available.



Drinking Water Manual

Part 4: Results Reporting & Issuing Boil Water Advisories

**Department of Health and Community Services
Public Health Division**

May 2011

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| PART C: CRITERIA FOR ISSUING A BOIL WATER ADVISORY | 11 |

INTRODUCTION

This document shall be used by Environmental Health Officer (EHOs) with the Government Service Centre, Department of Government Services, as part of their responsibilities to monitor the bacteriological quality of public water supplies. Specifically, the document provides guidance on reporting bacteriological water test results, criteria for issuing Boil Water Advisories and guidelines for the notification and the implementation of Boil Water Advisories.

RESPONSIBILITY

Environmental Health Officers (EHOs) and/or Environmental Technicians with the Government Service Centre, Department of Government Services are responsible for:

- The collection of water samples, for bacteriological testing, from public water supply distribution systems.
- The testing of chlorine residuals in public water supply distribution systems (e.g., at entry to distribution system and throughout distribution system).
- Coordination of testing with regional testing sites and/or the Public Health Laboratory

Environmental Health Officers are responsible for:

- The interpretation of test results and appropriate follow-up action, including advisories (as outlined in the document) advice and consultation.

Regional management of the Government Service Centre are responsible for ensuring that EHOs/Technicians carry out sampling in accordance with this protocol and the *Standards for Bacteriological Quality of Drinking Water* (Part 1 of the Drinking Water Manual).

PART A: BACTERIOLOGICAL RESULTS REPORTING

The reporting of bacteriological water analysis results to communities and the Medical Officers of Health (MOH) of the applicable Regional Health Authorities must comply with the following procedures.

Satisfactory Results

For satisfactory routine bacteriological water results of community drinking water, the Environmental Health Officer will forward the report to the community official by mail as outlined in table 1 below.

Table 1: Reporting of Satisfactory Sample Results

| SATISFACTORY ROUTINE BACTERIOLOGICAL WATER RESULTS | | | |
|---|----------------------------|----------------------------|---|
| REPORT TO | TYPE OF REPORT | METHOD OF REPORTING | TIME FRAME |
| Community Official | Paper Copy of Test Results | Mail | To Be Reported to community at the convenience of the Regional GSC. (Not to exceed one week). |

Regional Health Authorities will not be provided copies of satisfactory routine bacteriological water results.

Unsatisfactory Results

Results indicating that drinking water for a community may not be safe to consume must be reported to the community and Regional Health Authority immediately. This has to be done verbally and the Environmental Health Officer must talk to a live person. The verbal report is to be followed up with a written report. This is outlined in table 2. The specific criteria used to determine if a Boil Water Advisory is to be issued is provided in Part 1 of the Drinking Water Manual under "*Application of Standard for Bacteriological Quality of Public Drinking Water Supplies*"

Table 2: Reporting of Unsatisfactory Sample Results

| UNSATISFACTORY ROUTINE BACTERIOLOGICAL WATER RESULTS | | | |
|--|-----------------------|---|---|
| REPORT TO | TYPE OF REPORT | METHOD OF REPORTING | TIME FRAME |
| Community official responsible for water supply & any community sharing the water supply. | Verbal | Telephone | Immediately, upon receiving the unsatisfactory results. |
| | Paper Copy | MAIL (& Fax) | Immediately |
| MOH, or designate, of the Regional Health Authority | Verbal | Telephone* (see option page 6) | Immediately, upon receiving the unsatisfactory results. |
| | Paper Copy | MAIL (& Fax) | Immediately |

For community's that share a water supply, in addition to notifying the community that operates the supply, the other communities sharing the supply must also be notified of the Boil Water Advisory. This is discussed in detail in Part B.

Satisfactory Results, Following Boil Water Advisory

When a Boil Water Advisory is in place, drinking water samples are only collected when corrective measures have been carried out. If these samples are satisfactory, results are to be presented to the community and MOH in the manner outlined in table 3.

Table 3: Reporting of Satisfactory Samples Taken to Remove a Boil Water Advisory

| SATISFACTORY BACTERIOLOGICAL WATER RESULTS TAKEN TO REMOVE* A BOIL WATER ADVISORY | | | |
|--|-----------------------|----------------------------|---|
| REPORT TO | TYPE OF REPORT | METHOD OF REPORTING | TIME FRAME |
| Community official responsible for water supply. | Verbal | Telephone | Immediately, upon receiving the satisfactory results. |
| | Written | MAIL (& Fax) | Immediately |
| MOH, or designate, of the Regional Health Authority | Verbal | Telephone | Immediately, upon receiving the satisfactory results. |
| | Written | MAIL (& Fax) | Immediately |

* In order to remove a boil water advisory, at least two consecutive sets of samples showing the absence of total coliform and *E. coli* must be obtained along with adequate disinfection and disinfection residuals.

Unsatisfactory Results, Following Boil Water Advisory

If samples taken to determine whether or not a Boil Water Advisory can be removed are unsatisfactory, the Environmental Health Officer must follow the reporting procedure outlined in table 2.

PART B: PROCEDURES FOR ISSUING BOIL WATER ADVISORIES

Where, in the opinion of a Medical Officer of Health or an Environmental Health Officer, the quality of water in a public drinking water supply is, or may become, a health hazard (See part C for Boil Water Advisory Criteria) , community officials must be NOTIFIED IMMEDIATELY that a Boil Water Advisory is necessary. In addition, the community officials must take the necessary steps to inform all users (the public) of the existing or potential health hazard and the need to boil drinking water.

Once the decision has been made to issue a Boil Water Advisory, it is paramount that the message to boil drinking water gets to the drinking water users - the public - immediately.

The responsibility for this rests with the owner/operator of the drinking water supply. The Boil Water Advisory must be implemented by one of the following, depending on the nature of the drinking water supply.

- ☛ **municipal council**
- ☛ **water committee**
- ☛ **local service district**
- ☛ **other water purveyor/provider**

If the owner/operator of the water supply does not implement a Boil Water Advisory recommended by the Environmental Health Officer of the Government Service Centre and/or the Medical Officer of Health of the Regional Health Authority, then these two agencies will implement the Advisory.

1. Notification

Once a decision to issue a boil water advisory has been made (by EHO and /or MOH) it is critical that the owner/operator of the water supply, municipal officials in communities that are sharing the water supply and the consumers of the water be notified immediately. The notification procedure is presented in table 4.

In order to implement a Boil Water Advisory, the owner/operator of a water supply, and or municipal officials in communities sharing the water supply, must be notified immediately that the GSC or Regional Health Authority has recommended a Boil Water Advisory. Immediate notification must be done verbally (e.g. talk to a “live” person) and followed-up with a letter.

GSC OFFICES MUST MAINTAIN AN UP-TO-DATE COMMUNITY CONTACT LIST TO ENSURE THAT THE APPROPRIATE PEOPLE IN A COMMUNITY ARE NOTIFIED TO IMPLEMENT THE BOIL WATER ADVISORY (E.G., COMMUNITY CLERKS, MANAGERS, COUNCILLORS, OPERATORS OF WATER SYSTEM)

Table 4. Notification of Boil Water Advisory

| Decision to Issue Boil Water Advisory | Department/Agency to Notify | Time (format) |
|---------------------------------------|--|--|
| Municipality | Communities Sharing System | Immediately (by phone) |
| | Consumers | Immediately (see section 2.3-2.5) |
| | GSC (Environmental Health Officer) | Immediately (by phone) |
| | Regional Health Authority (MOH) | Immediately (by phone) |
| GSC/EHO III's | Municipality / LSD / Water Committee - include communities with shared systems (Person to Implement Advisory) | Immediately (by phone), talk to a "live" person. Follow-up with letter |
| | Regional Health Authority (MOH or Secondary Contact) | Immediately (by phone)* Follow-up with letter or email |
| | Municipal Affairs (Regional Engineer) | Next working day (email) Copy of letter |
| | Environment Conservation (Reg. Water and WasteWater Spec.) | Next working day (email) Copy of letter |
| Regional Health Authority | Municipality/LSD/Water Committee - include communities with shared systems (Person to Implement Advisory) | Immediately (by phone) Follow-up with letter |
| | Government Service Centre (Environmental Health Officer) | Immediately (by phone) Fax copy of letter |
| | Municipal Affairs (Regional Engineer) | Next working day (email) Copy of letter |
| | Environment Conservation (Reg. Water and WasteWater Spec.) | Next working day (email) Copy of letter |

* *Option(in consultation with Regional Health Authority):*

Where technology permits, an e-mail to key personnel in health can replace the direct telephone call. In the Regional Health Authorities e-mail the MOH, Environmental Health Coordinator/Director/Manager, Communicable Disease Nurse and the MOH's secretary.

2. Implementation of Boil Water Advisory

The steps provided in Table 5, below, should be taken immediately to implement an effective Boil Water Advisory.

Table 5. Steps to Implement a Boil Water Advisory

| Step | Action | Responsibility |
|------|--|---|
| 1 | Recommend to the operator (e.g., council) of the drinking water system that a boil water advisory be implemented immediately. This should include a recommendation for communities sharing the system to implement a boil water advisory, as well. | <ul style="list-style-type: none"> ● GSC/EHO |
| 2 | Prepare boil advisory notice for the operator (see sample notice in Part 5 of Manual). | <ul style="list-style-type: none"> ● GSC/EHO |
| 3 | Provide instructions on how to implement the boil water advisory to ensure consumers are informed (see pamphlet <i>Boil Water Advisories: Instructions on How to Effectively Implement a Boil Water Advisory</i> , sample warning signs and sample public service announcement). | <ul style="list-style-type: none"> ● GSC/EHO |
| 4 | Alert / inform water consumers to boil water before consuming (see pamphlet <i>What You Should Know About Boil Water Advisories</i>). | <ul style="list-style-type: none"> ● Municipality: drinking water system operator |
| 5 | Monitor the effectiveness of the boil water advisory. Check status of BWA monthly (see sample letter in Part 5 of Manual). | <ul style="list-style-type: none"> ● Municipality: drinking water system operator ● GSC/EHO |
| 6 | On a monthly basis, follow-up on the boil water advisory by notifying consumers to continue to boil. | <ul style="list-style-type: none"> ● Municipality: drinking water system operator |

1. The operator of the drinking water system and municipal officials in communities sharing the system, if applicable, must be informed immediately upon a decision to implement a Boil Water Advisory. This shall take place verbally (talk to a “live” person) and followed up with a letter. A sample letter is attached.
2. The GSC should prepare a Boil Water Advisory notice and provide it to the drinking water system operator by fax or hand delivery. A sample notice is available in Part 5 of the Manual. The Boil Water Advisory notice should give specific directions as to how to effectively boil drinking water and what water to boil.

Note: If hand delivery or a fax is not possible, boil water advisory information will be provided to the operator over the phone. The advisory will then be mailed.

2. Implementation of Boil Water Advisory (continued)

3. The GSC will provide the system operator and, if applicable, municipal officials in communities that share the system, with information on how to effectively implement a boil water advisory. The pamphlet *Boil Water Advisories: Instructions on How to Effectively Implement a Boil Water Advisory* should provide the direction that is needed.

In addition, the pamphlet *What You Should Know About Boil Water Advisories* will provide more specific direction for the public upon the issuance of a Boil Water Advisory.

4. The owner/operator of the drinking water system, and other municipal officials, will take the necessary steps to alert all water consumers that a boil water advisory has been implemented. A sample public service announcement and warning signs are provided in Part 5 of the manual.
5. The Government Service Centre on behalf of the Medical Officer of Health will monitor how effective the community council/local service district/water committee was in implementing the Boil Water Advisory and notifying water consumers. This is especially necessary in facilities catering to a segment of the population at an increased risk to waterborne illness and facilities serving a large number of people. Examples of these facilities are provided below.
 - ⇒ hotels, restaurants & food manufacturers
 - ⇒ clinics, hospitals and nursing homes
 - ⇒ day care centres and schools
 - ⇒ other public buildings
6. For Boil Water Advisories that remain in effect for more than a month, consumers must be provided with monthly reminders, by the owner/operator of the water supply, that the Boil Water Advisory is still in effect. This would ensure that people do not forget to continue to boil drinking water.
7. A Boil Water Advisory Status letter (see Part 5 of the Manual) is to be sent out monthly to municipalities that are on long term boil water advisories. The letter reminds municipal officials to call the EHO once corrective action has been taken and to tell residents and businesses that the boil water advisory is still in place.

3. Interdepartmental Communication

Effective interdepartmental communications is critical to the implementation of a Boil Water Advisory. The inter-departmental / inter-agency notification of the issuance of a Boil Water Advisory should adhere to the following criteria.

- A copy of the Boil Water Advisory Notification Letter will be sent to the appropriate regional official with the Department of Municipal Affairs and the Department of Environment and Conservation.
- The GSC will, as soon as possible/practical, notify the Regional Health Authority about a recommendation for a community to implement a boil water advisory.
- Government Service Centre EHOs, upon issuing a Boil Water Advisory, will input the necessary information into the MIMS Drinking Water Database as soon as possible.

4. Removal of Boil Water Advisory

Criteria for the removal of a Boil Water Advisory are usually the return of conditions to acceptable limits. These conditions are usually appropriate levels of chlorine to ensure adequate disinfection and bacteriological test results consistent with the provincial Standards for Bacterial Quality of Drinking Water (Part 1 of Drinking Water Manual). If waterborne illness was the reason for the issuance of the Boil Water Advisory, a return of illness levels to pre-outbreak levels may be one of the criteria used to remove the Boil Water Advisory. The process of removing a boil water advisory is provided in more detail below.

Removal of a boil water advisory should be considered when:

- a) **two (2) consecutive samples are negative for total coliform organisms and *for E. coli* bacteria. (Consecutive samples cannot be collected closer than 24 hours apart and not greater than two weeks apart.)**
- and b) **the cause of the problem, such as inadequate chlorination, is remedied,**
- and c) **where a disease outbreak has occurred, all indications are that the outbreak has been resolved and there is no further disease linked to the waterworks system.**

With respect to a boil water advisory resulting from a communicable disease

outbreak suspected to be caused by water, the absence of new cases may indicate the effectiveness of the advisory but not the elimination of the risk factor. In these cases, before removing the boil water advisory, the following must be considered:

- ▶ Water treatment deficiencies have been corrected;
- ▶ Source water quality has returned to normal;
- ▶ Tap water quality is within acceptable limits;
- ▶ Epidemiological evidence confirms that the outbreak is over;
- ▶ Potential cross-connections have been investigated and necessary remedial action taken.
- ▶ The outbreak has been shown not to be caused by water;
- ▶ Potential other causes of the outbreak have been investigated and necessary remedial action taken.

PART C: CRITERIA FOR ISSUING A BOIL WATER ADVISORY

Authority to Issue Boil Water Advisory

When the municipality and/or the monitoring agencies, Government Service Centre and Regional Health Authority, feel that there is a potential or actual communicable disease health hazard from a community's drinking water supply, a Boil Water Advisory should be issued.

For most communities, boil water advisories are issued by the council, local service district or water committee on advice from the Regional Health Authority and/or the Government Service Centre. Rarely, a community may be unwilling to issue a Boil Water Advisory but this can be accomplished by using the *Health and Community Services Act*, Section 5, where a health officer or inspector can issue an order and give directions in the interest of public health.

When to Issue a Boil Water Advisory

This section provides Environmental Health Officers and management of the Government Service Centre with information needed to determine if circumstances surrounding a community drinking water supply necessitate the issuance of a boil water advisory.

Generally, the reasons for which a boil water advisory will be recommended are:

- No disinfection (e.g., no chlorination)
- Inadequate chlorine levels (e.g., insufficient contact time)
- Unsatisfactory bacteriological test results (e.g., *E. coli* present)
- Waterborne disease (e.g., giardiasis)
- Gross contamination of water source (e.g., runoff from flooding)

The general reasons for issuing boil water advisories have been subdivided into "standard reasons" for issuing boil water advisories. These reasons are presented in table 6. EHOs are to include one of the boil water advisory "standard reasons" as part of the information that is submitted to compile the public water supply boil water advisory database.

Table 6: Standard Reasons for Issuing Boil Water Advisories

| Standard Reasons for Issuing Boil Water Advisories | Code |
|--|------|
| Water supply has no disinfection system | A |
| Chlorination system is turned off by operator, due to taste. | B1 |
| Chlorination system is turned off by operator, due to perceived health risks. | B2 |
| Chlorination system is turned off by operator, due to lack of funds to operate. | B3 |
| Disinfection system is off due to maintenance or mechanical failure. | C1 |
| Disinfection system is off due to lack of chlorine or other disinfectant. | C2 |
| Water distribution system is undergoing maintenance or repairs. | D1 |
| A cross connection is discovered in the distribution system. | D2 |
| Inadequately treated water was introduced into the system due to fireflows, flushing operations, minor power outage or other pressure loss. | D3 |
| Water entering the distribution system or facility, after a minimum 20 minute contact time does not have a free chlorine residual of at least 0.3 mg/l or equivalent CT value. | E1 |
| No free chlorine residual detected in the water distribution system. | E2 |
| Insufficient residual disinfectant in water system disinfected by means other than chlorination. | E3 |
| Total coliform detected AND repeat samples can not be taken as required. | F2T |
| <i>Escherichia coli</i> (<i>E. coli</i>) detected AND repeat samples can not be taken as required. | F2E |
| Total coliforms detected and confirmed in repeat sample. | F3 |
| <i>Escherichia coli</i> (<i>E. coli</i>) detected in an initial sample(s) is considered extensive and the water system has other known problems. | F4 |
| <i>Escherichia coli</i> (<i>E. coli</i>) detected and confirmed in repeat sample. | F5 |
| Viruses detected (eg, Hepatitis A, Norwalk). | F6 |
| Protozoa detected (eg, <i>Giardia</i> , <i>Cryptosporidium</i>). | F7 |
| Water supply system integrity compromised due to disaster (e.g. contamination of water source from flooding, gross contamination, major power failure, etc.). | G |
| Waterborne disease outbreak in the community. | H |

Revised: December 2009

No disinfection

A boil water advisory is to be implemented when the source drinking water is not continuously disinfected (e.g., chlorinated). This would include drinking water systems where:

- a chlorination unit is not installed to treat drinking water
- a community is unwilling to chlorinate
- chlorine disinfectant is not available
- chlorination equipment is not working
- the chlorination equipment is not operated due to a lack of training
- the chlorination system is not working because of power failures

Inadequate Chlorination

To protect public health, raw water from a community drinking water source must be continuously disinfected (e.g., chlorinated) and a chlorine residual must be maintained in the water distribution system. An Environmental Health Officer III will look for:

- a free chlorine residual at the entry to the distribution system.
- a chlorine residual (free or total) detectable at bacteriological water sample collection points throughout the distribution system.

To increase chlorination in the distribution system, the EHO III, along with the operator, Medical Officer of Health and officials with the Departments of Environment and Labour and Municipal and Provincial Affairs, should consider the following options to achieve a satisfactory chlorine residual.

- flushing of distribution lines (Note: this may impact on back siphonage)
- increasing amount of chlorine injected into the system
- swabbing
- pigging
- installation of booster pump
- pretreatment (e.g., filtration before chlorination to reduce chlorine demand)
- checking integrity of system (e.g., operator to check for leaks)
- checking for increase in water usage (e.g., industrial use consuming large amounts of water)

Where a chlorine residual is not detected throughout the distribution system, the EHO should consult with the MOH as to the course of action to take (e.g., issue BWA or work with community to achieve a residual in the distribution system). A relatively short period of time (7 to 10 days) should be given to achieve residual chlorine in the distribution system. The length of time given, if any, should be based on a decision by the MOH and EHO.

Unsatisfactory Bacteriological Test Results

Samples collected for bacteriological water analysis must meet with the bacterial standard of the *Standards for the Bacteriological Safety of Drinking Water*. With respect to unsatisfactory bacteriological test results, the standards should be applied as follows.

- If the bacteriological test reveals the presence of *E.coli*, re-sampling of the site, as well as up and downstream locations, should be carried out within 24 hours. However, a boil water advisory may be recommended before the re-sampling results are known depending upon the extent of *E.coli* contamination in the initial testing, combined with knowledge of other problems pertaining to the water system. Regardless, if the repeat test reveals the presence of *E.coli*, a boil water advisory is recommended.
- If the bacteriological test reveals the presence of total coliforms, but no *E.coli*, re-sampling of the site, as well as up and downstream locations, should be carried out as soon as is practically possible. If the consecutive test confirms the presence of total coliforms, but no *E.coli*, a boil water advisory is recommended for water systems that have only disinfection but no additional water treatment (such as coagulation, sedimentation, filtration or equivalent technologies) or have no significant operational procedures and controls over the water system. Regardless, remedial action shall commence in consultation with the water system operator.
- If repeat samples cannot be taken as outlined above, a boil advisory is recommended.

Evidence of Waterborne Disease

A boil water advisory must be issued when there is evidence, through disease surveillance of the Regional Health Authority or Department of Health and Community Services, that cases of communicable disease are caused by consuming drinking water.

Gross Contamination of Drinking Water Source

Certain circumstances may lead to the microbiological contamination of a drinking water source which could result in disinfection being ineffective. The gross contamination of a drinking water source could be caused by the following.

- flooding
- sewage waste
- industrial waste
- agricultural waste
- or other activities in the watershed

Summary

For Environmental Health Officers and GSC management, a recommendation for a community to issue a boil water advisory will most often be based upon a determination that the drinking water is bacteriologically unsatisfactory and/or the drinking water is not adequately disinfected.



Drinking Water Manual

Part 4 A

Private Water Samples

Reporting Bacteriological Test Results

Department of Health and Community Services
Public Health Division

2012

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Private Water Supply Bacteriological Standard

The bacteriological standard for Newfoundland and Labrador is:

Bacteriological standards are based on *Guidelines for Canadian Drinking Water Quality* 6th Edition, 1996 as revised, and shall be considered generally applicable to the Province of Newfoundland and Labrador. The *Guideline* notes that the maximum acceptable concentration (MAC) for the bacteriological quality of public, semi-public and private drinking water systems is no coliforms detectable per 100 mL. However, because coliforms are not uniformly distributed in water and are subject to considerable variation in public health significance, drinking water that fulfils the following conditions is considered to conform to this MAC:

- **No sample should contain *Escherichia coli* (*E.coli*).**
- No consecutive samples from the same site or no more than 10% of the samples from each distribution system in a given sample set should show the presence of total coliforms.

Private bacteriological water sample results will be reported as either unsatisfactory, substandard or satisfactory. Each category is described below.

Unsatisfactory Result:

A private well water sample is considered **unsatisfactory**, and unsafe for drinking, when the fecal coliform *E. coli* is present.

An unsatisfactory result indicates fecal contamination of the well. The drinking water should be boiled and corrective action should be taken to deal with fecal contamination entering the well. Retesting should be carried out following appropriate corrective action.

Substandard Result:

A private well water sample is considered **substandard**, but not an immediate health risk, when testing reveals total coliforms but no *E. coli*.

A substandard result indicates that surface water may be getting into the well and therefore at risk of fecal contamination, or that a bacterial growth has developed

within the well or plumbing system. Suitable disinfection of the well should be undertaken and the water retested to ensure there is no fecal contamination. Until disinfection is carried out and retest results are known, the water may be boiled or an alternate safe source may be used.

Satisfactory Result:

A private well water sample is considered **satisfactory** when total coliforms and *E. coli* are absent.

A satisfactory result meets with the provincial standard for the bacteriological quality of drinking water.

Reporting Bacteriological Results to Private Well Owners

Environmental Health Officers with the Government Service Centre, upon receipt of:

1. an unsatisfactory bacteriological water quality test result from a private water supply will:
 - ◆ immediately telephone the owner of the private water supply about the test result and provide appropriate advice to protect the health of those consuming the drinking water.
 - ◆ forward the results in the mail along, within two working days, along the pamphlet "*Guide to Safe Drinking Water*"

2. a substandard or satisfactory bacteriological water quality test result from a private water supply will:
 - ◆ forward the results in the mail within two working days.
 - ◆ include a copy of the pamphlet "*Guide to Safe Drinking Water*" with the test results.

Reporting Bacteriological Results to MOH/Health Region

Environmental Health Officers with the Government Service Centre will report private bacteriological water quality test results to Medical Officers of Health, or designate, when:

- ◆ there are developing patterns with respect to *E. coli* presence in groundwater in a community or portion of a community.
- ◆ *E. coli* is present in a private well serving more than one home.

Application of

Standards for Bacteriological Quality of Private Wells

1. Drinking water samples from private wells submitted to the Public Health Laboratory or Government Service Centres for bacteriological analysis will be tested for the presence of both total coliform bacteria and the fecal indicator *Escherichia coli* (*E. coli*). If neither are detected the sample fully meets the standard. The drinking water is considered satisfactory and is **gUZY** for private consumption. Routine sampling is recommended.
2. If the bacteriological test reveals the presence total coliforms, but no *E. coli*, in a 100 mL sample, the drinking water is considered **substandard** but not to pose an immediate health risk. Disinfection of the water source should be recommended to the owner. Retesting should be carried out following disinfection of the water source. Until disinfection is carried out and retest results are known, the water may be boiled before being consumed or an alternative safe source of drinking water may be used.
3. If the bacteriological test reveals the presence of *E. coli*, the drinking water is considered **unsatisfactory** and unsafe for drinking. It is recommended that the drinking water be boiled and that corrective action be taken to deal with fecal contamination entering the well. Retesting should be carried out following appropriate corrective action.

Reporting of the results will be carried out in accordance with the provincial document "*Reporting of Bacteriological Results from Private Water Supplies*".



Drinking Water Manual

Part 5: Boil Water Advisory Tools

Department of Health and Community Services
Public Health Division

May 2011

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1. Boil Water Advisory Notification Letter
2. Boil Water Advisory Status Letter
3. Boil Water Advisory Removal Letter
4. Sample Boil Water Advisory Notice
5. Sample Public Service Announcement
6. Boil Water Advisory Instructions (for Municipalities)
7. Boil Water Advisories for Consumers
8. Warning Signs (3)

SAMPLE BWA NOTIFICATION LETTER

(Insert date)

Dear: *(insert name and address of appropriate person(s))*

Note: be sure to send the BWA Notification Letter to communities sharing water supply systems)

Subject: Boil Water Advisory

(Insert name of Municipality/Local Service District)

(Insert name of Water Supply)

This letter is a follow-up to our telephone conversation on *(insert date and time)* concerning the issuance of a Boil Water Advisory for the public water supply of *(insert name of municipality or local service district, name of water supply and specific section of distribution system, if applicable)*.

A Boil Water Advisory is recommended for the following reason(s):

- *(enter reason code(s) and description of the code as per the most recent version BWA reason codes).*

Results of most recent bacteriological and chlorine test results are attached *(insert this sentence and test results if applicable to the issuing of the BWA)*.

As the operator/owner of a public water supply, you must immediately alert all users of your water supply that drinking water must be boiled before being consumed. As well consumers should be informed about the boil water advisory at regular intervals. For advisories that remain in effect for more than one month, a monthly reminder to continue to boil drinking water should be forwarded to water consumers.

To help with notifying consumers about the boil water advisory, please refer to the attached boil water advisory notice, boil water advisory pamphlets, sample warning signs and public service announcement. Pamphlets are available online for printing at <http://www.health.gov.nl.ca/health/publichealth/envhealth/drinkingwater.html#g1-4>. In addition, you can call *(enter office phone number)* to obtain multiple printed copies.

The boil water advisory shall remain in effect until the reason for issuing the advisory has been corrected and the following criteria have been met:

1. *[enter "One" or "Two"]* set(s) of satisfactory bacteriological water samples *(is or are)* obtained (absence of total coliform and absence of *E. coli* per 100ml of sample).
2. Satisfactory free chlorine residual is maintained at the entry to the distribution system.
3. Free chlorine residual is detectable & maintained throughout the distribution system.

Please note that you must contact me, or the nearest Government Service Centre location, to make arrangements for re-sampling of your drinking water once corrective measures have been taken.

If you have any questions, please do not hesitate to give me a call at *(enter telephone number of Environmental Health Officer)*.

Sincerely yours,

(Signature of EHO)

Environmental Health Officer

SAMPLE BOIL WATER ADVISORY REMINDER LETTER

[insert date]

Dear: *[insert name and address of appropriate person(s)]*
Note: be sure to send the BWA Status Letter to all communities sharing water supply systems)

Subject: Reminder of Boil Water Advisory
[Insert name of Municipality/Local Service District]
[Insert name of Water Supply]

This letter is a follow-up to the Boil Water Advisory issued for the public water supply of *[insert name of municipality or local service district, name of water supply and specific section of distribution system, if applicable]* on *[enter date BWA was issued]*.

As you are aware a Boil Water Advisory was issued for the following reason(s):

- *[enter reason code(s) and description of the code as per the most recent version BWA reason codes]*.

The boil water advisory was to remain in effect until the reason for issuing the advisory has been corrected and the following criteria have been met.

1. *[enter "One" or "Two"]* set(s) of satisfactory bacteriological water samples (*is or are*) obtained (absence of total coliform and absence of *E. coli* per 100ml of sample).
2. Satisfactory free chlorine residual is maintained at the entry to the distribution system.
3. Free chlorine residual is detectable & maintained throughout the distribution system.

As of today's date, I have not been notified by you whether or not the appropriate corrective action has been taken. At this time, I would appreciate being informed about the status of the corrective action. You can either phone me at *[enter phone number]* or email me at *[enter email address]* with this information.

If the corrective action has not been taken, the Boil Water Advisory will continue. Please ensure that steps are immediately taken to remind your residents and the businesses in your community about the necessity to continue to boil drinking water. If required, a *Boil Water Advisory Notice*, applicable boil water advisory pamphlets, sample warning signs and a sample public service announcement can be supplied to you upon request.

If the corrective action has been carried out, I will make arrangements for bacteriological and disinfectant residual testing that may lead to the removal of the Boil Water Advisory.

If you have any questions, please do not hesitate to give me a call at the number provided above.

Sincerely yours,

[Signature of EHO]

Environmental Health Officer

SAMPLE BWA REMOVAL LETTER

(Insert date)

Dear: *(insert name & address of appropriate person(s))*

Note: be sure to send the BWA Notification Letter to communities sharing water supply systems)

Subject: Removal of Boil Water Advisory
(Insert name of Municipality/Local Service District)
(Insert name of Water Supply)

This letter is a follow up to our telephone conversation on *(insert date and time)* concerning the removal of the Boil Water Advisory issued on *(insert date that the boil water advisory was issued)* for the public water supply of *(insert name of municipality or local service district, name of water supply and specific section of distribution system, if applicable)*.

Removal of the Boil Water Advisory is recommended at this time because the reason(s) for issuing the advisory, *(enter reason code(s) and description of the code as per the most recent version BWA reason codes)*, has been corrected and the following criteria have been met.

1. *[enter "One" or "Two"]* set(s) of satisfactory bacteriological water samples *(has or have)* been obtained (absence of total coliform and absence of *E. coli* per 100ml of sample).
2. Satisfactory free chlorine residual is maintained at the entry to the distribution system.
3. Free chlorine residual is detectable & maintained throughout the distribution system.

Regular bacteriological monitoring of the public water supply will now commence on a monthly basis.

If you have any questions, please do not hesitate to give me a call at *(enter telephone number of Environmental Health Officer)*.

Sincerely yours,

(Signature of EHO)
Environmental Health Officer

BOIL WATER ADVISORY

INFORMATION FOR THE PUBLIC

The Municipality of _____ has issued a **Boil Water Advisory**
(enter name of municipality)

for _____ as of _____
(enter the area encompassed by the boil water advisory) *(date)*

The boil water advisory has been issued for the following reason(s):

- ⇒
- ⇒
- ⇒

Consumers are advised to bring water that you might ingest to a rigorous rolling boil for one (1) minute.

For example, boil water used for:

- ⇒ drinking
- ⇒ brushing teeth
- ⇒ making ice
- ⇒ cooking
- ⇒ washing fruits and vegetables
- ⇒ making coffee/tea and other hot drinks
- ⇒ making juice from concentrate and powders
- ⇒ making infant formula and cereal

For further information about the Boil Water Advisory, please call:

Municipal office:

Government Service Centre:

Regional Health Authority:

NOTE: If using a home water treatment unit (e.g. filter), please read and follow the manufacturer's instructions.



PUBLIC SERVICE ANNOUNCEMENT

BOIL WATER ADVISORY

TO BE READ BY THE ANNOUNCER:

The Municipality (or Local Service District) of ***Insert name(s) of municipality*** is (or are) advising residents and businesses, effective immediately, to boil their drinking water. This would include water used for:

- drinking
- brushing teeth
- making ice
- making juices and other drinks from concentrate or powders
- cooking
- making coffee, tea, etc.
- making infant formula and cereal
- washing fruits and vegetables

Please bring water to a rigorous rolling boil for one (1) minute.

The Municipality (or Local Service District) of ***Insert name of municipality*** will advise residents when the boil water advisory is no longer in effect.

In the interest of protecting public health, your attention to this boil water advisory is appreciated.

More information can be obtained by contacting ***insert telephone number.***

Boil Water Advisory Instructions



Why should I implement a “Boil Water Advisory”?

A boil water advisory recommended by the Medical Officer of Health or an Environmental Health Officer must be acted upon immediately. A boil water advisory is necessary because of the potential for disease-causing microbes to be present in the drinking water you are supplying to the public.

What should I do first?

As the owner or operator of the drinking water supply, you must immediately alert all users of your water supply that drinking water must be boiled before being consumed.

Alert users not to drink the water without first boiling it!

Who should be alerted?

You must notify everyone receiving water from your drinking water supply. Your drinking water supply may be providing water to:

- the general public (those living in homes and apartments)
- workplaces
- public buildings such as hospitals, personal care homes, schools, child care centres, clinics, food premises, hotels and tourism establishments

It is extremely important to remember to contact the operators of all public facilities (schools, child care centres, hospitals, personal care homes, etc.) to notify them of the Boil Water Advisory!

How can consumers be alerted?

Consumers can be alerted in a number of ways. A few are listed below. A combination of these may be necessary to inform all consumers.

- use local media outlets (e.g. radio, television and newspapers)
- deposit boil water advisory notices in peoples’ mailboxes
- place warning signs on water taps at places where water is made available to consumers (e.g. gas stations, restaurants, campgrounds, schools)
- knock on individual doors and inform people verbally

How should I follow up on the advisory?

Inform consumers at regular intervals about the boil water advisory. For advisories that remain in effect for more than one month, a monthly reminder to continue to boil drinking water should be forwarded to water consumers.

Boil Water Advisories lasting longer than a month - remind residents monthly

What should consumers be told during an advisory?

Following the initial alert notification, consumers should be kept informed of the progress of a boil water advisory. You should develop a communication plan to ensure that consumers are given accurate information about the boil water advisory in a timely fashion.

Develop a communications plan and keep consumers informed

Who is available to help?

Don't forget that help is available from Government officials. A technical support team should be formed to work on solutions to the problem(s) which led to the Advisory. Regional staff from the following departments/agencies should be consulted.

1. Government Service Centre
2. Regional Health Authority
3. Department of Environment and Conservation
4. Department of Municipal Affairs

Where can I find out more?

If you have any questions about drinking water safety, please do not hesitate to contact the Government Service Centre or Regional Health Authority nearest you.



Department of Health and Community Services
Department of Environment and Conservation
Department of Government Services
Regional Health Authorities

Revised December 2008

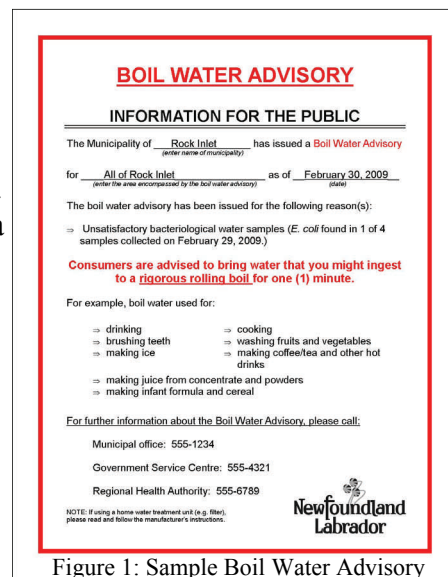


Figure 1: Sample Boil Water Advisory

Boil Water Advisories



Why are boil water advisories issued?

- inadequate disinfection of the community supply
- unsatisfactory bacteriological water quality
- reports of illness associated with drinking water
- repairs to the water system
- unusual occurrences, such as flooding

How long should the water be boiled?

All drinking water must be brought to a rigorous rolling boil for one (1) minute. Boiling for one minute will kill any disease-causing organisms in your water.

Should water used for additional purposes be boiled?



Boil water used for any activity where you might ingest the water, such as:

- drinking
- brushing teeth
- cooking
- washing fruits and vegetables
- making ice
- making coffee/tea
- making infant formula and cereal
- making juices and other drinks from concentrate or powders

Existing beverages and ice cubes made from water of questionable quality should be discarded. Ice cube trays and beverage containers should be sanitized before using again.



CAUTION !

Exercise caution when handling boiled water. To avoid scalding place the pot on the inside burner out of the reach of children. As well, do not put more water in the pot than you can comfortably lift.

What should I do if I don't wish to boil tap water?

Commercially pre-packaged bottled water can be used in place of boiled water. This may be expensive.

WARNING !

Water that looks safe may contain harmful disease causing micro-organisms. Don't drink water from roadside springs, ponds, brooks, etc. without boiling the water or treating the water in another effective way.

Can I shower if there is a boil water advisory in place?

Yes, you can shower but do not drink shower water. The ingestion of water may result in illness, if the water is contaminated. Care should be taken while bathing young children to ensure they do not accidentally consume the water.

Can the water be used for hand washing?

Yes, tap water can be used for hand washing. Use hot water and soap.



Can the water be used for washing dishes and clothes?

Yes, dishes and clothes can be washed in tap water.

Important!

If you use a water treatment unit, please follow the manufacturer's instructions.

What should I do in the event of a waterborne illness outbreak?

In the event of a waterborne illness outbreak, follow additional precautions that may be recommended by the Medical Officer of Health. Anyone with health concerns or experiencing symptoms such as diarrhea, nausea, cramps, or vomiting should seek the advice of their doctor.

Where can I find out more?

If you have any questions about drinking water safety, please do not hesitate to contact the Government Service Centre or Regional Health Authority nearest you.



Department of Health and Community Services
Department of Environment and Conservation
Department of Government Services
Regional Health Authorities

Revised March 2009

A Guide to Safe Drinking Water

Why should drinking water be tested for bacteria?

Water for drinking, cooking, brushing teeth, washing dishes and other domestic uses should be from a safe water supply. This means that the water from your well should be free from microorganisms, like bacteria, viruses and protozoa (e.g., *Giardia*) that may cause disease. Testing your well water gives you a better picture of your well water quality, and tells you whether or not it is safe to drink.

How is drinking water quality tested for bacterial quality?

Your drinking water is tested for the presence of indicator bacteria, specifically total coliforms and *Escherichia coli* (*E. coli*). Their presence indicates that your well may be contaminated by disease-causing microorganisms or at risk of contamination.

Total coliforms are a group of bacteria that can be found everywhere in the environment. Their presence in a drinking water sample indicates that there may be contamination because of problems with the well construction such as cracks in the casing or an improper seal around the wellhead. A properly constructed well should not allow surface water to enter the well.

E. coli is the only member of the coliform family of bacteria that is found only in the intestines of humans and animals. The presence of *E. coli* indicates recent contamination of your drinking water from human or animal feces which can also contain other harmful, disease causing organisms. These include bacteria such as *Salmonella*, *Campylobacter*, *E. coli* O157 and *Giardia*.

How can I have my drinking water tested?

Water sample collection kits can be obtained from the Public Health Laboratory at the Miller Centre on Forest Road in St. John's or a Government Service Centre in your area. Please refer to the Bacteriological Water Analysis Request/Report form for instructions on the collection of water samples and the submission of samples for testing.

What does your report mean?

1) Unsatisfactory Result: A private well water sample is considered unsatisfactory, and unsafe for drinking, when the fecal coliform *E. coli* is present. The drinking water should be boiled and corrective action should be taken to deal with fecal contamination entering the well. Retesting should be carried out following appropriate corrective action.

2) Substandard Result: A private well water sample is considered substandard, but not an immediate health risk, when testing reveals total coliforms but no *E. coli*. Suitable disinfection of the well should be undertaken and the water retested to ensure there is no fecal contamination. Until disinfection is carried out and retest results are known, the water may be boiled or an alternate safe source may be used.

3) Satisfactory Result: A private well water sample is considered satisfactory when total coliforms and the fecal coliform *E. coli* are absent.

What should I do if I have an unsatisfactory or substandard test result?

1. Verify proper construction of the well including the well head, pump, plumbing, and well liner. Correct any problems that are identified. When *E. coli* is detected sources of fecal contamination such as improperly working septic systems and feces from pets and wild animals should also be considered. Please refer to the “Sanitary Dug Well” information sheet for guidance with respect to the construction of dug wells.
2. Shock chlorinate the well and plumbing system (see instructions in the table below).
3. If the water remains contaminated after the shock chlorination, continue to boil the drinking water and consider an appropriate disinfection device or well reconstruction or replacement.

Steps for shock chlorinating a well:

1. Add the amount of unscented bleach to the well as determined according to the table below. Connect a garden hose to a household tap and wash down the inside wall of the well. This will ensure thorough mixing of the chlorine and the water throughout the well.
2. Open each tap in the home one at a time and allow the water to run through all taps until a smell of chlorine is detected from each. Then turn off the taps. If a strong smell is not detected, add more bleach to the well.
3. Allow the water to sit in the system for 12-24 hours.
4. Run water through the outside hose away from grass and shrubbery until the strong smell of chlorine disappears. Make certain that the water does not enter any watercourse. Finally, open the indoor taps until the system is completely flushed.
5. Wait a minimum 48 hours, then take a sample of the water for bacteriological testing. Satisfactory results in repeat tests over a period of one to three weeks following chlorination will probably indicate that the treatment has been effective. In the meantime, find another source of water or boil the water for one minute before drinking it. Do not use untreated water such as roadside springs. If the shock treatment solves the problem, repeat bacteriological testing in three to four months.
6. If the above steps do not correct the problem, the source of the ongoing contamination needs to be determined and corrected, possibly with professional help. If the problem can not be corrected, a new well or a drinking water disinfection device, should be considered.

| Depth of Water | New Well Casing Diameter | | Existing Well Casing Diameter | |
|----------------|--------------------------|----------------|-------------------------------|----------------|
| | 15 cm drilled well | 90 cm dug well | 15 cm drilled well | 90 cm dug well |
| 1 m | 100 ml | 3.2 L | 20 ml | 0.6 L |
| 3 m | 300 ml | 9.8 L | 60 ml | 2.0 L |
| 5 m | 500 ml | 16L | 100 ml | 3.0 L |
| 10 m | 1000 ml | 32 L | 200 ml | 6.5 L |

How can small volumes of contaminated water be made safe for drinking?

Boiling: Bring water to a vigorous boil for one minute and allow to cool; this is by far the most reliable method.

Chlorinating: To treat small amounts of water use unscented household bleach at the rate of at least two drops per each liter of water and allow the water stand for 30 minutes. If the water is turbid or cloudy, double the number of drops.



Department of Health and Community Services
Department of Environment and Conservation
Regional Health Authorities
Service NL




WARNING!

**Do Not Drink
This Water**



Department of Health and Community Services
Department of Government Services
Regional Health Authorities



WARNING!

**This Water Is Considered Unfit For
Drinking or Domestic Use**



Department of Health and Community Services
Department of Government Services
Regional Health Authorities




WARNING!

**This Water Must Be
Boiled Before Drinking**



Department of Health and Community Services
Department of Government Services
Regional Health Authorities





Drinking Water Manual

Part 6:

Upstream/Downstream Sampling of
Water Distribution Systems

**Department of Health and Community Services
Public Health Division**

(December 18, 2003)

Issue:

To ensure there is consistency in the manner in which Boil Water Advisories are issued in Newfoundland and Labrador, clarification on issuing boil water advisories based on repeat sample results from “upstream” and “down stream” locations is provided below.

Issued Reviewed By:

This issue was reviewed by the Drinking Water Technical Working Group in November 2003 and the following clarification and guidance is provided.

1. Application of Standards

The following statement is from the “Application of Standards for Bacteriological Quality of Public Drinking Water Supplies”.

*“If the bacteriological test reveals the presence of total coliforms, but no E. coli, **re-sampling of the site, as well as up and downstream locations, should be carried out as soon as is practically possible.** If the consecutive test confirms the presence of total coliforms, but no E. coli, a boil water advisory is recommended for water systems that have only disinfection but no additional water treatment (such as coagulation, sedimentation, filtration or equivalent technologies) or have no significant operational procedures and controls over the water system. Regardless, remedial action shall commence in consultation with the water system operator.”*

2. Situations to Consider

- A. Bacteriological testing identifies coliform bacteria in a sample collected from sampling site #1.

Re-sampling two days later occurs at sampling site #1 and at sites upstream (site #2) and downstream (site #3) locations.

The re-sampling results identify coliform bacteria at site #1 again but not at sites #2 and #3.

Action:

Boil Water Advisory not issued and remedial action can commence at site #1 for a site specific problem.

- B. Bacteriological testing identifies coliform bacteria in a sample collected from sampling site #1.

Resampling two days later occurs at sampling site #1 and at sites upstream (site #2) and downstream (site #3) locations.

The re-sampling results identify coliform bacteria at site #2 but not at site # 1 or site #3.

Action:

Given that re-sampling has identified coliform bacteria at another site in the distribution system, a boil water advisory is recommended.



Drinking Water Manual

Part 7:

PROTOCOL for COMMUNITIES SWITCHING to ALTERNATE WATER SUPPLIES

Prepared by:

Safe Drinking Water Technical Working Group

February 24, 2004

1. Criteria for Issuing a Non-consumption Advisory (NCA)

Due to a number of reasons, several municipalities in Newfoundland and Labrador may be forced to switch from their approved municipal water supply to a water supply with unknown water quality. Several reasons for switching to an alternate water supply are listed below.

- 1) Insufficient quantity of water for municipal users (e.g. water shortage).
- 2) Unexpected gross contamination of approved water source.
- 3) Failure of infrastructure at the inlet to the water treatment facilities

In situations where the municipality has no choice but to resort to using an unapproved source as a temporary water supply it is paramount that the health of the public be considered when making such changes. Until the alternate water supply has been reviewed and water quality testing carried out, the municipality shall advise all water supply users not to consume the water. This advisory is known as a “Non-consumption Advisory”(NCA).

Public Health Officials will act on the side of caution when alternate water supplies are used and the chemical quality of the water is unknown. A “Non-consumption Advisory” is to be issued.

The issuance of a “Non-consumption Advisory” is necessary until water supply regulators and public health officials are satisfied that:

- 1) The chemical quality of the alternate water supply will not pose a threat to the health of consumers; and
- 2) Treatment technologies for the alternate supply will be effective at removing (e.g., killing) potential pathogens from the alternate water supply.

For the most part, the necessity to resort to an alternate water supply occurs suddenly without much time to consider issues such as chemical quality and disinfection processes. When this situation occurs, a “Non-consumption Advisory” should be issued immediately.

2. Planning to Avoid Non-consumption Advisory

In many cases the communities that may have to resort to using an alternate supply are known. To prevent the issuance of a “Non-Consumption Advisory”, municipalities that are aware of potential problems with their approved water supply should consult with the Departments of Environment, Municipal & Provincial Affairs and Government Services to facilitate the review of an alternate supply that will provide water of an acceptable quality. This effort may avoid the issuance of a “Non-consumption Advisory” for the municipality.

3. Notification of Non-consumption Advisory

Once a decision to issue a “Non-consumption Advisory” has been made (by public health officials and water supply regulators) it is critical that the owner/operator of the water supply and the consumers of the water be notified immediately.

In order to implement a “Non-Consumption Advisory”, the owner/operator of a water supply must be notified immediately by public health officials (EHOs and/or MOHs) that they are recommending a “Non-consumption Advisory”. Immediate notification must be done verbally (e.g. talk to a “live” person) and followed-up with a letter.

Once the decision has been made to issue a “Non-Consumption Advisory”, it is paramount that the message “not to consume drinking water” gets to the drinking water users immediately.

The rapid dissemination of information about the advisory to water consumers/users in the community is necessary to ensure public understanding of the event and that the public is aware of measures they can take to protect their health.

4. Removing Non-consumption Advisory

The “Non-consumption Advisory” will be removed by Environmental Health Officers of the Department of Government Services acting on behalf of the Medical Officer of Health, when:

- 1) The municipality resorts back to the approved water supply **and** chlorine residual levels **and** bacteriological quality of drinking water in two consecutive sample sets, not taken within 24 hours apart, are satisfactory; or
- 2) Water supply regulators and public health officials, upon review of the alternate water supply data, including chemical test results, and water treatment methods are satisfied that the alternate water supply does not pose a threat to the health of water consumers.



Drinking Water

Non-Consumption Advisories

**Environmental Public Health Division
Department of Health and Community Services**

January 2012

Introduction

To ensure that water supply owners/operators and water consumers are notified in a timely fashion about unacceptable/uncertain physical, chemical and/or radiological water quality these *Guidelines for Issuing Drinking Water Non-Consumption Advisories* have been developed.

Drinking water testing and/or investigation may identify drinking water sources with unacceptable chemical and/or radiological quality with one or more parameters exceeding established health-based guidelines. In addition, physical or other contamination, with unknown/uncertain health impacts, may occur.

Guidelines for Canadian Drinking Water Quality

The *Guidelines for Canadian Drinking Water Quality* are published by Health Canada on behalf of the Federal-Provincial-Territorial Committee on Drinking Water (CDW).

The Guidelines are based on current, published scientific research related to health effects, aesthetic effects, and operational considerations. Health-based guidelines are established on the basis of comprehensive review of the known health effects associated with each contaminant, on exposure levels and on the availability of treatment and analytical technologies.

The CDW establishes the Guidelines specifically for contaminants that meet all of the following criteria:

1. Exposure to the contaminant could lead to adverse health effects;
2. The contaminant is frequently detected or could be expected to be found in a large number of drinking water supplies throughout Canada; and
3. The contaminant is detected, or could be expected to be detected, at a level that is of possible health significance.

Drinking water chemical and radiological parameters for which there is a health-based guideline are listed in tables 4 and 7 respectively of the *Guidelines for Canadian Drinking Water Quality*. The up-to-date list of parameters and their Maximum Acceptable Concentration (MAC) can be found at:

Chemical parameters:

http://www.hc-sc.gc.ca/ewh-semt/pubs/water-eau/2010-sum_guide-res_recom/index-eng.php#a13

Radiological parameters:

http://www.hc-sc.gc.ca/ewh-semt/pubs/water-eau/2010-sum_guide-res_recom/index-eng.php#a17

The technical documents for specific chemical and radiological parameters are available at:

http://www.hc-sc.gc.ca/ewh-semt/pubs/water-eau/index-eng.php#tech_doc

Decision to Issue Advisory

1. Chemical or Radiological Parameters

The decision to issue a non-consumption advisory based on the presence of a chemical or radiological drinking water parameter, or parameters, above the Maximum Acceptable Concentration (MAC) should be made by the regional Medical Officer of Health (MOH), or designate.

The following factors should be considered when issuing non-consumption advisories:

- Level above the MAC
- Number of occurrences above the MAC
- Seasonality of occurrences above MAC, if applicable
- Availability of safe alternate water supplies
- Potential for consumers to use water sources that may pose a greater and more immediate risk to health

2. Unknown Physical or Other Contaminant

The decision to issue a non-consumption advisory based on the presence of an unidentified physical or other contaminant/substance in a drinking water supply or distribution system should be made by the regional Medical Officer of Health (MOH), designate.

Communicating the Advisory

Government to Municipality

The non-consumption advisory should be communicated to the water supply owner/operator (e.g., municipal council office) by the regional MOH, or designate, immediately following the decision to issue the advisory.

The advisory should be provided verbally over the phone to a live person and followed-up with a written fax and e-mail, if applicable, to the water supply owner/operator.

Municipality to Residents

The water supply owner/operator (e.g., city, town or local service district officials) has the responsibility to notify consumers (residents, businesses and institutions) about the advisory.

The notification should be done immediately. The notification should be followed-up on a regular basis to ensure that consumers are reminded of the need to take measures to protect their health.

Environmental Health Officers with the Department of Government Services will monitor the effectiveness of the notification.

Contents of Advisory

A non-consumption advisory should:

- State that people should not consume drinking water from a specific drinking water supply because testing or investigation has identified a contaminant, or contaminants, that may be harmful if consumed; or because an unidentified physical or other contaminant is present in the water.
- State that people should find an alternate safe supply for drinking and provide examples of alternatives such as bottled water, if available.
- Provide specific instructions/advice to vulnerable groups who may be at a greater risk for harm from consuming the water.
- Include recommendations/advice related to dermal (e.g., bathing) and inhalation (e.g., water vapours from showering) routes of exposure to the drinking water parameter(s) of concern.

Rescinding an Advisory

A non-consumption advisory should be rescinded when:

- Test results confirm that contaminant(s) are below the MAC; and/or
- Effective treatment has been installed to remove the contaminant(s) of concern.
- The condition(s) that led to the advisory have been resolved.

Public Awareness Information

Health Canada, the Department of Health and Community Services and the Department of Environment and Conservation have fact sheets on a number of parameters (e.g., lead and arsenic) that may be found in unacceptable levels in public water supplies.

Links to these sources of information are provided below:

<http://www.hc-sc.gc.ca/hl-vs/iyh-vsv/environ/index2-eng.php>

<http://www.health.gov.nl.ca/health/publichealth/envhealth/drinkingwater.html>

<http://www.env.gov.nl.ca/env/waterres/quality/drinkingwater/index.html>