

Chapter 11 The Management of Municipal Water Systems

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Chapter 11 The Management of Municipal Water Systems

11.1 Introduction

In this chapter, I discuss the ways I envision bringing management and operating practices at water systems in Ontario to the highest standards possible. In particular, I recommend that municipal water providers¹ adopt a “quality management” approach, both through an accreditation program and through operational planning – including an emergency response plan – at all municipal water systems.

Ultimately, the safety of drinking water is protected by effective management systems and operating practices, run by skilled and well-trained staff. In Chapters 5 through 8, I discuss the technical barriers that protect the safety of drinking water. It is clear that the technology for treating and monitoring water quality to a high standard is well established. Failures in Walkerton, and elsewhere, appear to arise because of poor management or the inadequate implementation of good practices.²

The idea of quality management is that a water provider should continuously ensure that systems and processes are in place that take advantage of the available technology to design and implement effective multiple barriers. This approach expands the conventional focus and reliance on technological aspects of water systems to include the people responsible for managing and operating the system, and the strategies they adopt to ensure the safety of drinking water.

¹ The term “water provider” is intended to include both the owner and operator of a water system serving a municipality. The terms “owner” and “municipality” refer to the owner alone. The term “operating agency” refers to the entity assigned the direct responsibility for managing and operating the water system. Generally, legal requirements have been assigned to the owner/municipalities because they hold the title to the system, they have the statutory authority to raise revenues, they have the due diligence responsibilities discussed in Chapter 10, and the operating agency may change.

This chapter focuses on municipal water systems for two reasons. First, most Ontarians are served by those systems. Second, private communal systems, private household wells, and other non-municipal water systems raise some different issues, which I discuss in Chapter 14.

² See S.E. Hrudey et al., 2002, “A fatal waterborne disease epidemic in Walkerton, Ontario: Comparison with other waterborne outbreaks in the developed world,” proceedings at the Health-Related Water Microbiology Symposium, International Water Association World Water Congress, Melbourne, Australia, April 7–12.

There is one point I would like to make clear at the outset: the concept of quality management is not new, and I do not view it as antithetical to the current practices of water providers in Ontario. The water industry is moving to quality management in other jurisdictions, and many municipalities in Ontario have already adopted a managerial model that will comply with the requirements I am recommending here. As such, the recommendations are not intended to provoke a scramble to meet yet another level of operating standards; to do so could cause more harm than good. Rather, the recommendations are intended to give additional tools for water providers to build on and improve the many excellent management and operating practices that currently exist, and to spread those to the greatest extent possible across the province.

If the water industry meets this challenge, Ontario should be among the leading jurisdictions in terms of ensuring the safety of drinking water. In this regard, I am pleased by the support offered by the Ontario Municipal Water Association and the Ontario Water Works Association on behalf of their members for the quality management approach I am recommending. As these associations indicated at the Inquiry, quality management “has the ability to verify that industry best practices are being employed to produce water of the highest quality.”³

11.1.1 Drinking Water Quality Management

The purpose of the quality management approach in the context of drinking water is to protect public health by achieving consistent good practice in managing and operating a water system. The hallmarks of this approach include

- the adoption of best practices and continuous improvement;
- “real time” process control (e.g., the continuous monitoring of turbidity, chlorine residual, and disinfectant contact time) wherever feasible;
- the effective operation of robust multiple barriers to protect public health;
- preventive rather than strictly reactive strategies to identify and manage risks to public health; and

³ See A. Davies, for the Ontario Water Works Association/Ontario Municipal Water Association, 2001, “Effective water utility management and organizational behaviour: A report on selected issue 11 matters for the Walkerton Inquiry,” Walkerton Inquiry Submission, p. 20.

- effective leadership.⁴

An important assumption of quality management is that, in evaluating or improving a management system, one should look at the process by which something is produced as well as the end product. In this way, one is able to adopt a preventive approach of improving the process before public health is put at risk. The focus on prevention distinguishes quality management from more reactive approaches to management or regulation, as exemplified by the traditional emphasis on compliance with numerical standards of water quality.⁵ There are many conventional approaches to management and regulation that are geared to prevention – such as operator training and facilities approval – but the quality management approach can improve on them by promoting a comprehensive preventive strategy for drinking water safety.

11.1.2 Applying the Quality Management Approach

Quality management requires a commitment to seeking and implementing improvements at every level of the water provider's policy- and decision-making, from the policies of corporate management to the day-to-day decisions of those who have responsibility at the ground level. It begins with a commitment by the water provider, led by its owner and senior management, to improve the performance of the system continuously. But quality management must also be specific and clear from the perspective of operating staff. If it is not implemented in a practical and relevant way, in the context of the actual operation of a water system, then its value is limited.

⁴ This summary is adapted from the various models summarized in section 11.2.

⁵ In relation to regulation, the National Health and Medical Research Council of Australia has described this limitation to some of the conventional approaches as follows:

In the past there has been a heavy reliance by many agencies on compliance monitoring as a mechanism for managing drinking water quality and notionally for the protection of public health. However, reliance on compliance monitoring has major limitations including the shortcomings of sampling and analytical techniques; inadequate consideration of the range of events that impact on drinking water quality; and failure to provide an effective response to contaminants without a prescribed numerical guideline value or established method of analysis.

See National Health and Medical Research Council of Australia, 2001, *Framework for Management of Drinking Water Quality – Background* <www.health.gov.au/nhmrc/advice/waterbkd.htm> [accessed April 3, 2002].

The Ontario Municipal Water Association, Ontario Water Works Association, Ontario Public Service Employees Union, and water industry experts all expressed similar reasons for adopting quality management in their submissions to the Inquiry.

The implications of quality management depend on the size and complexity of the water system, or network of water systems, for which an operating agency is responsible.⁶ Large operating agencies, responsible for multiple water systems, will require a quality management system that is adaptable to a variety of situations. Smaller water providers, responsible for a single water system, may be able to develop a quality management system based on a relatively narrow set of circumstances.

In order to see how quality management should be applied, it is helpful to distinguish the corporate level of management from the operational level:

- The *corporate* management of an operating agency is responsible for an entire water supply system or network of water supply systems.
- The *operational* management of an individual water system, or of a specific component of that system (e.g., the treatment plant, distribution system, or monitoring system), is responsible for the day-to-day operation of that system or component.⁷

Managers and staff at both the corporate and the operational levels of a water system have a critical role to play in ensuring the provision of safe drinking water. Yet the means available to identify and realize opportunities for improvements will depend on the level of management in question.

11.1.2.1 *The Requirement for Accreditation*

I recommend below that all municipalities be required to have an accredited operating agency for their water system. Accreditation is intended to focus on the processes and systems that an operating agency puts in place at the corporate level to ensure that the entire organization is functioning effectively. Accreditation will be based on a drinking water quality management standard that has been developed by the industry, as well as other key stakeholders, and recognized by the provincial government.

⁶ In large systems, there might be hundreds of individual operators, supervised by dozens of plant and system managers, who are under the direction of a large corporate head office and management team. In small systems, on the other hand, a single person might be responsible for the daily operation of the system as well for many aspects of its management.

⁷ I discuss the role of individual operators, including the need for the certification and ongoing training of operators, in Chapter 12.

To be accredited, operating agencies would be required to adopt a quality management system and would be subject to independent audits by a certified accrediting body. The primary purpose is for senior management of the operating agency to be able to demonstrate to the owner of a water system that the system is being run effectively, so that the owner is confident that the system is capable of delivering safe drinking water. Having an accredited operating agency will do much to satisfy the owner's due diligence responsibilities and standard of care. I reiterate that many water providers have already adopted a managerial model similar to the type of quality management system I envision.

11.1.2.2 *The Requirement for an Operational Plan*

As part of its corporate quality management system, an operating agency will need to undertake operational planning at all of the individual water systems for which it is responsible. The safety benefits of the quality management approach make it desirable to formalize operational planning at the plant- or system-specific level as a regulatory requirement. Therefore, I recommend below that all municipalities be required to have an operational plan for their water system or, depending on the size and complexity, for each component of the system (e.g., the treatment plant, distribution system, and monitoring system). The plan should be public and should be subject to functional approval and review by the MOE, as I discuss in section 11.4.5.

I do not intend that the operational plan should become a whole new layer of paperwork for municipal water providers. Rather, I see it as a vehicle for management and staff to carefully outline, and periodically revisit, the barriers and strategies they have put in place to ensure safety. So that this requirement will not be overly bureaucratic, the general form of the operational plan should be left to the water provider to develop, and the MOE should provide model plans for assistance only. The existence of an accessible operational plan will also facilitate reviews of a water system by outside personnel, including MOE inspectors and consulting engineers.

11.2 Models of Drinking Water Quality Management

The examples of quality management plans outlined in the following sections are useful examples for both accreditation and operational planning in Ontario.

11.2.1 General Models

The quality management approach originated in general models such as ISO 9000, ISO 14000, and the HACCP (Hazard Analysis and Critical Control Point) system.⁸ These models provide generic requirements for organizations carrying out a wide range of activities.

11.2.1.1 ISO Standards

ISO 9000 is an international standard adopted in 1987 by the International Organization for Standardization (ISO) setting specific criteria for documenting and establishing a quality management plan.⁹ Its purpose is to show that a company documents its quality management principles and procedures, and that it operates according to them. Specific ISO standards have been designed and adopted in various industries, such as the aerospace, automobile manufacturing, and telecommunications industries. The European Union has begun to develop an ISO standard that is specific to the water industry.¹⁰

⁸ See International Organization for Standardization, *The Magical Demystifying Tour of ISO 9000 and ISO 14000* <www.iso.ch/iso/en/iso9000-14000/tour/magical.html> [accessed April 3, 2002]; and Canadian Food Inspection Agency, 2001, *Food Safety Enhancement Program Implementation manual* <www.inspection.gc.ca/english/ppc/psps/haccp/manu/manue.shtml> [accessed April 2, 2002].

⁹ The International Organization for Standardization was established in 1947 to develop common international standards in a range of areas. Its membership consists of national standards organizations from over 120 countries. For more information, see the ISO's Web site <www.iso.ch> [accessed April 3, 2002].

¹⁰ International Organization for Standardization, AFNOR (France), 2001, "ISO/TS/P 194, 2001 – Standardization of service activities relating to drinking water supply and sewerage: Quality criteria of the service and performance indicators," proposal for a new field of technical activity, April 17, 2001.

11.2.1.2 *The HACCP System*

The HACCP (Hazard Analysis and Critical Control Point) system is a quality management plan that aims to apply a preventive approach to food production as a means of ensuring food safety. Briefly, HACCP is a systematic approach to the identification, evaluation, and control of food safety hazards. Rather than checking products after they are manufactured, the system identifies critical points in the production process and puts controls at these points to reduce the risk of food contamination.

11.2.2 **Water Industry–Specific Models**

ISO standards and the HACCP system are generally not specific to the water industry. The starting point for an accreditation standard in Ontario should naturally be the frameworks that are specific to the water industry. Examples of these water-specific models include

- the American Water Works Association QualServe program, Partnership for Safe Drinking Water, and International Water Treatment Alliance;
- the Australian *Framework for Management of Drinking Water Quality*; and
- the *Guidelines for Drinking-Water Quality Management for New Zealand*.

Each of these models should be assessed in relation to the development of operational plans for municipal water systems and the creation of an accreditation standard. The models differ in various ways, such as in the degree to which they focus on a particular component of a water system (especially treatment plants), the degree to which they focus on specific barriers rather than the overall management system, and the degree to which they are oriented to systems of different size and complexity. As such, they will have different strengths and weaknesses. In designing Ontario's standard, the goal should be to include all components of the system that relate to ensuring drinking water quality, to address both the corporate and the operational level of management, and to incorporate systems of varying size and complexity.

11.2.2.1 *American Water Works Association Programs*

The Partnership for Safe Drinking Water and the International Water Treatment Alliance: The membership of the American Water Works Association (AWWA) includes utilities from across both the United States and Canada – the Ontario Water Works Association (OWWA) is the provincial AWWA chapter. The AWWA Partnership for Safe Drinking Water is a cooperative effort of U.S. agencies to review operating practices at treatment plants, in which more than 200 utilities have been participating since 1995.¹¹ The International Water Treatment Alliance adapts this program to other countries; it has recently been implemented in Quebec with provincial funding. The International Water Treatment Alliance is a cooperative effort of the AWWA, water utilities, and in some cases foreign water organizations dedicated to safe drinking water.¹²

Both programs are part of a broader effort to improve operational aspects of water facilities. As outlined below in relation to the AWWA QualServe program, the approach is based on data collection and self-assessment, peer review, and optional outside assessment.

The QualServe Program: QualServe is a voluntary quality improvement program created by AWWA (representing water utilities) and the Water Environment Federation (representing wastewater utilities) in 1997.¹³ Since its inception, the QualServe program has relied on two steps: self-assessment and peer review. In the first step, water providers and their staff are asked to fill out detailed questionnaires relating to all aspects of the management and operation of the water system. Their responses are then reviewed by a team of expert peers in the water industry who have undergone training in the QualServe

¹¹ The Partnership for Safe Drinking Water involves the American Water Works Association, the Association of Metropolitan Water Agencies, the U.S. Environmental Protection Agency, the National Association of Water Companies, the Association of State Drinking Water Administrators, and the American Water Works Research Foundation.

¹² E. Doyle et al., 2002, "Production and distribution of drinking water," Walkerton Inquiry Commissioned Paper 8, pp. 94–95; and J.A. MacDonald, for OWWA/OMWA, 2001, "Review of issue #8 – Production and distribution of drinking water," Walkerton Inquiry Submission, pp. 18–19.

¹³ See QualServe, 1997, "Self-assessment and peer review for water and wastewater utilities" (Denver, CO: AWWA/WEA); and QualServe, 1998, "Program guidance part 1: Guidance for participating utilities" (Denver, CO: AWWA/WEA). See <www.awwa.org/qualserve> [accessed April 9, 2002].

program.¹⁴ More recently, QualServe has expanded to a benchmarking program and an accreditation (described below). Overall, QualServe aims to assist utilities to achieve best practices in each of the processes involved in its operations and services, and to develop programs to improve performance on an ongoing basis.¹⁵

The AWWA Accreditation Program: The AWWA plans to integrate the existing QualServe program into a full accreditation program, based on third party audit and registration according to an accreditation standard.¹⁶ An AWWA committee is developing an evaluation system that will confer accreditation based on water and wastewater utilities meeting defined operating and management standards. Under the program, a utility would be able to accredit to standards for the treatment plant, distribution system, source water, business and planning processes, communications, wastewater collection, wastewater treatment, wastewater pre-treatment monitoring, biosolids handling and management, and conservation and reclamation of water. However, the accreditation program is several years away from being fully operational.¹⁷

11.2.2.2 *The Australian Framework for Management of Drinking Water Quality*

The Australian *Framework for Management of Drinking Water Quality*¹⁸ is intended as a template for best practices in the management and operation of water utilities, to support a more consistent national approach to drinking water quality.¹⁹ The rationale of the document is:

to promote an understanding of the entire water supply system, the events that can compromise drinking water quality and the

¹⁴ Peer review teams consist of three to five trained peers who share the tasks of examining the major areas of utility operations: customer relations, business operations, organizational development, water operations and/or wastewater operations. QualServe, 1997, p. 10.

¹⁵ The program is designed for utilities to conduct self-assessments every two to four years, and peer reviews every four to seven years.

¹⁶ See <www.awwa.org/qualserve/accreditation.htm> [accessed April 9, 2002]. See also MacDonald, p. 19.

¹⁷ The American Water Works Association anticipates that all of its accreditation standards will be available in 2005.

¹⁸ National Health and Medical Research Council of Australia/Agricultural and Resource Management Council of Australia and New Zealand Co-ordinating Group, 2001, *Framework for Management of Drinking Water Quality – A Preventative Strategy from Catchment to Consumer* <www.health.gov.au/nhmrc/advice/waterbkd.htm> [accessed April 3, 2002].

¹⁹ Ibid.

operational control necessary for assuring the ongoing reliability and safety of drinking water supplies.²⁰

The framework is organized into 12 elements: commitment to drinking water quality management, assessment of the drinking water supply system, planning-preventive strategies for drinking water quality management, implementation-operational procedures and process control, verification of drinking water quality, incident and emergency response, employee awareness and training, community involvement and awareness, research and development, documentation and reporting, evaluation and audit, review and continual improvement.

The development of the framework has been coordinated by the National Health and Medical Research Council of Australia under the auspices of the Agriculture and Resource Management Council of Australia and New Zealand. Although it has not yet been implemented as part of a national program in Australia, the framework is providing the primary basis for the 2002 restructuring and revision of the Australian Drinking Water Guidelines as a preventive, quality management approach to water quality.²¹

11.2.2.3 Guidelines for Drinking-Water Quality Management for New Zealand

Since 1993, public health “grading” of community water supplies in New Zealand serving more than 500 people is carried out by regional health authorities.²² The grading system adopts a preventive, process-oriented approach to the multi-barrier protection of drinking water.²³

²⁰ Ibid., p. 1.

²¹ The framework was also reviewed in May 2001 by the Microbiology Working Group and the Protection & Control Working Group of the World Health Organization (WHO) in connection with development of the third edition of the *WHO Drinking Water Guidelines*, forecast for release in 2003.

²² As part of the grading system, drinking water supplies are examined according to 33 aspects of the source and treatment of the water, and 22 aspects of the distribution system and treated water quality. All community water systems that serve more than 25 people for longer than 60 days a year are required to be registered on a national registry of community drinking water supplies. Government of New Zealand, Ministry of Health, 2001a, *Register of Community Drinking-Water Supplies in New Zealand* (Wellington: Ministry of Health), pp. 4, 9.

²³ Ibid., p. 9, which states in relation to the grading system: “There is a strong concern, not only about the quality of the end product, but also about whether adequate barriers to potential contamination are in place in the system.”

The New Zealand Ministry of Health is currently examining options for further integrating public health risk management plans into New Zealand's drinking water grading system.²⁴ The Guidelines for Drinking-Water Quality Management for New Zealand have been incorporated as "background and supporting information" in New Zealand's Drinking Water Quality Standards in order to demonstrate how risk management principles can be applied for community water supplies.²⁵ The guidelines would require water suppliers to undertake critical point identification, risk assessment, risk management, contingency planning, and quality assurance.²⁶ The intent is to strengthen the existing *Health Act* as it applies to drinking water supplies by:

- placing duties on drinking water suppliers to take all practicable steps to comply with drinking water standards;
- requiring drinking water suppliers to introduce and implement public health risk management plans;
- providing for Ministry of Health officers to act as assessors to verify compliance with standards, the adoption and implementation of public health risk management plans, and the competence of water supply staff who carry out process and field analyses; and
- requiring designated assessors to have their competence accredited by an internationally recognized agency.²⁷

To assist water suppliers in preparing for this requirement, the Ministry of Health has published a number of risk management planning guides covering various elements of the system, such as filtration, treatment, water storage, distribution, and staff training.²⁸ The guides provide useful models for

²⁴ K. Botherway, 2001, Office of the Parliamentary Commissioner for the Environment, New Zealand, e-mail to the Walkerton Inquiry, September 24.

²⁵ New Zealand, Ministry of Health, 2000a, *Drinking-Water Quality Standards for New Zealand 2000* (Wellington: Ministry of Health), p. 5.

²⁶ As proposed, these requirements would apply to four stages of water supply system: collection of raw water, treatment, distribution to consumers, and consumer storage and distribution. See New Zealand, Ministry of Health, 2000b, *Safe Drinking-Water: A Paper to Local Government* (Wellington: Ministry of Health), p. 10.

²⁷ New Zealand, Ministry of Health, 2001b, "Frequently asked questions about drinking water standards" <www.moh.govt.nz>.

²⁸ The risk management planning guides are available to water providers and to the public on the ministry's Web site <www.moh.govt.nz> [accessed April 3, 2002].

operational planning in Ontario water systems and are particularly helpful in terms of their application to small systems.

11.2.2.4 *Conclusion*

These examples of quality management design and implementation in other jurisdictions provide a strong basis for mandatory accreditation and operational planning in Ontario. There are other important examples of quality management, such as Ontario Clean Water Agency's (OCWA) Environmental Management System, which is based on ISO 14001.²⁹ OCWA's system may be useful not only because it originates in the Ontario context but also because it has been implemented by a large operating agency that is responsible for many small systems. As such, it has been implemented at both the corporate and the operational levels.

11.3 Accreditation

11.3.1 The Requirement for Accreditation

Recommendation 51: The provincial government should require all owners of municipal water systems, as a condition of their licence (see Recommendation 71), to have an accredited operating agency, whether internal or external to the municipality.

I am recommending the accreditation of operating agencies, which would require the operating agency to have a quality management system based on a drinking water quality management standard recognized by the Province. Although the quality management system would be adopted at the corporate level, the operating agency would have to demonstrate that it was implementing quality management at the water systems under its authority. Thus, the corporate quality management system would establish the organization's commitment to the quality management approach. It would also provide overarching direction about the implementation of operational planning to managers and staff at the plant- or system-specific level. A primary purpose of the quality management

²⁹ The Inquiry was limited in its ability to learn about OCWA's Environmental Management System because the provincial government did not permit Commission staff to meet or communicate directly with OCWA. General information about OCWA's system was provided to the Inquiry by the Ontario Public Service Employees Union and by experts outside the provincial government.

system is to enable senior management to demonstrate to the owner that its water system is being managed and operated to deliver safe drinking water on a reliable basis.

11.3.2 Independent Audits

Recommendation 52: Accreditation should be based on an independent audit and a periodic review by a certified accrediting body.

Accreditation should be verified by way of an external audit performed by an independent third party which itself must be approved for its competence and commitment. The role of the auditor is to visit and report on an operating agency's performance with respect to accreditation standards and to give a timeline for corrective action. Thus the auditor will review the agency's quality management system and examine how it has been implemented at the water system, or in a sampling of water systems, under the operating agency's responsibility.³⁰ Scheduled audits of an operating system should occur regularly. For reasons of accountability and transparency, audit results should be provided to the MOE and made available to the public. If the auditor finds a violation of a regulatory requirement, the auditor should report it to the Ministry of the Environment.

Auditors should be certified by a designated³¹ accrediting organization. For accreditation to be useful, audits should be carried out by persons with experience in the water industry. It would not be appropriate to rely on persons who have only general expertise in quality management (such as ISO or HACCP) and who do not have substantial experience in the water industry. Persons certified as auditors should therefore be required to have experience and expertise in relation to the provision of drinking water, and I would suggest that most auditors be drawn from the relevant industry associations, so long as

³⁰ The Ontario Public Service Employees Union submitted to the Inquiry that accreditation be facility-based for three reasons: (1) so that non-conformity in one facility does not affect operating privileges of conforming facilities operated by the same operating agency, (2) to increase the likelihood that the consequences of non-conformity will be applied, and (3) because different plants will have different valid drinking water production processes that need to be individually considered. In terms of the first reason, I recommend below a variety of responses to non-compliance that will address this concern. In terms of the second and third reasons, I am satisfied that an appropriate balance between thoroughness and practicality of implementation will be struck by the dual accreditation and operational planning approach that I am recommending.

³¹ By the Ministry of the Environment.

they are willing to play this role, complemented where necessary by staff from the MOE's Drinking Water Branch.

To ensure an adequate supply of auditors, members of the water industry – from within as well as from outside the province – should be encouraged to play a prominent role.³² The provincial government, in concert with industry associations, should take steps to enable water providers to make their managers and employees available as auditors. If necessary for the accreditation system to function effectively, the provincial government should indemnify participating industry associations and water providers from potential liability arising from the participation of their members or staff.

11.3.3 The Development of a Drinking Water Quality Management Standard

Recommendation 53: The Ministry of the Environment should initiate the development of a drinking water quality management standard for Ontario. Municipalities, the water industry, and other relevant stakeholders should be actively recruited to take part in the development of the standard. The water industry is recognized as an essential participant in this initiative.

The provincial government should initiate forthwith the development of a drinking water quality management standard. The MOE should enter into an agreement with an appropriate body to manage the development of the standard.³³ The process must actively recruit key stakeholders, particularly experienced representatives of the water industry, in light of the important role that water providers must play in it.

The standard should be based on models of drinking water quality management and industry best practices from other jurisdictions, although no single model need drive the development of the Ontario standard. The standard should be universally applicable; that is, it should accommodate water providers of various

³² During Part 2 of the Inquiry, I visited a number of water facilities that demonstrated some of the outstanding expertise that currently exists in Ontario; this expertise should be marshalled and directed to spreading good practices across the province.

³³ One option would be for the Province to contract with the Canadian Standards Association, a not-for-profit association that operates as part of the National Standards System coordinated by the Standards Council of Canada, to develop the standard.

sizes and complexity. To a reasonable extent, the process should also refer to the model operational plans developed by the MOE, as I recommend below.

The Ontario standard should not await the finalization of quality management standards in other jurisdictions. I do not consider it advisable, in particular, to await an AWWA or ISO accreditation standard.³⁴ Quality management is simply too important to rely on the expediency of actors outside the province. Enough progress has been made in developing the key concepts for drinking water quality management standards that Ontario can proceed expeditiously without awaiting cross-jurisdictional programs.

In light of the varying circumstances of water providers across Ontario, it is important that the drinking water quality management standard be adaptable, as appropriate, to water systems of different size and complexity. It should not exclude or discriminate against small water providers that are capable of effective operational planning according to the quality management approach. This is not an unrealistic expectation: quality management has been tailored to systems of varying size and complexity, including small systems, in other jurisdictions.³⁵

In particular, accreditation should not demand so much organizational depth that it dooms all small water providers to extinction or causes a mass “shakeout” in the industry. The emphasis must be on the ability of any operating agency to assure the delivery of safe water. Larger, more complex systems will require greater management complexity, while smaller systems may have much more straightforward management and operating requirements. Although accreditation will no doubt lead many municipalities with small water systems to regionalize or engage an external operator, it is also desirable for well-run

³⁴ Further, the accreditation standard for water systems should not be delayed to incorporate wastewater systems, even though it is probably desirable to have both a water and wastewater accreditation program, as contemplated by the AWWA accreditation standard discussed in section 11.2.

³⁵ QualServe, for example, has been adapted for use by small water utilities, although its original focus was on large and medium-sized systems. Also, the AWWA initiative for capacity development for smaller utilities highlights quality management tools for small systems, such as information management, regular reporting, audits, performance analysis, peer review, and, assessments of options for restructuring. See J.A. Beecher and S.J. Rubin, 2001, “Ten practices of highly effective water utilities,” *AWWA Opflow* (April), p. 6; and A. Davies, for OWWA/OMWA, Walkerton Inquiry Submission (Public Hearing, September 20, 2001), transcript p. 17. In addition, the Australian *Framework for Management of Drinking Water Quality* was developed by performing desktop trials by water providers, including some that operate many small water systems. Finally, the risk management planning guides developed by the New Zealand Ministry of Health have been designed for small systems.

small systems to be able to achieve accreditation. The provincial government should ensure that a number of capable small water providers participate in developing and implementing accreditation.

I have focused my comments here on small systems because they may present unique challenges in terms of the design of an accreditation standard. However, I recognize that municipalities of all sizes rely on a variety of arrangements for the management and operation of their water systems.³⁶ The accreditation standard will need to consider and accommodate these realities. I do not propose to be prescriptive in this regard. The details of accreditation are best left to those with the relevant experience and expertise in the industry.

11.3.4 The Role of the Water Industry

I have emphasized that the water industry must be actively recruited to participate in the standard development process, to allow those individuals who have the most expertise and experience in Ontario's industry to assume a leadership role in the process. Since the main reference points for defining due diligence are the best practices of the industry, leading water providers should be called on to play a central role in defining and implementing accreditation. It is they who are most familiar with how water systems can be organized to deliver water of the highest quality.

Industry leaders should welcome the opportunity to raise practices up to the best. Their common vision for ensuring the safety of drinking water will be essential to the successful implementation of accreditation and operational planning. The draft standard that emerges from the Ontario accreditation process should therefore not be recognized by the MOE without the approval and support of water industry representatives.

During the Inquiry, the concern was expressed that if the industry plays a prominent role in the standard development process, accreditation will emerge as a form of industry self-regulation and that somehow safety will be less

³⁶ For example, the municipality might contract out the operation of the treatment plant while retaining the operation of the distribution system; alternatively, the municipality might contract out the entire operation while retaining aspects of the overall management, such as billing and financial planning.

protected. I do not share this concern in light of the dual approach I am recommending – based on mandatory accreditation and operational plans – and because of the existence of much excellent practice in Ontario. Also, the goal of the water industry and the objective of accreditation are essentially the same: to maximize the safety of drinking water through the consistent use of good practices. By involving a diverse range of industry representatives and working in concert with government representatives, one would expect that best practices would be brought to the table and integrated into the standard. Moreover, experienced leaders in Ontario's water industry are in the best position to comment on how to design a standard that is practical and meaningful in relation to ground-level operational planning.

I also note that stakeholders from outside the industry, including consumer representatives and MOE personnel, should also be involved in the standard development process. Ultimately, it will be up to the provincial government to ensure that the standard that comes into force is appropriate from a safety perspective.

11.3.5 Peer Review

No matter how well it is run, an organization can benefit from constructive suggestions about its operation from people who do the same type of work in similar organizations. A benefit of mandatory quality management is that it will encourage the cross-fertilization of ideas and approaches from managers and operations staff of different water systems. This can be promoted through peer review, whereby management and staff obtain confidential and collegial feedback on their operations, and suggestions regarding any areas for improvement. In larger operating agencies, peer review opportunities may be available internally. Smaller water providers may need to participate in an external peer review program.

To support the implementation of mandatory accreditation and operational planning, therefore, the Province should contribute start-up funding for a formal peer review program. Such a program should be supported at least over the next few years, as municipalities develop their operational plans, as discussed in section 11.4. Participation in the program should be voluntary, but the provincial government should offer incentives to water providers, especially smaller ones, to participate. The AWWA's International Water Treatment Alliance (IWTA) is a good example of this type of self-assessment and peer

review program, although its application is focused on water treatment plants.³⁷ The Ontario Water and Wastewater Association offered in its submissions to the Inquiry to implement the IWTA program in Ontario, provided that the provincial government provides start-up funding.³⁸ I agree with this approach, although I also consider it reasonable to expect water providers to pay for the costs of undergoing an external peer review as part of the program.³⁹

11.3.6 The Role of the Ministry of the Environment

Recommendation 54: The Ministry of the Environment's Drinking Water Branch (see Recommendation 69) should have the responsibility for recognizing the drinking water quality management standard that will apply in Ontario and for ensuring that accreditation is properly implemented.

As I discuss in Chapter 13, accreditation is complementary to – not a substitute for – the regulatory role of the MOE. In addition, the water industry can and must play a central role. For these reasons, it is acceptable for the development and implementation of the accreditation standard to be contracted to a third party. The provincial government, however, remains responsible for the oversight of water systems in Ontario and, as such, it has a role to play in ensuring that accreditation serves its intended purpose.

The MOE should participate in the standard development process and should be responsible for recognizing the standard that emerges from that process. In addition, the MOE should ensure the proper implementation of accreditation, not by directly carrying out audits or administering the program, but by receiving and reviewing audit reports in conjunction with provincial approval and inspection of water systems. In this respect, the MOE should retain a residual audit capacity so that it can, if necessary, conduct an informed review

³⁷ Under the IWTA, peer review teams receive training from the AWWA that is oriented toward water or wastewater facilities of various sizes. Team members are drawn from experienced water and wastewater utilities' senior managers. All are volunteers who are reimbursed for travel expenses only. A number of municipal water providers in Ontario have taken part in the QualServe peer review program, including Fort Erie, Ottawa-Carleton, and Waterloo. For more information, see <www.awwa.org/qualserve> [accessed April 2, 2002].

³⁸ MacDonald, p. 19.

³⁹ If, for reasons of cost, the peer review program is not reasonably accessible to water providers, the MOE should compensate for this by making additional technical assistance available to those systems.

of an operating agency's quality management system, or verify the accuracy of an external audit.⁴⁰

The MOE is the most appropriate ministry to assume the regulatory responsibility for developing the accreditation standard. Staff in the MOE's Drinking Water Branch, in particular, will have specialized expertise and experience in drinking water. Given their supervisory role, MOE staff should fully understand how the standard has evolved both before and after it comes into force. In light of the MOE's role, the accreditation standard should be based on models in which regulatory authorities may participate in accreditation activities to maintain their access to information about the process and to ensure that it is being carried out appropriately. Finally, following the adoption of the provincial standard, the requirement for owners of water systems to have an accredited operating agency should be a statutory requirement under the *Safe Drinking Water Act* that I recommend in Chapter 13.

It is appropriate for the start-up cost of developing the drinking water quality management standard to be borne by the provincial government so that the process proceeds expeditiously. Once accreditation is in place, the MOE should ensure that it is properly funded whether by the government or as a self-supporting program. It is appropriate for the cost of external audits and follow-up visits to be borne by the accreditée. However, the MOE should ensure that the cost of audits is not unreasonable in light of the size and complexity of an operating agency.⁴¹

11.3.7 Timeline for Implementation

Recommendation 55: The drinking water quality management standard should come into force by a date to be fixed by the provincial government. All municipalities should be required under the *Safe Drinking Water Act* (see Recommendation 67) to have an operating agency for their water system accredited within a specified time.

⁴⁰ If accreditation functions as I envision, with the industry playing a lead role, then I anticipate that the need for a residual audit capacity will be relatively small. Staff of the MOE's Drinking Water Branch who have appropriate expertise in the water industry should conduct or participate in the audits as required.

⁴¹ If the market supply of external auditors does not allow for a reasonable cost, the Province could either set standardized fees or make sufficient MOE Drinking Water Branch staff available to carry out audits on a reasonable cost-recovery basis.

I have recommended that accreditation be implemented according to deadlines fixed by the Province. Based on information provided to the Inquiry, I suggest that the MOE endeavour to complete the standard development process for drinking water quality management, and that it come into force, by December 31, 2003. Further, I suggest that the MOE fix a date in 2006 as the final deadline for all municipalities to be required to have an accredited operating agency.

These are suggested deadlines. I recognize that, depending on the circumstances, the Province may find it necessary to adopt a different timeline. As I have mentioned above, it is important that accreditation not lead to a mass shakeout in Ontario's water industry; on the other hand, considering the energy that can be harnessed now in the aftermath of the Walkerton tragedy, the timeline should also be an expedited one.

It would make sense for accreditation to be phased in over time, beginning with larger operating agencies since many of them have already adopted a quality management system. Once the larger operating agencies become accredited, they will be in a better position to pursue options to regionalize or contract with smaller water providers and to make staff available for participating in the accreditation program as auditors. Adopting a phased approach also gives smaller municipalities more time to consider restructuring options, while still requiring them to develop an operational plan, as discussed below.

To help inform the planning for this implementation process, the following table is included to provide a rough approximation of the number of municipal water providers of different sizes in the province.⁴²

⁴² Table 11.1 summarizes the population served for each of the 265 municipalities identified in the Municipal Water Use Database (MUD). The table relies on the 1998 Sewage and Water Inspection Program (SWIP) database, as summarized in Doyle et al., the most recent complete information available.

Table 11.1 Summary of Municipal Water Providers by Size of Population Served

Population served	Number of municipalities	Total population served	Average population served
≥ 500	27	7,680	284
501–3,300	102	152,669	1,497
3,301–10,000	68	412,661	6,069
> 10,001–100,000	39	1,136,740	29,147
> 100,000	15	7,185,322	479,021
Missing	14		
Total	265	8,895,072	

11.4 Operational Planning

11.4.1 The Requirement for an Operational Plan

Recommendation 56: The provincial government should require municipalities to have operational plans for their water systems by a date to be fixed by the provincial government.

As part of its quality management system, an operating agency will no doubt engage in comprehensive operational planning at the individual water systems for which it is responsible. However, in light of the importance of strategies and decisions at the operational level to the ultimate safety of drinking water, all municipalities should be required under the *Safe Drinking Water Act* to have operational plans⁴³ for their water systems. This requirement would be in addition to other conditions of the owner's licence for municipal water systems (e.g., Certificate of Approval, Permit to Take Water, and financial plan), as discussed in Chapter 13.

⁴³ The size and complexity of the water system may determine whether a municipality requires a separate plan for distinct components of the system (e.g., the treatment plant, distribution system, or monitoring system).

The requirement for an operational plan applies at the level of the individual water system⁴⁴ and is based on plant- and system-specific measures. The purpose of the operational plan is to outline the current capability of a water provider's management and operating system for providing safe drinking water, to identify areas where improvement is needed, and to implement corrective action. Based on the quality management approach, the plan should include:

- the comprehensive self-assessment and implementation of effective multiple barriers;
- the identification of activities and processes considered essential for the control of water quality (“critical control points”); and
- the establishment of mechanisms to provide operational control at critical control points, including methods that will monitor performance and trigger corrective action where required.⁴⁵

The operational plan should be implemented as part of a formal program to ensure that all processes and activities are carried out effectively, including adequate skills and training for operations staff. The plan should be reviewed regularly to ensure that the preventive strategies are adequate and are being implemented, and to identify new opportunities for improvement. It should also be available to the public for inspection.⁴⁶

What the operational plan should *not* be is a mere collection of the design and operating specifications of the system's equipment.⁴⁷ This approach would be too narrow and detailed to be of use. Most importantly, it would not reflect a

⁴⁴ Use of the term “water system” is intended to include all of the physical components of a water supply system, including the water intake, treatment facilities, the distribution network, storage reservoirs, pumping stations, etc., serving a defined population. The issue of how to delineate a particular system, and whether to adopt a distinct operational plan for the various components of that system, will depend on the circumstances. In a large system, it might make sense to adopt a distinct operational plan for each treatment plant and an additional plan for the distribution system. In a smaller system, a single operational plan for the entire system might suffice. The goal should be to design the operational plan that is comprehensive, but also practically useful and accessible.

⁴⁵ Adapted from National Health and Medical Research Council of Australia.

⁴⁶ This is consistent with the public information requirements under O. Reg. 459/00, ss. 11–12.

⁴⁷ The “operating manual” for a water system, as currently required under O. Reg. 453/93 and Certificates of Approval, is typically detailed, dense, and not very accessible. The operational plan I have in mind is a more accessible summary of the critical information needed regarding the multiple barriers in place to ensure drinking water safety.

careful assessment of the role of the multiple barriers and operating processes in addressing specific threats to drinking water quality.

11.4.2 The Process of Operational Planning

Although the owner of a water system will be required to have an operational plan, the operating agency (whether municipally owned or not) will normally be responsible for developing, implementing, and updating the plan.⁴⁸ These activities will demonstrate the effectiveness of the agency's management and operating practices to the owner. Some operating agencies in Ontario have already adopted comprehensive operational planning, based on the quality management approach, although sometimes with a disproportionate focus on treatment plants. For industry leaders, all that may be needed is to review and formalize the operational plan, undergo peer review as necessary, submit the plan to the MOE, and establish an internal process to address any areas for improvement on an ongoing basis.

For other water systems, however, existing practices may not be adequate to generate an operational plan that addresses the full range of drinking water quality issues. Moreover, the existing management arrangements may not be structured, documented, or subject to external review. In these cases, there is no assurance that management is functioning effectively or that it is oriented to continuous improvement. Further, there may be a need to expand the quality management approach to all components of the water system. In these circumstances, it will be necessary to invest time and resources to develop the operational plan. The organizational culture of the water provider may need to change considerably.

In developing an operational plan, the first step is for the operating agency to assess the current management and operation of the water system.⁴⁹ This *self-assessment* should systemically engage both the operational management and staff, on a collaborative basis, in:

⁴⁸ Unlike the current requirements for engineer's reports under O. Reg. 459/00, it should be permissible for operational plans to be prepared by employees of a municipal water provider.

⁴⁹ This will entail a review of existing operating practices, operating manuals, Certificates of Approval, regulatory requirements, and other relevant material to determine how the operation of the system will effectively ensure drinking water safety.

- reviewing the multiple barriers in the water system;
- identifying critical activities in the system where, in the event of a breakdown, safety would be threatened; and
- implementing strategies to ensure multi-barrier protection and, specifically, to control any critical control points.⁵⁰

Given the changing nature of the multiple barriers that are in place, the understanding of risks, and the options for mitigation, the operational plan will necessarily be a working document.

11.4.3 The Relationship to Certificates of Approval

At present, municipalities are required to obtain a Certificate of Approval from the MOE for their water system. As I discuss in Chapter 13, the Certificate of Approval applies to “water works,” which may be a treatment plant, reservoir, pumping station, distribution system, or other element of the overall water system. Historically, the MOE approvals process for Certificates of Approval involved a detailed review of the design and construction of the facilities and the hardware of a water system. The orientation was not to the system’s operating conditions and requirements.

Since the early 1990s, the MOE has attached operating conditions to Certificates of Approval. These conditions include requirements to properly operate and maintain equipment (such as requirements for effective performance, adequate operator staffing and training, adequate funding, and adequate laboratory and process controls); to establish contingency plans and notification procedures; to prepare an operations and maintenance manual; and to establish procedures for responding to complaints.⁵¹ They also include performance requirements in relation to water quality standards and the requirement for a comprehensive monitoring program.

⁵⁰ The process is not intended to be a massive exercise in data collection. Rather, it should involve “the characterisation of the system at an appropriate level of detail to provide a useful information base from which to make effective decisions,” as described in National Health and Medical Research Council of Australia, p. 12.

⁵¹ See Ontario, Ministry of the Environment, 1992, *Review Procedures Manual for Approval of Municipal and Private Water and Sewage Works*, Appendix B.

The imposition of these requirements has been a step in the right direction. In my view, however, managerial and operating aspects are important enough to be outlined in a distinct document from the Certificate of Approval. This will allow a greater focus on the water providers' processes and practices at the plant- and system-specific level, and more readily permit improvements. Thus, municipalities should be required to have in place a comprehensive operational plan, oriented to the multiple barrier protection of public health, in addition to the Certificate of Approval, which should focus on the facilities and hardware of a system.

11.4.4 The Relationship to Engineering Reviews

Municipalities are currently required under Ontario Regulation 459/00 to engage a professional engineer to prepare a report for their water system for submission to the Ministry of the Environment. The engineer's report must follow terms of reference prepared by the ministry.⁵² As currently outlined, its principal objectives are to assess the potential for microbiological contamination, and to identify operational and physical improvements necessary to mitigate this potential using multiple barrier concepts.

Although engineers' reports currently include recommendations on both operational and physical aspects of the system, the most appropriate focus of these reviews is on physical aspects, as a companion document to the Certificate of Approval. Managerial and operational aspects should be dealt with as part of a distinct operational plan. The MOE should define the requirements for engineer's reports and operational plans so that they are complementary. From a cost standpoint, it is important that there not be significant duplication between the engineer's report and the operational plan.

11.4.5 The Role of the Ministry of the Environment

Recommendation 57: Operational plans should be approved and reviewed as part of the Ministry of the Environment approvals and inspections programs.

⁵² See Ontario, Ministry of the Environment, 2000, *Terms of Reference – Engineers' Reports for Water Works* <www.ene.gov.on.ca/envision/gp/4057e.pdf>.

Municipalities should be required to file their operational plans with the MOE as a condition of their owner's licence. Because operational plans are oriented to individual water systems, it is appropriate that they be subject to MOE approval, in connection with the Certificate of Approval, and to MOE inspections. Given that staff of the MOE's Drinking Water Branch will have specialized expertise in managing and operating water systems, they should be assigned these responsibilities.

In terms of MOE approval, I do not envision a detailed engineering review of operational plans, as was historically the case for Certificates of Approval. Rather, I envision a general or functional review of whether the operational plan is adequate for the purposes of documenting the management systems and operating practices that are in place to protect public health. The purpose is to provide a reference document to assess whether the system is being operated appropriately, has achieved its performance goals, and has complied with provincial requirements. The operational plan will also draw the attention of MOE inspectors to those aspects of the water system that are of the highest priority in relation to drinking water safety. Overall, operational planning is intended to improve the existing structure and effectiveness of regulatory oversight, not to merely impose a new layer of paperwork on water systems.

To support municipal water providers in developing operational plans, the MOE should provide guidance and technical assistance about how to develop and implement operational plans in different circumstances. The MOE should look to other jurisdictions, particularly New Zealand, in this regard.⁵³

In particular, the MOE should make available guidelines and models for operational plans that apply to different circumstances (e.g., size and complexity) and components (e.g., treatment plant, distribution system, monitoring system) of a drinking water system. These models should be designed to support, not prescribe, operational planning by municipal water providers. As such, water providers should be allowed to work from an MOE model or to develop their own plans, independent of MOE models.⁵⁴

⁵³ The New Zealand Ministry of Health has developed model risk management plans for water supply owners. The plans are tailored to small systems. Owners may also develop their own plans. Individual plans must be developed for each water supply. See New Zealand, Ministry of Health, 2000b, p. 10.

⁵⁴ The plan would be subject to MOE approval and inspection in either case.

A logical starting point would be for the MOE to work with a manageable number of exemplary facilities, large and small, to prototype operational plans and develop expertise in their implementation. At the same time, it might require all municipalities to supply basic information (e.g., thorough description of the entire system from source to consumer and a description of all personnel and their relevant experience) to lay the foundation for the operational plan.

11.4.6 Timeline for Implementation

I recommend above that the Province require municipalities to develop operational plans by a date to be fixed by the MOE. I would suggest that the MOE adopt December 31, 2003, as the deadline for municipalities to submit their operational plans to the MOE. The MOE should endeavour to make available model operational plans by December 31, 2002, to allow water providers at least one year to develop their plans. These model plans, in combination with MOE technical assistance and a peer review program, will provide a support package for small water providers.

I do not think that it is necessary to wait for the development of the drinking water quality management standard, discussed above, before requiring municipalities to submit operational plans. There will be ample opportunity for the plans to be adapted within the quality management systems adopted by operating agencies as part of accreditation. Thus, municipalities can and should carry out operational planning while the drinking water quality management standard is being developed.

Table 11.2 provides a general guide to how I see mandatory quality management – including both accreditation and operational planning – being implemented by the provincial government and by municipal water providers. I reiterate that the deadlines in the table are only suggestions.

Table 11.2 The Implementation of Mandatory Quality Management

Transitional Step	Timing of Implementation
Development of a drinking water quality management standard	MOE should initiate immediately. Target date for the standard to come into force: December 31, 2003.
Design and implementation of quality management systems	Water providers should initiate as soon as they deem it appropriate. Target date for municipalities to be required to have an accredited operating agency: 2006.
Implementation of a formal peer review program such as that of the International Water Treatment Alliance	MOE should begin discussions with industry associations immediately. Target date for peer reviews to begin: December 31, 2002.
Design and publication of MOE model operational plans	MOE should initiate immediately. Target date for publication: December 31, 2002.
Design and submission of operational plans	Water providers should initiate as soon as they deem it appropriate, with reference to MOE models, if necessary, once they are available. Target date for all municipalities to submit operational plans to the MOE: December 31, 2003.
Governance reviews	Municipalities should initiate as soon as they deem it necessary in relation to accreditation, operational planning, and other relevant recommendations of this Inquiry.

11.5 Other Considerations

11.5.1 Relationship to Municipal Governance Reviews

In Chapter 10, I encourage municipalities to conduct a governance review in relation to their water system. The governance reviews should consider the future requirements for accreditation and operational planning. I also reiterate that a key reason for these quality management measures is to put operating agencies in a stronger position to inform owners about the effectiveness of the management and operation of the water system, in connection with the owner's due diligence responsibilities.

11.5.2 Application to Municipal Water Systems

I have recommended that the requirements for accreditation and operational planning apply to municipal systems, rather than private communal systems

(e.g., small subdivisions, retirement communities, trailer parks) or other non-municipal systems serving the public (e.g., service stations, rural restaurants, rural schools).

It would obviously be preferable for quality management to be employed by all water systems in Ontario. However, the prospect of requiring all private communal systems and other non-municipal systems to carry out quality management is a daunting one. I have opted to recommend, for the time being, that the requirement only apply to municipal water systems. Once these measures are well established for municipal water systems, the provincial government should review the question of whether to require accreditation, and especially operational planning, in the circumstances of non-municipal systems.

I discuss the approach I envision for ensuring drinking water safety at non-municipal systems in Chapter 14.

11.5.3 Confidentiality Concerns

Confidentiality concerns that arise in relation to accreditation or operational planning should be resolved by the Province so as not to compromise the thoroughness and transparency of either accreditation audits or MOE approvals and inspections. An exception to this is the formal peer review program, the primary goal of which should be to resolve any confidentiality concerns in a way that does not compromise the confidentiality and collegiality of the peer review.

11.5.4 Relationship to Benchmarking

Benchmarking compares performance on the basis of numerical and process-related criteria.⁵⁵ Benchmarking may complement the process of self-assessment and peer review by allowing municipalities and operating agencies to compare

⁵⁵ In particular, the Inquiry heard submissions about the Canadian CAO Benchmarking Initiative, a process under development whereby municipalities create performance indicators in a number of different areas, including for water and wastewater services. See Ontario Municipal CAO's Benchmarking Initiative, 2001, "A Summary of Phase 1 and Phase 2 Pilot Projects" <www.caobenchmarking.ca/docs/newsinfo.asp> [accessed April 2, 2002]; and Strategic Alternatives, "Governance and methods of service delivery for water and sewage systems," Walkerton Inquiry Commissioned Paper 17, p. 17.

their performance with that of other water systems. The aim is to support continuous improvement by water system operating agencies.

In Ontario, benchmarking has been tied to municipal report cards mandated by the provincial government's Municipal Performance Measurement Program (MPMP), which was initiated by the Ministry of Municipal Affairs and Housing in 2000.⁵⁶ The stated purpose of the program is to determine the efficiency and effectiveness of municipal services, including water and sewage services.⁵⁷ In contrast to other benchmarking programs in Canada, the results of MPMP comparisons are to be made public. Concerns were expressed at the Inquiry that the performance comparisons would not allow for accurate comparisons of different water systems; however, they are also viewed as an important starting point for improving performance.

In my view, benchmarking can be complementary, but it is not integral, to accreditation and operational planning. Given the difficulties in achieving common measurements or benchmarks that will apply on a universal basis to all utilities, and the skepticism with which benchmarking may be viewed in some quarters of the industry, I suggest that performance comparisons be done by the operating agency itself, subject to review by the owner as part of its oversight duties. To encourage participation by a wide range of municipalities and operating agencies in the quality management initiatives I am recommending, they should not be used by the Province, or required as public measurements, in conjunction with the requirements for accreditation and operational planning.

As benchmarking becomes more widely accepted in the water industry, the Province may wish to incorporate the process as a part of the accreditation program, provided that there are assurances that the bases of comparison are fair and accurate. Developing and implementing mandatory quality management should not be delayed, however, for reasons related to the development of benchmarking generally or to the Municipal Performance Measurement Program.

⁵⁶ Ontario, Ministry of Municipal Affairs and Housing, 2002, "Municipal Performance Measurement Program – Year 2" <www.mah.gov.on.ca/business/mpmp/mpmp-e.asp> [accessed April 2, 2002]. Also see *Strategic Alternatives*, *ibid.*, pp. 11–12.

⁵⁷ For water and sewage services, this will include criteria for operating costs for water treatment and distribution, approximate water loss, test results, water leaks, boil water advisories, operating costs for sewage collection and treatment, sewage-main back-ups, test results, and untreated sewage released.

11.6 Emergency Response Planning

This section deals with emergency response planning. In the chapter thus far I have discussed the need for municipal water providers to have an operational plan. A critical component of an operational plan is an emergency response plan focused on events capable of affecting drinking water safety. Because of the importance of emergency response planning, I thought it useful to address this subject in some detail and in a separate section of this chapter.⁵⁸

In this section, I recommend that a generic emergency response plan for water providers be developed and that emergency response planning be a required element of accreditation and operational planning. In addition, I discuss the elements of an effective emergency response plan for water providers including the need for a guideline for the issuance of boil water advisories. The American Water Works Association (AWWA) has done a great deal of useful work in this area and I draw on their experience.

11.6.1 Defining Emergencies for Water Providers

According to AWWA, a water emergency is “an unforeseen or unplanned event that may degrade the quality or quantity of potable water supplies available to serve customers.”⁵⁹ Emergencies may be minor; that is, a fairly routine, normal, or localized event that affects few customers. Emergencies may also be major; that is, a disaster that affects an entire or large portion of a water system, lowers the quality and quantity of water, or places the health and safety of the community at risk.⁶⁰ In this section I am addressing only major emergencies.

The *Emergency Plans Act*⁶¹ currently provides the formal legal structure for municipal and provincial emergency response plans and authorizes Emergency

⁵⁸ By devoting a separate section to emergency response planning, I do not intend to suggest that the many other components of an operational plan are not equally important.

⁵⁹ American Water Works Association, 2001, *Emergency Planning for Water Utilities, Manual of Water Supply Practices M19*, 4th ed. (Denver, CO: AWWA), p. 4.

⁶⁰ Ibid. The urgency and severity of any emergency will depend on many factors including the magnitude of the changes arising and their capacity to cause harm, the lead time of any warning, the time available from first recognition of imminent danger for corrective action to be taken, and the duration over which harm may occur.

⁶¹ The *Emergency Plans Act*, R.S.O. 1990, c. E.9, defines “emergency” as “a situation or an impending situation caused by forces of nature, an accident, an intentional act, or otherwise, that constitutes a danger of major proportions to life or property.”

Measures Ontario⁶² to be the provincial agency responsible for monitoring, coordinating, and assisting in the formulation and implementation of provincial emergency plans, and ensuring that provincial plans are coordinated with municipal and federal emergency plans. A new *Emergency Readiness Act* has been introduced to the Ontario legislature⁶³ that will require municipalities to undertake a risk assessment and critical infrastructure identification process in developing their emergency program. Although a recent survey found that approximately 91% of Ontario municipalities have an emergency plan, fewer than 50% have a training program in place or have held regular exercises of their plan.⁶⁴ The value of any emergency response plan is very limited unless key personnel are well trained in the implementation of the plan.

11.6.2 Steps in Water Emergency Planning

Recommendation 58: The Ministry of the Environment should work with Emergency Measures Ontario and water industry associations to develop a generic emergency response plan for municipal water providers. A viable and current emergency response plan, and procedures for training and periodic testing of the plan, should be an essential element of mandatory accreditation and operational planning.

The experience and proposals of AWWA are particularly useful and instructive. They have proposed five steps for planning for emergencies affecting a drinking water provider: hazard identification and summary, vulnerability assessment, mitigation actions, preparedness planning (development of an emergency plan), and emergency response, recovery, and training.⁶⁵

⁶² Emergency Measures Ontario <www.sgcs.gov.on.ca/english/public/emo.html> [accessed April 9, 2002].

⁶³ Bill 148, *Emergency Readiness Act*, 2d Sess., 37th Leg., Ontario, 2001 (1st reading December 6, 2001).

⁶⁴ See <www.newswire.ca/government/ontario/english/releases/December2001/06/c4494.html> [accessed April 7, 2002].

⁶⁵ American Water Works Association.

11.6.2.1 *Hazard Identification and Summary*

A number of conditions can become drinking water emergencies and these can arise from natural or human-made hazards, or some combination of both, such as waterborne outbreaks, flooding, forest fires, construction accidents, power failures, nuclear power plant or major industrial incidents, hazardous material release, or source water contamination by any cause, vandalism, and terrorism.

Waterborne outbreaks are clearly the most common indicator of a major emergency and usually cause the most severe health consequences. In particular, waterborne outbreaks have been found in a recent review to correlate strongly with heavy precipitation.⁶⁶ Consequently, a drinking water emergency plan must thoroughly and explicitly address all conceivable means by which such plausible hazards could lead to a disease outbreak, and how the corresponding risks can be detected and potential consequences reduced.

11.6.2.2 *Vulnerability Assessment*

An assessment of the vulnerability of any water system to the hazards identified should follow a logical sequence of steps and evaluation, including:⁶⁷

1. Identify the major system components.⁶⁸
2. Evaluate the plausible effects of likely disaster hazards on system components, such as personnel shortages, contamination of water supplies by any means, contamination of air, well and pump damage, pipeline breaks and associated equipment damage, damage to structures, equipment and material damage or loss, process tank damage, electrical power outage, communications disruption and transportation failure.

⁶⁶ Of 548 waterborne disease outbreaks in the U.S. Environmental Protection Agency database, 51% were preceded by precipitation events above the 90th percentile in severity; F.C. Curriero et al., 2001, "The association between extreme precipitation and waterborne disease outbreaks in the United States, 1948–1994," *American Journal of Public Health* 91, p. 1194.

⁶⁷ American Water Works Association, p. 5.

⁶⁸ These may be grouped into the major features of the water supply, such as: administration and operations, source water supply, raw water transmission system, treatment facilities, storage facilities, distribution system, electrical power, transportation, and control systems/communications.

3. Decide on performance goals and determine acceptable levels of service for the system under stress.⁶⁹
4. Identify the vulnerability of system components that pose the greatest risk of failure or reduced performance as a result of each hazard identified.⁷⁰

11.6.2.3 *Mitigation Actions*

A variety of measures can be proposed to improve the ability of the water provider to respond to the identified hazards. The following questions have been suggested as the first step in screening any proposed mitigation actions:⁷¹

- How critical is the component to the system?
- What is the age of the component?
- What are the present and projected expansion, replacement, or construction programs?
- What is the cost of the mitigation action?

Major categories of the system that should be reviewed to determine what mitigation actions could reasonably be taken would include: personnel and likely shortages during an emergency; source water and transmission; treatment; equipment, chemical storage and piping; process basins or tanks; storage tanks; distribution system; system control; interagency coordination; and administration, transportation, and communications.

⁶⁹ Provision of water to satisfy public health needs is clearly a high priority, but the urgency of demands varies with different uses. Also, the quantities of water likely to be demanded under different disaster scenarios should be estimated so that the likely challenges and needs for priority rationing can be preplanned.

⁷⁰ Such forecasting exercises will always be speculative, but the process of attempting to predict component vulnerability should identify practical measures that can reduce the likelihood of complete system failure.

⁷¹ American Water Works Association, p. 39.

11.6.2.4 *Developing an Emergency Plan*

The critical issue for any emergency plan is that it must represent a process rather than a product.⁷² Like the operational plan for a water system, an emergency plan cannot be a document that is written only to be filed. It must represent a continuing process to maintain readiness to respond when the need arises. Continuing actions to keep the process alive include training in the response procedures, testing to determine the effectiveness of procedures, revision to improve procedures found to be ineffective, additional training in revised procedures and re-testing.

An effective emergency plan should reference existing resources, be concise and logical, and be coordinated with other agencies. It should include:⁷³

- a clear statement of purpose;
- identification of a control group that will deal with the emergency indicating its members, support personnel, legal authority, implementation procedures, and clearly identified responsibilities;
- a system for notifying the control group, and officials and agencies who must respond;
- a description of emergency operations procedures;
- a description of the communications systems that will be used;
- an address and telephone directory of vital services;⁷⁴
- plans for requesting provincial or federal assistance;
- provisions for dealing with the media and for notifying the public; and

⁷² Emergency Measures Ontario, 1999, *Emergency Planning: A Guide to Emergency Planning for Community Officials* (Toronto: Queen's Printer) <www.sgcs.gov.on.ca/english/public/emoguide/emo.html> [accessed April 8, 2002].

⁷³ American Water Works Association; and Emergency Measures Ontario, pp. 54–68.

⁷⁴ The local Public Health Unit, fire department, police, ambulance service, hospitals, nursing homes, retirement homes, water system operator, electricians, pump specialists, and soil excavators are examples.

- a list of recipients of the most recent edition of the plan.

11.6.2.5 *Emergency Response, Recovery, and Training*

When an emergency arises, the plan can only be effective if its implementation involves a series of rational steps. These steps include: analyzing the severity of the emergency, providing emergency assistance to save lives, reducing the probability of additional injuries or damage, performing emergency repairs based on priority demand, returning the system to normal levels, evaluating the emergency plan, and revising the emergency plan as necessary.⁷⁵

An important consideration during any water contamination episode is the degree of advance warning of the hazard that a water provider can obtain to allow appropriate responses, ranging from increased monitoring and treatment to complete system shutdown. Early warning systems for water providers have received increasing attention in recent years and continuous monitoring technologies have improved substantially. However, there are no universal early warning systems currently available that are capable of rapidly and reliably detecting the full range of hazards that any major water provider currently faces.⁷⁶ Thus, effective and adaptive responses are a critical aspect of protecting public health.

Effective personnel response to emergency situations requires proper training of water system operators. I make recommendations regarding operator training in Chapter 12.

11.6.3 Roles in Drinking Water Emergencies

11.6.3.1 *Ministry of the Environment and Emergency Measures Ontario*

As the provincial regulator of water systems, the Ministry of the Environment (MOE) is chiefly responsible for specifying an adequate level of drinking water emergency preparedness. Emergency Measures Ontario (EMO) is assuming increasing responsibility for requiring emergency response planning by Ontario

⁷⁵ American Water Works Association, pp. 54–68.

⁷⁶ T. Brosnan, 1999, *Early Warning Monitoring to Detect Hazardous Events in Water Supplies*, ILSI Risk Science Institute Workshop Report (Washington, DC: International Life Sciences Institute), pp. 24–26.

municipalities and the provincial government. Logically, there should be close cooperation and collaboration between the MOE and EMO in specifying the emergency planning requirements for drinking water providers. EMO can provide a general perspective regarding the content of emergency plans under Ontario's conditions. The MOE can provide the specific perspective of drinking water supply systems in Ontario. The development of this reference document should involve the participation and input from the larger water providers in the province, perhaps by means of a workshop to share experience and insight.

11.6.3.2 *Municipal Water Providers*

Every municipality in Ontario will be obliged to have an emergency plan under the provisions of the proposed *Emergency Readiness Act*. Clearly, drinking water safety must be an essential element of these plans. However, it would not be feasible for the general municipal plan to consider all the details that should be contained in the emergency plan prepared specifically for the water system. Ultimately, each municipal water provider should be required to prepare and evaluate an adequate, site-specific emergency response plan as part of its operational plan. The overall municipal plan should be focused on assuring effective coordination with this site-specific water emergency response plan.

11.6.3.3 *Medical Officers of Health*

Because public health will always be a concern in a water emergency, the Medical Officer of Health must be a central player in the emergency response plan for any water provider. In particular, boil water advisories and boil water orders will be a key consideration in dealing with any water contamination episode.⁷⁷

As I recommended in the Part 1 report of this Inquiry, the Public Health Branch of the Ministry of Health should develop a Boil Water Protocol in consultation with Medical Officers of Health, municipalities, and the MOE. This protocol should outline the circumstances in which a boil water advisory or a boil water

⁷⁷ There is a distinction between boil water advisories and boil water orders. A boil water advisory is generally issued by the Medical Officer of Health to advise consumers not to drink the water. A boil water order is issued by a Medical Officer of Health or a public health inspector to direct certain institutions to boil water before providing it to consumers, pursuant to the *Health Protection and Promotion Act*, R.S.O. 1990, c. H.7, s. 13.

order should be issued. It should also provide guidance as to an effective communications strategy for the dissemination of a boil water advisory or order.

In the spring of 2001, the Public Health Branch developed a draft boil water advisory protocol.⁷⁸ In reviewing the draft protocol, it would appear that it does not address the following issue that is integral to effective emergency response. The Boil Water Protocol should emphasize the importance of establishing an effective relationship among the water provider, the MOE, and the Medical Officer of Health in advance of any problems that might give rise to the need for a drinking water advisory. It is not possible to anticipate all possible adverse water quality conditions in advance. Therefore, effective communication and a common understanding of the water quality problem are important to assure the most effective public health response.

Municipal water providers must recognize the statutory obligations of the Medical Officer of Health to protect public health, while the Medical Officer of Health should recognize the benefit of informed discourse about water quality problems in forming a sound judgment about potential health risks. In most cases, close cooperation between the Medical Officer of Health, the water provider, and the MOE will allow for much more effective communication with the public. This cooperation, developed in advance of a crisis, is also of great importance where it becomes necessary to issue a boil water advisory. The Boil Water Protocol should address the need for this continued cooperation, including the need for water providers to develop guidelines relating to the issuance of boil water advisories, as discussed below.

Cooperation among the parties will be particularly important in cases that are not as clear as those in which there is a finding of *E. coli* or fecal coliforms in treated water. In these cases, sound judgment is required to determine the balance between failing to take action when it may be required and the issuance of false alarms that may lessen the credibility of future warnings. The communication among parties will be particularly important for cases of advisories for non-microbial contamination. For example, the proposal to issue an advisory to the public whenever any water quality parameter exceeds, by any margin, a maximum acceptable parameter concentration deserves more careful consideration.

⁷⁸ Ontario, Ministry of Health and Long-Term Care, 2001, "Protocol for the issuance of a boil water and a drinking water advisory (draft)" <www.gov.on.ca/health/english/pub/pubhealth/boil_water/boil_water_advisory.doc> [accessed April 15, 2002].

As stated above, the Medical Officer of Health cannot issue a boil water advisory effectively without cooperation from the water provider and the MOE. Without such cooperation there will inevitably be delays in action and decisions made on less complete information than should be available. Therefore, as part of an emergency response plan, water providers should develop a guideline relating to the issuance of boil water advisories and orders in cooperation with the local Medical Officer of Health and the local MOE office, based on the Boil Water Protocol developed by the Public Health Branch. The guideline should acknowledge the legal authority of the Medical Officer of Health to declare a boil water advisory, and should also outline the notification process, information exchange, and other procedural details to ensure that such advisories are issued as quickly and efficiently as possible, based on the best available information.

The guideline should also include a communications strategy between the water provider and the local Medical Officer of Health to ensure that the most effective means of informing consumers will be followed in the event of any drinking water emergency.

The importance of having a boil water protocol was illustrated in Sydney, Australia, in 1998. The Sydney water crisis provided a severe example of a major media event with considerable misinformation, largely because of an avoidable conflict between Sydney Water and the New South Wales Health Department over the interpretation of water quality monitoring results and the need for a boil water advisory. A subsequent Commission of Inquiry criticized the poor communications between the water provider and the health regulator.⁷⁹

An interesting contrast was an incident in Edmonton, one year earlier during the spring of 1997, when *Cryptosporidium* cysts were detected in treated water by Edmonton's water provider, Epcor Water Services (named Aqualta at that time). In this case, there was a reasonable level of collaboration between Epcor Water Services and the Medical Officer of Health of the Capital Health Authority. As a result of this experience, a very detailed boil water protocol has been jointly developed by Epcor Water Services, the Capital Health Authority, and Alberta Environment. This protocol offers a useful template for

⁷⁹ P. McClellan, 1998, *Sydney Water Inquiry* (Sydney, Australia: New South Wales Premier's Department) <www.premiers.nsw.gov.au/pubs.htm> [accessed April 9, 2002].

coordination between Ontario municipal water providers, Medical Officers of Health, and the Ministry of Environment.⁸⁰

11.6.3.4 *Public Information and Risk Communication*

The ability to communicate efficiently and effectively, especially during a crisis, is of critical importance. As mentioned in section 11.6.2.4, an emergency plan should clearly identify the responsibilities of a control group, including identification of the member who will take the lead with respect to communications. During a crisis, the members of the control group responsible for communications will need to provide ongoing and in-depth notification to several stakeholders including the medical community, media, consumers and the general public, and appointed or elected officials.⁸¹

Communications about risk are difficult to produce for a number of practical reasons related to the complexity and uncertainty that surrounds risk. Effective risk communication seeks to address these issues in the following ways. First, the public's communication needs about a specific set of risks (such as drinking water safety), and the information base available to the public, should be assessed periodically. Second, key messages should represent the latest consensus of expert knowledge on the subject. Third, technical terminology should be translated into clear language that is understandable to the public and free of ambiguity.

A number of steps can be taken to plan communications strategies before an emergency arises. These include: discussions between decision makers and the public about drinking water risks; the elaboration of standard operating procedures and training of key people in the case of emergency situations; the development of guidelines for communicating with the public; and periodic informal and personal contacts among experts, planners, decision makers, and the media.

In developing a communications strategy, a list of local and regional media should be compiled, including phone numbers and other contact information. The information should be given to municipal officials and the Medical Officer

⁸⁰ L. Gammie, D. Pelletier, and N. Fox, 2001, "Development of a Boil water emergency response plan for a water utility," proceedings at the 9th National Conference on Drinking Water, Regina, Saskatchewan, May 16–18, pp. 50–65.

⁸¹ J. Mainiero, *Waterborne Gastrointestinal Disease Outbreak Detection* (Denver, CO: AWWA Research Foundation), pp. 39–47.

of Health, and should be updated at least annually. To protect public health, consumers need to receive, understand, and comply with a risk message. To communicate a risk message to the public effectively, several goals need to be achieved, including: rapid decision making to allow timely notification; rapid communication with a target audience; and avoidance measures to be undertaken. Although only the Medical Officer of Health has the authority to issue a boil water advisory, once this is done, others can be brought in to draw attention to the announcement.

The announcement itself must be simple, direct, and unqualified. It should describe the risk and provide information on what members of the public should do. If possible, the Medical Officer of Health should make the announcement. Elected representatives, such as mayors and councillors, should speak for themselves. Local media have a strong sense of community responsibility and like to pitch in with news coverage during a crisis. Sometimes officials are fearful of creating panic if they approach the media. There may be exceptions, but generally media will report on an emergency in a responsible way if given the information.

