

Drinking Water Safety in Newfoundland and Labrador



Annual Report 2005



GOVERNMENT OF
NEWFOUNDLAND AND LABRADOR
Department of Environment and Conservation

**Drinking Water Safety
in
Newfoundland and Labrador
Annual Report 2005**

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Photo courtesy of Paul Neary, Department of Environment and Conservation.

Message from the Minister



As the Minister of Environment and Conservation I am pleased to introduce the fourth annual report on drinking water safety in Newfoundland and Labrador. The development of this report uses a multi-barrier approach which we call the Multi-barrier Strategic Action Plan, and it follows government's mandate to ensure drinking water safety. This report describes the many activities that contribute towards ensuring safe drinking water. It outlines progress made over the reporting year from April 1, 2004 to March 31, 2005 and the path forward for 2005-06 and beyond.

A key objective for this government is to prevent contamination of our water resources and to restore the wholesomeness of water where quality concerns exist. Drinking water originates from ponds, rivers and groundwater aquifers, is treated to varying degrees and is pumped through distribution systems to the taps in our homes and businesses. Because water passes through several steps, there are many things that can happen to affect the cleanliness, safety and security of drinking water. Therefore it is paramount to implement processes at each stage of the water system to ensure there are multiple safeguards in place at all times.

This multi-barrier approach to protecting drinking water takes a collaborative effort involving several departments and their staff with many diverse areas of specialized technical expertise. Reliable access to good quality water is extremely important to the people of this province and therefore government remains committed to building on the success of the Multi-barrier Strategic Action Plan and to taking necessary steps to ensure and improve drinking water safety. In cases where there are difficult water quality issues, it may take a concerted effort to find the ideal solution, and it may take time to get past interim measures such as boil water advisories. However government pledges to work hard on behalf of the people of Newfoundland and Labrador to ensure clean, safe and secure drinking water.

I acknowledge and extend thanks to my staff of the Water Resources Management Division for their commitment and hard work to drinking water safety. I also recognize the efforts of the front-line staff and management of the departments of Government Services, Municipal Affairs, and Health and Community Services as well as the Regional Integrated Health Boards, municipal governments and the Public Health Laboratory for their collaborative roles in the implementation of the Multi-barrier Strategic Action Plan for drinking water safety. I also extend thanks to the members of the Safe Drinking Water - Technical Working Group for their valuable work coordinating drinking water issues.

Clyde Jackman
Minister

Executive Summary

This fourth annual report on drinking water safety in Newfoundland and Labrador outlines accomplishments and activities for 2004-05 under the Multi-Barrier Strategic Action Plan (MBSAP) for drinking water safety. Chapter 1 of the report explains what the MBSAP actually entails and outlines the contents of the other chapters of the report.

Source water, whether it is a pond, brook or well, water treatment systems and the distribution system are the physical components where the first level of the MBSAP is applied. Source protection of surface or groundwater water supplies, of which there were 518 in the province, is an important way to protect the original natural quality of water from impacts due to land use activities and development. Water treatment comprised of 456 chlorination systems, 13 water treatment plants and several other systems with filtration or other treatment are operated to remove or inactivate microbiological contamination, remove chemical substances or to improve upon aesthetic parameters. The water distribution itself is an important determinant of water safety, but there are many challenges with this component as there are 546 water supply systems serving all types of communities from cities to small local service districts. Ageing infrastructure is being cited as one of the main issues that government addressed in 2004-05 by investing \$35.9 million for water and sewer projects.

The second level of the MBSAP includes chemical, physical and bacteriological water quality monitoring as well as, reporting, inspection and operator training. Statistics in Chapter 3 show that there were 1,903 tap water samples and 593 source water samples analyzed for over 30 parameters including THMs and HAAs as well as 19,410 samples for bacteriological water quality. New data management systems and reporting tools were developed to help manage this data. Whenever test results exceeded provincial standards appropriate action was taken. The number of boil advisories on public water supplies, of which there were 232 as of March 31, 2005, continues to draw attention but this number is declining. Apart from direct infrastructure improvements, inspections, issuing of construction and operating permits, and operator training are all helping to make continuous improvements to public water supplies.

The third and last level of the MBSAP deals with legislative and policy frameworks; public involvement and awareness; setting guidelines, standards and water quality objectives; and research and development. Some of the highlights in this area include enforcement of the *Water Resources Act*, as well as other applicable legislation. Government has made significant strides in providing information to the public about drinking water at the community level. For example, the Department of Environment and Conservation has introduced the Langelier Index which can be used by operators to optimize their water systems. Government is working with other federal agencies in area such as drinking water quality guidelines.

In conclusion, government is committed to ensuring drinking water safety by following a Multi-Barrier Strategic Action Plan. This plan will involve activities to be undertaken by four line departments; Environment and Conservation, Municipal Affairs, Health and Community Services and Government Services; each contributing uniquely to the plan by means of their respective mandates and programs. Coordination between the departments is ensured by a Technical Working Group which meets frequently and which reports to a committee of senior government officials.

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Glossary of Terms

Bacteria:

Microscopic unicellular organisms having a rigid cell wall structure.

Chlorination:

An oxidation process that is initiated through the addition of chlorine to water. Chlorine oxidizes microbiological material, organic compounds and inorganic compounds.

Chlorine:

A chemical used as a disinfectant and oxidizing agent for drinking water.

Coliform:

A group of bacteria commonly found in the environment and also in the intestinal tract of mammals, including humans, whose presence in water may indicate contamination by disease-causing microorganisms.

Colour:

A physical characteristic of water attributed to the presence of coloured organic substances, or metals.

Disinfection:

The process of inactivating pathogenic organisms (disease causing bacteria, viruses, fungi and protozoa) by either a chemical or physical means.

Geographic Information System (GIS):

An information system that is used to input, store, retrieve, manipulate, analyze and output geographically referenced data or geospatial data, in order to support decision making for planning and management of land use, natural resources, environment, transportation, urban facilities, and other administrative records.

Haloacetic acids (HAAs):

A group of compounds that can form when the chlorine used to disinfect drinking water reacts with naturally occurring organic matter (e.g., decaying leaves and vegetation). The haloacetic acids most commonly found in drinking water are monochloroacetic acid (MCA), dichloroacetic acid (DCA), trichloroacetic acid (TCA), monobromoacetic acid (MBA) and dibromoacetic acid (DBA).

Inorganic:

Relating or belonging to the class of chemical compounds that do not contain carbon as the principal element and are of mineral origins such as salt and iron.

Glossary of Terms

Organic:

Relating or belonging to the class of chemical compounds having a carbon basis such as hydrocarbons.

pH:

A measure on a scale from 0 to 14 of the acidity or alkalinity of a solution where 7 is neutral, greater than 7 is more basic and less than 7 is more acidic.

Protected Water Supply Area:

An area surrounding a public water supply source, either surface water or groundwater, which has the activities that take place in the area regulated by government. The area is protected under Section 39(1) of the Water Resources Act.

Public Water Supply System:

A water supply system operated by a community.

Trihalomethanes (THMs):

A group of compounds that can form when the chlorine used to disinfect drinking water reacts with naturally occurring organic matter (e.g., decaying leaves and vegetation). The trihalomethanes most commonly found in drinking water are chloroform, bromodichloromethane (BDCM), dibromochloromethane (DBCM) and bromoform.

Turbidity:

A measure of the cloudiness of water.

Water Supply System:

Term to describe the entire network (i.e. pumps, pipes, valves, water treatment units etc.) used to transport water from a water supply source to the consumer.

Water Treatment Plant:

The portion of a public water system which is designed to alter the physical, chemical, biological or radiological quality of the water or to remove any contaminants.



1 Introduction

1.1 Overview

This is the fourth annual report on the safety of drinking water quality in the province of Newfoundland and Labrador. It provides information on the progress and accomplishments made to ensure drinking water safety. This report was prepared in fulfillment of the Department of Environment and Conservation's (ENVC) commitment to issue an annual progress report on drinking water safety in the province.

The Government of Newfoundland and Labrador provides clean and safe drinking water to the public by implementing a Multi-Barrier Strategic Action Plan (MBSAP) for drinking water safety. This plan simply refers to the protection of drinking water on a variety of levels. The components of the MBSAP are shown in Figure 1 and include:

- Level 1** Source Water Protection; Water Treatment; and Water Distribution System
- Level 2** Monitoring; Inspection, Abatement and Enforcement; Management and Reporting; and Operator Education, Training and Certification
- Level 3** Legislative and Policy Frameworks; Public Involvement and Awareness; Guidelines, Standards and Objectives; and Research and Development

The primary goal is to ensure that adequate safeguards are in place at each stage of the water supply system to minimize the possibility of pathogens and other contaminants entering the water. Additional goals of the action plan are to provide public access to drinking water quality data, ensure open and transparent communication with the public on all drinking water quality related

issues, increase public confidence in drinking water, and ensure long term sustainability of water supply systems.

The key elements of the MBSAP are further complemented by inter-departmental cooperation whereby four government departments are working together. Figure 1 also shows the participating agencies for each key element of the MBSAP. A committee of Deputy Ministers deals with drinking water safety on a proactive basis. The committee is chaired by the Deputy Minister of Environment and Conservation, and includes the Deputy Minister of Health and Community Services, the Deputy Minister of Municipal Affairs, and the Deputy Minister of Government Services. The committee is supported by an inter-departmental Safe Drinking Water - Technical Working Group (SDW-TWG) with members from The Department of Environment and Conservation, Department of Municipal Affairs, Department of Health and Community Services and the Department of Government Services. The committee also includes representation from the Public Health Laboratory and the Medical Officers of Health.

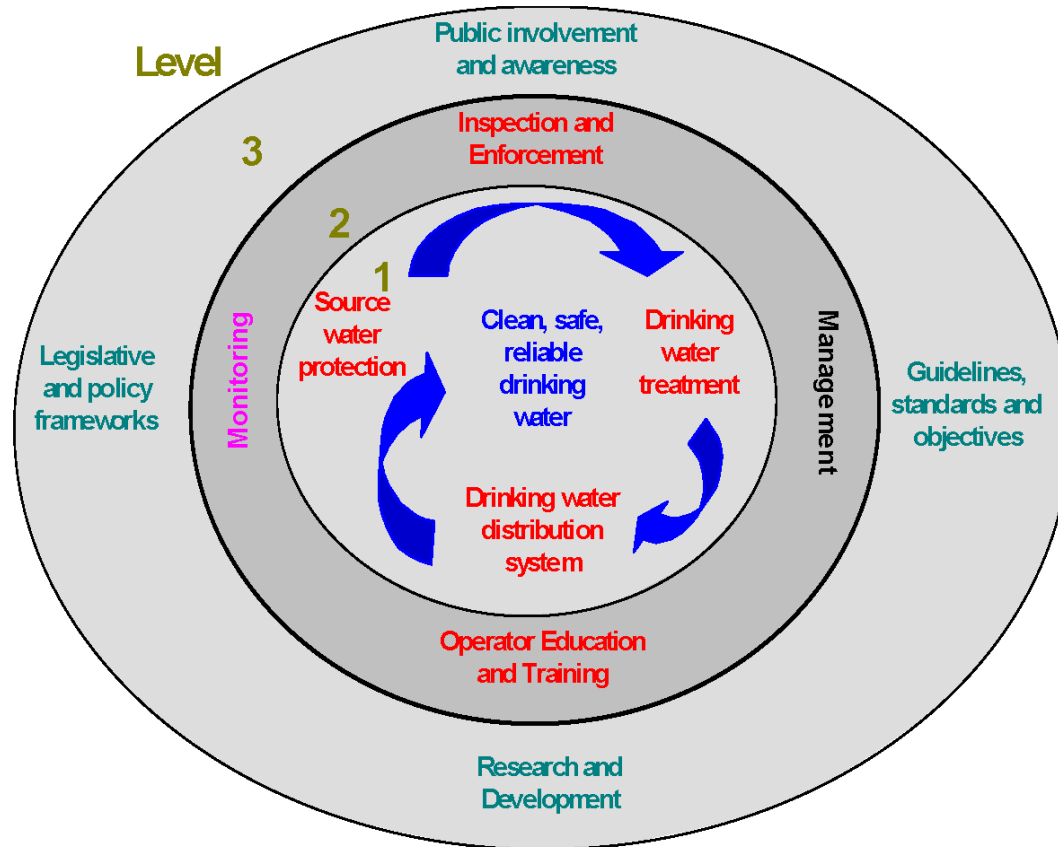
Under the leadership of the Deputy Minister's committee, the departments continue to made progress in implementing the MBSAP for drinking water safety. This report closely follows the key elements of the MBSAP as shown in Figure 1, and is primarily written to reflect available data for the fiscal year 2004-05 which is up to and including March 31, 2005.

1.2 Objectives

The main objective of this report is to provide an overview of the progress of activities on each component of the MBSAP for drinking water safety. The highlights of the various sections of the report are as follows:

Section 2 of this report provides details of the progress and accomplishments made on

Figure 1 : The Components of the Multi-Barrier Strategic Action Plan (MBSAP)



Level 1 and 2 **Department of Environment and Conservation**

Level 2 **Department of Environment and Conservation**
Department of Government Services

Level 2 **Department of Environment and Conservation**
Department of Municipal Affairs

Level 3 **Department of Environment and Conservation**
Department of Health and Community Services
Department of Government Services
Department of Municipal Affairs
Federal Government

activities under Level 1 of the MBSAP - Source Water Protection; Water Treatment; and Water Distribution System.

Section 3 provides details of the progress and accomplishments made on activities under Level 2 of the MBSAP - Monitoring; Inspection, Abatement and Enforcement; Management and Reporting; and Operator Education, Training and Certification.

Section 4 provides details of the progress and accomplishments made on activities

under Level 3 of the MBSAP - Legislative and Policy Frameworks; Public Involvement and Awareness; Guidelines, Standards and Objectives; and Research and Development.

Section 5 provides an overall summary of the progress and accomplishments made on activities under all levels of the MBSAP.

Section 6 provides details of the proposed activities of the path forward for the next fiscal year (2005-06) in order to provide clean, safe and secure drinking water.



2 Level 1 of the MBSAP

2.1 Source Water Protection

As of March 31, 2005 the public water supply database indicated that there are 600 communities in Newfoundland and Labrador with 546 public water supply systems as shown in Figure 2. Many communities have more than one water supply system while 225 communities do not have any public water supply system. The residents of these communities use private wells or other sources to meet their water needs. Also, there are 28 serviced areas in the province that share 24 drinking water sources.

There are 305 public surface water sources servicing the majority of the population in the province. This is due to the reliability of surface water supplies and easy access to a large number of lakes and ponds. There are 213 public groundwater sources consisting of both dug and drilled wells. Dug wells are usually between two and five meters deep, depending on the depth at which bedrock is encountered. The depth of drilled wells ranges from about 15 to 150 meters. Groundwater

wells are the water supply of choice for most smaller communities, for augmenting systems where distribution costs would otherwise preclude a single public water supply, and for private on-site water supplies.

This province continues to have one of the most well established source water protection programs in the country with approximately 90.5% of the total population of Newfoundland and Labrador receiving drinking water from protected surface and groundwater supplies. This is a slight improvement compared to the 2003-04 report where 90% of the population received drinking water from a protected water supply. The 279 active protected water supplies are indicated in Figure 2. Even though the source water protection program is very successful, in that most of the major water supply areas have been designated as protected areas, ENVC is continuing its efforts to designate remaining unprotected areas as protected areas on a need and feasibility basis. In the 2004-05 fiscal year, one additional surface water supply and 34 groundwater supplies were designated as protected water sup-



The Town of Nain's Protected Water Supply "Nain Brook and Anainik's Pond" is on the left in this photo. The town is on the right.

Tools for Sourcewater Protection

The protection of sourcewater is an integral part of the MBSAP. In support of sourcewater protection during the past fiscal year, several developments have occurred.

The drinking water quality geographic information system (DWQGIS) continues to be an invaluable tool used to aid in the protection of sourcewater quality and the management of water resources. Several developments and improvements to the DWQGIS system have occurred through the past year. Various training sessions have been conducted to enable government staff to become familiar with the application and to understand the capabilities and the functions.

The public water supply GIS data layer maintained by the Division has now been integrated into the inter-departmental land use atlas. The land use atlas layer is maintained by the Lands Branch of the ENVC and is used by the interdepartmental land use committee. The committee functions as a provincial referral and land use conflict identification and resolution mechanism between various departments of government for projects involving the use of Crown Land. By having the public water supply GIS data in the land use atlas, all government departments are able to see what activities occur in a water supply area and what land uses may potentially cause water quality issues or land use conflicts.

Previously, the water supplies area GIS layer only included the protected water supply areas in it. In the past fiscal year, the water supplies area GIS layer has been updated to include unprotected and potential water supply areas. This information is available to the public and stakeholders from the departmental web page. The GIS water supplies area layer will allow consultants, municipalities and other stakeholders to better plan and manage activities within watersheds or near watersheds using GIS.

An information booklet was developed and made available to the public in May 2004 entitled "Management of Protected Water Supply Areas". This booklet details information such as the legislation involved in the protection of water supply areas, how to have a water supply protected, regulatory permitting process for activities in protected water supply areas and monitoring and inspection in protected water supply areas. A copy of the information booklet can be found on the departmental web page at:

http://www.env.gov.nl.ca/env/Env/waterres/Forms/PDF/SurfaceWater/Designation_Process_Booklet_Mar26_2004.pdf

A watershed management plan was initiated for the Town of Steady Brook. Due to increased development and activity in the Steady Brook area, it was determined that a watershed management plan would be beneficial to help protect the integrity of the Steady Brook drinking water supply. This watershed management plan will review the physical attributes of the watershed, water quality, land use in the watershed, sensitivity of the watershed to various inputs and provide direction on the best approach to protect the water quality integrity of Steady Brook. For the development of the plan, analysis will be performed utilizing GIS and will incorporate the best available digital remote sensing data from various departments and organizations. As preliminary work for this undertaking, a pilot project investigating the use of remotely sensed data for land use analysis was conducted. Various data such as land use and a digital elevation model for the watershed was provided by government departments and reviewed in conjunction with the Steady Brook watershed management committee.

ply areas. In addition to these, 10 protected water supply areas were amended to protect the entire natural drainage areas and two protected water supplies were amended to refine the delineation of the drainage areas.

There are a total of six active watershed management committees in the province dealing with land management issues in the most sensitive water supply areas. This number has been reduced compared to the 2003-04 annual report due to the inactivity of some committees. Additional watershed monitoring committees will continue to be appointed, as the need arises. There were no new watershed management committees appointed in 2004-05. Watershed management plans are developed in cooperation with communities as and when needed.

2.2 Water Treatment

Chlorination is the most widely used method of water treatment throughout the province. Although it is primarily aimed at destroying and rendering harmless disease-causing micro-organisms, it also helps to protect the distribution system from microbial growth. The number of disinfection systems operating in the province continues to increase. For the 2004-05 fiscal year, there were 162 gas chlorination systems, compared to 139 reported in the past fiscal year, 284 hypo chlorination systems compared to 275 reported in the past fiscal year and the number of powder systems operating in the province remained constant at 10. In addition to chlorination, there are 13 operational conventional water treatment plants. Also, there are a number of communities that have infiltration galleries and filtration units to deal with site-specific water quality problems such as high colour, iron and manganese.

The number of water treatment facilities across the province continues to increase gradually. Several communities are in the process of evaluating, installing or commissioning new water treatment plants. Botwood and Peterview are in the process of being connected to the Exploits Regional Water Supply System. The communities that will have water treatment plants completed and operational in the next fiscal year include Conne River, Pasadena and Lourdes. Gander and

Isle aux Morts will have construction of water treatment plants on going in the next fiscal year. The water treatment plant in Burgeo is still not operational as they are experiencing legal issues regarding the treatment plant. Shoal Harbour will have the tender awarded for the construction of a new treatment plant in the next fiscal year and Baie Verte will be conducting a feasibility study regarding the installation of a new water treatment plant. The Department of Environment and Conservation, in consultation with the Department of Municipal Affairs, assesses water treatment needs of communities and makes recommendations for funding. The decision to implement a conventional or package water treatment facility is made based on a review of the available water quality data and the extent and nature of water quality problems. For example, most communities affected with



An ultraviolet (UV) disinfection system on the Town of Colliers #5 Well - Whalens Well. The UV system is the vertical silver tube on the left.

unacceptable levels of arsenic have been provided funding to develop alternate water supply sources.

Disinfection of drinking water is recognized as an essential component of the MBSAP and priority continued to be given to this component throughout the past fiscal year. Readers should refer to Department of Municipal Affairs for further information regarding municipal infrastructure funding programs.

2.3 Water Distribution System

According to the water system classification developed by the Association of Boards of Certification, of the 546 water supply systems in the province, there are 375 very small systems, 71 small systems, 58 medium systems, five large systems and one very large system. Additionally, there are 36 systems that do not have a known population associated with the system. In the 2003-04 annual report, there were 548 water supply systems in the province, with 413 very small systems, 72 small systems, 57 medium systems, five large systems and one very large system reported. The biggest difference is noted for the number of very small systems. The change in numbers is mostly due to the combining of some of the very small systems thus reducing their numbers. The majority of the water supply systems service a population in the range of 150 to 500 people. The distribution of different types of water supply systems is shown in Figure 2.

The main water supply infrastructure issues with respect to water distribution systems in the province are:

- aging infrastructure
- difficulty of employing/retaining qualified and trained operators
- small and remote systems being operated by volunteers with a high turn over rate in these volunteer operators

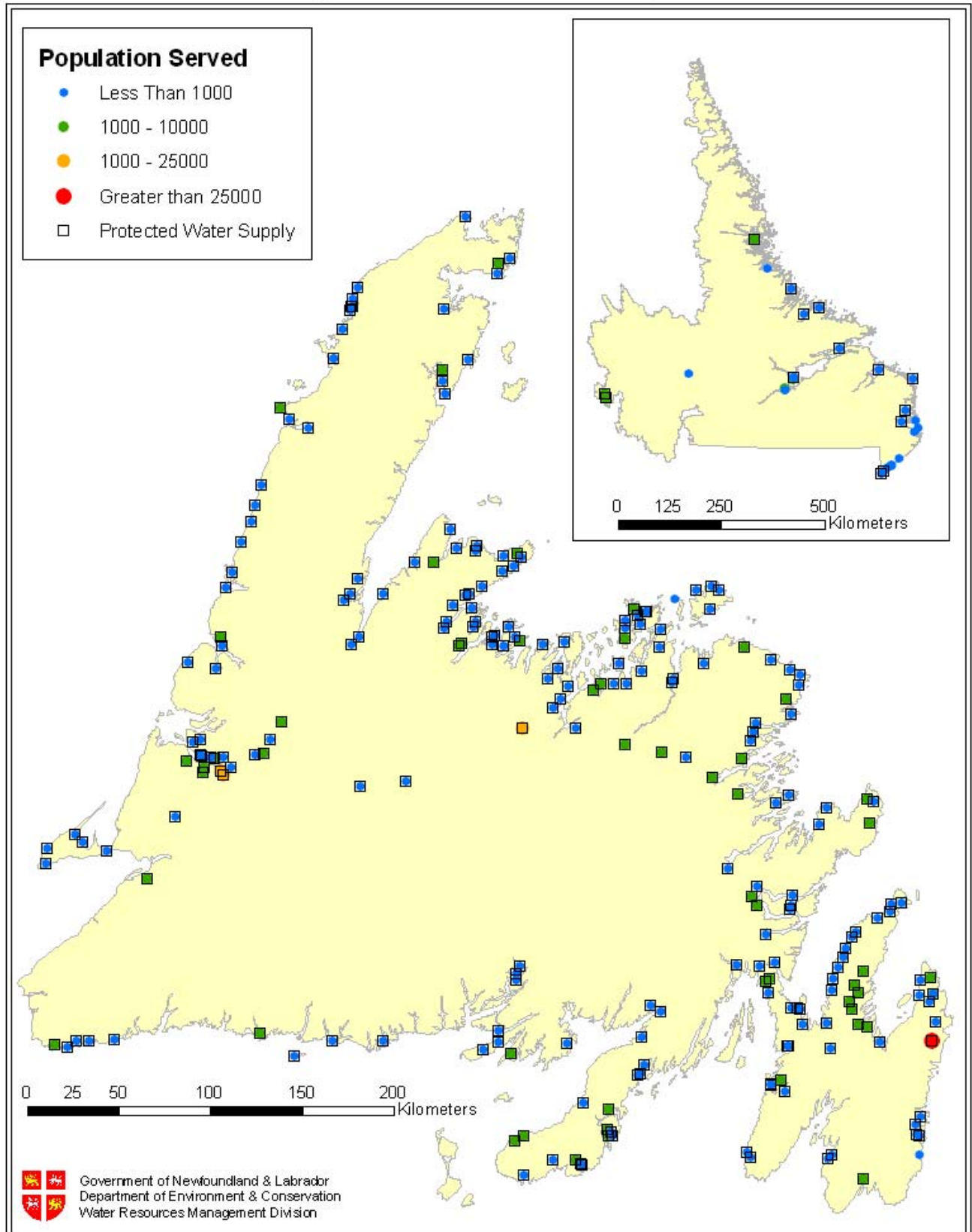
Aging infrastructure of water supply systems continues to be one of the greatest challenges faced while implementing the MBSAP. Government continues to invest heavily in the upgrade of existing, as well as in the construction of new water and sewer infrastructure. Based on information provided by the Department of Municipal Affairs, contracts in the amount of \$35.9 million dollars were awarded for water and sewer related infrastructure during 2004-05.

Proper operation and maintenance of water supply systems continues to be a challenge to smaller communities due to the difficulty of employing and retaining qualified and trained operators. The total cost incurred on annual operation and maintenance of water supply systems is also an issue due to the limited tax base of smaller communities. In order to overcome these issues, Government introduced a large scale operator education, training and certification program with no cost to municipalities in 2001 and implemented the hands-on training phase of the program in 2002. In 2004-05, the mobile training units delivered 224 on-site training sessions. These were in addition to the regular education seminars offered by ENVV. This program will be discussed in greater detail in Section 3.4.

The large number of communities, and a relatively small population spread over a large geographical area, makes the administration of public water supply systems and the provision of safe drinking water a challenging task. To address this situation government continues to encourage the concept of regional water systems and regional water operators. There are three operational regional systems in place. In addition, there is one regional water operator who is responsible for five communities.

Figure 2 : Public Water Supplies

Diversity of Public Water Systems





3 Level 2 of the MBSAP

3.1 Monitoring

Monitoring of drinking water quality is a key component of the MBSAP. The province continues to monitor drinking water quality of all public water supplies. This enables the province to adopt a proactive approach towards the safety of drinking water, in which emerging issues of concern are identified quickly and responded to in an efficient manner. The central coordination of sampling ensures that the same procedures are adhered to throughout the province and it allows for modifying and improving the sampling and analysis program in a very cost effective manner.

Routine monitoring of drinking water quality in this province is a joint responsibility of ENVC and Department of Government Services (GS). The Department of Environment and Conservation is responsible for chemical and physical monitoring of source and tap water quality while GS through its network of 15 offices, is responsible for monitoring bacteriological tap water quality and chlorine residuals. Larger municipali-

ties such as St. John's and Corner Brook also independently collect bacteriological samples which are submitted to Provincial Health Laboratories (PHL) for analysis.

3.1.1 Sampling

3.1.1.1 Chemical and Physical Water Quality Monitoring

Samples for physical and chemical analysis are taken from the source water (lake, pond, river, reservoir, well or spring) and from the distribution system. The distribution system samples, classified as tap water samples, are taken at a site significantly beyond the point at which treated water enters the distribution system. The delivery of the chemical drinking water quality monitoring program is carried out by five Watershed Management Specialists, one Groundwater Management Specialist and three Regional Water Quality Officers, along with their other duties and responsibilities.

Samples are collected semi-annually with the exception of trihalomethanes (THMs)



Harry Perry (left) of the Town of Natuashish and Groundwater Management Specialist Bob Lethbridge (right) collecting a sourcewater sample at the pump house in Natuashish .

which are collected on a quarterly basis. Haloacetic acids (HAAs) samples are collected from selected water supplies each year. If there are any known or emerging site-specific water quality issues at any water supply, the sampling frequency for inorganic parameters is changed from semi-annually to seasonal. Sampling is also carried out for various organic parameters for selected supplies each year. While the main emphasis of the sam-

pling is on tap water quality, source water quality is also monitored on a selective basis in order to assess the impact of land use activities, effectiveness of buffer zones and other environmental controls, THMs pre-cursor levels, and comparison between source and tap water quality.

During the period of April 1, 2004 to March 31, 2005, 2,485 source and tap water

Table1: Overview of Chemical/Physical Sampling Activity from April 1, 2004 to March 31, 2005

Parameter	Number of Source Samples			Number of Tap Samples		
	Total	Surface	Ground	Total	Surface	Ground
Inorganic Chemical Parameters	569	207	362	818	481	337
THMs	N/A: THMs are a result of chlorination , thus are not found in source water samples			793	758	35
HAAs	N/A: HAAs are a result of chlorination , thus are not found in source water samples			292	286	6
Organic Chemical Parameters	24	--	24	--	--	--



Bottles used for chemical and physical water quality sampling. From left to right, three plastic bottles for tapwater, two glass vials for HAAs and two glass vials for THMs.

samples were collected for various types of chemical analysis. An overview of the sampling activities for the past fiscal year can be seen in Table 1. For the 2004-05 fiscal year, approximately 3,454 inorganic tap, inorganic source, THM and HAA samples were scheduled to be collected from public water supplies. Of these scheduled samples, 2,472 samples were collected. The discrepancy in sampling numbers is mainly due to the lack of sampling conducted in the western region of Newfoundland and in Labrador due to the vacancy of a Watershed Management Specialist position in the ENVC western regional office located in Corner Brook. Other reasons for a sample not being conducted are lack of chlorination and seasonal inaccessibility to a sampling location.

Presently, the monitoring program is limited to public water supplies only. Consultation with stakeholders regarding the monitoring of institutional, commercial and private supplies has been completed and draft regulations are under consideration.

To help ensure that consumers have clean and safe drinking water provided by a public drinking water supply, the province has adopted the chemical and physical guidelines in the *Guidelines for Canadian Drinking Water Quality 6th Edition, 1996* (GCDWQ), as revised, as provincial objectives. The *Guidelines for Canadian Drinking Water Quality* are published by Health Canada. In order to keep interested parties informed of changes to the Guidelines between the publication of new editions, a summary table is updated and published periodically on Health Canada's website located at:

www.hc-sc.gc.ca/ewh-semt/pubs/water-eau/doc_sup-appui/sum_guide-res_recom/index_e.html

The provincial "Standards for Chemical and Physical Monitoring of Drinking Water" can be accessed at:

www.gov.nl.ca/env/Env/waterres/Policies/WQ-Standard-PhysicalChemical.asp

Presently, the GCDWQ do not recommend a limit for HAAs. However, the province continues to test for HAAs from tap samples that utilize surface water supplies to es-

tablish baseline data to be used as part of a national study for the development of HAAs guidelines. HAA samples are not taken where groundwater supplies are used since HAAs are not of concern with groundwater sources due to the absence of HAA precursors in groundwater. In total, 132 water supplies that serve 137 communities were sampled for HAAs in 2004-05. As seen in Table 1, a total of 292 samples for HAAs were taken. Monitoring efforts will continue to fill in data gaps in this area. The HAAs summary data for all communities sampled can be accessed at:

www.gov.nf.ca/env/Env/waterres/Surfacewater/HAA/HAA.asp

3.1.1.2 Bacteriological Water Quality Monitoring

The provincial "Standards for Bacteriological Quality of Drinking Water" can be accessed at:

www.gov.nl.ca/env/Env/waterres/Policies/WQ-Standards-Microbiological.asp

In total 19,410 bacteriological samples from public water supplies were tested during the 2004-05 fiscal year as shown in Table 3. The bacteriological water quality monitoring program is carried out by 36 Environmental Health Officer positions located in 15 Government Services offices throughout the Avalon, Eastern, Central, Western and Labrador regions. The ColiBlue is the standard test method currently in use for the determination of *E. coli*, with an option to use the Colilert method if need be under field conditions. The ColiBlue test method is a quantitative test method while the Colilert method is a qualitative, presence-absence, test method. Both methods simultaneously test for the presence of total coliforms and *E. coli* in a 100 millilitre water sample. The testing services are provided by the Public Health Laboratory (PHL) with regional testing sites that operate under the direction of the PHL. The results of these tests are compared to the current standards for bacteriological safety of drinking water and action is taken accordingly.

The PHL and regional testing sites also process bacteriological water samples submitted by individuals to test private wells. Bac-



Laboratory Technologist, Mr. Peter Kent, performing an analysis at the Public Health Laboratory, St. John's.

teriological results are reported to the individuals concerned and when fecal contamination is found it is reported to GS officials as well.

3.1.2 Results of Water Quality Monitoring

3.1.2.1 Chemical Indicators

Based on the information and knowledge gained through regulatory inspections and the drinking water quality monitoring program, the main challenges and issues with respect to chemical indicators of drinking water quality identified in 2004-05 are as follows:

- Aesthetic parameters - pH, colour, TDS, sodium and others
- Contaminants- barium, selenium, lead and turbidity
- THMs

Aesthetic Parameters

A number of water supplies have several aesthetic parameters such as pH, colour, sulphate, sodium, chloride, copper, iron and manganese whose values fall outside the recommended guidelines. Aesthetic parameters reflect substances or characteristics of drinking water, such as appearance and taste, that can affect its acceptance by consumers but

which usually do not pose any health effects. Improvement of aesthetic parameters contributes to the overall quality and safety of drinking water.

pH - There are about 43 communities where pH values in tap samples were below the pH of 5.0. The low pH in drinking water found in many areas of the province is due to source water originating in watersheds with a high percentage of bogs. Water with a pH of approximately 3 to 4 is a typical pH range in a bog environment. As viewed in Figure 3, certain areas of the province are more prone to low pH levels than others. Although pH is an aesthetic parameter which does not have direct health implications, low pH levels accelerates the corrosion process of pipes and fittings and the leaching of metals. There are about 12 communities where pH values are above the recommended guideline of 8.5. The Department of Environment and Conservation has been working with a number of communities to help adjust and optimize the pH in tap water.

Colour - The other main aesthetic parameter of concern is colour. There are about 176 communities with colour values in the tap samples above the recommended guideline of 15 True Colour Units (TCU) as shown in Figure 3. Colour in drinking water

may be due to the presence of coloured organic substances or metals such as iron, manganese and copper. High colour values are also a result of source water originating in watersheds with a high percentage of bogs. The presence of colour does not affect health directly, but causes water to be aesthetically displeasing. However, colour is of concern since the presence of colour in untreated source water may be an indirect indicator of the THMs formation potential when the water is chlorinated.

Bogs and wetlands produce large amounts of dissolved organic materials such as tannins, lignins and humic acids, which can give water a tea-like colour. Calcium carbonate from regions with limestone bedrock may give water a greenish colour, while ferric hydroxide (iron) may impart a reddish colour. The degree of colouring will depend on the concentrations of these and other substances. Water colour is highly influenced by land cover in a basin. Bogs and wetlands drainage will contribute high levels of colour to surface runoff, while less organic soils or exposed bedrock in a basin will contribute very little to colour. Treated drinking water should not have much apparent colour.

Others - There were exceedances detected at the tap in some of the public water supply systems for additional aesthetic parameters. These parameters are:

- Sulphate
- Sodium
- Chloride
- Copper
- Iron
- Manganese

These parameters are not a health related concern. Exceedances of these parameters are expected due to their natural abundance in the geology and waters of the province. For example, iron and manganese levels are often elevated in water supplies throughout the province due to the natural weathering of iron and manganese bearing rocks and minerals. Sulphate is another naturally occurring substance that may be leached from the soil or released from decaying plant matter and is commonly found in water supplies.

Contaminants

The main contaminant chemicals or parameters of concern in our public water supplies are: lead, turbidity, and THMs. Barium and selenium were also identified in reported water samples. Table 2 provides information on the total number of tap samples affected by each of the main contaminants.

Barium – Two samples from a groundwater based water supply system were identified as being affected by barium. After the exceedance was detected in the summer 2004 sampling, the water supply was re-sampled and the re-sample did not show elevated levels of barium. Barium was found to be elevated again during the winter 2005 quarterly sampling. Residents connected to the groundwater well with the exceedance have been advised not to consume the affected water. Barium exists in nature in ores containing mixtures of elements. The MAC for barium in drinking water is 1.0 mg/L.

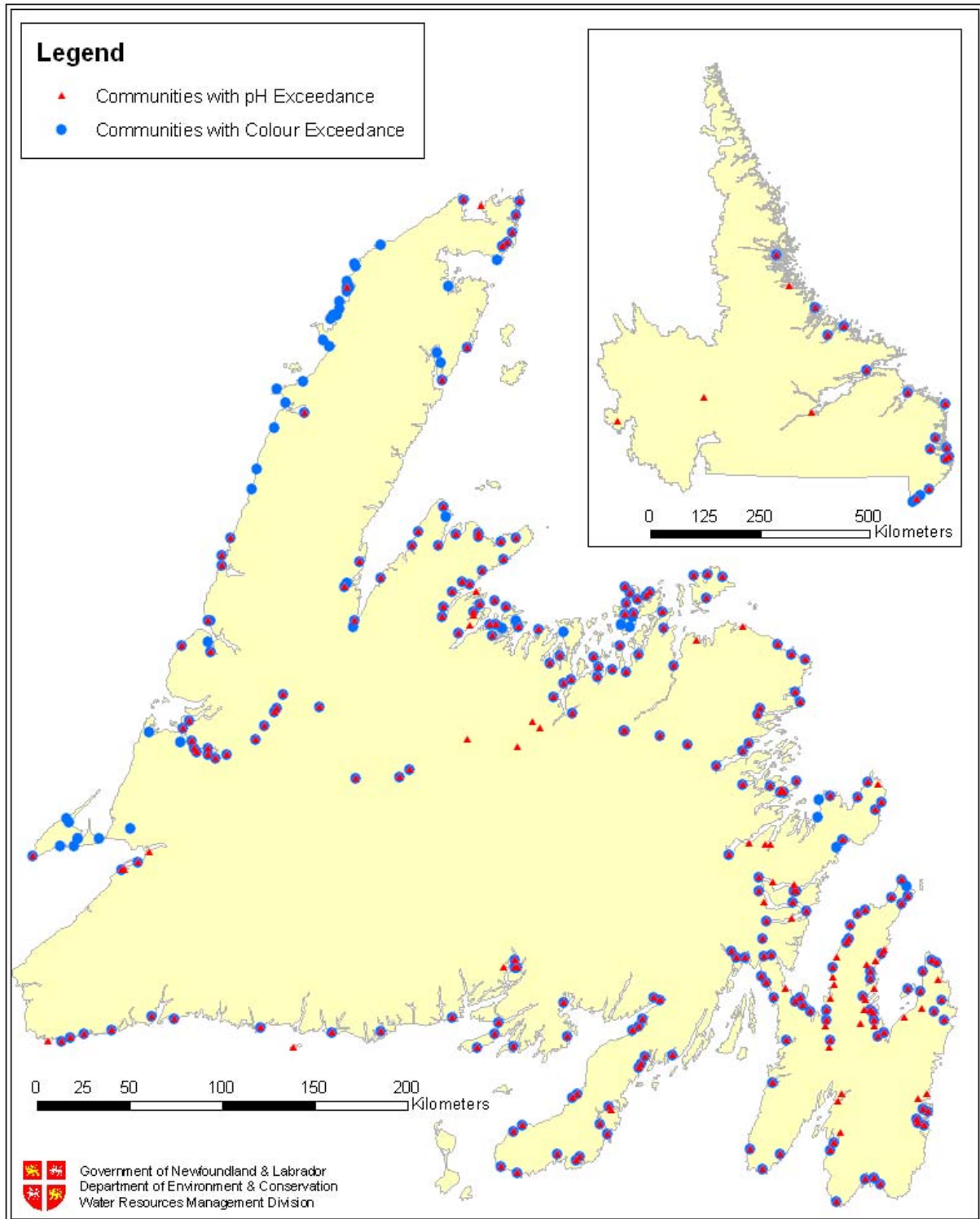
Selenium – One sample from a groundwater based water supply system was identified as being affected by selenium. The water supply was re-sampled and the subsequent sample did not show an elevated level of selenium. Selenium is a metal found in natural deposits as ores containing other elements. The MAC for selenium in drinking water is 0.010 mg/L.

Lead – Five samples in total were identified as being affected by lead. Two of the samples were from the one groundwater based water supply systems and three samples were from one surface water based water supply system. Lead may appear in drinking water as a result of dissolution from natural sources or more commonly, from distribution systems and plumbing containing lead in pipes, solder or service connections. The recommended guideline for lead in drinking water is 0.010 mg/L.

Most of these lead exceedances can be attributed to inadequate flushing of pipes and are thus not always representative of the water quality in the distribution system. While sampling protocols have been revised to ensure that tap samples are properly flushed and are representative of the water quality in the

Figure 3 : Location of Colour and pH Exceedances

Distribution of Colour and pH Exceedances



2004 sampling, the water supply was re-sampled and the re-sample did not show elevated levels of barium. Barium was found to be elevated again during the winter 2005 quarterly sampling. Residents connected to the groundwater well with the exceedance have been advised not to consume the affected water. Barium exists in nature in ores containing mixtures of elements. The MAC for barium in drinking water is 1.0 mg/L.

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Table 2: Number of Tap Samples with Contaminant Exceedances

Contaminants	Recommended Guideline	Number of Samples that Exceeded Guideline	Comments
Barium	1.0 mg/L	2	The water supply was re-sampled after the summer 2004 exceedance and the subsequent sample did not show elevated levels of barium. However, barium was found to be above the guideline again during winter 2005 sampling.
Selenium	0.01 mg/L	1	The water supply was re-sampled and the subsequent sample did not show elevated levels of selenium.
Lead	0.010 mg/L	5	The five lead exceedances can be attributed to inadequate flushing of pipes, local plumbing problems or low water usage.
Turbidity	1.0 NTU	74	Source control and treatment alternatives employed as appropriate.
THMs	100 µg/L	257	Being addressed through water treatment, chlorine demand management and operator education and training.

distribution system, in a few cases, local plumbing problems or low water usage at some sites require flushing to be carried out for extended periods beyond what is usually done. Such sites are identified on an ongoing basis and flushing protocols for these sites are modified to obtain representative samples from these locations.

Repeat samples collected from lead exceedance sites where extended flushing was carried out usually confirmed that the initial exceedance was flushing related rather than an actual problem with the water quality in the distribution system. Due to the fact that the first sample is usually not representative of water quality in the distribution system, an exceedance reporting protocol for lead is in place where lead exceedances are reported only if both the first and second samples indicate a lead exceedance. This reporting protocol protects the public from unnecessary inconvenience.

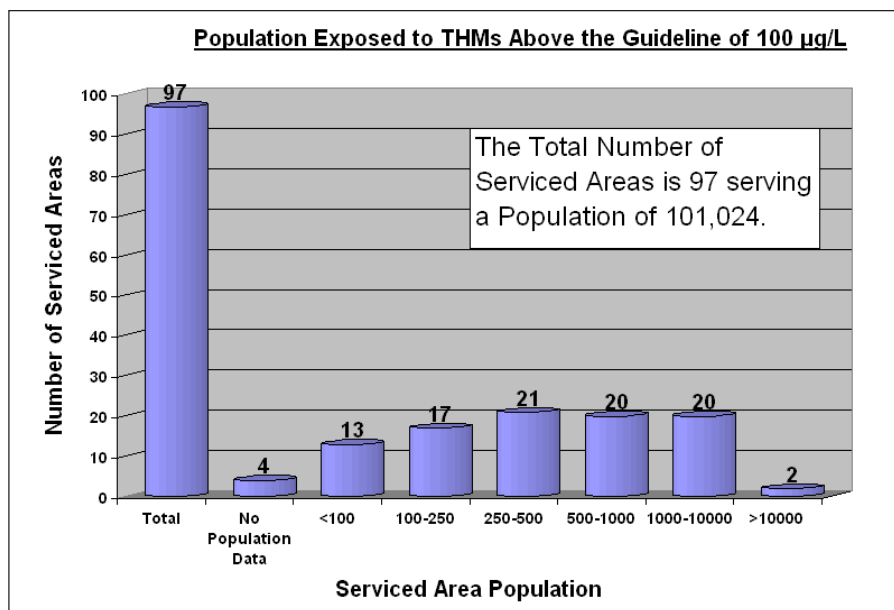
Turbidity - Another parameter of concern is turbidity. Elevated turbidity levels affected 74 samples. The MAC of turbidity in treated water is 1.0 NTU. High turbidity by itself is not considered a harmful condition, but its presence can reduce the effectiveness of disinfection.

Reducing turbidity in water supplies requires using good source control and treatment alternatives as appropriate. Groundwater wells usually do not exhibit turbidity, but if they do, it is a good indicator of surface water influence. The source and cause of the problem needs to be assessed and recommendations made to the communities on appropriate corrective measures on an individual basis.

THMs – The formation of THMs is a common problem in surface based public water supplies with chlorination as the only method of water treatment. Exceedances for THMs are usually not found in groundwater supplies due to low concentrations of organic precursors. There are 97 serviced areas, affecting 94 communities, where THMs levels are above the recommended guideline of 100 µg/L. As shown in Figure 4, the total population exposed to THMs above the recommended guideline was 101,024.

Further research continues to be conducted into appropriate measures to address elevated levels of THMs. Distribution models have been developed or are planned for seven communities having elevated THMs including Brighton, Burlington, Cartwright, St.

Figure 4 : Summary for Trihalomethanes



Paul's, Summerford / Cottlesville, Ferryland and Marystown. These distribution models will be used to develop generic "Best Management Practices" for chlorine usage to help reduce disinfection-by-products. Training sessions continue to be conducted for communities dealing with their chlorination systems. The objective of these training programs is to minimize the formation of THMs without compromising the bacteriological integrity of drinking water through the proper operation of water chlorination facilities.

Organics

At the request of Environment Canada's National Research Institute, a sampling program was designed and completed to determine the extent and concentration of perchlorate in this province. Perchlorate is a chemical with both natural and man made forms that can be found in groundwater supplies. Perchlorate has been associated with disruption of thyroid function which can potentially lead to thyroid tumor formation and delayed development of newborns where expectant mothers have been exposed to perchlorate.

A total of 24 public groundwater supplies were selected for perchlorate sampling based on location, geological setting, and proximity

to any man made activities that could possibly produce perchlorate. Perchlorate was not detected in any of the 24 samples. Funding for the sampling program was provided by Environment Canada.

3.1.2.2 Bacteriological Indicators (Boil Water Advisories)

The MBSAP identifies a series of measures to prevent possible contamination from reaching a consumer. Occasionally, due to the failure of perhaps one or more barriers, it becomes necessary to take the additional final step of issuing a boil water advisory to ensure that there is no disease causing bacterial or microbiological contamination of drinking water. Disinfecting water by boiling is one way to protect public health whenever the drinking water is of questionable microbiological quality.

There are many reasons why a boil water advisory (BWA) may be issued. The most common reasons are that a public water supply has no chlorination or other disinfection system, or if there is one, it is not working properly. Water tests may indicate a problem with insufficient levels of residual disinfectant, or the presence of the indicator bacteria, total coliforms, or *E. coli*. A boil water advisory may also be issued because it is

Table 3: Bacteriological Test Results from Public Water Supplies for the 2004-05 Fiscal Year

	GS Region					Totals
	Avalon	East	Central	West	North	
Number of Samples Tested	8,347	1,339	4,624	3,153	1,947	19,410
Total Number of Samples Positive for Total Coliforms	166 (2.0%)	42 (3.1%)	581 (12.6%)	225 (7.1%)	194 (10.0%)	1,208 (6.2%)
Total Number of Samples Positive for <i>E. coli</i>	16 (0.2%)	19 (1.4%)	41 (0.9%)	65 (2.1%)	59 (3.0%)	200 (1.0%)

known that contamination may have occurred following a major water main break, serious flooding, water treatment plant failure or because there is a waterborne disease outbreak due to waterborne agents such as *Giardiasis* in progress. These situations tend to occur rarely and corrective action can be taken quickly.

The results of tests conducted on the 19,410 bacteriological samples collected are shown in Table 3. 6.2% of samples collected were found to be unsatisfactory in terms of total coliforms and 1.0% were unsatisfactory in terms of *E. coli*. In addition to the samples collected by GS directly, several municipalities collect their own samples and submit them to the PHL in St. John's for analysis. The presence of total coliforms in concentrations greater than the guidelines indicates that the treatment is inadequate or that the distribution system is experiencing regrowth or infiltration. They are not necessarily an indication of the presence of fecal contamination. The presence of *E. coli* is a definite indicator of the presence of fecal contamination and must be dealt with as soon as reported.

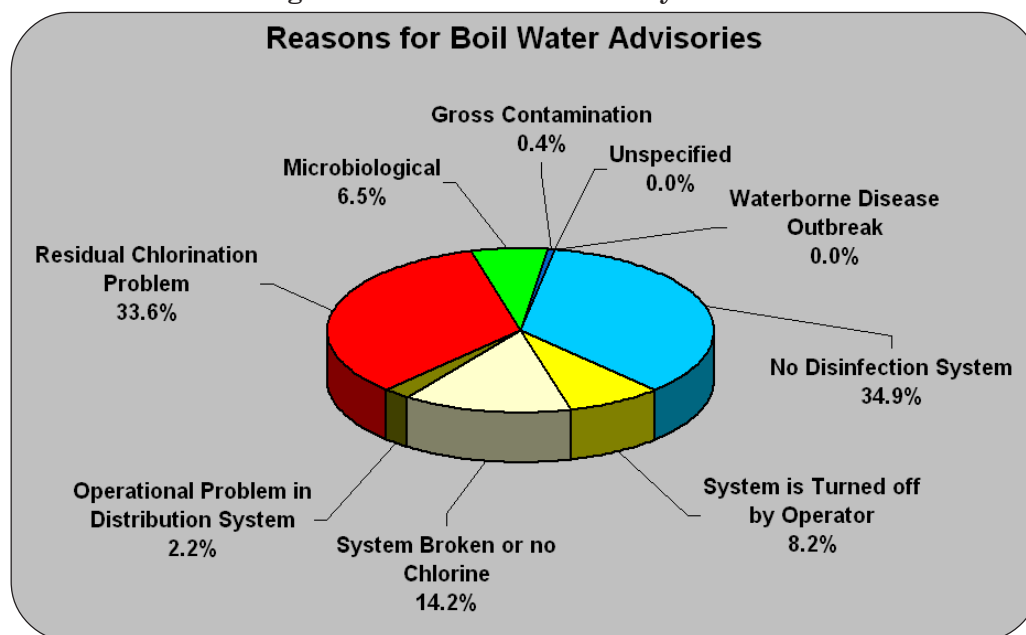
The number of boil water advisories in effect for public water supplies in Newfoundland and Labrador as of March 31, 2005 is 232. These boil water advisories affected 150 communities in the province, many of which have

more than one public water supply. On a population basis, this issue affected approximately 42,357 people. Figure 5 illustrates the various reasons for boil water advisories. It should be noted that the number of boil water advisories issued primarily due to failure of microbiological test results is relatively low at 6.5% and furthermore, poor test results are largely the result of failure to properly disinfect the water.

The number of communities affected by boil water advisories is less than the 223 that were affected by the 322 boil water advisories that were in place when the "Source to Tap" report was written in 2001. These figures do not include water supplies that were placed on a boil water advisory during the course of the year and were subsequently removed as problems were corrected. Additionally, these figures do not include any boil water advisories that were recommended for private water supply systems such as those owned by individuals, groups of individuals, commercial facilities or institutions. There were no waterborne disease outbreaks in the province last year.

The challenge for government, municipalities and individuals is to correct the deficiencies that necessitate boil water advisories. From the preceding facts and figures it is evident that the provision of adequate primary

Figure 5 : Boil Water Advisory Reasons



disinfection and the proper operation of existing chlorinators is the key to ensuring safe drinking water. Only when all public water supply systems become equipped with disinfection systems, and are operated and maintained by trained individuals, will there be further significant reduction in the number of boil water advisories.

3.2 Inspection, Abatement and Enforcement

3.2.1 Inspection

The Department of Environment and Conservation requires that all public waterworks be maintained and operated in a manner that provides safe and clean drinking water for the benefit of present and future generations of Newfoundlanders and Labradorians. This is enforced through informal site visits of public water supplies. If problems are reported or noted then a formal inspection is undertaken. During the past fiscal

year, 72 inspections were carried out pertaining to water and sewer related activities.

Public groundwater wells and other selected wells were also inspected on a regular basis in order to ensure that these wells were constructed as per requirements of the *Water Resources Act*. Approximately 286 inspections of public groundwater supplies were carried out in the past fiscal year. Finally, approximately 28 inspections were carried out on protected public water supplies to respond to public concerns in reference to development activities, as well to update land use inventory and identify the need for the preparation of watershed management plans.

3.2.2 Abatement

The problems identified as a part of the drinking water quality monitoring and regulatory inspections are dealt with using a number of conventional and non-conventional abatement strategies.



Ozone generator at the water treatment plant in the Town of Placentia (Dunville)

The Department of Environment and Conservation is assisting several communities in reducing THMs levels. As discussed earlier, focused “on-site” operator education and training is being undertaken to address THMs and other operational issues. Also, chlorine demand modeling was undertaken for selected communities to develop guidelines for chlorine demand management.

Contaminants with concentrations above the recommended guidelines, such as barium, selenium, lead and turbidity need to be assessed on a case by case basis to determine the source and the extent of contamination. Once a contaminant is detected with concentrations above the recommended guideline in a sample, the first action is to resample in order to confirm that the exceedance is an actual exceedance and not a sampling or analytical error. Once the exceedance has been confirmed and the source and extent have been determined, appropriate mitigative solutions are adopted.

Mitigation of elevated turbidity in water supplies, may take place at the source protection level or through water treatment. At the source protection level, reduction in turbidity values may be achieved by enforcing better control of activities in a watershed such as erosion, resource development, deforestation, etc., that might increase turbidity in the source water.

3.2.3 Enforcement

Issuing permits is an integral component of the enforcement of the MBSAP for drinking water safety. All public water supply and sewer systems in the province are regulated under the *Water Resources Act* which was assented to on May 22, 2002. 90 permits were issued throughout the past year dealing with various components (construction and operation) of water supply and sewer systems.

In addition to the above permits, ENVC also issued 101 permits under Sections 39 of



Water and Wastewater Specialist Ron Goulding inspecting a hypochlorination unit in the community of Lawn.

the *Water Resources Act*. This regulatory permitting process deals with development activities within public water supply areas and is designed to ensure the integrity of drinking water sources.

The *Water Resources Act* provides for the licensing of water well drillers in the province by setting minimum standards of training and experience in the construction of drilled wells. All non-domestic wells also require a permit from the ENVC before construction begins. During the 2004-05 fiscal year, 11 non domestic well permits were issued. A database of domestic well records is maintained by the ENVC with up to 50 items of information concerning a well including assessment of the water quality from each well. There are 16,537 records in the database, with several hundred well records added each year. This information has been put on compact disk and is referred to frequently by consultants, municipalities, other government departments, pump installers, water bottlers, well drillers, and realtors.

3.3 Data Management and Reporting

3.3.1 Data Management

A number of various data management tools are used to process, manage, analyze, and report drinking water quality data and other related information. These tools include:

- Drinking water quality database and reporting system
- Public water supply database
- ENVC drinking water quality data search engine
- Drinking water quality web based GIS application
- Municipal Information Management System (MIMS)

The Department of Environment and Conservation drinking water quality database and reporting system that had been completely revised and enhanced in the 2001-02 fiscal year continues to be successful in managing and reporting drinking water data. All chemical analysis results for samples taken under the chemical monitoring program across the province were stored in one provincial

database in the department including: surface water sources, groundwater wells and tap water (organic, inorganic, THMs, HAAs).

In the 2004-05 fiscal year changes were made on how the detection limit of laboratories conducting analysis is recorded. The detection limit is the lowest concentration of a substance that can be determined with confidence during analysis. Prior to March 31, 2004 analytical results less than the detection limit were reported as half the detection limit. After March 31, 2004 analytical results less than the detection are simply reported as less than detection limit (LTD) which is considered zero for all practical purposes. This change was facilitated to make comprehension of the reports more straight forward for the public.

The enterprise level Oracle database management system continues to be used for the management of drinking water quality data. Use of an enterprise level Oracle database and server allows for more effective sharing of data as well as an increased ability to spatially enable water resources data (e.g. associate water quality to water supply polygons in GIS). This greatly increases analysis capability of ENVC staff. In the 2004-05 fiscal year, a new program was developed to import the most recent boil water advisory information into the DWQ Oracle database on a daily basis. This function enables this up to date information to be readily available when it is needed. Further products based on this information are in the development stage and will be available once completed.

The drinking water quality web based GIS application that was developed and deployed in the Department of Environment and Conservation for internal use in the 2003-04 fiscal year had several additions and modifications during the 2004-05 fiscal year. This application allows all government staff to interactively analyze water quality records and spatial aspects of water supplies. This ability will improve government's response to integrated watershed management, water quality issues and enquires. The following are details of the recent development with the water quality web based GIS application:

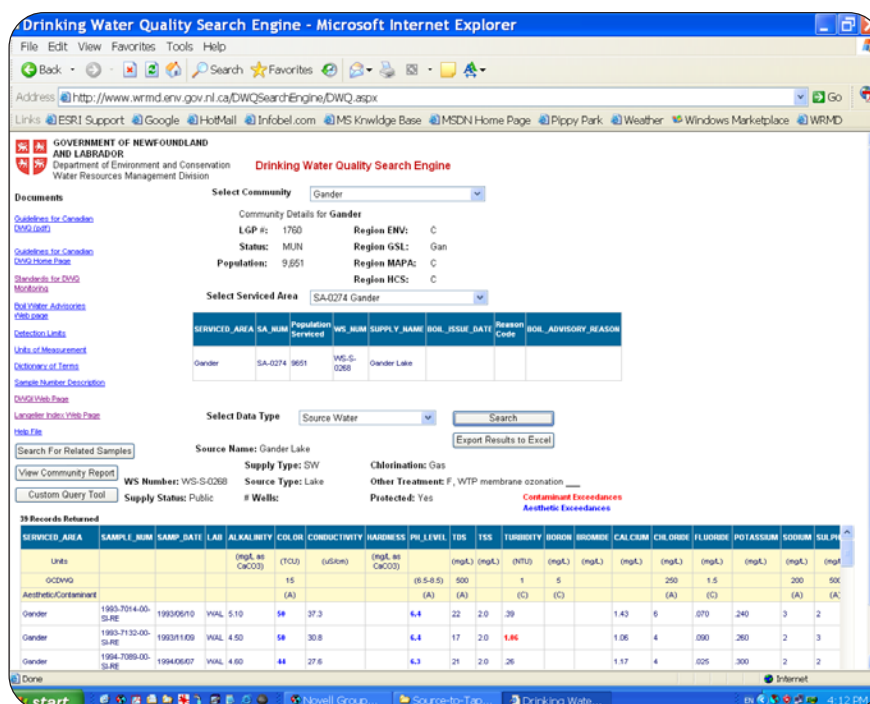
- The search engine data querying tool that was developed specifically for internal management and reporting of drinking water quality data and to respond to public enquires has been integrated into the drinking water quality web based application. There are the same data search capabilities as in the past but now data can be linked and viewed in a GIS layer. The department's drinking water quality data that is used in this application is updated on a quarterly basis.
- The Public Water Supply GIS data layer maintained by the Division has now been integrated into the inter-departmental Land Use Atlas. The land use atlas layer is maintained by the Lands Branch of the ENVC and is used by the interdepartmental land use committee (ILUC). The committee functions as a provincial referral and land use conflict identification and resolution mechanism between various departments of government for projects involving the use of Crown land. Provincial land use designations that are established under the authority of ILUC are recorded on digital maps in the land use atlas

which functions as a central registry for the provincial government. The land use designations in the atlas are available to government departments and the general public.

- Information on legislation related to public water supplies has also been added to the ENVC GIS data layer. This information includes items such as when the water supply area was protected under legislation, publication information from the Newfoundland Gazette and a link to the legislation on the House of Assembly web site.

The GIS application continues to be internal at the present time however, once the testing phase is complete, this GIS application will be made available to the public through the departmental web page.

The public water supply database contains a complete list of all communities with public water supply systems. The database is dynamic in nature and is continuously updated to reflect changes and new information gathered through ground truthing. To better perform the ground truthing activities, the field sheets for the drinking water quality



Screenshot of the Drinking Water Quality Search Engine Application.

monitoring program were reviewed and redesigned. The redesigned field sheets now show the most recent boil water advisory and chlorination information for each community at the beginning of the quarterly sampling season. This information is then able to be verified by ENVC staff while in the field.

In order to facilitate the sharing of water supply and water quality information among government departments, the Municipal Information Management System (MIMS) was created in 2002. MIMS is a database, managed by the Department of Municipal Affairs, which consists of several modules including basic information on all municipalities, waste management, capital works, financial details, municipal profiles and water supply information. This database provides essential information such as the area(s) serviced, the type of water supply, types of treatment, watershed or wellhead protection, boil water advisory status, bacteriological testing results, chemical testing results, and details on persons responsible for the system as well as their location. MIMS will be enhanced in several areas in the coming year to allow access by regional offices and to streamline entry of bacteriological test results.

A strategic plan on drinking water quality data management and communication was developed in the 2002-03 fiscal year and continues to be used to improve the collection, management and communication of drinking water quality data in order to provide the public with timely and user friendly access to accurate drinking water quality data.

3.3.2 Reporting

The interpretive annual community water quality report that was used for the first time in the 2001-02 fiscal year continues to be used successfully. The quarterly and annual reporting system was used to generate and mail out 273 quarterly reports during spring 2004, 241 quarterly reports during summer 2004, 295 quarterly and annual reports during fall 2004, and 230 quarterly reports during winter 2005.

In the 2004-05 fiscal year, a new report format was implemented for the quarterly and annual reports that are used

to report sampling results to the communities of the province. Modifications to the report format include:

- Regular and exceedance water quality information are now combined in the same table where aesthetic exceedances are indicated with a partial box around the parameter value and contaminant exceedances are indicated with a full box around the parameter value.
- A new Less Than Detect (LTD) protocol has been implemented. The new protocol has LTD values now stored as zero's and indicated with the text LTD. Less than detect values were previously reported as being equal to half the detection limit.
- A remarks field is now shown for groundwater source samples. The text in this field is used to identify a particular wellhead when multiple source samples are taken in well fields.

The early exceedance reporting system that was implemented in 2001-02 continues to be successfully utilized. This system allows the department to inform a community of any problems in tap samples collected from the community as soon as it is detected at the analytical laboratory. This system was used to report three tap sample exceedances during summer 2004, three tap sample exceedances during fall 2004, and two tap sample exceedances during winter 2005 to the communities. No tap sample exceedances were reported for the spring 2004 sampling season.

To provide the public with greater access to drinking water quality data, the database is continuously being refined and improved to allow better reporting of water quality information on the web. The web page provides the following information:

- historical drinking water quality data
- proposed sampling to be conducted in the upcoming fiscal year
- boil water advisory information
- operator education, training and certification schedule
- drinking water quality manual
- reports and publications

The web page can be visited at the following link: www.gov.nl.ca/Env/water

The Drinking Water Quality Index (DWQI) is a new value-added product that was specifically designed for public drinking water quality reports. The DWQI was introduced during the reporting of the fall 2004 sampling results. A DWQI is a means by which drinking water quality data is summarized for reporting to the public in a consistent manner. It is similar to the UV index or an air quality index in that it conveys to the public in simple terms, what the quality of drinking water is like from a drinking water supply. Essentially, the DWQI is calculated by comparing the water quality data to the *Guidelines for Canadian Drinking Water Quality*. The DWQI measures the scope, frequency, and amplitude of water quality exceedances and then combines the three measures into one score. This calculation produces a score between 0 and 100. A higher score indicates higher quality drinking water. The DWQI categories and the associated scores are as follows:

- Excellent: (WQI value 95-100) - Water quality is protected with a virtual absence of impairment; conditions are very close to pristine levels; these index values can only be obtained if all measurements meet recommended guidelines virtually all of the time.
- Very Good: (WQI value 89-94) - Water quality is protected with a slight presence of impairment; conditions are close to pristine levels.
- Good: (WQI value 80-88): - Water quality is protected with only a minor degree of impairment; conditions rarely depart from desirable levels.
- Fair: (WQI value 65-79) – Water quality is usually protected but occasionally impaired; conditions sometimes depart from desirable levels.
- Marginal: (WQI value 45-64) – Water quality is frequently impaired; conditions often depart from desirable levels.
- Poor: (WQI value 0-44) – Water quality is almost always impaired; conditions usually depart from desirable levels.

Additional information on the DWQI can be found on the departmental web page at:

<http://www.env.gov.nl.ca/env/Env/waterres/Surfacewater/DWQI/DWQI.asp>

In May 2004, the specification document “Invitation to Tender for Drinking Water Sample Analysis and Data Reporting Services” was reviewed and updated. The tender was submitted to the Government Purchasing Agency and was subsequently awarded to Accutest Laboratories Limited of Ottawa, Ontario. The contract was awarded in April 2004. The duration of the contract was originally for one year but has the option to extend it for two additional years.

During the 2004-05 fiscal year, a new computer application was developed for use in planning the drinking water quality sampling schedule. This application displays the number of samples that have been taken in the past, what samples were collected the previous year and whether there were any exceedances for any parameters. This application will be used for scheduling drinking water sampling in future years. The application is the first module in a system for auditing drinking water quality sampling. This will enable easier tracking of what samples were scheduled and what sampling was actually conducted.

3.4 Operator Education, Training And Certification (OETC)

3.4.1 Operator Education

ENCV continues to be committed to the delivery of the operator education, training and certification program as outlined in the 2001 strategic plan. Having fully qualified and trained operating personnel for water systems is extremely important for the safe and sustainable operation of water supply systems. The OETC continues to be successful with a great deal of interest expressed in it by municipalities of the province.

The focus of the operator education component continues to be on operator competency in the operation and maintenance of the province's water supply systems. The core program will always focus on disinfection practices, including chlorination, ozonation, and/or ultraviolet methods and equipment. The program will also provide education on other aspects of water distribution system operation and maintenance, and on water treatment facilities and technologies. The classroom style Operator Education Seminars are intended to provide operators and municipal officials with the knowledge needed to operate and maintain their water systems so as to provide safe, clean drinking water at reasonable costs.

As presented in Table 4, during 2004-05 the OETC program saw the delivery of 35 one day classroom seminars, covering various topics, in 20 locations throughout Newfoundland and Labrador. In addition to the one day classroom seminars, 12 half day seminars were presented in 12 locations. These half day sessions provided the opportunity for additional instruction and review in preparation for certification exams. Total attendance at these seminars was 603. There were 151 municipal systems represented at the seminars, 10 non municipal systems such as school boards, industry, parks and campgrounds, and three government departments responsible for water systems. Due to the ongoing concern for the number of boil water advisories and non-operational chlorination systems, all sessions are geared

towards water system safety. Each session emphasizes safe operation of the distribution system, the need for chlorination in a water supply system and proper operation and maintenance of chlorination equipment.

These educational seminars are made available free of charge to the municipality, group, or individual attending. The only cost to participants is for their travel and meals as every effort is made to hold the seminars at convenient locations throughout the province. Overnight travel is generally not required, except for people from coastal Labrador who must travel to Happy Valley-Goose Bay. The Department of Municipal Affairs provided financial assistance to municipalities to help cover the cost of travel and meals for municipal employees attending the seminars.

In addition to the preparation of the presentation and handout material for the



Operator Trainer Gerry Lahey demonstrating the use of Leak Detection Equipment.

classroom seminars made during the year, the following documents were prepared:

- Operator Education and Training – Progress Report
- On- site Operator Training Curriculum (Round V Curriculum)
- Operator Education Schedules
- Revision and updates to Web Page Information for OETC Section including On Site Training Curricula for Rounds I and II
- Display at the Newfoundland and Labrador Federation of Municipalities annual workshop in St. John’s in September 2004

The Department of Environment and Conservation hosted its annual “Clean and Safe Drinking Water Workshop” on September 21 to 23, 2004. The theme for the workshop was “Small System Operation, Maintenance and Treatment”. The workshop included a trade show to enable representatives from the drinking water industry to showcase equipment and technologies used in the supply and distribution of clean and safe drinking water.

3.4.2 Operator Training

The three Mobile Training Units (MTUs) that were made available to the OETC program in February 2003 continue to travel throughout the province delivering on-site training for operators within their communities. These units are 16 foot long cube vans equipped with a work area and training equipment to provide operators an opportunity to operate and maintain their equipment, and to demonstrate other tools and equipment. Equipment available as training aids in the MTUs include hypochlorinator pumps; hydrants; hydrant tools; valves; valve location equipment; backflow prevention devices; pipe location equipment; leak detection equipment; pressure gauges; flow meters; and confined entry safety equipment. Having this equipment available enables operators to work with and become more familiar with the water system equipment that they may have within the water systems of their own communities. In the past fiscal year, 224 public water supply systems have been visited by the MTUs. Training during these visits concentrated on maintenance of chlorination systems, leak detection in piping systems, pipe location and fire hydrant maintenance.

Table 4: Operator Education and Training Activities during the 2004-05 Fiscal Year

Seminars (one day and half day)	Total Attendance	Number of Persons	Number of Municipalities Represented	Number of Non- Municipal Institutions Represented	Government Departments Represented
47	767	603	151	10	3

3.4.3 Operator Certification

Operator certification demonstrates a certain level of competency in the operation and maintenance of water supply systems. The number of certification exams undertaken by water distribution system operators in this province continues to increase. Table 5 lists the certification exams that were administered by the OETC program during the past fiscal year.

Within the province, there are 109 municipalities with certified operators. Additionally, there are eight certified operators with Parks Canada (water and wastewater), three with Indian Bands and four with federal facilities. The department will continue to encourage and facilitate operator certification as and when appropriate.



A Mobile Training Unit (MTU) on-site in the Town of Harbour Grace.

Table 5: Certification Exams Administered during the 2004-05 Fiscal Year

Certification Exam	Number of Exams Administered
Water Distribution I	86
Water Distribution II	27
Water Distribution III	0
Water Treatment I	0
Water Treatment II	1
Water Treatment III	0



4 Level 3 of the MBSAP

4.1 Legislative and Policy Frameworks

The Department of Environment and Conservation strives to enforce sections 37, 38 and 39 of the *Water Resources Act* SNL 2002 cW-4-01, Environmental Control Water and Sewage regulation, Well Drilling Regulations and policy directives under the act relating to drinking water safety.

The Department of Municipal Affairs strives to enforce various sections of the *Municipal Affairs Act* SNL 1995 cM-20.1 and the *Municipalities Act* SNL 1999 cM-24 regarding infrastructure funding and administration of municipal infrastructure relating to drinking water safety.

4.2 Public Involvement and Awareness

The Department of Environment and Conservation is committed to ensuring public involvement and participation with respect to drinking water safety. All drinking water

quality data is available in the public domain. This is accomplished by having all drinking water related information posted on the departmental web page and sending quarterly drinking water quality reports to communities. Additionally, the annual drinking water quality report is available to the general public.

The numerous activities under the OETC program ensure the involvement of municipal operators and administrators. Particularly, the annual drinking water safety workshop is a great forum that encourages involvement from such groups as municipalities, consultants, government officials etc. This workshop not only provides the opportunity for the public to discuss issues with water industry professionals, but also the opportunity to discuss issues with other municipalities. By doing this, municipalities can learn from each other, see what issues other towns are facing and how they are dealing with them. The watershed



The opening session of the annual drinking water safety workshop held in Gander.

management committees that exist in some areas of the province also allow the active involvement of concerned stakeholders as well as the general public.

4.3 Guidelines, Standards and Objectives

The Department of Environment and Conservation has been working on the development or revision of a number of documents relating to drinking water safety. The document entitled "*Guidelines for the Design, Construction, Operation and Maintenance of Water and Sewer Works*" is completed in draft form and has been circulated to stakeholders for input and comments. The Atlantic Canada Guidelines for the Supply, Treatment, Storage, Distribution and Operation of Drinking Water Supply Systems were published in September 2004. The department was an active participant in the development of these guidelines. The guidelines can be found at:

<http://www.gov.ns.ca/enla/water/docs/WaterSystemGuidelines.pdf>

On an on-going basis ENVC, participates in the development of Canadian Guidelines for Drinking Water Quality through the national drinking water committee. The provincial standards for chemical and bacteriological drinking water are updated on a regular basis. The Drinking Water Quality Manual and Boil Water Advisory Guidelines are also reviewed and updated as required.

4.4 Research and Development

The Department of Environment and Conservation constantly strives to improve all aspects of the MBSAP for drinking water safety through research and development of new tools and methodologies.

The Drinking Water Quality web based GIS application that was developed in the previous fiscal year continued to be modified and enhanced. This application has developed from a tool used to display spatial GIS information to a multi functional GIS tool that can provide water quality information and present it in a spatial context. Other features

include land use information that can be viewed in conjunction with the protected water supply area map layers and information on legislation such as when a drinking water supply area was protected. The Drinking Water Quality web based GIS application has proven to be an imperative tool to the Water Resources Management Division.

The Langelier Index was introduced for the reporting of the fall 2004 drinking water quality data. The Langelier Index is an approximate indicator of the degree of saturation of calcium carbonate in water. It is calculated using the pH, alkalinity, calcium concentration, total dissolved solids, and water temperature of a water sample collected at the tap. The Langelier Index is one of several tools used by water operators for stabilizing water to control both internal corrosion and the deposition of scale. Water supply operators can optimize their water supply systems and identify leakage potentials using the Langelier Index. Leakage is a common problem in Newfoundland and Labrador due to the acidic nature of much of the water in the province. The Langelier Index has been the most useful tool developed for government departments and municipalities for the management of water supply systems on a proactive basis. The Langelier Index information will help communities to minimize the number of leaks, and will lead to savings of hundreds of thousands of dollars spent on leak detection and correction.

The department continues to work with Health Canada to develop guidelines for HAAs. To help develop these guidelines and in anticipation of the these guidelines, the department has been sampling selected supplies every year for HAAs.

Research continues to be conducted for a number of systems to help communities with high THMs concentrations and to develop guidelines that will help reduce the concentration of THMs. Work continues to be carried out in the area of chlorine demand management modeling. This modeling work will be used to develop generic Chlorine Best Management Practices (BMP) for the use of chlorine. These BMPs will help reduce the concentration of THMs and other disinfection by-products in drinking water.



5 Conclusions

Government is committed to ensuring the safety of drinking water for the residents of the province. The strategic action plan that government approved in May 2001 for drinking water safety is still being used and has been quite productive in providing results. This plan is based on the multi-barrier framework and is being implemented jointly by four government departments under the direction of the Deputy Minister's committee supported by a technical working group.

Substantial progress has been made on various elements of the MBSAP in the past fiscal year in order to provide clean, safe and secure drinking water to the people of this province. This includes the designation of 35 new protected water supply areas; investment of substantial capital funds on various water and sewer projects; improved internal reporting and management of drinking water quality data and boil water advisories through enhancements to the GIS application; reduction in number of boil water advisories; resolution of trihalomethanes and other drinking water quality issues (pH, colour, turbidity, barium, fluoride and lead) in a number of communities; improvements in regulatory approval and inspection systems; and delivery of 35 one-day seminars and 224 on-site training sessions under the operator education, training and certification program.

The GIS application continues to be an increasingly important tool in the management of water quality data and in the analysis of land use. The sampling and monitoring program continues to be conducted with samples collected from all public water supplies in the province. From this sampling, contaminants continue to be identified and are dealt with on a case by case basis. The system for reporting contaminant exceedances above the Guidelines for Canadian Drinking Water Quality continues to be used successfully in getting information to the community and all government departments involved. The need for specialized sampling in conjunction with federal government departments continues to be conducted as new issues emerge. The

Langelier Index has become a regular part of reporting water quality information to municipalities and should help reduce the number of leaks in a distribution system leading to savings in repair and maintenance costs. The WQI is another useful tool helping to provide drinking water quality information to the public. The WQI is able to take drinking water quality data and summarize it into straightforward terms providing information on the condition of drinking water quality for municipalities.

This report identifies the challenges and issues encountered throughout the 2004-05 fiscal year and the next section outlines a path forward to deal with them. Government, in cooperation with municipalities, will continue to respond to these challenges and it is anticipated that the already substantial improvements in relation to these issues will be augmented throughout the next year.



6 Path Forward

6.1 Government Action Plans - 2005 - 2006

6.1.1 Department of Environment and Conservation

In 2005-06 ENVC will continue to strengthen and expand all those elements of the MBSAP in which it is involved, especially source protection, regulation of water and sewer infrastructure, water quality monitoring and reporting, and its community based OETC program.

Source water protection is one of the key elements of the MBSAP and the first step to ensure drinking water safety. The Department of Environment and Conservation will continue to designate water supplies as protected areas as needed. In the coming fiscal year the policy directive for Land and Water Related Developments in Protected Water Supply Areas will be revised and updated. Revisions to this policy directive will help to improve legislative control of activities in protected public water supply areas. In order to strengthen its source protection program, in 2005-06 ENVC will continue to encourage the development of watershed management plans and establish watershed management committees as required. The watershed management plan for Steady Brook will continue to be worked on leading to an effective management tool once completed.

In the 2005-06 fiscal year, the Guidelines for the Design, Construction and Operation of Water and Sewerage Systems will be revised and updated. Also, a permitting system for the operation of water treatment plants will be developed. As part of these permits, terms and conditions will be established for a water treatment plant to operate under. These permits will provide better legislative control over how water treatment plants operate.

Approximately 3,236 samples will be collected for chemical water quality analysis in the upcoming fiscal year. In addition, samples will also be collected for QA/QC analysis and repeat sampling will be carried out on site specific exceedances. The entire cost of the chemical analysis will be borne by ENVC.

Based on the findings from drinking water quality monitoring, regulatory inspections and the OETC program, site specific contamination issues will continue to be identified and mitigation plans will be developed to address these issues on an as needed basis. Water treatment needs will be assessed as they arise for affected communities. As has been experienced to date, it is expected that priority concerns will be:

- Aesthetic parameters - pH and colour
- Contaminants such as turbidity, lead and barium
- THMs
- Bacteriological Parameters

The water well records database used to record information regarding groundwater wells in the province will be converted to an Oracle database management system. Use of an Oracle database management system allows for more effective sharing of data as well as having increased search capabilities.

The Department of Environment and Conservation will continue to improve public access to drinking water quality data especially through the departmental web page. The water supply atlas and public water supplies list will continue to be updated regularly. The drinking water quality information on the department's web page and in the DWQGIS application will be updated every quarter. The departmental drinking water quality web based GIS application will continue to evolve in the coming year. Once the testing of the application is completed, the application will be made available to the public through the departmental web page. Information on the departmental web page will be reviewed and updated to provide accurate, high quality in-

formation to the public. The department will continue to maintain boil water advisory information on its web page, based on the information provided by the GSCs.

The Water Quality Index reports and the Langelier Index reports that were introduced to the quarterly drinking water quality reports in the 2004-05 fiscal year will continue to be included in these reports. The WQI provides easy to understand information on drinking water quality and the Langelier Index provides valuable water quality information to help protect distribution systems that can lead to cost savings.

Health Canada is in the process of reviewing and updating the current guidelines for THMs and arsenic. The Federal Provincial-Territorial Committee on Drinking Water is the committee that is responsible for the establishment of the *Guidelines for Canadian Drinking Water Quality*. Through a consensus process, it votes on all proposed guidelines, and makes its recommendation to its parent committee, the Federal/Provincial/Territorial Committee on Environmental and Occupational Health (CEOH). CEOH must then approve all new or revised guidelines. The current guideline for THMs is 0.100 mg/L and the current guideline for arsenic is 0.025 mg/L. Guidelines are constantly reviewed and revised to reflect new treatment methods and new information on health risks.

The Department of Environment and Conservation will continue to focus its effort on operator education, training and volunteer certification to ensure the long term sustainability of the municipal water infrastructure and the delivery of clean and safe drinking water. Work in this area continues to be very well received by municipalities and has resulted in a number of operational and maintenance related improvements. The OETC program continues to provide training to the many municipalities across the province. The focus for training for the coming fiscal year will be on leak detection, pressure reducing valves and chlorination systems. In the 2005-06 fiscal year information for the OETC program will be available through the departmental web page. The public will be able to access a database to see the types of training equipment and resource materials

that are available and which ENVC regional office they are located in. The public can then request to see specific equipment or materials during the next on-site training session by the MTU.

The drinking water safety workshop continues to be held on an annual basis and is scheduled to be held in Gander on March 21st, 22nd and 23rd 2006. The theme for the workshop is "Operation and Maintenance of Water Supply Systems". The workshop will again include a trade show to enable representatives from the drinking water industry to showcase equipment and technologies used in the supply and distribution of clean and safe drinking water.

6.1.2 Department of Municipal Affairs

The Department of Municipal Affairs is encouraging regionalization of water supply systems where smaller communities in the region will be serviced by bigger communities. It is also encouraging water operator regionalization. The department will provide an appropriate level of funding for such projects. The department is encouraging municipalities to invest in treatment technology that is appropriate to their particular situation from a technical and from an economical point of view.

The department will continue to provide financial assistance to communities wishing to attend the training, workshop and certification courses relating to drinking water safety.

6.1.3 Department of Health and Community Services

In 2005-2006 the Department of Health and Community Services will continue with initiatives that support safe drinking and activities aimed at bringing about improvements and/or efficiencies to the provincial bacteriological water quality monitoring program.

The actions/initiatives are summarized below.

1. The Public Health Laboratory (PHL) will assume the responsibility of inputting municipal bacteriological water quality results into MIMS. Municipalities included in this initiative are St. John's, Mount Pearl, Paradise, Conception Bay South and other communities on the Avalon Peninsula.
2. Further information management enhancement will be achieved with the PHL taking over responsibility for the verification of bacteriological water quality reports for these municipalities. Water samples collected by Environmental Health Officers (EHOs) will be verified by themselves.
3. Following a successful pilot project during 2004-2005, bacteriological water quality testing will be enhanced on the northern peninsula and southern Labrador with the establishment of a permanent regional bacteriological water testing site in St. Anthony.
4. In an effort to streamline the entry of bacteriological water quality data into electronic information systems, the PHL will work with the Department of Municipal Affairs on enhancements to MIMS.
5. Policy and technical support will be provided to officials at the Department of Government Services who carry out bacteriological water quality monitoring and the interpretation of bacteriological water quality test results.
6. Drinking water safety promotional material will be reviewed, enhanced and made available to the public and municipal officials.

7. The Department of Health and Community Services and the Department of Environment and Conservation in partnership with the other organizations will host a *Climate Change and Health* conference late in 2005-2006. Water quality will be one of the topics discussed at the conference.

6.1.4 Department of Government Services

The 19,410 bacteriological water samples collected during the 2004/05 fiscal year represents a 4.3% increase over the 2003/04 total and over 98% of the number of water samples recommended in the Provincial Standards and the Guidelines for Canadian Drinking Water Quality. In part, staff shortages in some areas during the year, due to a country-wide shortage of Environmental Health Officers (EHOs), contributed to not achieving the 100% mark. The Department will continue to strive to meet the 100% target through active recruitment measures and monitoring of EHO activities.

A new communications protocol has been developed with municipalities to ensure that two consecutive, "Satisfactory" bacteriological tests are required before a non-consumption order is lifted. Non-consumption orders are generally associated with major water system failures such as widespread flooding or water main breakdown. These are not the same as boil water advisories where the water may be consumed provided it is boiled properly.

The protocol was developed to ensure that those municipalities that turn off their disinfection system while a non-consumption order is in place, have the system turned on again and the water tested before the non-consumption order is lifted. Checks are proposed for the MIMS system to ensure that this protocol is followed.

Government Services will also continue to work closely with the Public Health Laboratory and the Medical Officers of Health/Regional Integrated Health Authorities to maintain effective communication of bacterio-

logical water quality test results to communities and to recommend pro-active, preventative measures such as boil water advisories when necessary for the safety of public drinking water in the province.

6.2 Inter-Departmental Cooperation

The Safe Drinking Water - Technical Working Group (SDWTWG) consists of representatives from the four government departments responsible for certain aspects of providing clean and safe drinking water through the implementation of the MBSAP and includes representation from the Public Health Laboratory, the Medical Officers of Health and Executive Council.

The SDWTWG meets frequently and reports its activities to the steering committee of senior government officials. This working group ensures that the participating departments are always apprised of current events pertaining to drinking water. It allows appropriate efforts to be directed at emerging issues with the best available resources without duplication. The SDWTWG is an effective networking mechanism.

Some of the major accomplishments of the SDWTWG in 2004-05 include:

- Coordinate the implementation of the Municipal Information Management system for regional entry of bacteriological data and initiate other functional changes to the program.
- Review boil water advisories for communities in the province to ensure accurate public reporting along with the explanation of the appropriate reasons for the advisories.
- Review guidelines and discussion paper for commercial/institutional water supplies
- Discuss Health Canada's public consultation document for Arsenic.
- Review the role of private laboratories that carry out public health related water quality analysis.
- Review standard protocols for issuing and rescinding boil water advisories in communities where additionally there is a "Non-Consumption Order" in place.

- Help prepare and review the "*Drinking Water Safety in Newfoundland and Labrador Annual Report 2004*".

This coordinated approach by government will be continued to ensure substantial progress in implementing the MBSAP for drinking water safety.

