M I N I S T R Y   O F   T H E   E N V I R O N M E N T

Drinking Water Quality Management Standard Guidance Document

OCTOBER 2006

This Guidance Document is divided into three Parts:

Part I – Guide for the Standard
Part II – Templates for Procedures
Part III – Model Operational Plans

PART I

Guide for the Standard

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SECTION 1 – INTRODUCTION

Chapter 1 – Background

Key Points in Chapter 1

Justice O'Connor, in Part Two of the Report of the Walkerton Inquiry, recommended the adoption of quality management systems for drinking-water systems. It was also recommended that a standard specifically designed for drinking-water systems be developed and implemented in Ontario - the Drinking Water Quality Management Standard (DWQMS).

The adoption of quality management systems is not new to the drinking water community in Ontario; however the requirement to implement the DWQMS is now mandated through the *Safe Drinking Water Act, 2002*.

Chapter 1 – Background

1. Introduction

Clean and safe drinking water is vital to public health. In Ontario, the regulatory framework established under the *Safe Drinking Water Act, 2002*, sets high standards for drinking water quality and systems. These regulations focus on end-product testing and compliance based results, as verified by inspections carried out by Ministry of the Environment staff.

The Drinking Water Quality Management Standard (DWQMS) on the other hand endorses a more proactive and preventative approach to assuring drinking water quality. The DWQMS is based on quality and risk management principles, with conformance checked by auditors. The DWQMS provides additional protection in the form of management practices for drinking water safety, including the effective management of multi-barriers, leadership, communication and continual improvement. The DWQMS is one of the tools to help ensure the safety of drinking water in Ontario.

The concept of quality management was endorsed by The Honourable Dennis R. O'Connor in Part Two of the Report of the Walkerton Inquiry, and it was recommended that water systems in Ontario adopt a Quality Management System (QMS) approach. In his terms;

"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 continual 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;
- preventative rather than strictly reactive strategies to identify and manage risks to public health; and
- effective leadership"

The recommendation to adopt a QMS approach is mandated by the provincial government through the *Safe Drinking Water Act, 2002*. As a result of this legislation, the Ministry of the Environment in the Province of Ontario has developed, with water industry stakeholders, a Drinking Water Quality Management Standard (DWQMS). The DWQMS is applicable to all municipal residential drinking-water system Owners and their Operating Authorities in the Province of Ontario.

This Guidance Document has been developed to assist Owners and Operating Authorities in jointly developing and effectively implementing a Quality Management System for their drinking-water system – treatment, transmission and/or distribution.

2. Development of the DWQMS

The DWQMS was developed by a core group of water industry stakeholders and has been designed to be flexible for the variety of municipal residential drinking-water systems in Ontario.
Public consultations on the DWQMS took place through a series of workshops and through postings on the Ministry of the Environment's Environmental Bill of Rights (EBR). The DWQMS was also piloted at two points in its development: Phase 1, Content Assessment was completed during the development of the draft document; and Phase 2, Implementation Assessment was undertaken at six pilot sites to develop and test the Operational Plans.

The information gathered from these pilot sites has been used to: identify areas where clarification of the Standard is required; refine the DWQMS; assess resource and cost impacts; and assist in the development of this guidance material.

3. Acknowledgements

This Guidance Document would not exist without a great deal of time and effort from a number of people who are committed to the provision of safe drinking water for all residents of Ontario. The contributions of time and effort took place over the past few years – from the development of the draft DWQMS, up to and including the publication of this Guidance Document.

The Ministry would like to thank Water Earth Science Associates Inc. (WESA) for their efforts working with stakeholder municipalities and for their experience and knowledge with quality management systems, in the development of this guidance document.

Many stakeholders provided comments and ideas on the development of the guidance material, in particular the members of the Licensing Working Group and their staff who provided the voice of the Owners and Operating Authorities. The Ministry would like to thank the group members for their commitment to the project and for their tireless efforts in reviewing material, providing feedback and attending meetings:

Region of Durham – Bernie Kuslikis (also representing Municipal Engineers Association)
City of Dryden – Brad Johns (now with the City of Greater Sudbury), Barry Hardy and Ron Maylen
Lake Huron Primary Water Supply System – Andrew Henry and Erin Kirk
Township of Machin – Greg Penner
Greater Napanee – Max Christie (also representing the Ontario Municipal Water Association), Todd Harvey and Meaghan Lewis
Municipality of North Middlesex – Joe Adams, Sherry Maguire, Glen Bullock
Peterborough Utilities Commission – Wayne Stiver (also representing the Ontario Water Works Association)
City of Toronto – Patrick Newland and Alison Minato
Region of Waterloo – Thomas Schmidt and Nancy Kodusek

Information was also provided by T. Duncan Ellison of the Canadian Water and Wastewater Association (CWWA) in the development of the sections relating to a risk assessment/risk management approach to drinking water systems.

The Ministry is also grateful for the assistance and support from the Ontario Ministry of Agriculture, Food and Rural Affairs **(**OMAFRA) and in particular Pat Johnson and Troy Jenner for not only sharing their experiences with management systems and audits, but for also providing the foundation and format of this guidance document.

The Ministry's Safe Drinking Water Branch is responsible for leading the development and implementation of the Standard and this guidance document, in particular the following staff have worked tirelessly to listen to stakeholder concerns and to incorporate them into these documents:

Tim Archer
Susan Atlin
Bill Gregson
Kara Smith
Alistair Stewart
Indra Prashad

4. Executive Summary

This Guidance Document has been developed to assist Owners and Operating Authorities in jointly and effectively developing, implementing and maintaining Quality Management Systems for their subject systems. It is intended to be a useful resource, containing tips, ideas and suggestions that can help you through the implementation of the QMS. The practical information provided is intended to help you better manage your time and other resources during the implementation process. The guidance document is divided into three parts – Part I is the interpretative and implementation guide for the Standard; Part II contains sample Templates for various procedures; and Part III contains four model operational plans for varying drinking water systems.

Although every drinking-water system is unique, information throughout this Guide will be helpful in implementing and maintaining the requirements of the DWQMS in any subject system, regardless of size, complexity, Operating Authority or Owner.

This Guide covers the steps for implementing and maintaining the requirements of the DWQMS, from establishing team members and performing a gap analysis, through to recommendations for maintenance of the QMS after accreditation.

Chapter 2 – About the Guide

Key Points in Chapter 2

This Guide is an interpretive guide to the DWQMS and can be used by staff when developing, implementing or maintaining a drinking water quality management system.

A list of definitions and abbreviations is provided in this Chapter, and definitions are also provided in the margins throughout this Guide.

Chapter 2 – About the Guide

1. Purpose of the Guide

This Guide is intended to be an interpretative and implementation guide to the Drinking Water Quality Standard (DWQMS). The Guide has been designed to be feasible and practical for small and large drinking-water systems alike that provide treatment, transmission and/or distribution. This Guide will be useful for a variety of people involved in your QMS, including:

- Implementation Leads
- QMS team members
- Management of the Operating Authority
- Staff at the Operating Authority
- System Owners
- Anyone interested in the QMS.

Don't be discouraged by the size of the Guide. It includes a wealth of examples and helpful information for all types of systems, and is therefore quite extensive. You do not have to read it from beginning to end – use the chapters as you feel they will be useful to you.

2. The Implementation Approach

Part I of the guidance document includes an explanation of each element of the DWQMS and how to meet the Standard requirements. This Guide outlines a step-by-step process for developing and implementing the QMS at your drinking-water system.

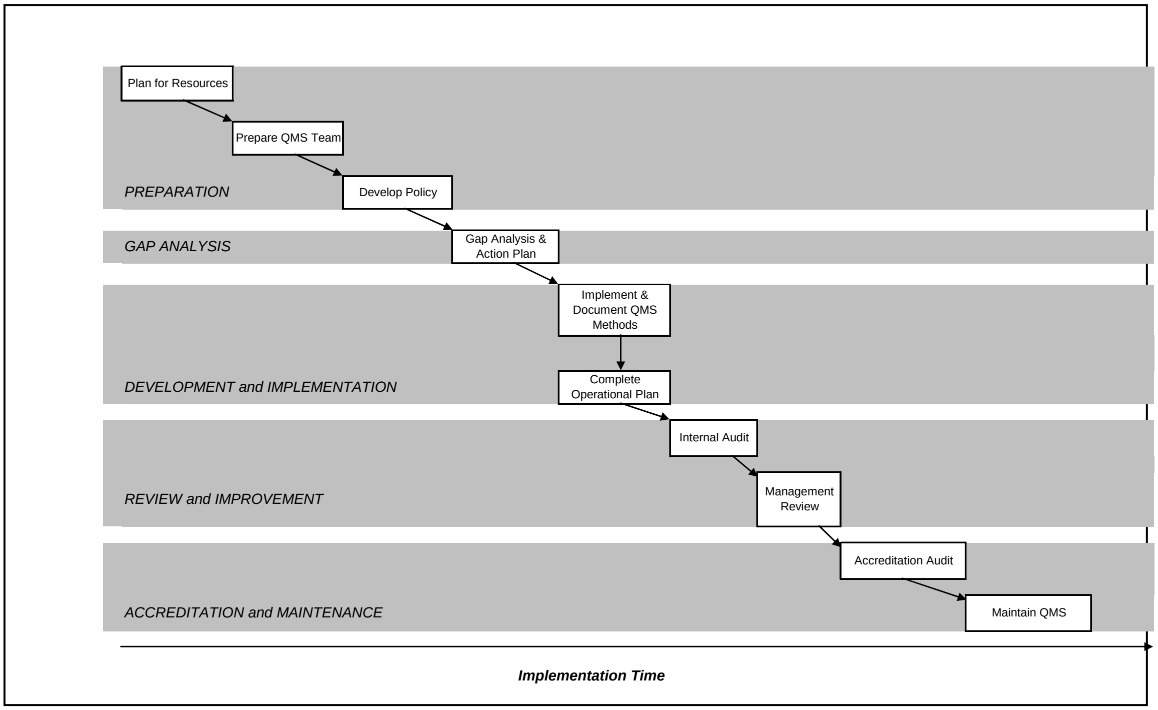
The quality management system implementation approach described in this Guide has been used at thousands of facilities throughout North America with great success. Experience gained from the implementation of the drinking water QMS at pilot sites of varying size, complexity and differing management structures in Ontario has been used in developing this material. The development approach builds on the existing management systems in place at drinking-water systems in Ontario. In addition to the information provided here, to effectively implement the DWQMS you will need an adequate understanding of your drinking water treatment process and the hazards which could affect the safety of the drinking water.

The development approach generally involves the following phases, which are mirrored by the sections in this Guide:

- Preparation for Implementation (including Resources, Setting up the QMS Team, QMS Policy)
- Gap Analysis
- Development & Implementation of QMS Requirements (including "Kick-off" meeting, Completion of Operational Plan)
- Review and Improvement (including Internal Audit, Management Review)
- Accreditation and Maintenance

This approach is shown in Figure 2.1.

Figure 2.1: Implementation approach used in this Guide



The time required to move through each of these phases depends on your efforts and resources, and on the complexity of your drinking-water system.

Figure 2.2 presents a chapter by chapter summary of Part I of the guidance document - for each chapter, the topics and DWQMS elements covered are summarized.

Figure 2.2: Summary of Part I Contents

Guidance Document Chapter	***Topics***	***Related DWQMS Element(s)***
Section 1 – Introduction		
Chapter 1 – Background	▪ Introduction, acknowledgement, executive summary	- -
Chapter 2 – About the Guide	▪ Purpose of the Guide ▪ Implementation Process ▪ How to use the Guide ▪ Glossary	- -
Chapter 3 – About the DWQMS	▪ Background on Quality Management Systems, the DWQMS, the Municipal Drinking Water Licensing Program, the *Safe Drinking Water Act, 2002* ▪ Benefits of Implementing the DWQMS ▪ Who must implement the DWQMS ▪ Elements and structure of the DWQMS	- -
Section 2 – Preparing for the Implementation		
Chapter 4 – Setting up the QMS Team and Implementation Resources	▪ Designate QMS team lead and other team members ▪ Define roles and responsibilities ▪ Assess and acquire necessary training ▪ Assess resources necessary for implementation ▪ Communication of new roles	1 – Quality Management System 3 – Commitment and Endorsement
Chapter 5 – Getting Started	▪ Define Top Management ▪ Begin process of obtaining Top Management commitment ▪ Establish QMS policy ▪ Operational Plan initial endorsement/development ▪ QMS representative and role	2 – QMS policy 3 –- Commitment and Endorsement 4 – QMS Representative
Section 3 – Gap Analysis and Action Plan		
Chapter 6 – Gap Analysis and Implementation Action Plan	▪ Gap analysis overview ▪ Perform gap analysis ▪ Create an implementation action plan	- -
Section 4 – **Establishing the QMS and Putting it in Place**		
Chapter 7 – "Kick-Off "Management Meeting	▪ Hold a Kick-Off management meeting ▪ Sample meeting agenda	3 – Commitment and Endorsement
Chapter 8 – Document and Records Control	▪ Purpose behind the control of documents and records ▪ Documents and records to include ▪ Consistency in documentation ▪ Issuing and protecting documentation ▪ Control procedure and operational plan	5 – Document and Records Control
Chapter 9 – Drinking-water System	▪ Drinking-water system description ▪ Process flow chart ▪ Upstream and downstream processes ▪ Connections to other drinking-water systems ▪ Operational Plan requirements	6 – Drinking-Water System

Guidance Document Chapter	***Topics***	***Related DWQMS Element(s)***
Chapter 10 – Risk Assessment and Risk Assessment Outcomes	▪ Risk assessment overview and team set up ▪ Overview of hazards and how to properly identify them ▪ Identifying available control measures ▪ Assessing risks and ranking hazardous events ▪ Identifying Critical Control Points (CCPs) ▪ Minimum CCPs and critical control limits ▪ Monitoring CCPs and response procedures ▪ Procedure for risk assessment ▪ Operational plan requirements	7 – Risk Assessment 8 – Risk Assessment Outcomes
Chapter 11 – Organizational Structure, Roles, Responsibilities, and Authorities	▪ Roles, responsibility and authorities overview ▪ Responsibilities template ▪ Organizational structure ▪ Communicating throughout the Operating Authority	9 – Organizational Structure, Roles, Responsibilities and Authorities
Chapter 12 – Competencies and Personnel Coverage	▪ Identify required knowledge skills and abilities ▪ Training Matrix, methods, and guidance ▪ Enhancing competencies	10 – Competencies 11 – Personnel coverage
Chapter 13 – Communications	▪ Communication procedure ▪ Implementing communication procedures	12 – Communications
Chapter 14 – Essential Supplies and Services	▪ List essential suppliers and services ▪ Ensuring procurement ▪ Monitoring supplies and services ▪ Operational Plan requirements	13 – Essential Supplies and Services
Chapter 15 – Infrastructure	▪ Determine, obtain and provide the infrastructure required for safe and effective operation ▪ Identify and implement infrastructure maintenance, rehabilitation and renewal program ▪ Maintenance program monitoring	14 – Review and Provision of Infrastructure 15 – Infrastructure Maintenance, Rehabilitation and Renewal
Chapter 16 – Sampling and Monitoring	▪ Document procedures for: calibration of on-line measurement and recording devices; sampling and monitoring under challenging conditions; upstream monitoring; how results are to be shared with owners and others ▪ Implement procedures	16 – Sampling and Monitoring 17 – Measurement and Recording Equipment Calibration and Maintenance
Chapter 17 – Emergency Preparedness and Response	▪ Develop procedures to maintain overall emergency preparedness, response and recovery, including training and testing ▪ List emergency contacts ▪ Develop communication procedures for emergencies ▪ Implement procedures ▪ Arrange for training in procedures, and testing of responses	18 – Emergency Management
Chapter 18 – Plan for Internal Audit	▪ Develop internal audit procedures ▪ Conducting audit, reporting, and follow-up	19 – Internal Audits
Chapter 19 – Plan for Management Review	▪ Develop management review procedures ▪ Specific information is required for management reviews ▪ Outputs of the management review shall include a record of decisions and actions	20 – Management Review
Chapter 20 – Completing the QMS Cycle	▪ Complete Operational Plan ▪ Endorse Operational Plan ▪ Ensure that everything required by the QMS and the Operational Plan is implemented ▪ Arrange for QMS awareness training ▪ Updates to the QMS need to be made as required	- -

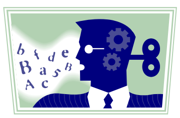
Guidance Document Chapter	***Topics***	***Related DWQMS Element(s)***
Section 5 – Review and Improvement of the QMS		
Chapter 21 – Performing an Internal Audit	▪ Perform an internal audit	19 – Internal Audits
Chapter 22 – Performing a Management Review	▪ Preparation for management review ▪ Perform a management review	20 – Management Review
Chapter 23 – Maintenance and Continual Improvement of the QMS	▪ Overview ▪ Importance of internal auditing	21 – Continual Improvement

3. How to Use This Guidance Document

Part I of the guidance document begins with an explanation of the DWQMS and its background, and takes you through the main steps of system development, implementation, accreditation, and maintenance. Using the principles and concepts introduced, and following the steps outlined in each chapter, you can develop and implement a QMS specific to your drinking-water system.

To help you get started, sample forms, checklists, policies, and procedures are provided. At the start of each chapter, key points explained in the chapter are summarized and elements of the DWQMS that are being addressed in that chapter are also addressed. At the end of each chapter, a checklist is provided, to ensure you complete the main steps before moving on to the next implementation steps.

Throughout the Guide, guidance symbols are also used in the margins:



Technical **Terms**

Technical Terms are defined and explained in the margin, to help explain terms that are being introduced for the first time.

Helpful **Tips**

These margin boxes provide helpful hints to aid you in your implementation. These hints are based on actual experience from the pilot site participants and from other parties involved in preparing this Guide.

Ready for the **Audit**

What do auditors like to see?
These margin boxes provide helpful information in preparing for an accreditation audit. To accredit your Operating Authority, you will need to achieve a successful audit.

4. Definitions and Abbreviations

Accreditation – the granting of a Certificate of Accreditation by the Accreditation Body to the Operating Authority of a Subject System.

Accreditation Body – the auditing organization recognized by the Ministry of the Environment that is responsible for the accreditation of Operating Authorities.

Action Plan – the product of the Gap Analysis which identifies the tasks for implementing a QMS. The Action Plan should include tasks, target dates, and people assigned to task duties.

Applicable Legislative And Regulatory Requirements – the *Safe Drinking Water Act, 2002*, the *Ontario Water Resources Act*, and all regulations and instruments issued under these Acts which are associated with drinking water.

Audit – a systematic and documented verification process that involves objectively obtaining and evaluating documents and processes to determine whether a Quality Management System conforms to the requirements of the DWQMS.

Authority – official permission or approval to carry out a responsibility or task.

Competence – the combination of observable and measurable knowledge, skills, and abilities which are required for a person to carry out assigned responsibilities.

Compliance – the fulfilment of a regulatory requirement.

Conformance – the fulfilment of a DWQMS requirement.

Consumer – the drinking water end user.

Control Measure – includes any processes, physical steps, or other contingencies that have been put in place to prevent or reduce a hazard, before it occurs.

Corrective Action – action to eliminate the cause of a detected non-conformity of the QMS with the requirements of the DWQMS or other undesirable situation.

Critical Control Limit – the point at which a Critical Control Point response procedure is initiated.

Critical Control Point (CCP) – an essential step or point in the subject system at which control can be applied by the Operating Authority to prevent or eliminate a drinking-water health hazard or to reduce it to an acceptable level.

Director – a Director as appointed by the Minister under section 6 of the *SDWA* for the purposes of section 16 of the *SDWA*.

Director's Direction – the Director's Direction for Operational Plan Submission issued under subsection 15(1) of the *SDWA*.

Document – includes a sound recording, video tape, film, photograph, chart, graph, map, plan, survey, book of account, and information recorded or stored by means of any device.

Drinking-Water Health Hazard – means, in respect of a drinking-water system,

a.) a condition of the system or a condition associated with the systems' waters, including any thing found in the waters,
    i.) that adversely affects, or is likely to adversely affect, the health of the users of the system,
    ii.) that deters or hinders, or is likely to deter or hinder, the prevention or suppression of disease, or
    iii.) that endangers or is likely to endanger public health,
b.) a prescribed condition of the drinking-water system or,
c.) a prescribed condition associated with the system's waters of the presence of a prescribed thing in the waters.

Drinking Water Quality Management Standard (DWQMS) – means the most recent Quality Management Standard approved by the Minister of the Environment in accordance with section 21 of the *Safe Drinking Water Act, 2002*.

Drinking-Water System – means a system of works, excluding plumbing, that is established for the purposes of providing users of the system with drinking water and that includes,

a.) any thing used for the collection, production, treatment, storage, supply or distribution of water,
b.) any thing related to the management of residue from the treatment process or the management of the discharge of a substance into the natural environment from the treatment system, and
c.) a well or intake that serves as the source or entry point of raw water supply for the system.

Emergency – a potential situation or service interruption that may result in the loss of the ability to maintain a supply of safe drinking water to consumers.

Emergency response – the effort to mitigate the impact of an emergency on consumers.

Facts – information recorded by the auditor to meet audit objectives, gathered in the course of performing an audit. Includes results of interviews, document information and observations.

Frequency – the number of times that an audit occurs per unit time, e.g. once per year.

Gap Analysis – the process of determining and evaluating the variance between the requirements of the DWQMS, and the methods and documents in place in your drinking-water system.

Hazard – a source of danger or a property that may cause drinking water to be unsafe for human consumption. A drinking water **hazard** is a biological, chemical, physical or radiological agent that has the potential to cause harm.

Hazardous Event – an incident or situation that can lead to the presence of a hazard.

Implementation Action Plan – the product of a Gap Analysis which identifies the tasks required for implementing a QMS. The Implementation Action Plan should include tasks, target dates, and people assigned to task duties.

Infrastructure – the set of interconnected structural elements that provide the framework for supporting the operation of the drinking-water system, including buildings, workspace, process equipment, hardware and software, and supporting services, such as transport or communication.

Ministry – means the Ministry of the Environment.

Monitoring – includes any checks or systems that are available to detect hazards or the potential for hazards.

Municipal Drinking-Water System – means a drinking-water system or part of a drinking-water system,

a.) that is owned by a municipality or by a municipal service board established under section 195 of the *Municipal Act, 2001*,
b.) that is owned by a corporation established under section 203 of the *Municipal Act, 2001*,
c.) from which a municipality obtains or will obtain water under the terms of a contract between the municipality and the owner of the system, or
d.) that is in a prescribed class.

Municipal Residential Drinking-Water System – a large municipal residential system or a small municipal residential system as defined in O. Reg. 170/03.

Non-compliance – a failure under the *Safe Drinking Water Act, 2002*, the *Ontario Water Resources Act*, or any regulations or instruments under these Acts which are associated with drinking water.

Non-conformance – the non-fulfilment of a DWQMS requirement.

Operating Authority – means, in respect of a subject system, the person or entity that is given responsibility by the owner for the operation, management, maintenance or alteration of the subject system

Operational Plan – means, in respect of a subject system, the Operational Plan required by the Director's Direction.

Operational Subsystem – means a part of a Municipal Residential Drinking-Water System operated by a single Operating Authority and designated by the Owner as being an Operational Subsystem.

Owner – includes, in respect of a drinking-water system, every person who is a legal or beneficial owner of all or part of the system, but does not include the Ontario Clean Water Agency or any of its predecessors where the Agency or predecessor is registered on title as the owner of the system.

Preventative Action – action intended to eliminate the cause or causes or potential non-conformances.

Public – subject system consumers and stakeholders.

Primary Disinfection – a process or series of processes intended to remove or inactivate human pathogens such as viruses, bacteria and protozoa in water.

Quality Management System (QMS) – a system to:

a.) establish policy and objectives, and to achieve those objectives, and
b.) direct and control an organization with regard to quality.

Record – a document stating results achieved or providing proof of activities performed.

Rehabilitation – the process of repairing or refurbishing an infrastructure element.

Renewal – the process of replacing the infrastructure element with new elements

Resources – tangible inputs that are required to deliver safe drinking water.

Responsibility – a charge, trust, or duty, for which one is responsible.

Retrievable - For documents, "retrievable" means the documents must be readily available for personnel to refer to, especially in emergency situations, or in areas where operational procedures would need to be promptly referenced. For example, sampling procedures should be available for reference where sampling activities are performed. For records, "retrievable" is a slightly more flexible term. Usually, a record is considered to be retrievable if it can be produced on request by the end of the business day. This definition stems from audits and inspections – if records can be provided by the end of the audit, it is usually considered to be retrievable.

Risk – the probability of identified hazards causing harm, including the magnitude of that harm or the consequences.

Risk assessment – an orderly methodology of identifying hazards or hazardous events that may affect the safety of drinking water and evaluating their significance.

Scope – a description of the extent and boundaries of an audit.

Secondary disinfection – a process or series of processes intended to provide and maintain a disinfectant residual in a drinking-water system's distribution system, and in plumbing connected to the distribution system, for the purposes of,

a) protecting water from microbiological re-contamination,
b) reducing bacterial regrowth,
c) controlling biofilm formation, and
d) serving as an indicator of distribution system integrity,

and includes the use of disinfectant residuals from primary disinfection to provide and maintain a disinfectant residual in a drinking-water system's distribution system for the purposes described in clauses (a) to (d).

Subject System – means:

a.) a Municipal Residential Drinking-Water System where the system is operated by one Operating Authority, or b.) where two or more parts of a Municipal Residential Drinking-Water System are operated by different Operating Authorities and have been designated as being Operational Subsystems by the Owner, an Operational Subsystem.

Supplier – an organization or person that provides a product or service that affects drinking water quality.

Top Management – a person, persons or a group of people at the highest management level within an Operating Authority that makes decisions respecting the QMS and recommendations to the Owner respecting the Subject System or Subject Systems.

Chapter 3 – About the DWQMS

Key Points in Chapter 3

Establishing, maintaining, and continually improving a Quality Management System (QMS) based on the requirements of the Drinking Water Quality Management Standard (DWQMS), is a mandated requirement in Ontario for Owners and Operating Authorities of municipal residential drinking-water systems.

To obtain a Municipal Drinking Water Licence (MDWL):

- An Operating Authority must be accredited by a third party Accreditation Body for the Subject System(s) that it operates,
- Accreditation will be based on the Operating Authority having a Quality Management System in place that meet the requirements of the DWQMS,
- The Operating Authority will be required to document its Quality Management System in an Operational Plan which will be endorsed by the Owner and submitted to the Ministry for "acceptance".

The DWQMS outlines a framework for planning, documenting and continually improving the management systems in place to support the production and delivery of safe drinking water.

The Operational Plan is a "living document", and will require an ongoing commitment and endorsement from the system Owner and from personnel throughout the organizational structure of the Operating Authority.

The DWQMS builds on concepts that are currently part of how many Owners and Operating Authorities manage and operate their drinking-water systems.

The QMS developed for your system will be a continuous cycle of review and improvement – Plan, Do, Check and Improve.

Chapter 3 – About the DWQMS

1. What is a Quality Management System?

A quality management system (QMS) is a system to: a) establish policy and objectives, and to achieve those objectives, and b) direct and control an organization with regard to quality.

Management systems and management system standards are not new. They have been around since the early 1950s. In 1987 the International Organization for Standardization (ISO), released the first version of the ISO 9001 Quality Management System Standard. Since that time, organizations all over the world have been implementing the requirements of “management system” standards.

Most management system standards are generic. They can be applied to any type or size of organization. They have been developed for the implementation of quality or environmental based “management systems” in any type of organization.

Management system standards have also been developed for specific industries or product sectors. For example, there are specific QMS standards for the automotive, medical device and drug industries. The Hazard Analysis and Critical Control Point (HACCP) standard is an internationally-recognized, science-based, food safety system that was developed to help ensure the manufacture of safe food products.

The Drinking Water Quality Management Standard (DWQMS) is a custom-made standard specific to the requirements of drinking-water systems in Ontario. Its requirements are similar to ISO-based quality management systems, but not equivalent.

2. What is the Drinking Water Quality Management Standard?

The Drinking Water Quality Management Standard (DWQMS) outlines the requirements of a quality management system to support the provision of safe drinking water. The requirements of the DWQMS are complementary to the legislated requirements. The emphasis of the DWQMS is on preventative and proactive management measures, whereas the legislated requirements focus on verification of existing processes and finished water quality monitoring to ensure safe water is produced.

The DWQMS approach emphasizes the importance of:

- Proactive/preventative rather than strictly reactive management strategies to identify and manage risks to public health;
- The establishment and documentation of management procedures;
- Achievement meeting these procedures; and
- Continual improvement of your management system.

As noted above, the definition of Quality Management System refers to the establishment of policies and objectives. The DWQMS has explicit requirements for policies but does not make specific reference to objectives. Objectives are, however, embedded or implicit in most of the DWQMS elements.

Auditors will be engaged by a third party accreditation body to provide accreditation services. Based on the results of an independent audit, the accreditation body will issue a Certificate of Accreditation to those Operating Authorities that have quality management systems that meet the requirements of the Standard.

3. What is an Operational Plan?

An Operational Plan is the documentation of your QMS. It is not an “Operations and Maintenance” manual. The “PLAN” requirements of the DWQMS identify the policies and procedures that must be documented in the Operational Plan. If a suitable procedure is already documented in another place, the Operational Plan can simply reference where that procedure is documented, though the referenced procedure must be available for reviews and audits of the Quality Management System.

If an Operating Authority is responsible for multiple subject systems, the Operating Authority may choose to develop common QMS procedures for elements that are common for all drinking-water systems. The common QMS components would need to be implemented both at the subject system level and at the corporate level, and corporate roles, responsibilities and authorities would need to be documented for each level.

The complexity of the QMS will depend to a degree on the size of the drinking-water system and its processes. For small drinking-water systems, which consist of a well with chlorination, the QMS and Operational Plan can be relatively simple and straightforward. For systems with a large number of staff, several connected surface water treatment plants, complex distribution systems, and interconnections to other systems, the quality management system will be correspondingly much larger and more comprehensive. Stand alone distribution systems must also implement the DWQMS.

The Model Operational Plans, which are included in Part III of this Guidance Document, provide examples of how the DWQMS can be applied to systems with a range of sizes, complexity and organizational structures.

4. The DWQMS, the Municipal Drinking Water Licence Program and the *Safe Drinking Water Act, 2002*

Recommendation 71 of Justice O’Connor’s Walkerton Inquiry Part Two Report stated that the Ministry should move towards a municipal licensing regime incorporating the concepts of quality management. This recommendation forms the basis of the Municipal Drinking Water Licence (MDWL) program.

The MDWL is a new approvals framework for municipal residential drinking-water systems, replacing the current approvals instrument, the Certificate of Approval. Requirements for the issuance of an MDWL as outlined in subsection 44.1 of the *Safe Drinking Water Act, 2002 (SDWA)* are essentially the same as Recommendation 71. The requirements for the issuance of a licence are:

- A Drinking Water Works Permit (replacing a “Certificate of Approval”);
- A Permit to Take Water;
- An approved Operational Plan;
- An Accredited Operating Authority; and,
- An approved Financial Plan, if required.

The first two elements of the Licence are based on existing Ministry programs, while the requirement for a Financial Plan is linked to the *Sustainable Water and Sewage Systems Act.* The remaining two elements of the Licence; the Operational Plan and the Accreditation of the Operating Authority, will be fulfilled through the implementation of the DWQMS.

5. The DWQMS and Other Ministry Programs – How Does It Fit?

Some of the DWQMS requirements may be perceived to be similar to the requirements of other Ministry programs. In this section, the differences between the DWQMS and the other Ministry programs are explained.

DWQMS Audits versus Ministry Inspections

The roles of Ministry inspectors and DWQMS auditors are different. Inspectors assess whether regulatory compliance was achieved, whereas auditors assess whether the necessary elements of the management system are in place to meet the requirements of the DWQMS.

Inspectors verify that past performance and the physical infrastructure of the drinking-water system meet legislated requirements. Compliance is assessed after the fact. Auditors, on the other hand, assess planning and ongoing activities, responsibilities, practices, documents, processes, resources and records to confirm that the policies and procedures that the Operating Authority has committed to in the Operational Plan are effectively implemented and conform to the requirements of the DWQMS. The DWQMS focuses on preventative and proactive measures, as additional barriers for drinking water safety.

Source Water Protection

The source water assessment required by the DWQMS is limited and localized compared to the broad reaching source protection planning that will be required under the *Clean Water Act (CWA).*

The *CWA* will require the development of comprehensive Source Water Protection Plans on a watershed basis. These Source Water Protection Plans will include the identification of “threats” to source water quality. Similarly, “hazards” to your source water quality will be identified through the risk assessment activities for the DWQMS. Under the DWQMS, the scope of this activity is limited to hazards in the near vicinity of your intake or well, whereas under the *CWA,* the activity will be much larger in scope and could potentially include the entire watershed. (Note: the term “threats” has the same meaning as the term “hazards” used in the DWQMS.)

The Source Water Protection Plans to be created and carried out by Source Protection Committees under the *CWA* will include measures for reducing, managing and monitoring risks to source water to reduce the risk of significant source water threats throughout the entire watershed.

Under the DWQMS however, source water hazards only need to be identified – measures for preventing or reducing these hazards from occurring are not required. However, if you have management procedures to control certain source water hazards in your drinking-water system, should they occur, they will need to be addressed in the Operational Plan.

Once Source Water Protection Committees are established, information on source water hazards completed for the DWQMS can be integrated within the larger source water protection program.

6. Why Adopt the DWQMS Approach?

The DWQMS sets out a framework for the Operating Authority to develop a quality management system (QMS) that is relevant and appropriate for the drinking-water system and for the Owner to endorse and accept the QMS. The QMS is the foundation for:

- The establishment and documentation of management procedures;
- The achievement of conformance with the procedures; and
- Demonstration of conformity through an auditing process.

The DWQMS has been developed specifically to address the needs of the municipal residential drinking-water systems in Ontario. The DWQMS contains elements of both the ISO 9001 standard with respect to management systems and the HACCP approach to product safety. The Ontario standard recognizes our regulatory structure, and the HACCP component has been modified from the traditional food safety methodology to a Risk Assessment approach which reflects the multi-barriers for drinking water safety and the need to continuously supply safe drinking water.

Although the DWQMS is new to Ontario, the concepts of quality management and risk assessment are familiar at most drinking-water systems. Several water systems in Ontario have already adopted formal quality management systems and have been registered in accordance with ISO 9001, ISO 14001 and/or HACCP requirements. Although a formal QMS may not be in place, most drinking-water systems already have effective management systems and practices in place that cover many of the DWQMS requirements. Also, all drinking-water systems should be familiar with the risk assessment and management concepts through the Engineer's Reports prepared under O.Reg 459/00, which had as a primary objective, the assessment of the potential for microbiological contamination, and the identification of operational and physical improvements necessary to improve drinking water safety. The risk and emergency management activities required by the DWQMS are an extension of the exercise started with the Engineer's Report, and through inclusion in the Standard will be subject to continual review and improvement.

The DWQMS contains concepts that are currently part of how Owners and Operating Authorities manage and operate their drinking-water systems. The DWQMS however, requires that these concepts be formalized and documented in an Operational Plan, and that there is a strong commitment throughout the organization to continuously review and improve these practices.

The implementation of the DWQMS will provide municipal residential drinking-water system Owners and Operating Authorities with the tools necessary to ensure the continual improvement of their drinking-water systems.

7. Benefits of Implementing the DWQMS

Management systems are preventative and proactive in nature and focus on continual improvement. They emphasize a holistic, system-wide approach and attempt to determine the source of problems (root causes) or non-conformances and then make changes to reduce the frequency of their occurrences. A robust management system, when effectively implemented, provides a number of benefits to an organization. Some of the benefits of the DWQMS approach are:

- Owners and Top Management are given tools to continually assess their systems and to help ensure that "Standard of Care" provisions are met. The Standard of Care provisions, s. 19 of the *Safe Drinking Water Act, 2002* require that those persons with oversight responsibilities for a municipal drinking-water system exercise a level of care, diligence and skill that a reasonably prudent person would be expected to take in a similar situation.
- Accountability for the provision of safe drinking water is shared throughout the entire Operating Authority as well as with the Owner. Through the implementation of the DWQMS, operations staff is given a means to communicate water quality safety issues throughout the organization.
- Management systems create a foundation for improved communication, planning and operational control. During abnormal and emergency conditions, it is essential that documented response procedures are available and that everyone involved is aware of their roles and responsibilities to maintain drinking water safety.
- The DWQMS process emphasizes the need to monitor indicators of problems before the problems result in regulatory non-compliance. Appropriate responses and control measures are identified and continually reviewed.
- The DWQMS recognizes that multi-barriers are necessary to control drinking water quality risks particularly with respect to microbiological pathogens, and requires the continual review of the effectiveness of each of these barriers through the risk assessment and management process.
- Through the risk assessment and associated management activities, risks are prioritized and potential control measures are identified to reduce risks and improve water quality safety. This systematic process allows effective decision making, and money and resources to be spent wisely.
- The documentation of processes and procedures in the Operational Plan ensures that all personnel have access to the same information, and that consistent methodologies are used.
- By adopting a management system approach, operational efficiencies are often identified.
- The implementation of a QMS promotes consumer and Owner confidence in the quality of the drinking water end product.

8. Who Must Implement the DWQMS?

The DWQMS requires an Operating Authority to establish a QMS for each 'subject system' that it operates, and to document the QMS in an Operational Plan. A subject-drinking water system is defined as a municipal residential drinking-water system or parts thereof operated by the Operating Authority. This means that if a municipal residential drinking-water system has one Operating Authority for the treatment system and a different Operating Authority for the distribution system, two separate Operational Plans would have to be developed.

Although the Operating Authority is responsible for the development, implementation and maintenance of the QMS at each of its systems, the Operational Plans become the property of the Owner. In this way critical information to support the production of safe drinking-water is retained with the drinking-water system.

9. Who Assumes Responsibility for the DWQMS?

The DWQMS sets out a framework for the Operating Authority to develop a quality management system (QMS) relevant and appropriate for the drinking-water system and for the Owner to endorse and accept the QMS.

Under the new MDWL program, both the Owner and Operating Authority will have new roles and responsibilities as generally outlined below.

Owner

- Submit application for a Municipal Drinking Water Licence, Drinking Water Works Permit and Permit to Take Water (unless one is already available and valid).
- Ensure an Operational Plan is developed and submitted.
- Endorse the contents of the Operational Plan and submit to the Ministry for acceptance.
- Retain ownership of the Operational Plan.
- Develop and submit Financial Plan (when required).
- Ensure the drinking-water system is being operated by an Accredited Operating Authority.
- Monitor the QMS and the need for resources to support the QMS.
- Ensure compliance with the Terms and Conditions of the Municipal Drinking Water Licence and its components.

Operating Authority

- Develop the Operational Plan in consultation with the Owner.
- Effectively implement and maintain the QMS.
- Conduct internal audits and management reviews of the QMS.
- Obtain Accreditation from third-party Accreditation Body.
- Communicate with the Owner about the QMS and resource requirements.
- Ensure compliance with the Terms and Conditions of the Municipal Drinking Water Licence and its components.

The roles and responsibilities for both the Owner and Operating Authority will be further defined by your QMS and documented in your Operational Plan. Responsibilities for the QMS are shared throughout the organizational structure of the Operating Authority through to Top Management, and the organizational structure of the Owner through to elected municipal officials.

10. Additional Resources for Implementation

There are several resources to help you with your implementation. Resources include:

- This Guidance Document,
- Training workshops organized by the Ministry of the Environment, and
- Peer Support programs, where municipalities may be able to share information and resources.

11. Structure of the DWQMS

The DWQMS is divided into three steps – Plan/Do, Check and Improve. This structure originates from the Plan-Do-Check-Act methodology seen in some International Standards, with the ‘Plan’ and ‘Do’ steps as separate steps. However, the structure of the DWQMS has been modified to better reflect the implementation and maintenance methodology used by the municipal pilot sites. Even with this change, the steps remain cyclic, so that the quality management system is able to continually evolve and improve.

Plan/Do - Develop and implement an Operational Plan, and define and communicate the roles and responsibilities of the Owner/Operating Authority, while defining and carrying out plant and distribution activities and processes to ensure safe drinking water.

Check - Review the effectiveness of the quality management system and its implementation by conducting internal audits and management reviews. This provides feedback on the workings of the system.

Improve - Plan and implement a process to use the feedback from internal audits and management reviews in order to make improvements to the QMS.

12. Elements of the DWQMS

Each step in the QMS cycle described above is comprised of groups of elements. Each element covers a specific QMS topic, and outlines particular policies and procedures you must have in place.

The DWQMS has:

- eighteen elements in the PLAN and DO step
- two elements in the CHECK step
- one element in the IMPROVE step

Within most elements, there are ‘PLAN’ and ‘DO’ requirements. The ‘PLAN’ requirements within an element typically describe what method or documentation shall be decided upon or prepared, while the ‘DO’ requirements describe what must then be implemented.

SECTION 2 – PREPARING FOR QMS IMPLEMENTATION

Chapter 4 – Setting Up the QMS Team and Implementation Resources

Key Points in Chapter 4

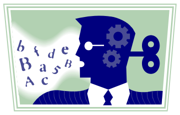
The DWQMS requires that Top Management ensures resources are provided for the QMS.

Planning for and identifying required resources will help Top Management be aware of the QMS, and its responsibilities.

The primary resources required for QMS initial development and implementation are staff time and the costs associated with QMS training.

Training should be made available to the QMS Implementation staff on the DWQMS and its requirements.

Chapter 4 – Setting Up the QMS Team and Implementation Resources



Technical **Terms**

Top Management is a person, persons or a group of people at the highest management level within an Operating Authority that makes decisions respecting the QMS and recommendations to the Owner respecting the Subject System or Subject Systems.

The development, implementation, maintenance and continual improvement of your drinking water quality management system require resources, planning and commitment. It is also important to remember that the QMS will be a living system, and that additional resources will be required on an ongoing basis to maintain and improve the system.

At the start of implementation, staff will need to be identified to assume responsibility for the project. Management will typically be involved at the start of implementation and will assign staff to this role. By involving management at the beginning of the implementation process, you will be able to ensure that the necessary resources are available for your drinking water QMS. Element 3 (d) of the DWQMS requires that Top Management ensures the availability of the necessary resources for the development, implementation, and continual improvement of the QMS.

Helpful **Tips**

A good cross-functional team may include:

- An administrative person
- An operator
- A maintenance person
- A management person
- A representative of the Owner

1. Assign Implementation Lead

Like any project, your QMS requires an overall managing role, responsible for overseeing the development and implementation of the system. This person is assigned the role of "Implementation Lead".

The Ideal Implementation Lead Should…

- Be familiar with your drinking-water system
- Have knowledge of good practices for drinking-water systems
- Be familiar with the DWQMS
- Understand the importance of document and record control
- Communicate the importance of management commitment and endorsement
- Be aware of audit principles and what will demonstrate the DWQMS is effectively implemented
- Be familiar with standard operating procedures
- Be aware of risk assessment and management principles
- Be familiar with applicable regulatory requirements

The Implementation Lead should also have good people and organizational skills, be objective, have good communication skills, and be capable of leading a team. The Implementation Lead does not have to be from Management, but it is essential that they communicate with Management about the QMS during implementation.

Some of the key tasks for the Implementation Lead include:

- Arranging for staff training and orientation;
- Completing a Gap Analysis;
- Creating an implementation action plan and keeping it updated;
- Carrying out the implementation tasks, or designating them to others;
- Keeping the QMS implementation on schedule; and
- Reporting progress of implementation to management.

The role of the Implementation Lead is not defined or required by the DWQMS. However, you will find that many of the roles and responsibilities are similar to those of the QMS Representative, which is an on-going role required by the DWQMS. Depending on your organization, it may make sense for the Implementation Lead to also become the QMS Representative, but this is at your discretion. The person who may be best suited as a QMS Representative may not be able to dedicate the necessary time for the implementation role.

2. Assign QMS Implementation Team Members

Depending on the size of your drinking-water system and the number of Operating Authority staff, a QMS team may be necessary for implementation. The QMS team is a group of people who share the responsibilities of implementation. Because the QMS encompasses all areas and aspects of the drinking-water system, including staff with expertise and knowledge of current operations and your management system is important. As a team, the tasks are shared, and can be assigned to the individuals most suited to each task.

For the risk assessment task in particular, a team approach including people familiar with water systems is necessary. Some systems may benefit from teaming with neighbouring drinking-water systems to complete this task. More detail on the risk assessment activity is provided in Chapter 10 – Risk Assessment and Risk Assessment Outcomes.

The following are some of the tasks that the team may be responsible for:

- Interviews with staff for input on QMS procedures;
- Meetings to brainstorm ideas, methods, and documentation;
- Writing documents; and
- Review and approval of procedures and documents.

The DWQMS and this Guidance Document have been developed and written to enable implementation by existing staff.

3. Examples of Implementation Teams from the Pilots

Below are examples of some of the pilot participant teams:

For a drinking water treatment and distribution system servicing approximately 10,000 people in Ontario the implementation team consisted of:

- Implementation Lead – Manager of Operations – Owner/Operating Authority
- QMS Implementation Team Member – Documentation/Process Technician – Owner/Operating Authority

Another pilot participant was a small distribution system servicing approximately 2,500 consumers. The implementation team consisted of:

- Implementation Lead – Public Works Superintendent – Owner/Operating Authority
- QMS Implementation Team Member – Administrative Assistant – Owner/Operating Authority

Helpful **Tips**

Training for implementation can be acquired in different ways including:

- Reading this Guidance Document
- Attendance at Ministry sponsored DWQMS Implementation Workshops
- Taking courses related to Management systems and auditing principles
- Communicating with peers in the industry

4. Resources

The primary initial resources required for development and implementation of the DWQMS will be staff time. The resource needs should be identified with the involvement of your Implementation Lead. The Implementation Lead can then help ensure necessary resources are provided by communicating with Top Management and the Owner, as required.

QMS resources and the responsibility of the Owner and Operating Authority to provide them are discussed further in Chapter 5 – Getting Started.

5. Acquire Necessary Training

Training will likely be needed for all QMS team members. The Implementation Lead will require the most in-depth training, whereas the necessary training for other team members may be more limited in scope.

Arrange for the required training. Methods of achieving training are identified in the box in the margin. Top Management may also require training, depending on their degree of involvement and interest.

In general, training will increase awareness and knowledge of:

- The DWQMS;
- How the DWQMS is implemented, maintained and improved;
- Management systems;
- Auditing principles;
- Resources that may be required;
- Benefits of having a QMS; and
- Responsibilities under the DWQMS.

Acquiring the necessary training for the Implementation Lead, the QMS Team, and Top Management will make implementation more efficient, and your quality management system more robust.

6. Communicate New Roles

Ensure that Operating Authority personnel and management who are involved in the QMS development and implementation, or who will be affected by it, are aware of their new roles and the responsibilities associated with those roles.

Each implementation team member should be aware of the other team member roles. This can done in an announcement, email message, or posting, but is important to show management and staff that the QMS implementation has initiated, and that it is important.

Complete the Chapter Checklist below by checking off the items that have been completed. By completing all of the items, you will be ready to move on to the next chapter.

CHAPTER CHECKLIST	*Check When Complete*
QMS Implementation Lead has been assigned	
QMS Implementation team members have been set-up, if appropriate	
Training needs have been identified for the QMS Implementation Lead, Implementation Team members, and management	
Training has been arranged	
Training has been completed	
The new roles of the QMS Implementation Team have been communicated	

Chapter 5 – Getting Started

Key Points in Chapter 5

Defining who your Top Management is and then obtaining Top Management commitment to the QMS, are two crucial steps in getting started.

Following Top Management commitment, the next important step is establishing a QMS Policy which sets the foundation for the QMS. This policy demonstrates the assurance of the Operating Authority that quality management is important.

A QMS Representative must be appointed. The QMS Representative may be the same person who was your Implementation Lead or it can be someone else within your organization.

Chapter 5 – Getting Started

1. Translating the DWQMS

What the Standard says…

1. Quality Management System

PLAN – The Operational Plan shall document a Quality Management System that meets the requirements of this Standard.

DO – The Operating Authority shall establish and maintain the Quality Management System in accordance with the requirements of this Standard and the policies and procedures documented in the Operational Plan.

What does it mean?

Element 1 requires that you develop and document a QMS that meets the requirements of the DWQMS. You are about to begin this. The DO requirement of this element requires that you establish and maintain the QMS according to what you have written in your Operational Plan, and according to the requirements of the DWQMS.

The PLAN elements of the Standard outline what must be documented in the Operational Plan. By completing each of the PLAN Sections you will end up with a description of what you have in place for all of the elements in the Standard and the majority of your Operational Plan will be developed.

Before you begin, it is important that you can visualize the outcome of the implementation – what your Operational Plan will look like. It is a good idea to spend some time reading over all the Standard elements prior to beginning, and to start to plan how you will address them, building on the systems, processes and documentation that you already have in place.

The Operational Plan is a document or series of documents that outlines the processes and procedures for the overall quality management of the drinking-water system. For smaller systems, these may all be contained in one document. For medium and larger sized systems, the Operational Plan may be one main document which outlines key points, then refers to other documents, which are located throughout the water system. It is not a requirement that all of the documents in the Operational Plan be compiled together, but they should be thorough, complete, and easy to navigate.

Many organizations have found it most efficient to develop an Operational Plan shell document, which can easily fit into a small binder, which outlines each requirement of the Standard. Where procedures, forms, or other supporting documents are required, the shell document simply refers to those documents, and where they can be found.

Model Operational Plans are included as part of this Guidance Document, in Part III. The models are examples of Operational Plans, based on various types and sizes of drinking-water systems. Use the models to help you visualize what your Operational Plan may look like. It is crucial to note that the models are not meant for you to simply change the names and adopt as your own – what is described in the Model Operational Plans may not suit your drinking-water system. By following this Guidance Document, using the templates, and following along with the Model Operational Plans, you will have the tools required to implement your own QMS, based on the DWQMS requirements.

With the visual concept of an Operational Plan introduced, there are two key steps in getting your QMS implementation started: establishing a QMS Policy (outlined in Element 2 of the DWQMS); and obtaining Commitment and Endorsement (outlined in Element 3). This chapter describes how to complete these two key steps.

Obtaining Commitment and Endorsement

This section discusses how to obtain commitment from Top Management.

2. Translating the DWQMS

3.	**Commitment and Endorsement** PLAN – The Operational Plan shall contain a written endorsement of its contents by Top Management and the Owner. DO – Top Management shall provide evidence of its commitment to an effective Quality Management System by: a.) ensuring that a Quality Management System is in place that meets the requirements of this Standard, b.) ensuring that the Operating Authority is aware of all applicable legislative and regulatory requirements, c.) communicating the Quality Management System according to the procedure for communications, and d.) determining, obtaining or providing the resources needed to maintain and continually improve the Quality Management System.

What does it mean?

This is a critical element to put into place early on in the implementation. The PLAN component of Element 3 requires that the Operational Plan is endorsed, in writing, by Top Management and the Owner. The DO component of Element 3 requires that Top Management is able to ***prove*** its commitment to the QMS. Top Management must be involved in the QMS, and provide direction and resources. This involvement must be demonstrated by awareness and in the QMS documentation. There are broad responsibilities for Top Management outlined in the DO component of Element 3. Documents and records that will be created as a result of implementing the QMS will help provide proof of management commitment.

Top Management commitment is a crucial part of a successful QMS implementation. Without the authority, direction and support of Top Management, it would be very difficult to plan the implementation and to create a QMS. The QMS must be adopted as an integral part of your organization and necessary resources must be provided, from now and into the future. The lack of Top Management commitment can be a major reason for the failure of management systems.

3. Identify Top Management for Your QMS

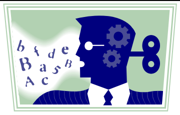
Responsibilities for the QMS are shared throughout the organizational structure of the Operating Authority through to the most senior officials. This is necessary as the quality management approach requires a commitment to seeking and implementing improvements at every level of decision-making, from the policies of corporate management to the day-to-day decisions of those who have responsibility at the ground level. See also Chapter 11 of this guidance document which outlines the requirements for Element 9 of the standard with respect to describing Organizational structure, roles, responsibilities and authorities.

The Part Two Report of the Walkerton Inquiry identified the need for all levels of management within an Operating Authority to understand their responsibilities with respect to the delivery of safe drinking water. Contract Operating Authorities will have a level of Corporate Management, including its Board of Directors and senior management, which are responsible for many different water systems, and the Corporate Management must be capable of managing a large and complex organization in order to ensure the provision of safe drinking water.

The DWQMS definition for Top Management requires that your Top Management must be people that meet the following criteria:
They work within the Operating Authority,
They will make decisions about your QMS,
They will make recommendations to the Owner about the Subject System or Subject Systems, and
They are at the highest level of management within the Operating Authority making these decisions and recommendations.

Top management does not have to be a single person. The intent is, however, that Top Management includes all levels of management, including the highest corporate level if appropriate.

Below are several examples of QMS Top Management structures for various drinking-water systems:



Technical Terms

Top Management is a person, persons or a group of people at the highest management level within an Operating Authority that makes decisions respecting the QMS and recommendations to the Owner respecting the Subject System or Subject Systems.

Helpful **Tips**

Remember to consider the key responsibilities for Top Management outlined in Element 3, when defining Top Management.

You can expand your Top Management to include other key people or groups that you feel may be beneficial to the maintenance of the QMS.

Example 1 – Small Private Operating Authority
A drinking-water system is operated by a private Operating Authority which is responsible for three small drinking-water systems in Ontario. The Operating Authority has defined Top Management as the President and Board Members of the Operating Authority itself. They defined it this way because the Chief Executive Officer (CEO) and Board Members are aware of the specific operations at each of the three drinking-water systems, are intimately involved in making decisions and providing resources for each drinking-water system, and regularly communicate with the Owner. Management reviews are carried out by the management of each individual system, and the results of the management reviews are forwarded to Top Management as well as the Owner.

Example 2 – Large Private Operating Authority
A privately operated drinking-water system is operated by a large Operating Authority, responsible for many drinking-water systems across Ontario. The Top Management for their QMS is defined as the Chief Executive Officer (CEO) and Board Members for recommendations regarding the corporate aspects of the QMS. The Operating Authority system manager for that drinking-water system, and the Operating Authority area and district managers responsible for that area of Ontario also have Top Management roles as they are responsible for making recommendations to system owners about the drinking-water system. Management reviews are completed by the manager for each drinking-water system. The results of these management reviews including overall QMS performance and issues are reported to both the district managers and the corporate levels of management in their role as Top Management, and are also forwarded to the Owner.

Example 3 – Municipally-operated System
A municipally operated system defined Top Management as the Water System Manager and Supervisor, as well as the Water Committee Chair. The Water Committee Chair is a member of council who liaises between the staff who are responsible for the operation of the drinking water system (Operating Authority) and the Mayor and Council (Owner). The Water Committee Chair thus represents both the Owner and Operating Authority. Management reviews are performed by Top Management, with results being presented to the Owner (elected municipal officials).

Example 4 – Large Municipal Operating Authority
A municipality is responsible for the operation of eight municipal residential drinking water systems of varying size and complexity. Two levels of Top Management were defined for each system – corporate and operational. Corporate Top Management was identified as the Commissioner of Public Works and the Director of Water Supply as they make recommendations to the Owner on each of the drinking water systems, make decisions respecting corporate aspects of the QMS, and review the management review reports for each system. Each system also has an operational level of Top Management which includes the System Manager and Supervisor who perform management reviews for their systems and makes decisions on system-specific aspects of the QMS. The Owner is kept informed by the Commissioner of Public Works and the Director of Public Works and receives copies of the management review reports.

4. How to Obtain Top Management Commitment

Obtaining or establishing Top Management commitment is both a "front end" and ongoing activity. Here are some steps that can help you obtain Top Management commitment.

Inform and Include Top Management

During implementation, your Implementation Lead should be responsible for ensuring that Top Management is informed about the progress of the implementation through update meetings, reports, or other methods as appropriate. All levels of management should be Standard and this Guidance Document.

By including the Implementation Lead in the planning, and having the Implementation Lead communicate with Top Management, Top Management will understand what is needed to get the job done and the requirements for ongoing maintenance of the DWQMS. By being informed about the actual implementation, Top Management is learning the requirements of the Standard and fulfilling those requirements for which it is responsible.

Without real management commitment, the DWQMS will only be a paper exercise that will prove to be very difficult to implement, awkward to maintain and impossible to improve, and will not add any value to the operation of the drinking-water system. If it's not important to Top Management, why should it be important to anybody else?

Proving Management Commitment

The DO component of Element 3 of the DWQMS requires that Top Management be able to prove commitment to the development, implementation and continual improvement of the QMS. This proof will be created as you continue to follow this Guidance Document, and implement your QMS.

If you are in Top Management and you want to demonstrate commitment:

Become engaged in the implementation process (you don't have to manage or lead it, but oversight is a positive contribution).

Read, understand and participate in the completion of those requirements of the Standard that are intended for Top Management.

Ready for the
Audit

What do auditors like to see for management commitment?

- Expect the auditor to interview a sample of personnel in Top Management
- The auditor will ask questions about how the QMS has performed, how it is communicated, and how and why Top Management is involved in the QMS.
- The auditor will be investigating Top Management's awareness of the QMS and how it integrates with operations
- The auditor will look for participation of Top Management in the management review process by interviewing and reviewing documents. Participation may include discussion of topics and initiated action items.

Ask about the progress of the implementation as a course of running the drinking-water system. Be proactive, you don't have to wait for a scheduled meeting to get a quick verbal update.

5. Resources

The DO component of Element 3 requires that Top Management determine, obtain or provide the resources needed to maintain and continually improve the QMS. For this requirement, "obtain" means the procurement of resources within the Operating Authority's responsibility and/or purchasing authority. For resource procurement beyond this authority, "obtain" shall be interpreted as meaning a duty to provide reasonable notification to the Owner of the identified needs, along with some assessment of the risks of not providing the resources and possible options where feasible. "Obtain" implies that the Owner must be aware of the Operating Authority's needs and the possible consequences of not meeting them. This is critical for the Operating Authority particularly where it does do not have full authority.

Develop the QMS Policy

1. Translating the DWQMS

What the Standard says…

2. Quality Management System Policy

PLAN – The Operational Plan shall document a Quality Management System Policy that provides the foundation for the Quality Management System, and:

a.) is appropriate for the size and type of the subject system,
b.) includes a commitment to the maintenance and continual improvement of the Quality Management System,
c.) includes a commitment to the consumer to provide safe drinking water,
d.) includes a commitment to comply with applicable legislation and regulations, and
e.) is in a form that provides for ready communication to all Operating Authority personnel, the Owner and the public.

DO – The Operating Authority shall establish and maintain a Quality Management System that is consistent with the Policy.

What does it mean?

Element 2 of the DWQMS requires the development of a QMS policy. A policy is the driver for the quality management system – firm documented commitments to demonstrate the Operating Authority's assurance that quality management is important. The PLAN component outlines three main commitments that must be in the policy: a commitment to maintain and continually improve the QMS, to comply with applicable legislation and regulations, and to the consumer to provide safe drinking water. In this manner, the organization's commitment to drinking water quality is documented. The PLAN component of this element also requires that the policy be in a form that can be easily communicated. The DO component requires that the Operating Authority ensures the QMS is consistent with the commitments made in the QMS policy.

2. Prepare the QMS Policy

The QMS Policy is the backbone of the quality management system. This is an important step that should be performed with input from Top Management.

Use the checklist below to create the minimum statements required in your QMS policy.

CHECKLIST	
Requirement	***Complete?***
Create a statement that describes your commitment to, at a minimum; comply with applicable legislation and regulations.	
Create a statement that states your commitment to maintain and continually improve the QMS.	
Create a statement that states your commitment to the consumer to provide safe drinking water.	

Review the policy, and ensure that the commitments made are appropriate to the size and type of the Subject System.	
Ensure the policy is in a form that will be easy to communicate. You will need to communicate the policy to Operating Authority personnel, the Owner, and to the public. Think of what it will look like when communicated, and how you will do that.	

Larger organizations in particular may choose to make commitments that go beyond the minimum requirements of the Standard. These additional commitments could include such things as commitments to:

- Implement and/or maintain other management systems such as an environmental management system (ISO 14001)
- Be an active participant in industry associations
- Be involved in research and development
- Pilot new technologies as appropriate
- Promote energy and resource conservation.

Although not necessary to meet the requirements of the DWQMS, these additional commitments may serve to increase consumer confidence, advance the drinking water industry, improve drinking water safety and quality, reduce certain liabilities, or reduce operational costs and environmental impacts.

Keep in mind that if additional commitments are made in the policy statement, the external auditor will seek proof that they are being met. As these additional commitments are not a required part of the DWQMS, they do not have to be documented in the Operational Plan; however some organizations may choose to do so.

Figure 5.1 shows an example of a QMS policy created under the DWQMS for a large treatment system, operated and maintained by an independent Operating Authority. Figure 5.2 shows an example of a QMS policy created under the DWQMS for a small well supply and distribution system, owned and operated by the municipality.

Figure 5.1: Sample QMS Policy for a large treatment system.

QMS POLICY FOR LAKE ONTARIO WATER SUPPLY SYSTEM

The ABC Board utilizes the services of Water Inc., an independent contract Operating Authority, to operate and maintain the water supply system. Together, the ABC Board and Water Inc. are committed to:

- Managing and operating the Lake Ontario Water Supply System in a responsible manner in accordance with documented quality management system policies and procedures.
- Providing the customer with clean, safe drinking water.
- Promoting Owner and consumer confidence in the safety of the drinking water supply.
- At a minimum, meeting all applicable legislative and other requirements, and encouraging our suppliers and subcontractors to similarly meet these requirements.
- *Promoting resource stewardship, including conservation.*[1]
- *Being a quality leader in the business sector in which we participate.*[1]

The ABC Board and Water Inc. strive to accomplish our goals through the dedication, support and participation of all employees, and the maintenance and continual improvement of our Quality Management System.

ABC Board of Management - Owner ***Water Inc. – Operating Authority***
June 1, 2006
Note: 1 – these are additional commitments beyond the requirements of the DWQMS.

Figure 5.2: Sample QMS Policy for a well supply and distribution system

QMS POLICY FOR THE WESTHILL WATER SUPPLY AND DISTRIBUTION SYSTEM

The Municipality of the Town of Westhill owns, maintains and operates the Westhill Water Supply and Distribution System.

The Town of Westhill is committed to:
1. ensuring a consistent supply of safe, high quality drinking water,
2. maintaining and continually improving its quality management system, and
3. meeting or surpassing applicable regulations and legislation.

The Muncipality of the Town of Westhill
June 1, 2006

Policy commitments are for everyone with responsibilities related to the drinking-water system. Encourage management to be involved in creating the policy, not just approving it after it is written. Top Management input during policy creation not only enhances its value, but shows commitment. The policy must be supported by Top Management and the Owner, through an endorsement of the Operational Plan – it is the cornerstone of the system.

3. Approve the QMS Policy

After creating the policy, issue the draft policy to Top Management for review and approval. Once approved, the policy does not stay the same indefinitely – it will be reviewed and approved in a continual process. The purpose of the review is to ensure the QMS Policy is current and appropriate for the QMS and the drinking-water system. Chapter 23 of this Guidance Document discusses in more details the QMS activities you will perform once you have your QMS in place. However, at this stage, you should decide the frequency and methodology for Top Management to regularly review the QMS Policy.

4. Operational Plan - Add the QMS Policy

The QMS Policy must be documented in the Operational Plan. Ensure this documentation is complete. Although not required in the DWQMS, it is helpful to describe in the Operational Plan, how the policy statement was developed, how it will be reviewed by Top Management, and how often this review will occur. This will ensure that QMS Policy development, review and approval are always performed consistently.

5. QMS Consistent with QMS Policy

The DO component of Element 2 requires that the Operating Authority establish and maintain a QMS that is consistent with the QMS Policy. This means the commitments you make in the QMS Policy must be an integral part of your QMS.

You should be able to demonstrate, with documentation, that your QMS is consistent with the QMS Policy – especially the commitments.

For example, the sample policy in Figure 5.2 has three key commitments. Documentation to support commitment #1 may include consideration of the Annual Report prepared for the MOE under O. Reg. 170/03. To demonstrate commitment #2, the Operating Authority may refer to all QMS documents showing updates and revisions (revisions indicate a document was reviewed, edited, and subsequently improved), or results of management reviews and internal audits and subsequent actions (see Chapters 18 and 19).

A crucial part of ensuring the QMS is consistent with the QMS Policy is the communication of the QMS Policy to Operating Authority personnel. This is discussed further in “Chapter 13 – Communications”.

Ready for the **Audit**

What do auditors like to see for QMS Policy?

- A QMS Policy that is appropriate for the size and type of the Subject System or Subject Systems
- The required commitments in the policy
- A policy available in a form to allow for ready communication
- That the policy is part of the Operational Plan
- That staff, especially management, are able to discuss how the QMS is consistent with the QMS Policy – how the commitments are being met

When interviewing personnel about any topic, throughout the entire audit, auditors will assess policy understanding and awareness. They may ask interviewees: “What does the QMS Policy mean to you?” or “Explain what you think the QMS Policy means?”

Remember that during both internal and/or external audits, Top Management is expected to demonstrate conformance to the QMS Policy. Your data should support the statements contained in your Policy.

6. QMS Representative

What the Standard says…

4. Quality Management System Representative

PLAN – The Operational Plan shall identify a Quality Management System representative.

DO – Top Management shall appoint and authorize a Quality Management System representative who, irrespective of other responsibilities, shall:

a.) administer the Quality Management System by ensuring that processes and procedures needed for the Quality Management System are established and maintained,
b.) report to Top Management on the performance of the Quality Management System and any need for improvement,
c.) ensure that current versions of documents required by the Quality Management System are being used at all times,
d.) ensure that personnel are aware of all applicable legislative and regulatory requirements that pertain to their duties for the operation of the subject system, and
e.) promote awareness of the Quality Management System throughout the Operating Authority.

What does it mean?

Element 4 describes specific requirements for a special role in the QMS – the Quality Management System Representative - who is appointed by Top Management. Element 4 requires that the Operational Plan identifies a QMS representative. The responsibilities and authorities for that specific role are prescribed in parts a) to e) of the DO component. The Quality Management System Representative is generally responsible for the QMS, and channels important QMS information to Top Management. The QMS Representative may be, but is not required to be from system management or Top Management.

7. About the QMS Representative Role

The QMS Representative, who is appointed by Top Management, performs a key role in the QMS. The individual chosen for this role may the Implementation Lead identified earlier in this guidance document; however, it can be someone independent of the Implementation process. This role focuses on the QMS once implemented. It is an ongoing role and relates to the ongoing maintenance of the QMS during your first QMS cycle, the accreditation of the Operating Authority, and beyond.

Top Management should appoint, in writing, the QMS Representative. It is important that Top Management appoint a person with the ability and authority to be responsible for the QMS, and to communicate QMS issues clearly and promptly. The QMS Representative should have sufficient authority to ensure that the needed processes are established, implemented and maintained throughout the organization, and to report to Top Management on performance and any needed improvement. In the written appointment, Top Management should document that it appoints and authorizes the QMS Representative.

The QMS Representative must be aware of their responsibilities. Ensure that the QMS Representative has reviewed the responsibilities listed in Element 4 with Top Management, and is comfortable with them. Of course, the QMS Representative does not have to carry out all of the tasks necessary to achieve the awareness and performance required, but is responsible for ensuring that those tasks are complete. The prescribed responsibilities are:

a) Ensuring that processes and procedures needed for the QMS are established and maintained.

This means that the QMS Representative is responsible for the QMS being established and maintained. If resources are required, or other issues arise, it is the responsibility of the QMS Representative to address those needs by reporting and discussing them with Top Management.

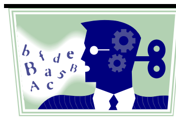
b) Reporting to Top Management on the performance of the QMS and any need for improvement.

It is not acceptable for a QMS to fail because Top Management was not aware of any need for improvement. The QMS Representative is responsible for ensuring effective communication of these issues.

c) Ensuring that current versions of documents required by the QMS are being used at all times.

Ultimately, it is the QMS Representative who is responsible for document control.

d) Ensuring that personnel are aware of all applicable legislative and regulatory requirements that pertain to their duties for the operation of the Subject System or Subject Systems.



Technical **Terms**

Responsibility is a charge, trust, or duty, for which one is responsible. To be responsible means to be correspondent or answerable, accountable to another for something.

Authority is official permission or approval to carry out a responsibility or task.

Helpful **Tips**

The QMS Representative role can be filled by more than one person. For large, complex systems, one QMS Representative alone may not have sufficient time or skills to fulfill all of the QMS Representative responsibilities.

Ready for the **Audit**

Expect the auditor to interview the QMS Representative.

The auditor will want to see that the QMS Representative fully understands their responsibilities, and that the authority to carry out those responsibilities has been provided.

The auditor may also want the QMS Representative to prove that those responsibilities have been met. For example, to show an auditor that the performance of the QMS has been reported to Top Management, the QMS Representative may be asked to show meeting minutes or email messages.

The auditor will also review the Operational Plan to ensure the QMS Representative is documented there. The auditor may also review other documentation to verify that the QMS Representative has been made aware of their responsibilities.

The auditor may also ask for documents to demonstrate that Top Management appointed and authorized the QMS Representative.

Ultimately, it is the QMS Representative who is responsible for ensuring that personnel are aware of their legislative and regulatory responsibilities.

e) Promoting awareness of the QMS throughout the Operating Authority.

Spreading the QMS information throughout the Operating Authority is the ultimate responsibility of the QMS Representative.

The QMS Representative should…

- Be familiar with your drinking-water system
- Have knowledge of good practices for drinking-water systems
- Be familiar with the DWQMS
- Understand the importance of management commitment
- Be familiar with audit principles and what will be needed to demonstrate that DWQMS requirements have been met to an auditor
- Be familiar with applicable legislative and regulatory requirements

Complete the Chapter Checklist below either as you go through the chapter or at the end. By completing all of the items, you will be ready to move on to the next section of the Guidance Document.

FINAL CHECKLIST	*Check When Complete*
Identification of Top management	
Management commitment obtained	
Creation of QMS Policy	
Have all the points on the Checklist for Creating the QMS Policy been addressed?	
Approval of the QMS Policy	
Addition of the QMS Policy to the Operational Plan	
Appointment of a QMS Representative	
Authorization of the QMS Representative to carry out the listed responsibilities	
Identification of the QMS Representative in the Operational Plan	

SECTION 3 – GAP ANALYSIS AND IMPLEMENTATION ACTION PLAN

Chapter 6 – Gap Analysis and Implementation Action Plan

Key Points in Chapter 6

Performing a Gap Analysis at this stage will help you estimate the time and resources you will need to implement the QMS.

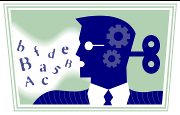
The Gap Analysis is not a requirement of the DWQMS, however it is good practice to undertake one prior to implementing the DWQMS. The Gap Analysis will allow you to build on the systems you already have and identify areas where the DWQMS requirements are not yet being met.

The Gap Analysis involves not only reviewing processes and procedures that are documented, but also reviewing methods in place that may not be documented.

The Gap Analysis is undertaken by the QMS Implementation Team and findings should be discussed with the Top Management and the QMS Representative.

An Implementation Action Plan should be created based on the results of the Gap Analysis.

Chapter 6 – Gap Analysis and Implementation Action Plan



Technical **Terms**

A **Gap Analysis** is the process of determining and evaluating the variance between the requirements of the DWQMS, and the methods and documents in place in your drinking-water system.

1. Gap Analysis Overview

In a Gap Analysis, you review what you currently have in place against the requirements of the DWQMS; assess where the gaps are, and how to best reduce these gaps. The results of the Gap Analysis will help you to estimate how much time and what resources you will need to implement the QMS. Once this is known, you can develop an Implementation Action Plan and begin to put the missing pieces into place, building as much as possible on what you already have.

A Gap Analysis will require that you review your existing documents and activities for conformance with the requirements of the DWQMS. Not all documents need to be reviewed in detail, but you must be aware of what information they contain, and how it may be used as is or adapted for the QMS.

To perform the Gap Analysis, a checklist is used, which covers all elements of the DWQMS (a sample checklist template is provided in Part II of this guidance document). The checklist provides tips on where to look for DWQMS elements that may already be in place. The Gap Analysis is undertaken by the Implementation Team and other personnel as required.

Helpful **Tips**

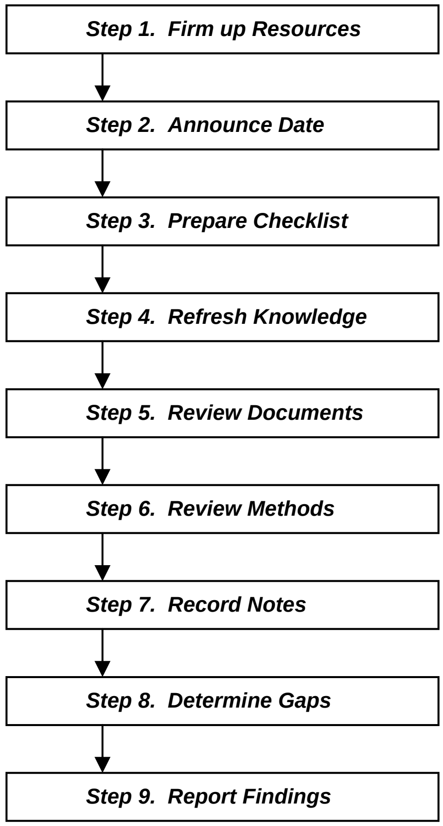
Always remember that the purpose of a Gap Analysis is not to point out what is wrong. Instead, it is to identify areas that will need attention, and it is a positive and effective first step in the development and documentation of your QMS.

Observe, ask questions, read documents, and gather information from staff members. All of these **notes** are recorded on a checklist, and a list of gaps is developed. If there is a team of reviewers, this is done at a team meeting. Following the gap analysis, meet with key personnel to explain the gaps found, and distribute the completed Gap Analysis Checklist with the gaps clearly identified.

2. How to Perform a Gap Analysis

Figure 6.1 shows the typical steps taken in a Gap Analysis. Each step is described in more detail in this chapter.

Figure 6.1: Typical Gap Analysis approach.



Step 1. Firm up Resources. To begin, ensure that Top Management is in agreement about the purpose of the Gap Analysis and how much time it will take. A Gap Analysis performed by one reviewer can take anywhere from 1-2 days for very small systems to 8-10 days, or longer, for larger systems.

You should confirm the availability of the reviewers also. The Implementation team usually performs the gap analysis. However other personnel may be required to support the team. Utilizing personnel from other municipalities or school co-operative education programs, for example, may be an option.

Step 2. Announce Date. Choose a date and notify management and staff. You will need to ask questions, read documents, and tour the facility, which can affect staff schedules, so people must be made aware of what may be involved.

Step 3. Prepare a Gap Analysis Checklist. Use the template provided in Part II or create your own checklist. The template includes ideas of where you may look to find the information that you need. Discuss with reviewers how to use the checklist and what you expect them to do with the checklists once they are complete (file a copy with you, file original with you, electronic vs. hard copies etc.).

Step 4. Refresh Your Knowledge. Make site visits if you are not familiar with all areas of an extensive system to ensure that you are comfortable with your understanding of what happens and where it happens. Also, review the checklist and any other pertinent resource material.

Step 5. Review Documents. Collect documents and using the first column of the checklist, which lists each requirement of the DWQMS; seek out those requirements in the documents you review. Be objective and open-minded. Here is a sample list of some of the documents you may want to start with (if they exist).

- "As built" drawings
- Process flow schematics
- Equipment manuals
- First Engineer's Reports prepared for the MOE (assessment of treatment processes, raw and treated water quality, assessment of hazards)
- Official Plans
- Hydrogeological Studies (capture zones, water quality, assessment of hazards)
- Design Reports and Briefs: Treatment processes
- Optimization Studies: Water quality, treatment requirements
- Emergency plans, contact lists, and response procedures
- Inspection Reports
- Standard Operating Procedures and Work Instructions
- Operations and Maintenance Manuals
- Plant Records
- Maintenance and Repair Records
- Calibration Records

Step 6. Review Methods and Procedures. In this step, you observe the methods and procedures that are in place that may satisfy the requirements of the DWQMS, even if they are not documented. Using the first column of the checklist, which lists each requirement of the DWQMS; seek out those requirements in the methods you observe. Observe, interview, and listen to information from people when you interview them.

For example, in evaluating Element 6 of the DWQMS, you are looking for a documented description of the Subject System and the water source.

Seek out the requirements in documents that you have access to. The First Engineers Report, the Design Brief or Report, Certificates of Approval, or Operation and Maintenance Manuals for the water system may contain some of the required information. It is always helpful to ask staff for assistance – someone else may know where the documents may be found.

Step 7. Record Notes. Record notes when you review documents and methods. In the "Notes" column, record details about documents you review, people interviewed, and observations of activities. These notes document what you observed during your assessment. Record any concerns and comments also, especially if you feel a method that is in place is not effective.

Under the “Method in Place?” column, enter a “Yes” or “No” if you observed a method in place that meets the requirements of the DWQMS, even if it is not documented. If a “method” is not required, then enter “NA” for “Not Applicable”.

Under the “Documented?” column, enter a “Yes” or “No” if the requirement has been documented. If documentation is not required, then enter “NA” for “Not Applicable”.

Step 8. Determine gaps. If you reviewed the QMS with a team, discuss your checklist results with other reviewers. The purpose of this step is to review your notes, and decide on areas that have gaps between the system and the DWQMS requirements. For each DWQMS requirement, a gap exists when :

- No method or documentation is in place for a requirement
- A method is in place that satisfies the requirement, but it is not documented
- A method is in place but it is not effective.

Record the final decisions about gaps in the “Gap?” column of the checklist. To simplify the review of your completed checklist, highlight the requirements that have gaps associated with them.

Figure 6.2 shows an example of one completed section from a Gap Analysis Checklist.

Figure 6.2: Example of completed section of a Gap Analysis Checklist.

Requirement	Notes	Method in Place?	Documented?	Gap?
12. Communications				
PLAN – The Operational Plan shall document a procedure for communications that describes how the relevant aspects of the Quality Management System are communicated between Top Management and:	*No documented communication procedure is in place. Existing processes do not address the QMS.*	*Yes*	*No*	*Yes*
- the Owner,	*Top Management and Owner:* - *email (between Owner and Operating Authority management)* - *posting of Council meeting minutes on intranet, internet* - *communication meetings, where Operating Authority management communicate Owner activities, decisions*	*Yes*	*No*	*Yes*
- Operating Authority personnel,	*Top Management and Operating Authority personnel:* - *email (between OA management and staff)* - *suggestions box in lunchroom, but not described in procedure.*	*Yes*	*No*	*Yes*
- Suppliers, and	*Top Management and Suppliers: currently only the purchasing dept communicates with Suppliers.*	*No*		*Yes*
- the public.	*Top Management and public: through website www.sample.com, and billing stuffers but not described in a procedure.*	*Yes*		*Yes*
DO – The Operating Authority shall implement and conform to the procedure.	*No formal procedure is in place to be implemented, although some processes are in place. Processes need to be expanded to include the QMS*	*No*		*Yes*

Reviewer describes what is found, observed, read, or what is missing

Reviewer records which requirements (from the first column) have gaps

Step 9. Report findings. The gaps now need to be discussed with the implementation team in a closing meeting. If management, operators, and the implementation team are included in this discussion, it will help everyone understand where the QMS currently is and what gaps exist.

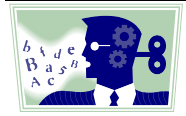
3. Create an Implementation Action Plan

With all of the gaps identified, it will now be much easier to start implementation of the QMS. Implementation is more successful using a documented Implementation Action Plan that outlines the tasks, the people responsible for carrying out those tasks, and a realistic time schedule. This should be a document that is uncomplicated to create and edit – a simple table or a spreadsheet is sufficient.

A template for an Implementation Action Plan can be found in Appendix B. The implementation approach in the template matches the steps outlined in this Guidance Document. Figure 6.3 shows an example with sections of an Implementation Action Plan ready for use. To customize and complete your action plan, here are some tips:

Add dates. Based on the results of the Gap Analysis and the challenges you anticipate within your system, add a target date for each step. Keep the dates realistic – err on the side of caution and allow more rather than less time – no one can predict the roadblocks you may encounter.

Add names. Next to each implementation task, add initials or names of the people best suited to complete them. In many cases, especially with smaller municipalities, many or all of the major tasks may be assigned to the Implementation Lead. This is not unusual, however, you should ensure that target dates are realistic based on one person's efforts.



Technical **Terms**

An **Implementation Action Plan** is the product of the Gap Analysis which identifies the tasks for implementing a QMS. The Implementation Action Plan should include tasks, target dates, and people assigned to task duties.

Figure 6.3: Sample section of completed Implementation Action Plan.

Implementation Step	Tasks	When	Who
Communication	***Decide how QMS will be communicated with Suppliers***	*June 30*	*BR/RM*
	Decide upon any additional QMS communication	*July 15*	*Managers*
	Create communications procedure	*July 21*	*BR*
	Review and approve procedure	*July 21*	*BR / SS*
	Implement procedure	*Sept 30*	*Managers / All staff*

Add target dates for completion of tasks

Add responsibilities

Date and distribute. Date the Implementation Action Plan, and issue it to key personnel, being sure to present it to the people with task responsibilities. The Implementation Lead should keep this Implementation Action Plan updated. As delays or changes occur, review the schedule and make appropriate changes to other tasks that may also be affected by the delay.

Complete the Chapter Checklist below, by checking off the items that have been completed. By completing all of the items, you will be ready to move on to the next chapter.

CHAPTER CHECKLIST	*Check When Complete*
Preparations for Gap Analysis	
Document review performed	
Review of methods and activities	
Gap Analysis Checklist complete	
Gaps identified	
Discussion of Gap Analysis findings with key personnel	
Creation of Implementation Action Plan with tasks, target dates, and assignment of personnel to complete tasks	
Distribution of the Implementation Action Plan to key personnel	
Plan to keep the Implementation Action Plan updated with changes or delays	

SECTION 4 – ESTABLISHING THE QMS AND PUTTING IT INTO PLACE

Chapter 7 – “Kick-off” Management Meeting

Key Points in Chapter 7

An effective way to initiate the QMS implementation, arouse interest, and educate key personnel is to arrange for a “Kick-off” Management Meeting. This meeting should include Top Management, the QMS Representative (if different from the Implementation Lead), the Implementation Lead and other personnel including Owner representatives.

The “Kick-off” Management Meeting should review the implementation road ahead, and confirm the implementation timeline.

This meeting is one means to obtain management commitment, as discussed in Chapter 5.

Chapter 7 – "Kick-off" Management Meeting

The purpose of the "kick-off" meeting is to inform and educate everyone on DWQMS requirements and to ensure that everyone is aware of and in support of the DWQMS Implementation Plan.

Normally, the "kick-off" meeting is held after the Gap Analysis has been completed and presented, and after the Implementation Action Plan has been created. Here are some key points to know when planning your "kick-off" meeting:

- For a small to medium size organization, the meeting typically takes several hours.
- The attendees should include top operational management, the implementation team, and other key participants. Board members and elected municipal representatives may also be invited.
- Arrange for someone to take attendance and record minutes.

For systems with a large number of employees, more than one meeting may need to be scheduled.

Try to limit the number of attendees to about 10 for each meeting, or 20 for large systems. This will allow for a better flow of information.

Use the example below as a guide when establishing the agenda for the "kick-off" meeting.

SAMPLE AGENDA FOR "KICK-OFF" MEETING

1. Introduce everyone
2. Describe purpose of meeting: *"To educate key personnel about the Standard and the implementation process"*
3. Have Top Management re-state their commitment to the implementation and maintenance of the QMS.
4. Provide a basic overview of DWQMS requirements.
5. Summarize the results of the Gap Analysis.
6. Verify findings of the Gap Analysis.
7. Present and explain the proposed Implementation Action Plan, and seek out participants to assist with addressing tasks.
8. Confirm participants for key tasks in the Implementation Action Plan.
9. Questions, comments or concerns.
10. Review and Close

Here are some helpful tips when arranging and carrying out the meeting:

Provide a brief summary of the benefits others have experienced through implementing management systems. Remind everyone of the advantages that can result from implementing management systems.

Use the "kick-off" meeting to confirm the timeline for the implementation. While you have the key personnel who will be involved in implementation all in one room, this is an excellent opportunity to review and confirm the overall timeline.

Highlight the positive findings from your gap analysis. Build on the systems you have in place, and take credit for your organizations' good practices.

Provide a general description of tasks. Don't get bogged down with discussing the details of each requirement, or "what if" scenarios.

***Remind the attendees that the implementation action plan is just that – a plan*.** It may, from time to time, need to be changed to meet the ongoing needs of the organization.

Be realistic on how much information to provide. This should not be your only meeting with key personnel, therefore tailor the amount of information presented accordingly. Participants will need time to become familiar with QMS concepts and more than one opportunity for learning should be provided.

After the meeting, issue a memo to all attendees thanking them for their participation with a copy of the meeting minutes. Include a revised copy of the Implementation Action Plan if changes were made. Most important of all – make certain that you are prepared to begin the implementation the moment the meeting is over.

Helpful **Tips**

Remember to arrange for someone to take attendance and record minutes.

Minutes from the 'kick-off' meeting are one way of showing an auditor evidence of management commitment.

Complete the Chapter Checklist below by checking off the items that have been completed. By completing all of the items, you will be ready to move on to the next chapter.

CHAPTER CHECKLIST	*Check When Complete*
Identification of key personnel for the "Kick-off" Management Meeting	
Preparation of an agenda and scheduling of meeting	
"Kick-off" Management meeting completed	
Minutes of the meeting completed	
Review and update of the Implementation Action Plan	
Confirmation of the timeline for implementation	
Distribution of meeting minutes and revised Implementation Action Plan	

Chapter 8 – Document and Records Control

Key Points in Chapter 8

You must write down what you do to ensure that procedures are in place to provide safe drinking water.

Clear, consistent documents are crucial to the effectiveness of a drinking water quality management system.

Current versions of operational documents must be available to those who need them, when they need them.

Records must be available as proof of the effectiveness of the quality management system, and your water system's operation.

Documents and records must be controlled to ensure that personnel have the most up-to-date information available.

Chapter 8 – Document and Records Control

Quiz: Test your understanding of Document and Record Control

Try this quiz now, and then again after you have finished reading this chapter.

Answer TRUE or FALSE	**TRUE**	**FALSE**
1. Records should be kept forever, but documents should not.		
2. We can go back and change a record if we have to.		
3. It is a good idea *not* to leave blanks when filling out a form.		
4. We need a procedure that describes how we control records and documents.		

Answers

1. False – The length of time that you retain records or documents depends on legislation, standards, and internal company policies and preferences.

2. False – Records cannot be changed. They are static results or data that provide objective evidence that a specific action was performed.

3. True – Even if there is no information to fill in, you should enter a reason why, such as "NA" for "Not Applicable', or "NR" for "Not Required". Without this, when the record is reviewed at a later date, an auditor may think the form was not complete.

4. True - The DWQMS requires that you describe your document and record control methods in a written procedure.

1. Translating the DWQMS

What the Standard says…

5. Document and Records Control

PLAN – The Operational Plan shall document a procedure for document and records control that describes how:

a.) documents required by the Quality Management System are:
   i. kept current, legible and readily identifiable
   ii. retrievable
   iii. stored, protected, retained and disposed of, and
b.) records required by the Quality Management System are:
   i. kept legible, and readily identifiable
   ii. retrievable
   iii. stored, protected, retained and disposed of.

DO – The Operating Authority shall implement and conform to the procedure for document and records control and shall ensure that the Quality Management System documentation for the subject system includes:

a.) the Operational Plan and its associated policies and procedures,
b.) documents and records determined by the Operating Authority as being needed to ensure the effective planning, operation and control of its operations, and
c.) the results of internal and external audits and management reviews.

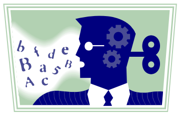
What does it mean?

Element 5 requires that you establish a process to manage and control the documents and records needed by the QMS, and that you need a procedure to describe this process. A document and records control process is needed to ensure that documents are kept up-to-date with changes in your operations and changes in applicable legislation and regulations, that documents and records are legible, and can be easily located and identified. The procedure must also describe how documents and records are stored (so that they are protected from damage or loss), define record retention times, and methods for disposal afterwards.

The DO component of this Element requires that you follow the procedure. It also details what documentation constitutes the documented QMS. The creation and management of these documents and records are implicitly covered by following the Procedure.

2. Why Do I Need to Control Documents and Records?

The establishment and maintenance of an effective document and records control system is the foundation of any quality management system.



Technical **Terms**

Document – includes a sound recording, video tape, film, photograph, chart, graph, map, plan, survey, book of account, and information recorded or stored by means of any device.

Record – a document stating results achieved or providing proof of activities performed.

Controlling your documents and records will:

- Develop and protect the knowledge base of your QMS
- Facilitate training of new personnel
- Ensure consistent procedures are followed
- Ensure the most up-to-date versions of documents are easily retrievable
- Provide accountability
- Facilitate review and audit by auditors
- Facilitate inspections
- Establish due diligence
- Promote Owner and consumer confidence
- Facilitate internal and external communications
- Ensure that decisions are based on current, and accurate information

Document and records control is a key element in assisting the Operating Authority to deliver safe drinking water. For example, without document and records control, if you have a large number of staff, or recent staff turnover, it may be difficult to ensure procedures are consistently followed by everyone. Or, in urgent situations, it may not always be possible to quickly retrieve a necessary record or document. Your document and records control will help you to manage these situations.

Helpful **Tips**

Everyone will need to read and use QMS documents. Because documents need to evolve as the system evolves, you must teach all personnel to always:

- Check that the version of the document that they are using is the most current version
- Communicate changes that impact your drinking-water system to the appropriate personnel, so QMS updates can be made.

3. Documents and Records Explained

Documents provide the foundation of the QMS. They include the QMS Policy, the Operational Plan and related procedures, instructions, manuals, records, forms, and some communications, in paper or electronic form. Documents can be internal, or can come from external sources, such as legislation or permits. Regardless of its source, if a document is part of the quality management system for your drinking-water system, it must be controlled.

Records are proof of activities performed, or results achieved, and refer to events that happened in the past. A quality record provides evidence that quality requirements have been fulfilled, and can show the effectiveness of the operation of a QMS element. A record can be written or stored on any data medium. Records must also be controlled.

Documents can be changed; records cannot be changed.

The best document control system is usually the simplest one that can be easily brought into the existing system. The sophistication of the system will vary with the size and complexity of the operation. Build on what you already have in place – record retention is already required for your drinking-water system under O. Reg. 170/03 and 128/04. For these records, you merely need to document what you already do to meet DWQMS requirements.

4. Which Documents and Records are Included?

Begin by assessing the types of documents and records within your drinking-water system that may be included in the scope of your QMS.

Internal QMS Documents include the Operational Plan, your QMS Policy, and other policies, procedures, instructions, and program requirements.

External QMS Documents include legislation and regulations directly applicable to your drinking-water system, the DWQMS, and legal permits and licences. These documents are not controlled by you, but may be changed by external parties. Your responsibility under the DWQMS is to ensure that your versions of all QMS documents, internal or external, are up-to date, and that revised/updated documents are reviewed to see if there are any implications for your drinking-water system, and that changes that impact your drinking-water system are communicated to appropriate staff.

QMS Records include test results, completed forms and checklists, reports, and meeting minutes. Although they cannot be edited or updated like other documents, they still require control, in terms of storage and accessibility.

Some examples of documents and records are shown in Figure 8.1.

Figure 8.1: Examples of documents and records that should be within the scope of your QMS.

EXAMPLES		
Internal QMS Documents	***External QMS Documents***	***QMS Records***
Operational Plan	Legislation and Regulations	External laboratory test results
Policies	Permits	In-house laboratory test results
QMS Procedures	Licences and Certificates	Completed Operator Log books
Work Instructions	The DWQMS	Completed checklists
Standard Operating Procedures	Industry Standards	Raw water quality records
Blank Forms and Checklists		Monitoring records
		Training records
		Meeting minutes

5. Retrievable Documents and Records

Information must be available to be useful. The DWQMS requires that documents and records are "retrievable"; however this means different things for documents and records.

For documents, "retrievable" means that the documents must be readily available for personnel to refer to, especially in emergency situations, or in areas where operational procedures need to be promptly referenced. For example, sampling procedures should be available for reference where sampling activities are performed.

For records, "retrievable" is a slightly more flexible term. Usually, a record is considered to be retrievable if it can be produced on request by the end of the business day. This definition stems from audits – if a record can be provided by the end of an audit, it is usually considered to be retrievable.

Note that for document retrieval, personnel may need only to view documents, not to change them. Only people authorized to make changes to documents should have that editing capability, especially for electronic documents. Using "read-only" formats for electronic documents and using password protection for master copies are two methods of helping protect electronic documents.

Answer the following questions for your drinking-water system. Be sure to interview personnel and "test" document access in remote locations or challenging situations before answering.

Answer YES or NO	***YES***	***NO***
Can all personnel find the documents and records they need?		
Can they access them easily and right away?		
Can they still access them in off-hours?		
Can they still access them in an emergency, during a hydro outage for example?		
Are documents available where they are needed?		
Can changes to documents only be made by authorized people?		

If you have answered "No" to any of the questions, you will need to make changes to the availability of documents and records.

6. Keeping Documents Current

As processes and activities change within the drinking-water system, the Operational Plan and its policies and procedures and other documents may need to be updated. Element 5 requires that QMS documents be kept current.

Designate a staff member to be responsible for making document edits in a timely manner as changes occur, and ensure they have access to the master QMS documents. Depending on the complexity of your drinking-water system, more than one staff member may be assigned to this duty. The document editor you choose should be someone who is aware of changes as, or even before, they occur.

In addition to document reviews as changes occur, it is suggested that at least once per year, a team of reviewers should be scheduled to check *all* QMS documents, to ensure that the information is still correct and current. This review activity is recorded on the "QMS Schedule', found in Appendix N.

7. Making Documents Consistent

It is important that the QMS be flexible. However, creating some basic requirements for how documents and records look and what information they display will make it easier for personnel and auditors. Here are some good documentation guidelines:

Use unique, simple and clear titles. Keep titles simple but informative. For titles of forms, choose titles that "match" the originating procedure, to help traceability. Numbering documents is a very effective way of managing, locating, and retrieving documents.

Number pages. Number each page, including the total number of pages in the document (e.g. Page 1 of 4)

Show revision dates. For documents, make sure a "date of revision" is visible to instantly indicate when the document was last updated. Adding a revision date to the header or footer ensures visibility of key information on each page. A list or table of all revision dates should also be included in the document to prove the document is being reviewed and revised. For records, ensure that a date is always recorded with data.

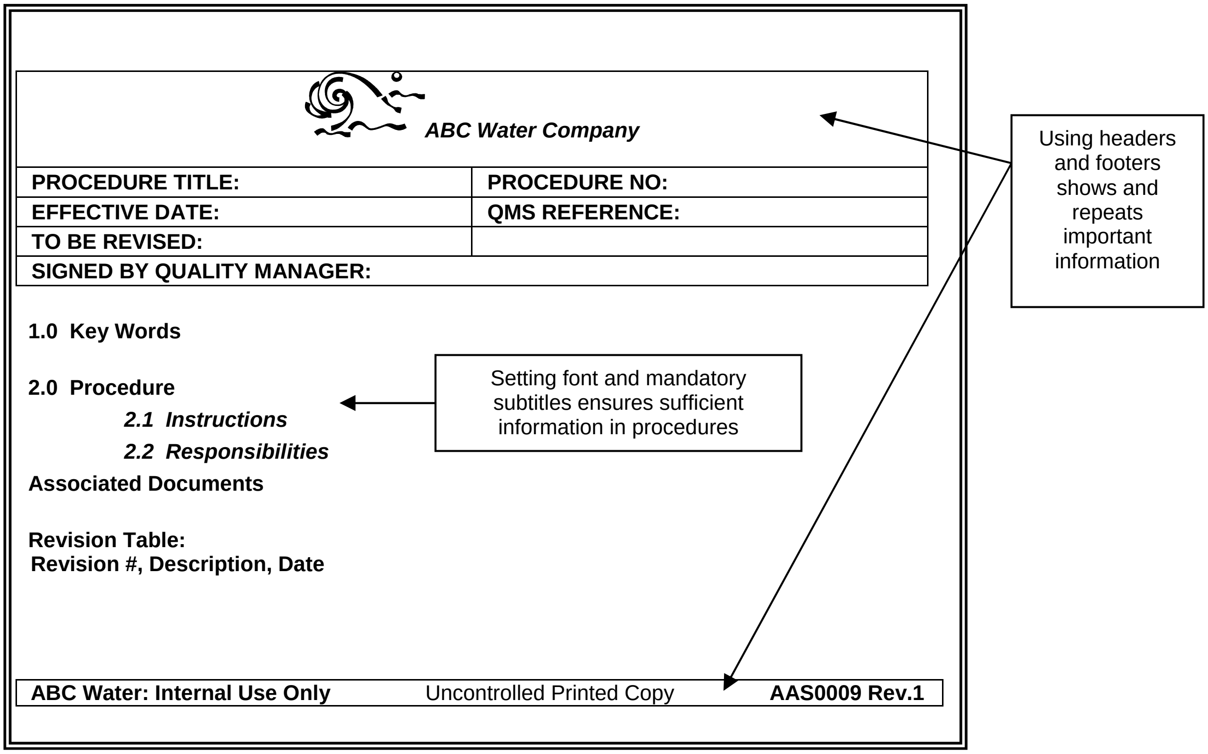
Establish a consistent format. Decide on the preferred format for headers, footers, logos, subtitles, and font. This makes QMS documents easily recognizable, and also simplifies the creation of new documents. An example of a document format is shown in Figure 8.2.

Helpful **Tips**

Some ways to make sure your QMS document editor stays aware of upcoming system changes:

- Invite them to planning meetings where system changes may be discussed
- Create a reminder checklist that prompts the editor to stay aware of changes, and gives direction about what QMS updates may be required as a result
- Add a monthly reminder to the editor's calendar to review changes with managers
- Ensure the editor receives copies of Municipal Council meeting minutes, where appropriate

Figure 8.2: An example of a procedure format, based on a format preferred by one of the pilot drinking water supply systems.



8. Issuing Documents

Before any QMS document is used, it should be reviewed and approved. Without this step, errors can occur, methods can be inconsistent, and considerable risk to drinking water can arise. Reviewers are responsible for:

- Checking that documents are technically correct, complete, and up-to-date
- Determining that the information is practical, and makes sense
- Ensuring that application of the document will be effective and efficient
- Approving the document if it meets these criteria

Select appropriate reviewers for the different types of QMS documents. Also, establish a method for approval that will easily prove that a document was reviewed and approved. This can be achieved with digital or written signatures, or confirmation email messages, for example.

As changes occur, documents will need to be updated, as described in Step 6. It is crucial to ensure that personnel are aware of the changes, revised documents are available, and obsolete documents are removed from use. When documents are available only in digital form, this is easily done. However, when paper copies of documents are in circulation, you should be aware of the printed copy locations, so that the printed copies may be immediately and easily replaced. The Table you will create in Step 11 will assist you with managing document locations.

9. Protecting Documents and Records

Documents and records can be stored in digital or paper format, both with unique protection challenges. Damage or loss may come from humidity, water, fire, accidental deletion, misfiling, dust, theft, accidental disposal, or physical damage, to name a few. Digital records should be backed up to protect them from loss or damage. Paper records should be stored safely and protected.

Examples of digital records may include:

- email messages
- Digital laboratory test results
- SCADA files
- Data spreadsheets
- Maintenance work orders

If you archive documents, the DWQMS requires that archived documents are protected and available. Archiving documents is usually done to free up filing space, and to “thin out” bulky files. Ensure archived documents are easily retrieved and available by:

- Keeping archive areas neat and organized
- Clearly labelling archive boxes, binders and files
- Choosing an archive area away from everyday traffic

Ready for the **Audit**

What do auditors like to see?

- Typed or neatly printed records
- Pens used to record data, not pencils
- No blanks left on forms
- Documents found easily and quickly
- Organized file-keeping
- Dates and titles on all documents
- Proof that documents are kept up-to-date

10. Retaining and Disposing of Documents and Records

Documents and records must have designated minimum retention times, which must comply with applicable legislated requirements, and conform to the DWQMS. Once established, documents and records must be filed according to designated storage times. Some storage times are legislated, while other storage times may also be set by the Municipality, parent company, or other management. Minimum requirements for drinking water-related record retention times are listed in Figure 8.3.

Figure 8.3: Related Legislated Minimum Retention Times

Record	***Retention Time***	***Legislation***
Operator training records	5 years	O. Reg. 128/04 under *SDWA, 2002*
Annual Reports and Summary Reports prepared by the Owner	5 years	O. Reg. 170/03 under *SDWA, 2002*
Log books and other record-keeping mechanisms	5 years	O. Reg. 128/04 under *SDWA, 2002*
Lab analyses of water samples for chemical tests	15 years	O. Reg. 170/03 under *SDWA, 2002*
Lab analyses of water samples for microbiological, chlorine and turbidity tests, and fluoride tests where fluoridation is provided	5 years	O. Reg. 170/03 under *SDWA, 2002*

You must also decide what to do with documents and records after the storage time has expired. Shredding and recycling are common methods for disposal, or you may choose to retain documents and records indefinitely and maintain records in archives. You should be able to prove awareness of minimum times from legislation or other sources, even if you choose to retain documents and records indefinitely.

11. Optional Document and Record Control Table

To help control documents and records, you can create a Document and Record Control Table, although this is not a requirement of the DWQMS. The table can be an effective means of satisfying DWQMS document and records control requirements, and will simplify document updates, since you can consider all of the document and record control requirements at a glance. For larger systems, separate tables for documents and records may be more effective.

A template for the Document and Record Control Table can be found in Appendix C. A sample section of the Document and Record Control Table can be seen in Figure 8.4.

Figure 8.4: Example Document and Record Control Table

Document and Record Control Table								**NR = not required**
Date of Revision:	*June 1, 2006*	**Document Requirements**				**Record Requirements**		
Document or Record?	**Type of Document**	**File Location (of master)**	**Location of Printed Documents**	**Authorized Editor**	**Reviewers / Approvers**	**File Location**	**Retention Time**	**Disposal Method**
R	*External Lab Test Results*	*NR*	*NR*	*NR*	*NR*	*control room*	*15 years*	*shred*
R	*Training Records*	*NR*	*NR*	*NR*	*NR*	*QMS Manager, personnel files*	*indefinitely*	*not applicable*
D	*Emergency Response Manual*	*o:/QMS/emerg*	*control room, QMS office, front lobby, loading dock*	*H&S Committee*	*Senior Managers*	*NR*	*NR*	*NR*
D	*Operational Plan*	*o:/QMS/plan*	*control room, QMS office*	*QMS Manager*	*Senior Managers, Council*	*NR*	*NR*	*NR*
D	*Printed Legislation*	*web bookmark QMS office*	*QMS office*	*not applicable*	*QMS Manager*	*NR*	*NR*	*NR*

Complete the document and record control table for your drinking-water system. Be sure to consider all of the types of QMS documents and records within your drinking-water system.

12. Control Procedure and Operational Plan

The DWQMS requires that your Operational Plan includes a documented procedure to describe document and records control for your drinking-water system. Depending on the complexity of your drinking-water system, you may choose to have separate procedures for document control and record control, to better organize your requirements.

Using the new format established in Step 5, create a Document and Record Control Procedure, or separate procedures, including a link to the Document and Record Control Table. In addition to the information in the table, you will need to describe:

- How documents and records are retrievable
- How documents are kept current
- Your requirements for format and legibility
- The method for review and approval
- How documents and records are protected and stored.

If you choose not to use a Document and Record Control Table, you will need to cover all of the requirements listed in the PLAN component in Element 5 directly in your procedure.

A sample Document and Record Control Procedure can be found in Appendix P. The sophistication of the procedure you create will vary with the size, complexity, and culture of your drinking-water system. Figure 8.5 is an example of a completed Record Control Procedure (because this example drinking-water system is complex, the document control would be covered in a separate procedure).

Helpful **Tips**

For writing a procedure:

- Start by jotting down what is important
- If the instructions are short, list the steps one by one.
- If the instructions are long or more complex, group the steps.
- If the user of the procedure must make decisions, use a flow chart.
- Remember to keep sentences short and precise.

Figure 8.5: Sample Record Control Procedure

INSERT LOGO HERE
IF APPROPRIATE

Title: Control of Records	Control I.D. Pro 2	Rev: Draft Date: 9/Feb/06
Author:	Reviewer:	Approver:

1.0 Purpose

The purpose of this procedure is to describe the methods for identification, storage, protection, retrieval, retention time and disposition of records.

2.0 Scope

This procedure is applicable to water department employees who manage or perform work related to the water plant and distribution operations. This procedure covers all Quality records identified in the implemented DWQMS.

3.0 References

DWQMS Element 5
Ontario Regulation 128/04
Ontario Regulation 170/03
SDWA, 2002 Section 17, Clause (2)

4.0 Definitions

Soft Copy – a record that is generated or retained in electronic format

Current Record – a record that has not yet exceeded its specified minimum retention time

5.0 Procedure

5.1 Records are maintained as objective evidence that the requirements of the applicable legislation and regulations and the DWQMS have been effectively met.

5.2 Records may be retained in hard copy (i.e. test reports, lab results, equipment maintenance and calibration…) or in soft copy (i.e. SCADA, excel…).

Records Required by MOE Regulations

5.3 All records required by the MOE regulations (referenced above) to demonstrate compliance and/or conformance shall be maintained per the regulations

5.4 Record retention

5.4.1 Minimum retention times for all MOE required records are as follows:

5 Years

Test Records Per

- Schedules 6, 7, 8, 10, 23 and 24 of O. Reg. 170/03
- Schedule 3 of O. Reg. 169/03

Training Records per

- Certification of Operators – O. Reg. 128/04

Reports per

- Annual Reports, Section 11 of O.Reg. 170/03
- Summary Reports for Municipalities, Schedule 22 of O. Reg. 170/03

5.4.2 All other records where a minimum retention time is not specified by the applicable regulation. This includes records required by the DWQMS.

15 Years
Test Records per
- Schedule 13 and17, (Sections 17-10 through 17-13) of O. Reg. 170/03

Reports per
- Schedule 21 of O. Reg. 170/03
- Engineers Report

5.4.3 All records required to demonstrate conformance to the requirements of the DWQMS shall be retained for the following minimum time periods:

5 Years
- Corrective Action Requests
- Preventative Action Requests
- Internal QMS Audit Reports
- Management Review Minutes
- Calibration Results
- Consumer Enquiries (Relating to Drinking Water Quality)
- Service Requests
- Water Committee Minutes
- Supplier Evaluations

5.5 All logs, records and reports that demonstrate compliance and/or conformance shall be retained/filed chronologically [O. Reg. 128/04 27 (2)] by type and in such a manner as to make them accessible. Additionally, data/information entered into all logs, records and reports shall clearly identify the individual responsible for making the entry.

5.6 All records and reports that demonstrate compliance and/or conformance shall be stored in a manner that protects them from damage or deterioration. Care shall be taken to ensure that no records, hard or soft copy, are exposed to elements or conditions that may damage the integrity of the information contained therein.

5.7 All records generated by the SCADA system may be retained in either hard or soft copy per the retention times indicated in section 5.4.

5.8 Records that have exceeded the minimum retention times prescribed by regulation or this procedure shall be disposed of in a manner appropriate to the nature of the information contained therein. Any records that are retained for knowledge, legal or other purposes beyond the specified minimum retention time shall be stored separate from those records that are deemed to be current. Where required by regulation, records shall be made available to the public upon request.

5.9 All records shall be readily retrievable for the purposes of the utility Owner or for inspection by a regulatory body.

6.0 <u>Associated Forms/Procedures/Work Instructions</u>

7.0 <u>Records</u>

8.0 <u>Change History</u>

Rev. Level	Date	Change	By

When you have completed the procedure, arrange for its review and approval.

13. Implementing the Procedure

From this point forward, when creating, filing, archiving, and disposing of QMS documents and records, personnel must follow the requirements that you've established.

With document and records control firmly established, personnel must be made aware of the requirements. Later, in "Chapter 20 – Completing the QMS Cycle", the task of training personnel in QMS concepts and new requirements will be discussed. However, key personnel who are assisting with implementation must be made aware of applicable document and record control requirements now. This can be done informally, simply by discussing the new procedure with them.

The final task is completing the relevant section of your Operational Plan. Element 5 requires a documented procedure, so add your "Document and Records Control Procedure" to the Operational Plan.

Complete the Chapter Checklist below by checking off the items that have been completed. By completing all of the items, you will be ready to move on to the next chapter.

CHAPTER CHECKLIST	*Check When Complete*
Completed the Quiz in Section 5 to test your understanding of document and records control	
Documents and records are retrievable	
Documents can only be edited by authorized personnel	
A method is in place to keep documents current	
A consistent format for documents and records has been established	
All the "Ready for the Audit" points in this chapter's margins are in place	
A method is in place for reviewing and approving documents	
A method is in place for issuing updated documents, and removing obsolete ones	
Documents and records are protected	
Retention times for records have been determined	
Disposal methods for records have been determined	
The Document and Record Control Table is complete	
The Document and Records Control Procedure is written and approved	
The Document and Records Control Procedure has been added to the Operational Plan	

Chapter 9 – Drinking-Water System

Key Points in Chapter 9

In this chapter, a description of your drinking-water system should be developed that provides readers with a thorough understanding of your drinking-water system.

The concept of effective multiple barriers is a cornerstone to the production and delivery of safe drinking water.

Chapter 9 – Drinking-Water System

1. Introduction

The purpose of the tasks outlined in Chapters 9 and 10 is to ensure processes and procedures are in place to assess 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 these improvements.

The key features of this approach to assessing risks include:

- Practising prevention rather than reaction
- Distinguishing greater risks from lesser ones
- Reviewing results and performance to learn from experience, and
- Investing resources in risk assessment that are proportional to the risk posed.

With the DWQMS, responsibility for risk assessment activities is given to the Operating Authority and operational staff with the most comprehensive knowledge of the drinking-water system. You will find that many elements necessary to prevent, control and mitigate drinking water hazards are already in place, and that procedures only need to be documented to satisfy the requirements of the DWQMS.

The risk assessment approach as laid out in the next two chapters will lead to:

- An assessment of the multiple barriers;
- The identification of activities and processes considered essential for the control of water quality (critical control points) where in the event of a breakdown water safety could be threatened; and
- The establishment of mechanisms to provide operational control at critical points, including methods that will monitor performance and trigger response measures where required.

2. The Multi-Barrier Approach

The best way to achieve a healthy public water supply is to put in place multiple barriers that keep water contaminants from reaching people. An overview of the multi-barrier approach follows.

The multi-barrier approach is an integrated system of procedures, processes and tools that collectively prevent or reduce the contamination of drinking water from source to consumer in order to reduce risks to public health (ad. Source to Tap). The multiple barriers include the three main components of the drinking-water system: source water, water treatment and water distribution. The management and monitoring systems for the three main drinking-water system components are equally important.

The management systems should ensure the development of well-planned, thorough and practised responses to adverse situations, including specific responses to the loss of control and for emergency situations. These are required when other processes fail or there are indicators of deteriorating water quality. The multiple barriers include:

- **Source protection** to keep the raw water as clean as possible in order to lower the risk that drinking water hazards are present.
- **Treatment** to remove and/or inactivate drinking water hazards.
- Maintenance of the integrity of the **distribution system** to prevent recontamination after treatment.
- **Monitoring programs** including on-line monitoring to detect system problems which could impair drinking water safety, and to verify the performance of the system components and finished drinking water quality.
- Effective **management** systems including automatic control systems, well developed responses, and operating practices are the ultimate means for protecting the safety of drinking-water systems.

Source water protection issues will be managed primarily through the Source Water Protection Committees to be established under the *Clean Water Act*. Emergency preparedness and response will be addressed under Element 18 of the DWQMS (Chapter 17). Through the risk assessment process, treatment and distribution system barriers will be assessed as they apply to your drinking-water system. The monitoring, control and management systems to ensure drinking water quality and safety will be documented, assessed and improved. Figure 9.1 provides an indication of how the multi-barrier approach could be applied for a surface water treatment system.

Figure 9.1: Example of the Multi-barrier Approach (Adapted from Walkerton Part II Report)

Hazard	***Barrier***	***Typical Risk Management Approach***
Pathogens Chemical contaminants Radionuclides	Source	Source Water Protection Plan Upstream sewage treatment Choice of water source
Pathogens	Treatment	Water quality standards Chemically assisted filtration Disinfection
Infiltration – introduction of pathogens and chemical contaminates Pathogen regrowth	Distribution system	Chlorine residual System pressure Capital maintenance plan
Undetected system failures	Monitoring	On-line monitoring Alarms and shut-offs as appropriate Logbooks, trend analyses
Failure to act promptly when control limits are not met Failure to communicate promptly with health authorities and the public	Management Systems	Response measures Communication procedures

The purpose of the First Engineer’s Report for your drinking-water system was to assess the potential for microbiological contamination and mitigate this potential, and to identify operational and physical improvements necessary to mitigate contamination using the multiple barrier concept. This task builds on the system assessment process initiated with the First Engineer’s Report.

3. Translating the DWQMS

What the standard says…

6. Drinking-Water System

PLAN – The Operational Plan shall document, as applicable:

a.) for the subject system:
  i. a description of the system including all treatment processes and distribution system components
  ii. the name of the Owner and Operating Authority
  iii. a process flow chart
  iv. a description of the water source, including:
    i. general characteristics of the raw water supply
    ii. common event-driven fluctuations and
    iii. any resulting operational challenges and threats
  v. a description of any critical upstream or downstream processes relied upon to ensure the provision of safe drinking water.

b.) if the subject system is an operational subsystem, a summary description of the municipal residential drinking-water system it is a part of.

c.) if the subject system is connected to one or more other drinking-water systems owned by different owners, a summary description of those systems which:
  i. indicates whether the subject system obtains water from or supplies water to those systems, and
  ii. names the Owner and Operating Authority of those systems

DO – The Operating Authority shall ensure that the description of the drinking-water system is kept current.

What does it mean?

The purpose of Element 6 of the DWQMS is to provide a broad overview and foster a basic understanding of your drinking-water system and its water source. The outcome of this task is a process description and flow chart. Your drinking water system should be described including key treatment processes such as primary and secondary disinfection. Major components of your distribution system should also be described.

The name of the Owner and Operating Authority should be documented. If part of a larger drinking water system, the larger system must be described and the Owner and Operating Authority should also be named. Although not required by the DWQMS, a general description of both the Owner and Operating Authority, and the relationship between the two, can be useful and very informative.

The water source should be identified and described. This description may possibly be obtained from your First Engineer's Report. The water source should be characterized in terms of both general characteristics of the raw water supply, and common event driven fluctuations due to changes of seasons, storms, spring run-off, algae blooms, lake turnover, etc. Key operational challenges and threats should also be identified.

You must also show important processes beyond your system boundaries that you rely upon. For example, if your system consists of a distribution system only, a critical upstream process relied upon is the supply of safe drinking water and the operation of the upstream water treatment plant.

Finally, the DO component of Element 6 requires that you keep all of this information current.

4. What Level of Detail is Required?

A great deal of detail is not required. The Process Flow Diagrams (PFD) and the Process and Instrumentation Diagrams (P&ID) required for the review of applications for Certificates of Approval, for example, are often more detailed than are needed. These drawings typically provide more information than is required, can be difficult to understand, and can make it hard to distinguish key process elements from less important ones. Critical information on the processes and systems to ensure drinking water safety should be presented in an accessible manner.

The QMS process flow chart should be easy to understand and should provide a broad overview of the drinking-water system, and the components that are critical for maintaining process performance.

5. What are the Steps Involved?

Begin by compiling and reviewing background information to help you through the following steps:

- Describe the drinking-water system
- Construct a process flow chart of the drinking-water system
- Identify and describe the water source, including general characteristics, common event-driven fluctuations, and operational challenges
- Describe the upstream or downstream processes relied upon
- Describe the larger drinking-water system that you are a part of, if applicable
- Prepare a section to include in the Operational Plan

6. Description of the Drinking-Water System

The description of your drinking-water system provides background information for the risk assessment to be completed in the next Chapter. It establishes a common information base for assessing the risks with the production and delivery of safe drinking water (Elements 7 and 8 of the DWQMS)

The information in this section will provide the basis for making effective decisions about managing risks. Documentation is required to allow the information to be easily accessed and reviewed.

Begin by generally describing the drinking-water system. The following table shows some tips for information to include.

Helpful **Tips**

The information required for this element of the Standard should be already available to your team in your drinking-water system documentation (review your Annual Report, Engineer's Reports, and Inspection Reports, for example).

Reviewing and inserting what you already have will involve less effort than creating it.

Treatment process schematics, water system maps, and watershed maps can assist in preparing the overview.

When preparing the description of your drinking-water system, use language that your employees will understand. This is ***your*** drinking water QMS.

You can use schematics, flow charts, tables and/or graphical tools when describing your system. Pictorial representations are often more readily understood.

Component	Details
Subject System Ownership	Name
Subject System Operating Authority	Name
Subject System Description	If your system includes treatment, describe all treatment processes If your system includes distribution, describe names or numbers of reservoirs, pressure zones, booster pumping stations, number of customers, size of infrastructure etc. (keep it simple)
Water Source Description	Include general characteristics of the raw water supply, any common event-driven fluctuations and any resulting operational challenges and threats
Critical Upstream Processes Relied Upon	Describe
Critical Downstream Processes Relied Upon	Describe
Connected System Ownership	Name
Connected System Operating Authority	Name
Connected System Description	Describe and indicate whether the Subject System obtains water from or supplies water to the connected system

7. Description of Water Source

The description of the water source should consider general characteristics of the raw water supply, common event-driven fluctuations, and any resulting operational challenges or threats. It could also consider the parameters identified below in Figure 9.2.

Figure 9.2: Examples of parameters that could be considered for the type of water source identified

Source	***Component***	***Parameter***
Groundwater	Aquifer	• Confined and unconfined aquifers • Soils, geology • Depth to water table • Capture zones • Recharge areas • General description of land uses • Well head protection zones • Contaminated sites and potential sources of contamination • Monitoring wells
Surface Water Sources	Catchment	• Watershed boundaries • Tributary rivers and streams and lakes • General description of land use such as developed areas, natural areas, forestry, recreational activities, agricultural land uses • Point sources of pollution such as treated sewage outfalls and storm water discharges • Contaminated sites and potential sources of contamination

For systems where source waters are protected and water quality fluctuations are minor, all that may be required is a summary of several key parameters. You may wish to include more detail for poorer quality sources where significant treatment challenges exist to produce water that meets applicable legislative and regulatory requirements. Historical variations may also be tracked or trended as appropriate to identify changes in raw water quality over time.

The simplest method of assessing water quality data is to summarize it in a table which presents annual and long term average values and ranges, along with seasonal and/or event driven fluctuations. You may choose to prepare charts trending data over time. You may also choose to correlate raw water quality data with meteorological data (e.g. *E. coli* counts may increase following rainfall due to storm water run-off discharges), or for certain parameters assess treatment performance by comparing raw water quality with treated water quality. Figure 9.3 presents some examples of source water quality fluctuations. Figure 9.4 shows a typical source water description for a lake-based water treatment system.

Figure 9.3: Examples of Fluctuations in Water Source Quality and Challenges

Type of Fluctuation	**Description**	**Operational Challenges/Threats**
Historical Variation	▪ *Increasing nitrate concentrations in well supply*	▪ *Treatment not provided for nitrate removal*
Historical Variation	▪ *Trending of data demonstrates increasing turbidity and E.coli counts over several years at surface water plant*	▪ *Chemically Assisted Filtration and disinfection process performance*
Seasonal fluctuation	▪ *Concentrations of iron and manganese in well water increase seasonally*	▪ *Performance and capacity of green sand filters*
Seasonal fluctuation	▪ *Trihalomethanes (THMs) in treated water increase and approach ODWQS*	▪ *Optimization of chemically assisted filtration process for THM precursor removal*
Seasonal fluctuation	▪ *Taste and odour in late summer and fall - presence of Methylisoborneol and Geosmin*	▪ *Maintaining effective treatment with powdered activated carbon*
Event driven fluctuation	▪ *Increases in turbidity, and E. Coli counts following rainfall events due to storm water discharges*	▪ *Chemically Assisted Filtration and disinfection process performance*

Figure 9.4: Example of a drinking-water system description for a lake-based water treatment system.

General

The primary raw water source for the treatment plant is the Bay of Trent in Lake Mohawk. The Bay's shoreline stretches in a Z-shape from Hudson to Erie for 5 kilometres. The Bay's watershed is over 500 square kilometres, and includes lands drained by the Trenton, Hudson, Pike and Kelowna Rivers and a host of smaller tributaries. Kelowna is located in the north-eastern part of the Bay on the Kelowna River.

Lake Mohawk water is typically very low in turbidity (<1 NTU), low in colour, slightly basic, and marginally hard (~120mg/L as $CaCO_3$). Temperature fluctuates significantly throughout the seasons ranging from approximately 4 Celsius in the winter to as high as 25 Celsius during the summer. Chemical and bacteriological analysis of the raw water indicates a source of relatively good quality. E. Coli counts in the raw water are typically < 2/100 ml, with counts increasing in the summer to up to 15/100 ml.

Seasonal and/or Event Driven Fluctuations

Seasonal changes in raw water temperatures cause vertical turnover of the lake water during spring and fall. Turnover typically takes place over a relatively short duration (~2 to 7 days). During that period, settled solids from the lakebed are re-suspended resulting in increased raw water turbidity with values up to 20 NTU. Operators must be prepared to make appropriate plant adjustments to treat the elevated levels of turbidity experienced during turnover events.

Changes in water temperature will also impact treatment process performance (settling, disinfection). Optimal treatment requires timely adjustments to treatment chemical dosages (disinfectants and coagulants) in response to temperature fluctuations.

Operational Challenges

Lake Mohawk provides high quality source water, which is, for the most part consistently low in bacteriological contamination and turbidity. While operator response is needed to adjust chemicals in response to elevated turbidity and temperature changes, the most significant challenge related to the source water is the 16 km pipeline through which the water is transported to the treatment facility. Only one pipe exists, which means repairs to pumping equipment or the pipeline itself results in an interrupted supply to the treatment facility. The raw water reservoir located adjacent to the plant provides one day's storage time at the plant's rated capacity, and provides some time for maintenance and repair. It is essential that the communications and monitoring equipment from the remote low lift pumping station and raw water reservoir remain in good working order so that problems are identified quickly. Preventative and breakdown maintenance is carefully planned to minimize the interruption to raw water supply.

The contingency source from the Kelowna River should be used only under extreme circumstances, as river quality is inferior and therefore more difficult to treat. Additionally, rapid mixing of the alum with the raw water is not possible when using the river source, resulting in less than ideal conditions for optimal coagulant performance.

Raw Water Supply and pre-chlorination

A pumping station on the shore of Lake Mohawk pumps raw water through a 500mm pipeline to a raw water storage reservoir. Sodium hypochlorite is added at the Lake Mohawk intake to provide pre-chlorination and also for zebra mussel control when water temperatures are above 12° C. The addition of sodium hypochlorite to the raw water serves as a measure to prevent microbiological growth within the raw water pipeline and reservoir. The plant has an alternate, backup intake pipe to the Kelowna River.

Coagulation / Flocculation / Sedimentation

Water flows by gravity from the raw water reservoir through two 150mm valves to the water treatment plant where the coagulant alum (hydrated aluminium sulphate) is injected into the raw water line upstream from the flocculation basin. Rapid mixing of the alum with the raw water occurs as the raw water passes through an in-line static mixer. The coagulant allows for the destabilization of the charge of particles present in the raw water, which then join together or agglomerate to form floc. The alum-water solution enters the baffled flocculation basin where gentle mixing results in the formation of floc masses. The process water then flows into sedimentation tanks where the floc is allowed to settle. Supernatant (the clear liquid above the settled floc) overflows the sedimentation tank effluent weir to the top of the dual media filters.

Figure 9.4 continued: Example of a drinking-water description for a lake-based water treatment system.

Filtration

Treatment comprises two parallel dual media filters. The top layer of the filter is granular activated carbon (GAC). The filter media below the GAC layer is sand. The GAC is effective in removing organic compounds, including those responsible for unpleasant taste and odour sometimes experienced during the warmer months. Residual flocculated particulate matter carried over from the sedimentation process is trapped primarily in the sand portion of the filter. Filtered water passes through the filter under-drain into the treated water clearwells.

Post Filtration Chlorination

Chlorine is also added to the water entering the baffled clearwells. These tanks are designed to provide a minimum chlorine contact time based on the flow through the tanks and the chlorine dosage. This chlorine contact process achieves inactivation of Giardia and viruses that may remain in the water following chemically assisted filtration.

Primary Disinfection

Primary disinfection includes the treatment processes designed for the removal and inactivation of microbiological pathogens as discussed above. Pathogen removal is achieved through coagulation / flocculation / sedimentation / filtration processes, and pathogen inactivation is achieved by post filtration chlorination (post disinfection) that occurs immediately upstream from the clearwells. Both chemically assisted filtration and disinfection are mandated requirements to achieve primary disinfection for surface waters as outlined in the MOE publication “Procedure for Disinfection of Drinking Water in Ontario”. Monitoring of the primary disinfection process includes coagulant addition, turbidity of the water from each filter, and the chlorine residual concentration after the clearwell.

Secondary Disinfection

Secondary disinfection is accomplished by adding sufficient chlorine at the purification plant to maintain a chlorine residual throughout the entire distribution system. Monitoring of secondary disinfection includes on-line monitoring of the chlorine residual entering the distribution system, and the collection of grab samples throughout the distribution system for chlorine residual.

Process Waste Residuals Management

Filter backwash water and sedimentation tank solids are directed to an equalization tank from where they are pumped to a residuals thickening process. The thickened sludge is pumped to the municipal sanitary sewer. The clarified effluent from the thickener is de-chlorinated and discharged to the Kelowna River.

Distribution System and Elevated Storage Tank

Treated water is pumped from the clearwells into the water distribution sub-system. Distribution piping typically ranges in size from 150 mm to 250 mm, and may consist of cast iron, ductile iron, concrete, or PVC, depending on the location and age. Two pressure booster stations are used to ensure adequate system pressure in areas of higher elevation or locations significantly removed from the plant and elevated storage tank. Typical system pressure ranges from 45 to 80 P.S.I. The elevated storage tank is an integral component of the distribution system. The purpose of the storage tank is to provide relatively constant system pressure and a reserve volume of water for community fire protection.

Figure 9.5: Example of drinking-water description for a groundwater system.

General
The Mountain Grove water system is owned and operated by the Town of Mountain Grove.

Water Source
The Town of Mountain Grove obtains its raw water from two drilled wells. The wells penetrate a sand/gravel aquifer of glacial origin. The aquifer has a relatively short flow path that is typical of local flow systems. Characterization of the aquifer can be found as part of the Town of Mountain Grove's Ground Water Source Protection Program.

The capture zone or recharge area is approximately 290 km^2. The aquifer itself is estimated to extend over an area of approximately 52.5 km^2. The outflow, or discharge, is to several streams and the Ardoch Wetlands that in turn feed into the Crow River. The maximum saturated thickness of the sand and gravel beds of the aquifer is just over 55 m, but generally ranges in depths from 32 m to 53 m. At present it is estimated that the aquifer can continuously produce up to 2,860 l/s of water.

The chemistry of the water makes it highly suitable as a source for drinking water. Iron and manganese are present, but not in sufficient quantity to warrant filtration. The water temperature is relatively constant, and the hydraulic conductivity is high, turbidity is low and pH is considered normal for groundwater systems.

Raw Water Characteristics

	Temperature	pH	Turbidity
Average	2.2°C	7.4	.09
Range	1.4°C to 4.2°C	7.1 – 7.6	.06 - .15

Data collected over the last 15 years indicates that the water source is stable and consistent. Other than private residential wells, there are no other users taking water from the aquifer. There have been no challenges encountered, and none are anticipated.

Water Treatment

Dale Road Pumphouse/Treatment Facility.
The Dale Road pump house/treatment facility is located adjacent to the supply wells. The original facility was constructed in 1968 with one 200mm supply well (Well No. 1). In 1994 the facility was upgraded and a second 300 mm well (Well No. 2) was constructed. Both wells are founded at a depth of 41m. The last upgrade was completed in 2003 to address issues raised in the First Engineers Report for the system. This upgrade included the addition of a second cell to the contact tank to ensure that the required chlorine contact times could be met under all flow conditions, upgrades to the SCADA systems, the addition of a standby diesel generator and the addition of a second on-line chlorine residual analyzer.

Well No. 2 (300mm) is the normal duty well. Well No.1 serves as a back-up in the event of maintenance, or a mechanical or other failure in the duty well, or low water level in the clear well. The raw water is metered, chlorinated, mixed (static mixer) and analyzed for free chlorine residual before entering the clear well. Chlorine is added in the form of sodium hypochlorite (NaOCl). The feed system consists of a day tank with two chemical feed pumps (one duty and one standby).

As water in the clear well is depleted, a level indicator signals the well pump to refill the clear well. If levels in the clear well continue to drop, the second well pump will be called to start. The primary disinfection NaOCl pump is interlocked to start with the well pumps. The dosage is paced to the flow signal from the raw water flow meter. The clear well provides the necessary contact time for primary disinfection to achieve 2-log disinfection of viruses during all flow conditions.

Water flows from the clear well into the pump well. There are five high lift pumps; two jockey pumps (duty and standby), two vertical turbine high lift pumps (duty and standby) and one fire pump. Water is pumped to the discharge header.

On-line equipment monitors and records treated water flow, turbidity, pressure and chlorine residual prior to entry to the distribution system. There is an auxiliary sodium hypochlorite addition point located after the chlorine residual analyzer where if necessary additional chlorine can be added to maintain secondary disinfection in the distribution system. The sodium hypochlorite feed system consists of a duty and standby feed pump and a day tank.

Water Distribution
Processed water is pumped through 4.1km of 150mm mains to 166 service connections (153 Residential, 13 Commercial). The distribution system also includes 6 fire hydrants. There are 4 backflow prevention valves located within the distribution at commercial facilities. The Typical system pressure range is 45 – 50 psi.

8. Process Flow Chart

The process flow chart, in conjunction with the description of your drinking-water system, should provide a high-level overview of your drinking-water system. The flow chart should show the processes and equipment used to treat, store, monitor and/or distribute drinking water. If the process flow chart is complex, break it into smaller, logical process steps.

For distribution systems, a detailed map of the distribution system is not required. A simple process flow chart, showing pumping stations, system storage and re-disinfection facilities, is all that is required.

The process flow chart should focus on processes in your drinking-water system, that contribute directly to water treatment, transmission or distribution activities.

Some of the process steps that you may want to include are:

Water Source
Intakes (surface water or groundwater)
Coarse and fine screens
Raw water storage
Low lift pumping stations
Raw water transmission mains, etc

Treatment Elements
Zebra mussel control
Coagulation
Flocculation
Sedimentation
Filtration (e.g. gravity, pressure, bag filters, cartridge filters, greensand filtration)
Membrane Filtration
Granular activated carbon
Aeration
Disinfection (e.g. chlorination, ozonation, UV disinfection)

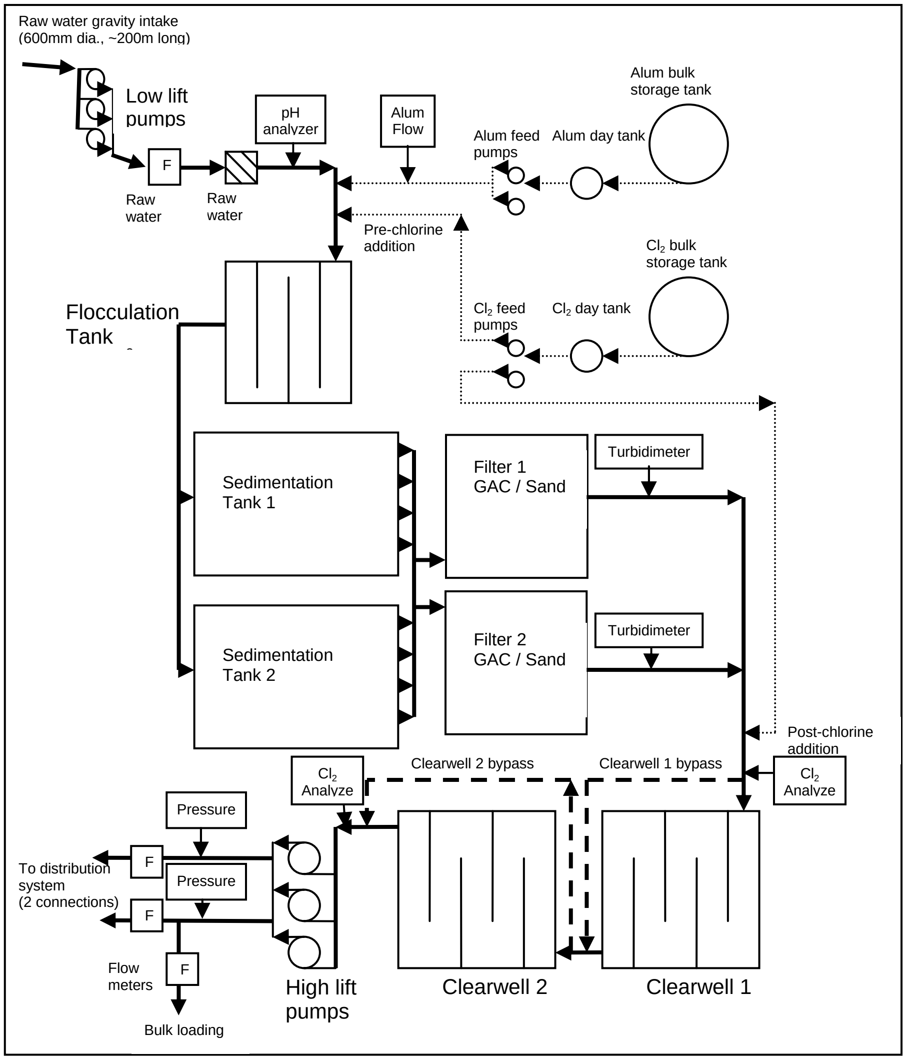
Chemical Addition
Chlorine
Chlorine dioxide
Ammonia
Coagulant and coagulant aids
Lime
Sodium Hydroxide

Monitoring
Flow
pH
Temperature
Conductivity
Streaming current monitors
Turbidity and/or particle counts
Disinfectant residual
UV parameters, etc.

Distribution
Pumping stations
System storage
Re-disinfection facilities
Pressure boosting stations

Figure 9.6 shows an example of a process flow chart for a surface water treatment system. Note that this example does not include waste treatment processes.

Figure 9.6: Example of a process flow chart for a surface water treatment system



9. Upstream and Downstream Processes

Sometimes you rely on processes that are outside of your drinking-water system and your control. If those processes are not in place, the provision of safe drinking water could be affected. In the DWQMS, these processes are referred to as “critical upstream or downstream processes”.

An example of a critical upstream process would be the water treatment plant for a stand-alone water distribution system. If the treatment plant is not operating properly, the water quality in the distribution system could be affected. A critical downstream process could be backflow preventers for a water distribution system that depends upon the presence and operation of backflow preventers at each service connection. If the backflow preventers are missing or not operating properly and system pressure falls in the distribution system, contaminants could be accidentally introduced into the system.

In your system description, ensure that critical upstream or downstream processes that you rely upon are identified. It is up to you to define what processes, if any, you would like to include.

10. Connections to Other Drinking-Water Systems

If your Subject System is part of a larger municipal residential drinking-water system, you have to provide a summary description of the larger drinking-water system in your Operational Plan. For example, scenarios where a Subject System may be part of a larger drinking-water system include:

- If the Subject System regularly supplies drinking water to neighbouring drinking-water systems
- If the Subject System periodically supports other drinking-water systems as needed (e.g. occasional supply to reservoirs in periods of high demand)
- If the Subject System is connected to other drinking-water systems for emergency preparedness reasons (e.g. normally closed connecting valves).

The description of the larger municipal residential drinking-water system should be general, and should include the name of each Owner and Operating Authority of the larger system.

11. Operational Plan: Drinking-Water System

The final task in this chapter is for you to include your "Drinking-Water System" description in your Operational Plan. Under a "Drinking-Water System" section or tab divider, insert the descriptions you have prepared, and the process flow chart. If you would rather not insert documents into the Operational Plan binder, then just write down where those documents can be found.

Now that the information is prepared, it must be kept up-to-date. Identify the most effective method for making sure changes in the system, source, ownership, or upstream/downstream processes are promptly updated in the QMS documentation. This method may come from a combination of processes – perhaps a periodic check to review the information, an automatic trigger from an approval of infrastructure funds, or a prompt from a sign-off form when new equipment is implemented – the key is to ensure that the updates are made in a timely manner. Assign specific Operating Authority personnel the responsibility of updating the information prepared under Element 6.

Ready for the **Audit**

What do auditors like to see?

- That descriptions are current and thorough
- A process flow chart that matches the description of the drinking-water system, and the actual system observed by the Auditor during the external audit.

Complete the Chapter Checklist below, by checking off the items that have been completed. By completing all of the items, you will be ready to move on to the next chapter.

CHAPTER CHECKLIST	*Check When Complete*
Has a description of the drinking-water system including all treatment processes and distribution system components been prepared?	
Were general characteristics of the raw water supply included in the description?	
Were common event-driven fluctuations included in the description?	
Were resulting operational challenges included in the description?	
Is a process flow chart available?	
Have critical upstream or downstream processes relied upon been described?	
If the Subject System is part of a larger drinking-water system, has a summary description of the larger system been prepared?	
If the Subject System is part of a larger drinking-water system, has the name of each Owner and Operating Authority been included?	

Chapter 10 – Risk Assessment and Risk Assessment Outcomes

In this chapter, the risk assessment process is discussed including:

- ☐ How potential hazards and hazardous events are identified
- ☐ How risks are assessed
- ☐ How hazardous events are ranked according to the associated risk
- ☐ How control measures are identified
- ☐ How critical control points are identified
- ☐ How critical control limits are identified for the critical control points
- ☐ How critical control limits are monitored
- ☐ How deviations from critical control limits are responded to
- ☐ How deviations from critical control limits are reported and recorded
- ☐ How the risk assessment is verified and redone
- ☐ How equipment reliability and redundancy are considered in the risk assessment process

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Chapter 10 – Risk Assessment and Risk Assessment Outcomes

1. Translating the DWQMS

What the standard says…

7. Risk Assessment

PLAN – The Operational Plan shall document a risk assessment process that:

a.) identifies potential hazardous events and associated hazards,
b.) assesses the risks associated with the occurrence of hazardous events,
c.) ranks the hazardous events according to the associated risk,
d.) identifies control measures to address the potential hazards and hazardous events,
e.) identifies critical control points,
f.) identifies a method to verify at least once a year, the currency of the information and the validity of the assumptions used in the risk assessment,
g.) ensures that a risk assessment is conducted at least once every thirty-six months, and
h.) considers the reliability and redundancy of equipment.

DO – The Operating Authority shall perform a risk assessment consistent with the documented process.

8. Risk Assessment Outcomes

PLAN – The Operational Plan shall document:

a.) the identified potential hazardous events and associated hazards,
b.) the assessed risks associated with the occurrence of hazardous events,
c.) the ranked hazardous events,
d.) the identified control measures to address the potential hazards and hazardous events,
e.) the identified critical control points and their respective critical control limits,
f.) procedures and/or processes to monitor the critical control limits,
g.) procedures to respond to deviations from the critical control limits, and
h.) procedures for reporting and recording deviations from the critical control limits.

DO – The Operating Authority shall implement and conform to the procedures.

What does it mean?

Elements 7 and 8 of the DWQMS require that you complete a risk assessment for your drinking-water system, then implement and document the means for you to manage those risks. All potential hazards and hazardous events are identified, and for each, the level of risk is assessed. A structured approach is important to ensure nothing is overlooked and that the areas of highest risk are identified.

This task includes the following steps:

- Identifying potential hazardous events and hazards and that could affect drinking water safety;
- Assessing the risk associated with the occurrence of a hazardous event;
- Ranking the hazardous events according to the associated risk
- Identifying control measures that you have in place to address the hazards and hazardous events;
- Identifying critical control points;

- Establishing critical control limits for each critical control point;
- Ensuring that the risk assessment is kept current; and,
- Documenting the risk assessment process and outcomes

The risk assessment will be facilitated by developing a Risk Assessment Table. As you conduct this assessment, you will need to document the results of each step and the risk assessment procedure. The risk assessment process is an ongoing activity. Once a year the currency of the information and the validity of the information used in the risk assessment must be verified. The risk assessment must be redone every three years at a minimum unless changing conditions indicate that it should be done more frequently.

More detailed examples are provided in the Model Operational Plans (Part III of the Guidance Document) and a blank template has been provided in Part II of the Guidance Document.

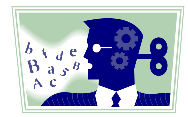
2. Risk Assessment Overview

This chapter of the Guidance Document is a crucial one. By performing a risk assessment, you are identifying hazards in your drinking-water system, and the control measures to address those hazards. You are also “zeroing in” on the most critical process steps to make sure control limits are set and monitoring and response procedures are in place. The task is common sense, interesting to complete, and typically leads to a greater understanding of your drinking-water system and its vulnerabilities, better management systems, and improved controls.

It is important to keep in mind that the process is subjective, no two risk assessment teams will assess risks in exactly the same way for the same system. However, utilizing a team leads to a balanced outcome.

The risk assessment tasks required by the DWQMS are in many respects a follow-up to the First Engineer’s report completed for most drinking-water systems. The principal objective of these reports was to assess the potential for microbiological contamination, and to identify operational and physical improvements necessary to mitigate this potential using multiple barrier concepts. As a result, improvements were implemented at many systems. The focus of the current risk assessment task is primarily on operational and managerial aspects for the existing system.

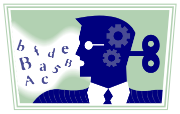
All drinking water hazards are considered in this exercise, although microbiological hazards remain a major focus due to the potential health consequences, and the presence of treatment systems for their control.



Technical **Terms**

A Risk Assessment is an orderly methodology of identifying hazards or hazardous events that may affect the safety of drinking water and evaluating their significance.

Risk is the probability of identified hazards causing harm, including the magnitude of that harm or the consequences.



Technical **Terms**

A **Hazard** is a source of danger or a property that may cause drinking water to be unsafe for human consumption. A drinking water **hazard** is a biological, chemical, physical or radiological agent that has the potential to cause harm.

A **Hazardous Event** is an incident or situation that can lead to the presence of a hazard.

Hazards and hazardous events can result from natural or technological causes, or from human activities.

The following are the main tasks for the risk assessment:

- ☐ Setting Up a Risk Assessment Team
- ☐ Choosing a Risk Assessment Approach
- ☐ Setting up a Risk Assessment Table
- ☐ Identifying Hazardous Events and Associated Hazards
- ☐ Identifying Available Control Measures
- ☐ Assessing Risks
- ☐ Ranking Hazardous Events
- ☐ Identifying Critical Control Points
- ☐ Setting Critical Control Limits
- ☐ Monitoring Critical Control Points
- ☐ Establishing Procedures for Deviations from Critical Control Limits
- ☐ Keeping the Risk Assessment Current

These tasks are explained in more detail below.

3. Setting Up a Risk Assessment Team

Performing a risk assessment is largely a brainstorming exercise and it is recommended that a minimum of three people be part of the assessment team.

This activity requires experience with the drinking-water system and knowledge of the kind of hazards and hazardous events which your system may be subject to. Maintenance staff, operators and managers have a wealth of experience and knowledge, and they should be involved in this task. For small systems with limited staff you may want to include personnel from neighbouring systems. You may decide to include team members with expertise in areas such as public health issues, process control and technical experts.

The risk assessment will likely take several days to complete – perhaps even longer for larger systems. If it is more conducive to your operations schedule and demands, arrange to perform the risk assessment in stages.

4. Choosing a Risk Assessment Approach

The first step in performing the risk assessment is to decide on a process to use. One example is provided in this Guidance Document. It is not the only method that works, but it is the method that will be explained in detail in this Guidance Document.

Another option is described in the Health Canada document titled “Canadian Guidance Document for Managing Drinking-Water Systems: A Risk Assessment / Risk Management Approach”. Another possible approach is the Failure Mode and Effects Analysis commonly used in manufacturing and assembly industries, as an integral part of ISO 9001 quality management systems.

Any approach that your team is comfortable with is acceptable provided it meets the requirements of Elements 7 and 8 of the DWQMS. Before starting the Risk Assessment, the team will need to review the steps involved in the assessment method you choose.

5. An Overview of Hazards

To begin the Risk Assessment, have your team become familiar with the different types of hazards that may affect drinking water quality. The four types of hazards – biological, chemical, physical, and radiological, are described below:

Biological Hazards

Biological pathogens are usually considered the most significant drinking water health risk because the effects are acute; if ingested, pathogens can cause gastrointestinal illness within a period of hours or days. (Ad. From Source to Tap, Guidance on the Multi-Barrier Approach to Safe Drinking Water, CCME, 2004). Waterborne biological hazards include bacterial, viral and parasitic organisms. These organisms are commonly associated with faecal wastes from humans and other animals, and some can occur naturally in the environment. Although most bacteria are not pathogenic, pathogens such as E. coli O157, Legionella, Salmonella typhi, and Shigella are commonly associated with waterborne disease. Viruses of concern include, but are not limited to, Hepatitis A and Norovirus. Protozoa of concern include Giardia and Cryptosporidium; both are common contaminants in natural bodies of surface water.

Chemical Hazards

Chemical contaminants may be naturally occurring or may be added or created during the processing of water. Harmful chemicals at high levels have been associated with acute cases of waterborne illnesses and can be responsible for chronic illness at lower levels of exposure. Chemical hazards in drinking water may come from the source water or occur in the treatment and distribution system. They include but are not limited to: toxic spills, naturally occurring minerals, heavy metals, dissolved gases (e.g. radon), pesticides, fertilizers, endocrine disruptors, personal care products and pharmaceutical residuals, cyanotoxins, flocculants, coagulants, lubricants, copper, iron, zinc, and lead from pipes and fittings.

Physical Hazards

Physical hazards can result from contamination and/or poor procedures at different points in the chain from source to customer. Sediments are the most common physical hazard associated with drinking water and are of concern as they may carry with them microbiological hazards and interfere with disinfection system efficacy. Other physical hazards include biofilms, pipe materials or sloughed metal.

Radiological Hazards

Radiological hazards may arise from man-made or natural sources, with naturally occurring chemicals (uranium, radon, etc.) most frequently being found in groundwater. If there is the potential for the accidental release of man-made radiologicals, such as tritium or other radionuclides, these sources should also be considered. With accidental releases, surface waters may be at a greater risk.

Additional information on drinking water hazards is available in the following Ministry publications:

- Technical Support Document for Ontario Drinking Water Standards, Objectives and Guidelines (June, 2003)
- Ontario Drinking-Water Quality Standards Regulation O.Reg. 169/03, supporting information and fact sheets
- Procedure for Disinfection of Drinking Water in Ontario

Hazards related only to drinking water safety must be considered. Under the scope of the QMS, health and safety or environmental hazards, for example, need not be included if they do not pose a hazard to drinking water safety.

6. Setting Up A Risk Assessment Table

In order to effectively conduct a risk assessment, you must consider all of the different processes of your drinking-water system, from the source to the point of delivery. These steps were identified in your Process Flow Chart (prepared in the previous chapter). For each process step, potential hazards are brainstormed, and documented in a Risk Assessment Table. A template for this table is provided in Appendix D in Part II of the Guidance Document. This template will provide your team with a structured approach for progressing through the steps.

Copy each of the process steps from the Process Flow Chart to the "Activity or Process Step" column of the Risk Assessment Table. An example of a Risk Assessment Table is shown below.

Figure 10.1: Risk Assessment Table showing some process steps from the Process Flow Chart.

Activity or Process Step	***Description of Hazardous Event/ Hazard***	***Control Measures***
Source Water		
Intake		
Low Lift Pumps		

7. Identifying Hazardous Events and Associated Hazards

The first step of the Risk Assessment is to assess existing and potential hazardous events and hazards that could affect the safety of the drinking water.

For each process step in your Risk Assessment Table, brainstorm hazards or hazardous events that *could* affect drinking water quality, and record them in the "Description of Hazardous Event/Hazard" column. Here you can describe the hazard, and the hazardous event that may cause it.

> For example, one hazardous event that may occur in distribution systems is the loss of the main power supply. All systems are potentially at risk in the event of a long term power outage, particularly if standby power generators are not available.
>
> Systems with elevated storage are at a lower risk as consumer needs can be supplied for a period of time from stored water. Systems which do not have elevated storage are at a greater risk as they will be unable to supply water immediately, and system pressure could fall unacceptably low. With low system pressures, the potential exists for infiltration of chemically or biologically contaminated water into the watermains.
>
> In your Risk Assessment Table under the distribution system portion of your "Activity or Process Steps', you could include power outage as a potential hazardous event.
>
> Note: this hazardous event could also be identified under the treatment section of the Risk Assessment Table due to the inability to produce water.

Hazardous events can be natural or technological in origin, or result from human activities. Natural events include floods, ice storms, drought and spring run-off. Technological events could include equipment failure or power outage. Human activities which could lead to a drinking water risk include vandalism, terrorism, chemical spills, and construction accidents.

Remember that all potential hazards and hazardous events should be identified even if there are control measures in place.

Helpful **Tips**

- Remember to consider normal operations, maintenance activities, and emergency situations.
- Remember the four types of hazards for drinking water - biological, chemical, physical and radiological.
- All potential hazards and hazardous events, large and small, should be identified and included.
- Even though a hazard or hazardous event may not appear to be significant, it should be discussed by the team and included in the Risk Assessment Table.

There may be more than one type of hazard or hazardous event for each activity or process step. Hazards or hazardous events may be introduced from processes upstream or downstream (e.g. backflow from a cross connection) - don't forget to think beyond the boundaries of the drinking-water system.

For example, a backup diesel emergency generator may be in place at the water treatment plant to provide power to the water treatment plant in the event of a power failure. Even though that control measure is in place, a power outage is still identified as a hazardous event.

For hazards or hazardous events that are associated with the entire system, rather than just one process, such as power outage, the table needs only to be filled out once. Identify these with an asterisk, and provide an explanatory footnote.

Be sure to describe the hazard, such as "*Chemical contamination of source water* " or "*Potential for biological/chemical contamination due to loss of supply, low pressures, and potential for infiltration into the distribution system."* An example is shown in Figure 10.2. These are the same activity or process steps identified in the previous example. This example will be developed through the chapter.

Figure 10.2: Risk Assessment Table showing some activity or process steps and hazardous events and associated hazards.

Activity or Process Step	**Description of Hazardous Event/ Hazard**
Source Water	*Rail Car Derailment; Spill / accidents on spur rail lines; <200m to lake; plus railway bridge over tributary creek* *Chemical contamination of source water*
Source Water	*Community on lake uses private septic systems. Discharge of inadequately treated septic system effluent into lake near water treatment plant intake.* *Biological contamination of source water*
Source Water	*Algal blooms, clogging of filters, potential for toxin producing cyanobacteria* *Biological /Chemical contamination of source water*
Intake	*Collapse or breakage of single intake pipe and blockage of intake screens with bags and other debris.* *Potential for biological /chemical contamination due to loss of supply, low pressures, and infiltration into the distribution system.*
Treatment	*Coagulant interruption* *Biological contamination due to ineffective chemically assisted filtration and pathogen removal*
Treatment	*Filter turbidity breakthrough* *Biological contamination due to ineffective chemically assisted filtration and pathogen removal*

Note: The above table has been developed for the purpose of explaining concepts. The control measures identified should not be taken as being necessarily suggested or required by the Ministry.

8. Identifying Available Control Measures

Now you will begin to identify measures in place to control the hazards and hazardous events that have been identified. This is where you describe what is currently in place to keep the hazards or hazardous event under control. You are not required to prepare control procedures, but to simply describe what control measures are in place. This task must be performed for all hazards and hazardous events. Figure 10.3 shows an example Risk Assessment Table that includes control descriptions.

A few examples of control measures that may be in place include:

Grass strips implemented along all water courses
Control or operating procedures (e.g. operators may be trained in proper procedures for backwashing)
Backup equipment (e.g. a spare UV disinfection unit may be available in case one needs to be taken off-line)
Fail-safe alarms (e.g. SCADA alarms may sound for low water levels, high filtered water turbidity, low chlorine, etc.)
Backup emergency power (e.g. an automatic emergency generator may start in the event of a power loss)

It is important to note that not all hazards or hazardous events will be controllable through your subsequent processes. The best that can be achieved with some hazards or hazardous events is monitoring or response. These hazardous events may be considered emergencies and dealt with through emergency response and recovery procedures (see Chapter 17).

Equipment redundancy is one way of controlling a hazard or hazardous event. Be sure to consider the reliability and redundancy of equipment when identifying control measures.

For example, in Figure 10.2, the collapse or breakage of a single intake pipe was identified as a potential hazardous event. Potential for biological / chemical contamination due to the loss of supply, low pressures, and the potential for infiltration into the distribution system were all identified as resulting hazards. If a dual intake system is in place, this redundancy should be noted as a means of controlling the potential hazard.

Ready for the **Audit**

What do auditors look for?

Documented hazards and hazardous events for the drinking-water system, which match hazards and hazardous events that the Auditors became aware of during the document review or the site visit.

Documented control measures that are in place for hazards and hazardous events.

Figure 10.3: Risk Assessment Table showing some control and response measures that may be in place for the hazards listed.

Activity or Process Step	Description of Hazardous Event/ Hazard	Control / Response Measures
Source Water	*Rail Car Derailment; Spill / accidents on spur rail lines; <200m to lake* *Chemical contamination of source water*	*Some contaminants may be removed by treatment. Until contaminant is identified assume no method of control. Consider developing response procedure or emergency response procedure.*
Source Water	*Community on lake uses private septic systems. Discharge of inadequately treated septic system effluent into lake near water treatment plant intake.* *Biological contamination of source water*	*First barrier - Source water protection – addressed in a separate Ministry initiative* *Second barrier – Treatment - microbiological contamination controlled by chemically assisted filtration and disinfection.*
Source Water	*Algal blooms, clogging of filters, potential for toxin producing cyanobacteria* *Biological /Chemical contamination of source water*	*Controlled by chemically assisted filtration and addition of powdered activated carbon to assist in removal of toxins.*
Intake	*Collapse or breakage of single intake pipe and blockage of intake screens with bags and other debris.* *Potential for contamination due to loss of supply, low pressures, and infiltration into the distribution system.*	*No Control available* *Consider developing response procedure or emergency response procedure.*
Coagulant Addition	*Coagulant interruption* *Biological contamination due to ineffective chemically assisted filtration and pathogen removal*	*Automatic controls shut down low lift pumps and treatment system on loss of signal.* *Investigate problem, maintenance, pump up pumps, spare parts.*
Filters	*Filter turbidity breakthrough* *Biological contamination due to ineffective chemically assisted filtration and pathogen removal*	*Automatic controls stop water production on high turbidity. Backwash initiated, followed by filter to waste cycle.*

Note: The above table has been developed for the purpose of explaining concepts. The control measures identified should not be taken as being necessarily suggested or required by the Ministry.

9. Assessing Risks

With hazards and hazardous events now identified, the risks associated with the hazardous events must be assessed. One option for assessing risk is presented below. This option calculates risk based on likelihood, consequence and detectability. Another option is presented in the Health Canada document "Canadian Guidance Document for Managing Drinking-Water Systems: Risk Assessment / Risk Management Approach", and is similar, but does not include detectability. These two options are not the only methods to identify significant hazards. You may choose to adopt one of these methods or a variation of one of these methods, or you may adopt another method if it best suits your system.

Helpful **Tips**

Typically high likelihood / high consequence / low detectability events are given priority.

Low likelihood / low consequence events / high detectability events are usually not prioritized for management actions, until the high priority events are managed.

Likelihood is the probability of a hazard or hazardous event occurring, sometimes called "Frequency". It is determined by "how often'" or "how likely" a hazard or a hazardous event occurs. It must take into account hazards or hazardous events that have occurred in the past and their likelihood of recurrence and must also predict the likelihood of hazards and hazardous events that have not occurred to date. Both emergency events and predictable events should be considered.

Consequence is the severity of the results of the hazard/hazardous event if the hazard is not controlled. Some risk assessment methodologies measure consequence in terms of potential human health impacts only. Other methodologies include other considerations in assessing consequence which can include: consumer/public concern and impacts on operation with associated costs. The consequence of an event can be affected by the concentration of contaminants present and their nature, the duration of the exposure (in time) and the geographical area of the exposure or the number of persons exposed. Sensitivity of the exposed population may also be a factor in determining consequence.

Detectability has also been used as a risk factor in this example, but its use is optional. With this approach, as the detectability of a hazard decreases, the associated risk may be considered to increase. Hazards that cannot be defined or detected have a higher risk factor as you do not know when appropriate control measures should be implemented. Risks that can be monitored in real time are lower risks, as appropriate control measures can be taken.

Likelihood, consequence and detectability are expressed by a system of numerical weighting. In the approach outlined in this example, the likelihood, consequence and detectability for each hazardous event were each assigned a value of between 1 and 5, with a value of 5 representing the highest risk. An example of a numerical risk-rating scheme is presented in Figure 10.4.

Figure 10.4: Likelihood, consequence and detectability rating system.

Description	***Likelihood of Hazardous Event Occurring***	***Rating***
Rare	May occur in exceptional circumstances, and has not occurred in past.	1
Unlikely	Could occur at some time, historically has occurred less than once every 5 or 10 years.	2
Possible	Has occurred or may occur once or more per year.	3
Likely	Has occurred or may occur on a monthly to quarterly basis.	4
Very likely	One or more occurrences on a monthly or more frequent basis.	5

Description	***Consequence of Hazardous Event Occurring***	***Rating***
Insignificant	Insignificant impact, little public exposure, little or no health risk.	1
Minor	Limited public exposure, minor health risk.	2
Moderate	Minor public exposure, health impact for small population.	3
Major	Large population at risk.	4
Catastrophic	Major impact for large population, complete failure of systems.	5

Description	***Detectability of Hazardous Event***	***Rating***
Very Detectable	Easy to detect, on-line monitoring through SCADA.	1
Moderately Detectable	Moderately detectable, alarm present but not in SCADA, may require operator to walk by and notice alarm; problem is indicated promptly by in-house lab test results.	2
Normally Detectable	Normally detectable, visually detectable on rounds or regular maintenance.	3
Poorly Detectable	Poorly detectable, visually detectable but not inspected on a regular basis; not normally detected before problem becomes evident; lab tests are not done on a regular basis (e.g. quarterly).	4
Undetectable	Cannot detect.	5

One of the benefits of incorporating detectability into the risk assessment is that the team members may become more aware of the hazards and hazardous events that are difficult to detect or that are undetectable. As a result, control measures or procedures may be put in place to address them.

> For example, watermain breaks frequently occur in water distribution systems, particularly during winter months. Depending on the severity of the breaks and depending on the system, they may cause a decrease in water pressure and they may allow contaminants from outside the watermain to enter into the distribution system. Since watermain breaks occur below the ground surface, they may or may not be easily detectable. Therefore, a watermain break would generally be assigned a higher numerical value to reflect the poor detectability. It may be decided to implement control measures such as a leak detection program to mitigate this risk.

Figure 10.5 shows likelihood, consequence and detectability ratings assigned to example hazardous events/hazards, all recorded in the Risk Assessment Table. The ratings provided in the table have been developed to describe concepts and should not be interpreted as being necessarily suggested or required by the Ministry.

10. Ranking Hazardous Events

A simple way of ranking the hazardous events according to the associated risk is presented here, using the likelihood, consequence and detectability ratings that you have already determined. By summing the numbers assigned for likelihood, consequence and detectability, you can rank your hazardous events.

RANK = LIKELIHOOD + CONSEQUENCE + DETECTABILITY

Figure 10.5 shows the calculated risk ratings assigned to example hazardous events, recorded in the Risk Assessment Table.

In risk assessment approaches which use only likelihood and consequence as risk criteria, the risk numbers are commonly multiplied to provide a risk rating.

In your Risk Assessment Table, sum up your likelihood, consequence and detectability ratings for each hazardous event. Select a threshold number for high risk hazardous events which must be further considered. This threshold number should be set to capture all hazardous events which are sufficiently severe to warrant that the hazardous event be “managed”.

For example, refer to Figure 10.5. An Operating Authority may select a threshold number of “7”. Process steps associated with hazardous events ranked above 7 are considered high risk hazardous events which require further investigation to assess whether they are critical control points.

In Figure 10.5, the hazardous event of “Coagulant interruption, causing bbiological contamination” is ranked above 7. Based on this threshold, the coagulant addition process, identified in the first column of Figure 10.5, would then be considered a high risk hazardous event. .

The ranking model is a tool to help you identify CCPs, but it does not need to be rigid. The QMS must be flexible to the needs of the Operating Authority, including the CCP determination.

Helpful **Tips**

The team performing the risk assessment should rely on site-specific knowledge of the water system. The hazardous events should be ranked through a collaborative process by the risk assessment team.

Note that in the traditional approach to risk assessment and **critical control point (CCP)** identification, only the last step at which a hazard can be controlled is defined as a CCP. However, in a risk assessment for a drinking - water system based on the **multi-barrier approach**, there will be several control points that might address any particular hazard or hazardous event. Therefore several CCPs may be identified for each hazardous event.

11. Identifying Critical Control Points

A critical control point (CCP) is an essential step or point in the Subject System where you apply some sort of control, to prevent or eliminate a drinking-water health hazard or to reduce it to an acceptable level. In the traditional approach to risk assessment and CCP identification, only the last step at which a hazard can be controlled is defined as a CCP. However, in the risk assessment process for a drinking-water system based on the multiple barrier approach, there could be several control points that could address any particular hazard or hazardous event. Therefore, several CCPs may be identified for each hazardous event.

Elements 7 and 8 of the DWQMS require you to:

- Identify critical control points,
- Identify control measures and critical control limits,
- Document procedures and/or processes to monitor the critical control limits,
- Document procedures to respond to deviations from critical control limits,
- Document procedures for reporting and recording deviations from critical control limits.

To identify critical control points in your drinking-water system, you must first rank your hazardous events as outlined in the previous step and assess whether they exceed your risk threshold. The second step is to identify whether or not the hazardous event can be controlled. If the hazardous event cannot be controlled to prevent, eliminate or reduce a drinking-water health hazard, it is not a CCP.

Identify your critical control points on your Risk Assessment Table, by completing the “CCP?” column.

As the plan is refined over several years and the risks are addressed, the threshold number can be reduced to allow lower ranked hazardous events to be managed.

If control measures are not in place for hazardous events with high rankings, you are not required to put them in place (unless of course they are required to meet the requirements of applicable legislation and regulations). There are several ways in which you could deal with the CCPs associated with these hazardous events as outlined below:

- The Operating Authority may decide that improvements to control measures are warranted for certain hazardous events with a high ranking. These improvements could be part of long-term planning for the system, such as a plan to twin a single intake pipe or transmission main in a 5 or 10 year planning period.
- For hazardous events which cannot be controlled, it may be appropriate to develop contingency procedures or emergency response procedures (see Chapter 17).

You may choose to identify long term plans or emergency response procedures in the CCP? Column of the Risk Assessment Table, but this is not a specific requirement of the DWQMS.

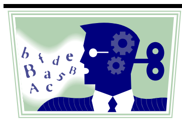
Figure 10.5 shows the “CCP?” column completed for sample hazards and hazardous events.

Figure 10.5: Example Risk Assessment Table[1].

Activity or Process Step	Description of Hazardous Event/ Hazard	Control Measures	Likelihood	Consequence	Detectability	Total (High Risk CCP Threshold=7)	CCP?
Source Water	*Rail Car Derailment; Spill Chemical contamination of source water*	***No control** - Some contaminants may be removed by treatment. Until contaminant is identified assume no method of control.*	*1*	*5*	*2*	*8*	*No – No control available at this point (Emergency Response Procedure)*
Source Water	*Community on lake uses private septic systems. Biological contamination of source water*	*Not currently at this step. First barrier - Source water protection – to be addressed in a separate Ministry initiative. Second barrier – chemically assisted filtration and disinfection.*	*1*	*2*	*3*	*6*	*No - Below risk threshold for CCP (also control not available at this point)*
Source Water	*Algal blooms Biological /Chemical contamination of source water Taste and odour*	*Controlled by chemically assisted filtration and addition of powdered activated carbon (PAC).*	*3*	*3*	*1*	*7*	*Yes*
Intake	*Collapse or breakage of single intake pipe Potential for loss of water quantity & quality.*	***No Control available***	*2*	*3*	*1*	*6*	*No - Below risk threshold for CCP (also control not available at this point) (Contingency or Emergency Response Procedure)*
Coagulant Addition	*Coagulant interruption Biological contamination – ineffective chemically assisted filtration*	*Automatic controls shut down low lift pumps and treatment system on loss of alum flow signal. Operators investigate problem & perform maintenance or repair, spare parts and pumps available.*	*3*	*4*	*1*	*8*	*Yes*
Filters	*Filter turbidity breakthrough Biological contamination ineffective chemically assisted filtration*	*Automatic controls stop water production on high turbidity. Backwash initiated, followed by filter to waste cycle.*	*1*	*4*	*1*	*6*	*Yes* ***Below risk threshold for CCP but included as it is a "Recommended Minimum CCP"***

Note: The table has been developed to describe concepts and should not be interpreted as being necessarily suggested or required by the Ministry.

12. Recommended Minimum CCPs



Technical **Terms**

"Primary Disinfection – a process or series of processes intended to remove or inactivate human pathogens such as viruses, bacteria and protozoa in water.

The minimum treatment processes to achieve primary disinfection are different for groundwater and surface water sources. Details are provided in O. Reg. 170/03 and the *Procedure for Disinfection of Drinking Water in Ontario*.

Secondary disinfection – a process or series of processes intended to provide and maintain a disinfectant residual in a drinking-water system's distribution system, and in plumbing connected to the distribution system, for the purposes of,

a) protecting water from microbiological re-contamination,
b) reducing bacterial regrowth,
c) controlling biofilm formation, and
d) serving as an indicator of distribution system integrity,

and includes the use of disinfectant residuals from primary disinfection to provide and maintain a disinfectant residual in a drinking-water system's distribution system for the purposes described in clauses (a) to (d).

Through the previous tasks, CCPs were identified based on your team's assessment. It is recommended that you also include the CCPs which control the treatment and disinfection processes for your system. These are referred to as "Recommended Minimum CCPs".

The **Recommended Minimum CCPs** are those control points required by regulation to meet minimum treatment requirements for primary disinfection and secondary disinfection as outlined in O. Reg. 170/03 and the *Procedure for Disinfection of Drinking Water in Ontario*.

The control points generally meet the characteristics of an "ideal" critical control point as they typically are:

- Able to prevent, eliminate or reduce hazards,
- Monitored, preferably in real time,
- Able to have determined control limits, and,
- Essential to ensure the safety of the drinking-water.

These control points also provide important barriers in the multiple barrier process to ensure that pathogens that could be present in the water are effectively inactivated and/or removed and that secondary disinfection is maintained in the distribution system. For these reasons, it is recommended that they be included as CCPs.

Treatment Requirements and Secondary Disinfection

The following provides an overview of drinking water treatment requirements under O. Reg. 170/03 and the Ministry's *Procedure for Disinfection of Drinking Water in Ontario* for both groundwater and surface water supplies.

For groundwater supplies, treatment is required to be:

1) capable of achieving at least 99% removal or inactivation of viruses by the time the water enters the distribution system; and
2) in accordance with the Ministry's *Procedure for Disinfection of Drinking Water in Ontario*.

For surface water supplies, treatment is required to be:

1) designed to be capable of chemically assisted filtration;
2) capable of achieving at least 99% removal or inactivation of *Cryptosporidium* oocysts, at least 99.9% removal or inactivation of *Giardia* cysts, and at least 99.99% removal or inactivation of viruses by the time the water enters the distribution system; and
3) shall be in accordance with the Ministry's *Procedure for Disinfection of Drinking Water in Ontario*; or
4) other water treatment equipment that, in the Director's opinion, is designed to be capable of producing water of equal to or better quality than that noted above.

For both surface water and groundwater supplies, secondary disinfection shall be achieved by:

1) chlorination or chloramination equipment designed in accordance with the Ministry's *Procedure for Disinfection of Drinking Water in Ontario* and capable of achieving a free chlorine residual of 0.2 mg/L if the system uses chlorination or a combined chlorine residual of 1.0 mg/L if the system uses chloramination; or
2) other water treatment equipment that, in the Director's opinion, is designed to be capable of providing secondary disinfection equal to or better quality than that noted above as outlined in the O.Reg 170/or and the *Procedure for Disinfection of Drinking Water in Ontario*.

How to determine Recommended Minimum CCPs

In general, processes within a water treatment plant required to ensure compliance with O. Reg. 170/03 and the *Procedure for Disinfection of Drinking Water in Ontario* are recommended to be included as CCPs, at a minimum. Within the distribution system, only those control points required for ensuring secondary disinfection would be considered recommended CCPs.

When determining which CCPs meet the criteria for recommended minimum CCPs within your system you should consider the following:

1) Does the step/process contribute to the minimum log removal or inactivation of pathogens in the drinking water?
2) Is the step/process necessary to meet the requirements of the *Procedure for Disinfection of Drinking Water in Ontario*?
3) Is the step/process necessary for maintaining a distribution system disinfectant residual?

Answering “yes” to one or more of the questions above would designate the CCP in question as a recommended minimum CCP. Examples are provided below to illustrate minimum CCPs for various systems.

As previously discussed, for each recommended minimum CCP it is important to identify the available monitoring in place as well as establishing the critical control limits. You should review your Risk Assessment Table to ensure that the recommended minimum CCPs have been identified.

The examples which follow discuss how recommended minimum CCPs are identified. As an optional task, identify the recommended minimum CCPs in the CCP column.

Example 1 – Treatment (Primary Disinfection) for Groundwater System:
A small drinking-water supply system consists of a single groundwater well, sodium hypochlorite chemical feed system, and a section of dedicated watermain prior to entering the distribution system to provide chlorine contact time for 2-log virus inactivation. An on-line analyzer monitors the chlorine residual as it leaves the plant.

In this example, the sodium hypochlorite feed system is required for providing primary disinfection and is therefore a minimum CCP.

Example 2 – Treatment for Surface Water Source Water:
A surface water treatment plant treats a low turbidity water source using a combination of direct filtration, and ultraviolet (UV) disinfection. UV is used for additional inactivation of Giardia, as inadequate chlorine contact time is available. Chlorine is added just prior to the water entering the distribution system for virus inactivation and for secondary disinfection.

In order to satisfy the *Procedure for Disinfection of Drinking Water in Ontario* the direct filtration process must, among other requirements:

- use a chemical coagulant at all times,
- monitor and adjust chemical dosages in response to variations in raw water quality,
- maintain effective backwash and filter ripening procedures,
- continuously monitor filtrate turbidity from each filter,
- ensure a filtered water turbidity of less than or equal to 0.5 NTU in 95% of the measurements each month.

Based on these requirements and the system's treatment process, the following components would be considered as minimum CCPs for treatment:

1. Coagulant Dosing System – requirement for chemically assisted-filtration. Alum pumps and alum flow switch are monitored through SCADA and alarm if feed is lost.
2. Filters – requirement for chemically assisted-filtration. Filtered water turbidity is monitored by SCADA and automatic control procedures.
3. UV system – requirement for additional pathogen (Giardia) inactivation. Operation is monitored by SCADA.
4. Chlorination system – required for primary disinfection of certain viruses. Minimum chlorine contact time (CT) must be met prior to entry into the distribution system. SCADA system monitors output from the on-line chlorine residual analyzer and will alarm.

Example 3 – Secondary Disinfection
Secondary disinfection in both of the above examples is achieved by the addition of chlorine. The chlorine system is therefore a minimum CCP for secondary disinfection. SCADA system monitors output from the on-line chlorine residual analyzer and will alarm. The chlorine residual is also monitored in the distribution system.

Note that in the Risk Assessment Table (Figure 10.5), two of the CCPs identified are recommended minimum CCPs. These are the "coagulant feed system" and the "filtration system', both of which are necessary to meet treatment requirements and comply with the *Procedure for Disinfection of Drinking Water in Ontario*.

13. Setting Critical Control Limits

You must now establish critical control limits for your identified CCPs, including minimum CCPs. Critical control limits must be clearly expressed in your Operational Plan. Numerical critical control limits, such as chlorine residuals, must be indicated as a maximum (value not to exceed), minimum (value that must be exceeded), or range with clearly defined upper and lower values.

Critical control limits are typically set more stringently than regulatory requirements. This can be beneficial as deviations from a critical control limit would then not result in regulatory non-compliance, and the Operating Authority would have time to respond and bring the process back under control.

Critical control limits can be derived from existing regulatory standards and guidelines, scientific literature, experimental studies, and consultation with experts. But you must also take into account operational capabilities to measure the variable for which the limit is established (acceptable operational deviations +/-).

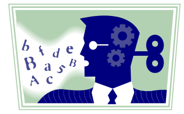
If a critical control limit is incorrectly assigned, it means that the production of safe water may be compromised.

Critical control limits can be identified for many different readings or observations such as:

- Temperature
- pH
- Chlorine residual
- UV dosage and intensity
- Turbidity
- Pressure
- Visual observations
- Customer complaints.

For each CCP, your team needs to decide what critical control limits apply. Record the critical control limits for each CCP in the Risk Assessment Table. If the information is too complex for that table, create a separate procedure for that CCP and write the critical control limits there.

Remember, critical control limits need only to be assigned to critical control points.

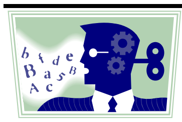


Technical **Terms**

Critical control limit – the point at which a Critical Control Point response procedure is initiated.

Helpful **Tips**

Critical control limits can be set at the regulatory limits but if you do so, you will not have the ability to respond and correct the situation prior to being in regulatory non-compliance.



Technical **Terms**

Monitoring – includes any checks or systems that are available to detect hazards or the potential for hazards.

For example, turbidity is used to monitor the effectiveness of the chemically assisted filtration process at removing microbiological pathogens. Turbidity does not monitor the hazard of microbiological pathogens, but provides an indication that the process is operating effectively. Turbidity is known as a **surrogate parameter**.

A **control measure** – includes any processes, physical steps, or other contingencies that have been put in place to prevent or reduce a hazard, before it occurs.

For example, for a surface treatment system using chemically assisted filtration, the filters were identified as a CCP. On-line turbidimeters monitor filtered water turbidity which is an important indicator of filtration efficiency. The *Procedure for Disinfection of Drinking Water in Ontario* requires that the filtered water turbidity be less than 0.3 NTU 95 percent of the time. In addition, O. Reg. 170/03 prescribes turbidity as an adverse result it the drinking-water system is required to provide filtration, and a result indicates that turbidity exceeds 1.0 NTU. The filtered water turbidity is trended automatically by the SCADA system to determine the 95th percentile value.

To establish critical control limits, the Operating Authority reviews the historical values for filtered water turbidity. Filtered water turbidity should be as low as possible to provide the greatest removal of microbiological pathogens such as Giardia and Cryptospodium which could be present in the source water. In addition, it is desirable to have internal control limits less than the regulatory limit to avoid exceedances. Based on the review, the following limits are programmed into the SCADA system to control the operation of each individual filter.

0.15 NTU – automatic filter backwash sequence initiated
0.20 NTU – alarm sent out and flow through filter is stopped. Operator investigates in accordance with the response procedure.

14. Monitoring Critical Control Points

Element 8 of the DWQMS requires that procedures and/or processes to monitor the critical control points be documented in the Operational Plan. Now that you have identified the critical control limits for CCPs, you must document the procedures and/or the processes you have for monitoring your CCPs. Monitoring your drinking-water system is necessary to let you know if you're within those critical control limits.

Monitoring provides alerts that the critical control limits have been exceeded and response measures should be activated to maintain control of the hazard. The three main purposes of monitoring are to:

- Track system performance so a critical control limit is not exceeded,
- Indicate when a loss of control and a deviation have actually occurred so response procedures can be undertaken, and
- Provide records for accountability.

Critical control limits are monitored to ensure that the critical control limits are met. Monitoring of CCPs may be by observation or by measurement. The results should be recorded or it is difficult to demonstrate that monitoring is in fact taking place.

Monitoring includes any checks or systems that are available to monitor a hazardous event or a hazard. Monitoring may include process monitoring that occurs throughout the drinking-water system, such as:

- Raw and treated water flow
- Raw and treated water chlorine residual
- Filtered water turbidity
- Distribution system pressure
- Reservoir water levels

Monitoring may also include:

- Visual checks
- Customer complaints monitoring
- SCADA alarm monitoring
- Security monitoring
- Daily/weekly/monthly system checks such as chemical levels, calibration checks, etc.

Using the Risk Assessment Table, describe the monitoring processes in place for the CCPs, or use separate procedures with control limits and monitoring instructions described. If you have separate procedures or other related documentation, simply refer to this in the table. Examples of monitoring processes for CCPs are included with the model operational plans in Part III of this Guidance Document. Sample monitoring processes are described in Figure 10.6.

15. Establishing Procedures for Deviations from Critical Control Limits

Each CCP must have one or more documented response procedure that can be implemented to respond if a critical control limit is exceeded.

Now that you have identified your CCPs and how to monitor them, you need to establish procedures to outline the actions that must be taken if monitoring indicates that the critical control limits are not met. These procedures are necessary to ensure or regain control of the hazardous event and hazard, minimize the risk of the production and/or distribution of "unsafe" drinking water, and prevent a recurrence from happening. These are called response or corrective procedures.

Under the "Response Procedure" column in the Risk Assessment Table, refer to the name of the response procedure. The procedure should describe:

- Who responds,
- How the hazardous event and hazard are corrected or addressed,
- Who the hazard occurrence is reported to,
- How it is reported, and

- How the whole event should be recorded.

If the information is too complex for that table, create a separate procedure for that CCP and write monitoring instructions there. Remember to use the tips for writing a procedure outlined in "Chapter 8 – Document and Records Control".

To ensure that your response procedures are effective, it is crucial to include instructions in your response procedures about investigating *why* a critical control limit was exceeded, and choosing appropriate response actions as a result. Although not directly required under the DWQMS, a good guideline for checking that your response procedures will be effective is to answer the following questions:

Will the CCP be back under control if you follow the procedure?
Are there instructions on how to report that the deviation has occurred?
Are there instructions on how to identify the *cause* of the deviation?
Are there instructions on how to eliminate the *cause* of the deviation?
Are there instructions for preventing the deviation from happening again?
Are there instructions for making sure that no affected water reaches a consumer?
Are there instructions on how to record the deviation?

Figure 10.6 shows a table summarizing the critical control limits and response procedures for each identified CCP from the example Risk Assessment Table. Examples of response procedures for deviations of critical control limits are included with the model operational plans in Part III of this Guidance Document. Figure 10.7 shows an example of a response procedure for a situation when turbidity in treated water has exceeded critical control limits.

Figure 10.6: Critical control limits and Summary of Response Procedures for CCPs.

Activity or Process Step	Description of Hazardous Event/ Hazard	Critical Control Limits	Monitoring Processes and/or Procedures	Response Procedures (Detailed procedures are also required)
Source Water	*Algal blooms, clogging of filters, potential for Microcystin toxin* *Biological/Chemical contamination of source water*	*If any of the following occur, they indicate that that PAC addition should be started:* • *Visual observation of deteriorating water quality,* • *presence of Geosmin and MIB and recommendation from taste and odour panel* • *or taste and odour complaints* *For chemically assisted filtration processes - see below for alum and filtered water turbidity*	*Visual observations of raw water quality.* *Shortened filter run times.* *Taste and Odour panel* *Monitor chemically assisted filtration processes – alum feed and filtered water turbidity.* *Complaints from consumers about taste and odour.* *Monitoring for Geosmin and Methylisoborneol (MIB).*	*As per below for coagulant addition and filtered water turbidity.* *Standard Operating Procedure for PAC system.*
Coagulant Addition	*Coagulant interruption* *Biological contamination due to ineffective chemically assisted filtration and pathogen removal*	*Loss of alum flow signal - stop filtration on loss of alum flow signal, investigate feed system*	*Flow switch on alum line, signal from alum pump.* *Routine system checks.*	*Automatic controls shut down low lift pumps and treatment system on loss of signal. Alarm* *Operator investigates the problem. Responses could include: maintenance of feed system; flushing of lines; use of spare pumps; replacement of faulty parts, etc.*
Filters	*Filter turbidity breakthrough* *Biological contamination due to ineffective chemically assisted filtration and pathogen removal*	*0.15 NTU – automatic filter backwash sequence initiated* *0.20 NTU – alarm sent out and flow through filter is stopped*	*Continuous on-line monitoring of filtered water turbidity with automatic controls.* *Alarm if limits exceeded.*	*Automatic controls stop water filtration on high filtered water turbidity. Operator investigates. Performance of other filters and the operation of the chemical feed systems are reviewed. Key raw water parameters and settled water turbidity is checked. If necessary jar tests are completed and the coagulant and polymer addition are adjusted to optimize performance.*

Note: The table has been developed to describe concepts and should not be interpreted as being necessarily suggested or required by the Ministry.

In the following example (Figure 10.7), settled water turbidity is monitored by SCADA in addition to filter water turbidity. Please note that monitoring of settled water turbidity is not a regulated requirement, but has been added by the Operating Authority as it can provide advance warning of poor treatment performance.

Figure 10.7: Response procedure for turbidity exceeding critical control limits at a surface water treatment plant with chemically assisted filtration.

Abnormal operating conditions have occurred when a **SCADA turbidity alarm limit** has been exceeded. The steps taken require some discretion on the part of the Operator and reliance on the Operator's practical experience depending on the circumstance

High Filter Turbidity
- If a SCADA alarm occurs because the filter turbidity has reached **0.20 NTU** follow the procedure outlined below**:**

High Settled Water Turbidity
- If a SCADA alarm occurs because the settled water turbidity reaches **1.0 NTU** or above follow the procedure outlined below:

Response Procedure
1. Look at the raw water turbidity to see if it is high also
2. Increase the alum dosage
- The alum dosage is increased in the SCADA program. The Operator enters the setpoints manually and the adjustments will take effect in approximately an hour
- The amount to increase the alum dosage varies depending on the conditions at the time
- The Operator should use their discretion and experience to determine how much to increase the alum dosage
- The conditions can change within minutes due to rapid variations in raw water turbidity
- It takes approximately an hour for the changes to take effect through the system
3. In the meantime, if the settled water turbidity increases and the turbidity at more than one filter is increasing, the Operator should add filter aid
4. Once the filter aid is added, results should be seen in 20 to 30 minutes and the filtered water turbidity should drop (filter aid is described at the end of this section)
5. Backwash any filters with high turbidity
6. If a filter is backwashed more filter aid must be added
7. Filter aid spreads over an entire side of the filtration process so if you backwash one filter on that side you have to backwash them all
8. If the filtered water turbidity increases above 0.25 NTU, see below

Filter-Aid
- Filter-aid can be used if the Operator notices filter turbidities climbing
- Filter-aid is a type of polymer that can be dosed at the filters
- The equipment present consists of a dry polymer feeder with storage capacity, hot air blower, polymer wetting disperser, a mixing tank with a portable electric mixer, a solution storage tank and transfer pumps
- To make the filter aid, 8 to 10 ounces is added to 100 gallons of water, and add all 100 gallons to one side of the filter gallery
- Watch the filter turbidities on the SCADA screen in the control room and use experience to vary the speed as to how fast the filter aid is added
- The filter-aid is pumped into the filter and spreads over the filter like a blanket
- If too much filter-aid is used head loss can occur
- If 1.5 m of head loss occurs the filter must be backwashed as required above (see Operator Control Section)

When treated water turbidity reaches 0.25 NTU or above the Operator shall
1. Notify the Manager immediately.
2. Open filter to waste valves. Do not discharge filtered water to clearwells until control is regained.
3. Perform jar tests as necessary to optimize treatment, backwash filters
4. If settled water turbidity is high, discharge settled water through drain until settled water is below 2.0 NTU.
5. Adjust chemical addition regime, operate single filter only in filter to waste mode, until filtered water turbidity is below 0.15 NTU
6. Enter a full description of the incident and the cause in the Operators Log Book.

Note: the above procedure is provided to illustrate concepts only, and the content should not be interpreted as being necessarily suggested or required by the Ministry. Response procedures will vary and are dependent on the treatment process, monitoring and controls available, and operating authority preferences.

Helpful **Tips**

A QMS Awareness training session will be set up later during implementation "Chapter 20 – Completing the QMS Cycle". This will introduce all personnel to the QMS. The risk assessment, CCPs and CCP procedures are topics that you will discuss.

16. Keeping the Risk Assessment Current

Besides documenting the risk assessment process and outcomes, you must also document in your Operational Plan a method to keep the information current.

Updates to the Risk Assessment

Every year you need to verify the currency of the information and the validity of the information used in the risk assessment, and the risk assessment must be redone every three years at a minimum.

The currency of the information and the validity of the assumptions can be verified in different ways. You may choose to have this task designated to a single person or adopt a team approach.

- Consider who you might want to contact to discuss any changes to your source water – the source water protection committee, Conservation Authorities, sewage treatment system managers, storm water planning departments, etc.
- Municipal planning departments may have information about significant new developments
- Have regulatory changes affected your risk assessment?
- Operations staff is in the best position to know if the drinking-water system has changed in a way that could impact the risk assessment. Some of the changes that could be important include: the addition of new treatment trains or equipment; new monitoring and/or control measures; decommissioning of old equipment, planned maintenance and repair of key pieces of infrastructure; and long term water level changes in your source water.

Every year you need to document that this review was performed. If significant changes occurred, the associated areas of the risk assessment should be updated.

Include in your procedure how you intend to redo the risk assessment every three years. For example, the procedure may simply state that redoing the task every three years is the responsibility of the Public Works Manager who will establish and convene a risk assessment team. Note that it you can change the risk assessment methodology in future risk assessments.

Risk Assessment Procedure

The procedure must describe the Risk Assessment process used so that people reviewing or updating the risk assessment can understand the process used.

Using the tips for writing a procedure outlined in "Chapter 8 – Document and Records Control", write a "How to Perform a Risk Assessment" procedure. Be sure to cover the following items:

- ☐ How potential hazards and hazardous events are identified
- ☐ How risks are assessed
- ☐ How hazardous events are ranked according to the associated risk
- ☐ How control measures are identified
- ☐ How critical control points are identified
- ☐ How critical control limits are identified for the critical control points
- ☐ How critical control limits are monitored
- ☐ How deviations from critical control limits are responded to
- ☐ How deviations from critical control limits are reported and recorded
- ☐ How the risk assessment is verified and redone
- ☐ How equipment reliability and redundancy are considered

For each item, remember to cover who performs each task, what their actions are, and where and how to write down and file the results. If you followed the risk assessment approach outlined in this Guidance document, you can refer to this Guidance Document. If you chose your own model for the Risk Assessment or CCP determination, detailed instructions will have to be provided or referred to.

17. Approving and Implementing

Send dated copies of the "Risk Assessment Table" and the "How to Perform a Risk Assessment" procedure to reviewers, along with the specific procedures you may have created for each CCP. The procedures should be reviewed by your Risk Assessment Team along with any other staff, such as operators, who may have valuable input. Finalize the table, if necessary meeting with other team members to discuss revisions.

Once the procedures have been approved, you must make sure they are followed.

If subcontractors or suppliers have any responsibilities in the CCP procedures, they should be informed. In "Chapter 14 – Essential Supplies and Services", various ways of communicating with subcontractors and suppliers are discussed.

18. Operational Plan: Risk Assessment and CCPs

The final task in this chapter is to describe what you've done for "Risk Assessment in the Operational Plan. In the Operational Plan binder, create a section called "Risk Assessment. Insert the "How to Perform a Risk Assessment" procedure, and also insert the Risk Assessment Table. Add any CCP procedures you've created.

Now that the information is prepared, it must be kept up-to-date. Identify the most effective method for making sure changes in the system are promptly updated in the QMS documentation. Assign specific Operating Authority personnel the responsibility of managing updates to the documentation for the Risk Assessment and Risk Assessment Outcomes.

Ready for the **Audit**

What do auditors expect to see?

- A documented risk assessment process in the Operational Plan that describes how everything listed in Element 7 is performed
- Documented potential hazards and hazardous events
- Documented risks and ranked hazardous events
- Documented control measures for hazardous events
- Documented critical control points and limits
- Documented procedures and/or processes for monitoring CCPs
- Documented response, recording and reporting procedures for CCP deviations
- Consideration of equipment reliability and redundancy
- Relevant Operating Authority personnel aware of the contents of the procedures
- A process for review and updating all of the documents
- The Operating Authority doing what is said in the documentation

Complete the Chapter Checklist below, by checking off the items that have been completed. By completing all of the items, you will be ready to move on to the next chapter.

CHAPTER CHECKLIST	*Check When Complete*
Set-up of team to perform the Risk Assessment	
Identification of hazards and hazardous events	
Assessment of risks using a consistent methodology	
Ranking of hazardous events according to risk	
Identification of available control measures for each hazard	
Identification of critical control points	
Review of recommended minimum critical control points	
Establishment of critical control limits for the critical control points	
Identification of monitoring processes for critical control limits	
Establishment of procedures for deviations from critical control limits	
Establishment of procedures for reporting and recording deviations from critical control limits	
Has equipment reliability and redundancy been considered	
Completion of a Risk Assessment Table	
Creation of a procedure that describes how you performed the risk assessment	
Identification of a method to verify and update the risk assessment	
Does the Risk Assessment Procedure cover everything in Element 7?	
Review and approval of all of the documentation created in this chapter	
Release of the documentation to relevant personnel	
Is all of the required documentation from Elements 7 and 8 in the Operational Plan?	

Chapter 11 – Organizational Structure, Roles, Responsibilities and Authorities

Key Points in Chapter 11

Clearly defined roles, responsibilities and authorities are an important component of an effective QMS.

Personnel need to know their roles, responsibilities and authorities, and how they relate to those of other employees or groups.

Responsibility for the DWQMS is shared throughout the Operating Authority including Top Management.

Chapter 11 – Organizational Structure, Roles, Responsibilities and Authorities

1. Translating the DWQMS

What the Standard says…

9. Organizational Structure, Roles, Responsibilities and Authorities

PLAN – The Operational Plan shall:

a.) describe the organizational structure of the Operating Authority including respective roles, responsibilities and authorities,
b.) delineate corporate oversight roles, responsibilities and authorities in the case where the Operating Authority operates multiple subject systems,
c.) identify the person, persons or group of people within the management structure of the organization responsible for undertaking the Management Review,
d.) identify the person, persons or group of people, having Top Management responsibilities required by this Standard, along with their responsibilities, and
e.) identify the Owner of the subject system.

DO – The Operating Authority shall keep current the description of the organizational structure including respective roles, responsibilities and authorities, and shall communicate this information to Operating Authority personnel and the Owner.

What does it mean?

Element 9 requires that you describe the organizational structure of the Operating Authority including respective roles, responsibilities and authorities. If the Operating Authority operates more than one drinking-water system, the Operational Plan must also describe corporate oversight roles, responsibilities and authorities.

The person, persons, or group of people with Top Management responsibilities must also be identified, as must those who are responsible for undertaking Management Reviews.

The DO component of Element 9 requires that the all of the information from Element 9 is kept current and is communicated to Operating Authority personnel and to the Owner.

2. Roles, Responsibilities and Authorities Overview

You must ensure that the roles, responsibilities and authorities of all of your personnel, as they relate to drinking water quality, are clearly defined and documented in your Operational Plan. Properly defined and communicated roles, responsibilities and authorities reduce the risks associated with operational activities that may be inherent in medium to large organizations. Everyone knows who does what and when, and by what authority it is done.

In your Operational Plan, describe the roles, responsibilities and authorities of Operating Authority personnel. If the Operating Authority operates other drinking-water systems, or if your Top Management that you defined in Chapter 5 includes higher levels of corporate management, the corporate oversight roles involved must also be described in the Operational Plan.

Identify the Owner of the Subject System in your Operational Plan. The roles, responsibilities and authorities of the Owner are not required by the DWQMS to be documented in the Operational Plan.

Some typical roles that may be documented in the Operational Plan include:

Top Management

- Operating Authority CEO and/or Board Members for a private Operating Authority
- Elected Municipal Officials for a municipally operated drinking-water system

Operational Management and Staff

- Water Department Superintendent
- Water Treatment Plant Foreperson
- Distribution Foreperson
- Water Treatment Plant Operator
- Distribution Operator
- Maintenance Manager

3. Using the Responsibilities Template

A simple method for tabulating this information is to complete the Responsibilities Template, found in Appendix E (see Part II of this Guidance Document). Figure 11.1 shows an example of this table. Remember to include all functional titles within your organization. Some of these may be shared roles, and some responsibilities may also be shared.

> For example, if an Operating Authority is contracted by the Owner to manage and operate more than one utility (water, electricity distribution, fibre optics network…) then the CEO, the VP of Finance and purchasing personnel may serve all segments of the business not just the water works.
>
> However, their roles, responsibilities and authorities as they relate to drinking water Quality still need to be described in this section of the Operational Plan.

Figure 11.1: Example of roles, responsibilities, and authorities, prepared using the Responsibilities Table template

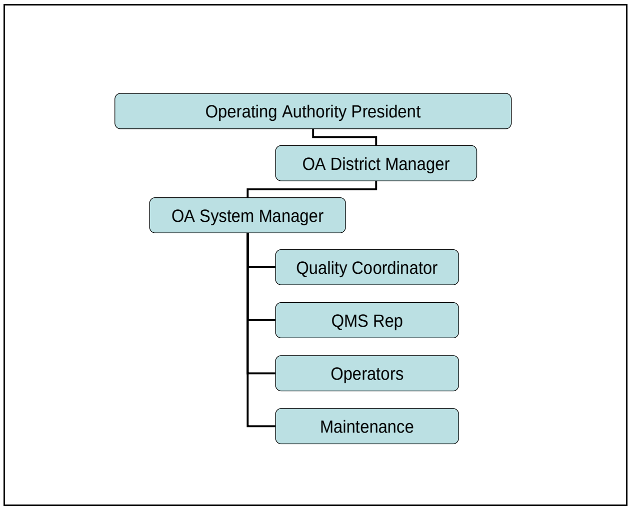
Title	Responsibilities	Authorities
Operating Authority CEO	- *Ensuring operations are performed as per the Contract between the Operating Authority and the Owner and regulatory requirements* - *Obtaining resources or infrastructure as necessary from the Owner* - *Providing resources or infrastructure as necessary* - *Ensuring that the DWQMS is implemented and maintained, and that the Operating Authority is accredited* - *Communicating with the Owner about the drinking water system and the QMS*	- *To perform listed responsibilities* - *To recommend system and QMS improvements or changes, as per the operating contract* - *To implement improvements or changes, as per the operating contract*
WTP Manager	- *Maintain regulatory compliance* - *System Overall Responsible Operator* - *Schedule work assignments* - *Monitor water quality and demand* - *Supervision of operations and maintenance staff* - *Maintain provincial operator licensing at certification level of plant* - *Work safety program* - *Facility budget development* - *Appointed QMS representative* - *Undertakes management reviews* - *Reporting on operations and the QMS to Top Management and the CEO as necessary*	- *To perform listed responsibilities* - *Develop, approve and direct implementation of standard safety and operating strategies / policies* - *To administer the QMS* - *Reporting of adverse water quality incidences to regulatory agencies, the Owner, Top Management and the public*
WTP Operator	- *Report and act upon non-conformances* - *Designated Operator In Charge* - *Follow procedures, complete forms* - *File records* - *Attend training* - *Receive and communicate external complaints* - *Regularly communicate to the Quality Manager* - *Carry out required operations and maintenance activities* - *Maintain Operator's licence*	- *To perform listed responsibilities*

4. Organizational Structure

The DWQMS also requires the Operating Authority to "set out" the "organizational structure". The intent of including this information is to show how the various roles within the Operating Authority relate to one another.

This is typically done through the use of an organizational chart. Figure 11.2 shows an example of an organizational chart for a water treatment system. The Operating Authority may also simply "list" the positions within the organization and provide narrative as to the reporting requirements of each position.

Figure 11.2: Example of an organizational chart



Ensure that roles or titles listed in the Organizational chart match those used throughout your Operational Plan. Use role titles that are familiar to personnel - do not create new titles.

Defining roles, responsibilities and authorities of personnel, as well as the overall organizational structure of the Operating Authority is another proactive method of reducing risk to and variation in the production of safe drinking water.

The Owner of the subject drinking water system must also be identified,

5. Communicating Throughout the Operating Authority

The final step in this chapter is to communicate all roles, responsibilities and authorities, and organizational structure information to all personnel in the Operating Authority.

This can be done informally simply by emailing, posting a bulletin or by personally discussing the information that you prepared in this chapter with all personnel.

In “Chapter 20 – Completing the QMS Cycle”, the task of training personnel in QMS concepts, including organizational structure, will be discussed.

Helpful **Tips**

One benefit of performing this step in your QMS implementation is checking that people with assigned responsibilities actually have the authority to properly perform those responsibilities

Ready for the **Audit**

Throughout the audit, auditors may interview personnel for various reasons. Often, regardless of the nature of the interview, the auditor will ask the interviewee about their awareness of roles, responsibilities and authorities, and organizational structure, to collect proof for when these elements are evaluated.

The auditor will often ask interviewees who the QMS Representative is.

Complete the Chapter Checklist below, by checking off the items that have been completed. By completing all of the items, you will be ready to move on to the next chapter.

CHAPTER CHECKLIST	*Check When Complete*
Identification of a QMS Representative	
Completion of the Responsibilities Table, including roles, responsibilities and authorities for the Operating Authority	
Completion of the Responsibilities Table, including corporate oversight roles, responsibilities and authorities for the Operating Authority if operating more than one drinking-water system	
Identification of the Owner of the drinking-water system	
Charting of an organizational structure for the Operating Authority	
Communication of the information in the Responsibilities Table and in the Organizational Chart throughout the Operating Authority	

Chapter 12 – Competencies and Personnel Coverage

Key Points in Chapter 12

Personnel must be competent based upon appropriate education, training, skills and experience.

You must identify and arrange for the necessary training for all personnel whose work affects drinking water quality.

Employees need to be aware of the relevance and importance of their activities, and how they contribute to assuring quality.

You must have procedures to ensure the drinking-water system is “covered” at all times by competent personnel.

Chapter 12 – Competencies and Personnel Coverage

Quiz: Test your understanding of Competencies and Personnel Coverage

Try this quiz now, and then again after you have finished reading this chapter.

Answer TRUE or FALSE	TRUE	FALSE
1. Maintenance of an Operator's certification licence is all we need to demonstrate competency.		
2. Copies of certification licences are all we need to refer to in our Operational Plan.		
3. We can use our existing training matrix to show how we will meet our competency requirements.		
4. "Competency" means "training".		
5. We can refer to our "Collective Agreement" when describing our personnel coverage.		

Answers

*1. Yes or No – This question cannot be answered without identifying competency requirements for each role. Depending on the particular role in your drinking-water system, you may find that certification is the only competency requirement. However, for another system, additional competencies may be required such as training in confined spaces, WHMIS training, SCADA, and word processing. Be sure to consider **all** of the knowledge, skills and abilities that someone may draw upon to carry out their responsibilities. Often, there are more competency requirements upon closer examination.*

2. False – Copies of licences are records to demonstrate a particular competency requirement has been fulfilled. The DWQMS requires that your Operational Plan identifies what competency requirements exist for your personnel, and the activities in place to meet those requirements.

3. True – If you have an existing Training Matrix in place, use it. Just be sure it includes all of the competencies that you identify, and that it meets the requirements that are detailed in this Chapter.

4. False – Competence can be defined as the "demonstrated ability to apply knowledge and skills". In order to assess competence, you must consider an employee's education, training, skills and experience. A person may receive training and still not be competent to perform a certain task.

5. True – If your Collective Agreement describes how roles within the drinking-water system are filled at all times, it is a helpful supporting document for your Operational Plan.

1. Translating the DWQMS

What the Standard says…

10. Competencies

PLAN – The Operational Plan shall document:

a.) competencies required for personnel performing duties directly affecting drinking water quality,
b.) activities to develop and maintain competencies for personnel performing duties directly affecting drinking water quality, and
c.) activities to ensure that personnel are aware of the relevance of their duties and how they affect safe drinking water.

DO – The Operating Authority shall undertake activities to:

a.) meet and maintain competencies for personnel directly affecting drinking water quality and shall maintain records of these activities, and
b.) ensure that personnel are aware of the relevance of their duties and how they affect safe drinking water, and shall maintain records of these activities.

11. Personnel Coverage

PLAN – The Operational Plan shall document a procedure to ensure that sufficient personnel meeting identified competencies are available for duties that directly affect drinking water quality.

DO – The Operating Authority shall implement and conform to the procedure.

What does it mean?

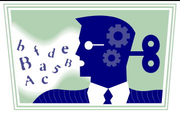
Element 10 of the DWQMS requires that you document in your Operational Plan, the knowledge, skills, and abilities that personnel whose jobs affect drinking water quality, must have and the activities necessary to ensure that competency requirements are met.

The DO component of Element 10 requires that you ensure the competency requirements identified in the Operational Plan are met. Also, you must ensure that personnel are particularly aware of the relevance and importance of their duties and how they affect the provision of safe drinking water.

The DO component of Element 10 also requires that you maintain records of the activities undertaken to ensure that competency requirements are met.

Element 11 of the DWQMS requires that you have a procedure in place to describe how sufficient personnel meeting the identified competencies are available for duties that directly affect drinking water quality.

The DO component of Element 11 requires that you ensure competent personnel are available to perform their duties. This availability should follow your plans for coverage.



Technical **Terms**

Competence – the combination of observable and measurable knowledge, skills, and abilities which are required for a person to carry out assigned responsibilities.

Your knowledgeable, skilled and capable staff is one of the most important barriers to ensure drinking water safety. Identifying required competencies for staff members performing duties directly affecting drinking water quality, and making sure those competencies are met, is an important function of the QMS.

2. Identifying Competencies

Certification requirements are legislated for Operations staff of drinking-water systems. The DWQMS requires that you identify all competency requirements, including those that are not regulated.

A Competency Requirements Table is one method that can be used. Using the roles identified in Element 10 of the DWQMS (see "Chapter 11 – Organizational Structure, Roles, Responsibilities and Authorities"), you can develop a list of the required and desired competencies. Figure 13.1 shows an example of a Competency Requirements Table. The template for this table is available in Appendix F (see Part II of this Guidance Document).

One of the requirements of Element 10 of the DWQMS is that staff is aware of the relevance of their duties and how they affect safe drinking water. You may determine that this requirement is primarily covered through your planned training activities. At a minimum, however, it is a good idea to cover this in the QMS Awareness Training Session which is discussed in Chapter 20 – Completing the QMS Cycle. The objective of this Training Session is to ensure personnel are aware of the QMS requirements that are being put into place, especially those related to their specific roles. Remember that the auditor will question staff to determine that they are aware of the relevance of their duties.

Figure 13.1: Example of a Competency Requirements Table

Competency Requirements Table		
Role	***Required Competencies***	***Desired Competencies***
WTP Foreman	WTP Class III Certification Distribution Class I Certification Supervision Experience/Training System Overall Responsible Operator SCADA Training WHMIS Training Mechanical Aptitude Internal Auditor Training First Aid Taining (Including CPR) MS Word & Excel Training	Leadership Training Distribution Class III Certification
Distribution Foreman	Distribution Class III Certification WTP Class II Certification Supervision Experience/Training DZ Operator's Licence WHMIS Training Internal Auditor Training First Aid Training (Including CPR) MS Word & Excel Training	Leadership Training Project Management Training WTP Class III Certification
WTP Operator 1	WTP Class III Certification Designated OIC SCADA Training WHMIS Training Mechanical Aptitude Internal Auditor Training First Aid Training (Including CPR) MS Word & Excel Training	Distribution OIT Certification
WTP Operator 2	WTP Class II Certification Designated OIC SCADA Training WHMIS Training First Aid Training MS Word & Excel Training	WTP Class III Certification Distribution OIT Certification Internal Auditor Training
Distribution Operator 1	Distribution Class III Certification DZ Operator's Licence Confined Space Training CWB Certification Mechanical Aptitude First Aid Training (Including CPR)	

Whenever possible, avoid the use of an individual's name. Instead, describe the competencies required for the "role" or "function".

Use the "Desired Competencies" section to list the items that will fit the future needs of the Operating Authority.

The Table should list <u>*all*</u> required competencies. It may be helpful to include a reference to relevant legislation and regulations, as appropriate.

3. Training Matrix

Element 10 of the DWQMS requires that your Operational Plan identify the activities you will undertake to meet and maintain the competencies that you have identified.

This can be partially satisfied through the development and use of a Training Matrix. The Training Matrix can be set up to reflect the regulatory requirements for training, and then be expanded to include all other training needed to meet the required and desired competencies identified in Step 2.

A Training Matrix is a document that organizes employee names, roles, dates of training, duration of training, and training expiry information. An example of a Training Matrix is shown in Figure 13.2.

Developing and using a training matrix helps streamline your planning process to ensure competencies are planned for, met, and documented. Using a training matrix can also simplify the process of tracking certification training hours, a requirement under O. Reg. 128/04. If you track training and hours using a different method, refer to that method. Note that the training described in an Operational Plan that has been accepted by the Ministry under the Municipal Drinking Water Licence Regime does not equate to "Director Approval" for training, as required under O. Reg. 128/04.

Helpful **Tips**

To streamline your planning, the Training Matrix can actually incorporate the information from the Competencies Requirements Table. This table, however, may become complex with this much information.

For simplicity, the Training Matrix and the Competencies Requirements Table are separate here. However, you should always check, when planning training, that each employee has fulfilled their required competencies by comparing what is *required* from the Competencies Requirements Table against what they have *acquired*, which is recorded in the Training Matrix.

Figure 13.2: Example of a training matrix

Operating Authority Training Matrix								
Employee	***Role***	***Highest Level System Operator***	***Hours of Training Required***	***WT Certificate Expiry Date***	***WD/WDS Certificate Expiry Date***	***Training Cycle***	***Date Certificate Renewal Course Completed***	***Hours of Training Completed (in current cycle)***
Jean Smith	*WTP Foreman*	*3*	*120 (over 3 yrs)*	*Aug 31, 2009*	*Mar 31, 2009*	*Apr 1, 2006-March 31 2009*	*August 12, 2007*	*20 CEUs 65 on-the-job practical*
Fran Halton	*Distribution Foreman*	*2*	*105 (over 3 yrs)*	*Sept. 30, 2008*	*Oct 31, 2009*	*Oct 1, 2005-Sept 30, 2008*		*14 CEUs 60 on the job practical*

Create your training matrix using the template in Appendix G (see Part II of this Guidance Document). If you already have a training plan in place, and choose not to use the Training Competencies Table or the Training Matrix, ensure that your plan describes what competencies are required, desired, and acquired, along with dates of training and expiry.

4. Training Methods

A description of the training methods to be used can also help to satisfy Element 10. Competency requirements can be satisfied through the use of in-house, off-site, or on-line training, attendance at seminars, presentations by subject matter experts, or on-the-job training. Training in standard operating procedures and emergency response and recovery procedures could be included as part or your in-house training. In your Operational Plan, describe the training methods to be used. You do not have to describe which training uses which method – just simply list the training methods you prefer. Figure 13.3 shows an example of information that may be included in the Operational Plan for “competencies”.

Helpful **Tips**

You may have already documented personnel coverage as part of your Collective Agreement.

Figure 13.3: Example of "Competencies" section from Operational Plan

<u>Competencies</u>

All water department foremen and treatment plant operators shall, at a minimum, attain and maintain a Class I certification as per Ontario Regulation 128/04. The water treatment Foreperson/Lead Hand shall maintain, at a minimum, a Class II certification.

All water department distribution employees shall, at a minimum, maintain a Class I certification as per Ontario Regulation 128/04 and in accordance with the classification of the works. The water distribution Foreperson/Lead Hand shall maintain, at a minimum, a Class II certification.

Additionally, annual training is provided to ensure that personnel meet or exceed minimum standards for annual training hours and continuing education hours as established in O.Reg. 128/04 to maintain operator certification for the operation of a Water Works.

Training effectiveness is evaluated.

5. Implementing Competency Requirements

Now you must implement what you have planned. That is, you must ensure that the competency requirements you have identified are met and maintained. You may need to arrange for training and compile training records. Because arranging for training can be a challenge, due to availability of staff, costs, and scheduling constraints, it is wise to start planning training now.

6. Training Effectiveness

To completely close the loop of this requirement, it is good practice to evaluate the effectiveness of the training provided. This is often done by testing or through demonstration of the knowledge gained. This is not a requirement of the DWQMS.

7. Personnel Coverage

The DWQMS requires that in your Operational Plan, you document processes and procedures to ensure coverage for the roles identified in your Competencies Requirements Table.

Create a procedure to describe coverage, and add it to your Operational Plan (or refer to it). You may begin by describing how the regular shifts are structured in your water system. If you use on-call availability to ensure staff are available at all times, describe the on-call program, by including details about:

- the on-call schedule
- who sets the schedule
- rationale for contacting personnel
- response times for contacting personnel.

In your Operational Plan you must identify how the designated Overall Responsible Operator (ORO) requirements under O. Reg. 128/04 are met. If a particular position is the primary ORO for the system this should be identified in the competencies requirements table. Only one person may be an ORO at any give time, however, within the system several individuals may perform this role. For example, there may be a different ORO identified for each shift, for weekends/holidays or during non-staffed on-call hours. If the ORO is temporarily not on-site, a description of how they would be contacted and the response time required to arrive on-site if required should be included. If the primary ORO's work location/office is not normally on-site, include a description of rationale for an off-site ORO, the main work location/office, the frequency of the site visits and the response time to arrive on site if necessary.

If the operations staff in your system is unionized, you should outline how competencies and personnel coverage are maintained during a walk-out. This could include maintaining operator certification for management staff who can assume operational duties during a strike, or having an arrangement with staff from another system to operate the plant in a strike situation.

Again, if this information is elsewhere, simply include a reference to that document. Including this coverage information in your Operational Plan demonstrates how the QMS ensures that any role that is important to providing safe drinking water has backup and support when needed.

Ready for the **Audit**

What do auditors like to see?

The Auditor will look for planning and proof of competency. Training records, attendance records, test results, enrolment acceptance, diplomas, education abstracts and certificates all constitute proof.

The auditor will also review the training matrix to see if all required competencies have been satisfied.

The auditor will review your Operational Plan to check that it identifies your competency requirements, and key activities undertaken to meet and maintain competencies.

The auditor will interview personnel to assess whether they are aware of the relevance of their duties and how they affect safe drinking water.

The auditor will review your Operational Plan to check that it describes how you ensure your drinking-water system is adequately covered by competent personnel.

The Auditor will look for proof of personnel coverage. This may involve reviewing Operator schedules.

If SCADA monitoring is incorporated into your coverage (e.g. auto-dialers for SCADA alarm response), describe this coverage, or refer to the document where it is already explained.

If coverage involves checks on remote locations, such as reservoirs, describe these checks.

Figure 13.4 shows an example of information that may be included in the Operational Plan for "personnel coverage".

Figure 13.4: Example of "Personnel Coverage" section of the Operational Plan

Personnel Coverage

The water treatment plant is staffed from Monday to Thursday from 7:00 a.m. until 12:00 p.m. and on Friday from 7:00 a.m. to 7:00 p.m. The Water Treatment foreman is the primary overall responsible operator (ORO). Back-up OROs are identified in the shift log, as required.

There is an assigned on-call water treatment plant operator during off-hours. The on-call operator shall conduct a physical verification of conditions at the plant once per day during weekends and statutory holidays. The normal on-call schedule for water treatment plant operators shall be from quitting time on Monday to start time the following Monday. The water treatment plant foreman establishes and maintains the on-call schedule.

At all other times, the water treatment plant is monitored by the SCADA system. The SCADA system has an auto-dialler that has been programmed to contact LUSI personnel whenever conditions warrant. The on-call operator is the designated OIC and will respond to and investigate all alarms within 45 minutes. An ORO is available by pager when not physically at the system and is able to respond on-site within 90 minutes if required.

There are daily checks at the booster station and water towers conducted by water distribution personnel. The time of the visit and the details of any related action taken are recorded in the on-site daily log.

Ensure that the personnel coverage information you have described in your Operational Plan is in place and functioning effectively in your water system.

8. Enhancing "Competencies"

Although not a specifically referenced in the DWQMS, to enhance the implementation of the competency requirements discussed in this chapter, it is recommended that you consider developing and documenting *procedures* for the identification of training needs, the provision of training, and the evaluation of training effectiveness.

Incorporation of these procedures into your QMS can greatly enhance your training programs, but is not a Standard requirement.

Complete the Chapter Checklist below, by checking off the items that have been completed. By completing all of the items, you will be ready to move on to the next chapter.

CHAPTER CHECKLIST *Did you make sure…..*	*Check When Complete*
Identification of required and desired competencies	
Documentation of activities to develop and maintain competencies	
Documentation of activities planned and undertaken to ensure awareness of the relevance of duties that affect safe drinking water	
Preparation of a training matrix, or some other means of describing how competencies are met	
Description of training methods	
Preparation of personnel coverage procedures	

Chapter 13 – Communications

Key Points in Chapter 13

A QMS that is not communicated is a QMS that is not implemented.

You must have methods for communicating the QMS to the Owner, all Operating Authority personnel, suppliers and the public.

Chapter 13 – Communications

1. Translating the DWQMS

What the Standard says…

12. Communications

PLAN – The Operational Plan shall document a procedure for communications that describes how the relevant aspects of the Quality Management System are communicated between Top Management and:

a.) the Owner,
b.) Operating Authority personnel,
c.) Suppliers, and
d.) the public.

DO – The Operating Authority shall implement and conform to the procedure.

What does it mean?

Element 12 requires you to have a documented procedure that describes how the QMS is communicated. Specifically, the procedures must address how QMS information is communicated from Top Management to the Owner, Operating Authority personnel, suppliers, and the public, and vice versa.

A QMS that is not communicated is a QMS that is not implemented. Unless effectively communicated, not everyone will know about the QMS, understand its importance or follow the processes and procedures it establishes. Your Quality Management System must be communicated by Top Management to the Owner, personnel at the Operating Authority, suppliers, and the public.

There are several methods that are available for communicating the QMS which are explained in this chapter.

2. Communicate the QMS Policy

Communication of the QMS Policy to Operating Authority personnel is critical to the success of the QMS as it is the driver for the QMS and establishes firm documented commitments to demonstrate the Operating Authority's assurance that quality management is important. The QMS Policy must also be made easily available to the public. It is also wise, although not required by the DWQMS, to send a copy of your policy to your suppliers and services at least once, especially essential suppliers (essential suppliers are discussed in "Chapter 14 – Essential Supplies and Services").

Some of the communication methods available include:

- Discussion at staff meetings – Discuss the main commitments of the policy at staff or communication meetings
- QMS awareness sessions to let staff know about the QMS
- Posting the policy – For example, post copies at all facilities, both operational and administrative, at sign-in desks, and public and service entrance areas
- Web site – Create a link to the policy for public availability
- Mail stuffers – Add a printed copy of the policy to water bills to customers, or cheque payments to vendors
- By fax, mail or e-mail to suppliers (keep a list of company names you've shared the Policy with to avoid repeats)
- Include it in your Purchase Order fine print

It is also important to consider QMS communication in the other direction – from the Owner, Operating Authority personnel, suppliers and the public *to* Top Management. For example, if a consumer has comments or suggestions about the QMS or water quality in general, the Operating Authority should have a mechanism in place to receive those comments. The means of communication about the QMS from the Owner, Operating Authority personnel, suppliers and the public *to* Top Management should be described in the Communication Procedure.

In "Chapter 20 – Completing the QMS Cycle", the task of training personnel in QMS concepts, including the QMS Policy, will be discussed.

Helpful **Tips**

To write a procedure:

- Start by jotting down what is important
- If the instructions are short, list the steps one by one.
- If the instructions are long or more complex, group the steps.
- If the reader must make decisions, use a flow chart.
- Remember to keep sentences short and precise

3. Owner Communication

In Element 3 of the DWQMS, you are required to obtain a written endorsement of the Operational Plan by the Owner (covered later in "Chapter 20 – Completing the QMS Cycle"). By providing a current copy of the Operational Plan to the Owner, you are ensuring that the endorsement is an "informed" endorsement. This is one way communication with the Owner is achieved.

Both the Owner and Operating Authority should always be in possession of a current copy of the Operational Plan. Summaries of changes that have been made should be included. This keeps the Owner informed and meets the intent of Elements 3 and 10, and also helps ensure that the Owner is meeting the provisions of Section 11 - Duties of owners and operating authorities, of the *SDWA*.

Depending on the nature of your management structure, you may involve the Owner in other areas of the QMS, such as management review, creation or endorsement of QMS Policy, Risk Assessment, or provision of infrastructure.

Create a Communication Procedure, and document how Owner communication is achieved. Keep the procedure simple, and remember to discuss how the QMS is communicated to and from the Owner.

4. Operating Authority Personnel Communication

You must have a method to communicate the QMS to all Operating Authority personnel. “Personnel” includes all people working at the Operating Authority – regular staff, part time and temporary staff, and summer and co-op students. This also includes non-staff working on site. Different staff members may have different knowledge needs with respect to the QMS. Administrative staff may need only a very high level of knowledge, whereas operational staff may need to know more about the QMS such as the need to follow procedures and processes, record information related to the QMS, and the need to know how what they do affects drinking water safety.

Information Sessions

An effective way to communicate the DWQMS to Operating Authority personnel is to conduct information sessions for all staff. These sessions can be used to provide an overview of the entire QMS and, when applicable, serve as a method to introduce or roll-out procedures that are specific to all functional areas of the Operating Authority. Your first information session should be scheduled during the later stages of your implementation, and is described in “Chapter 20 – Completing the QMS Cycle”.

Many organizations use the “lunch and learn” approach for communicating QMS structure and requirements. Each method will require a record of attendees for demonstration to the auditor – using a sign-in sheet is helpful for documenting this.

Circulate Documents

Another common method for communicating the QMS is to circulate QMS documents. Although not required under the DWQMS, a “Document Transmittal Sheet” can be attached to the procedures, work

Ready for the **Audit**

Throughout the audit, auditors may interview Operating Authority personnel for various reasons. Often, regardless of the nature of the interview, the auditor will ask the interviewee about their awareness of roles, responsibilities, authorities and organizational structure, to collect proof for when these elements are evaluated. This type of information needs to be communicated as per your Communication Procedure.

The auditor will often ask interviewees who the QMS Representative is.

instructions and other QMS documentation. The Document Transmittal Sheet requests that the employee read the attached documentation (listed on the Sheet) and then sign and return the sheet to the issuer. The transmittal sheet is now proof that the employee has received components of the documented system.

The use of the Document Transmittal Sheet is restrictive in that it does not allow for discussion of questions. It is only an acknowledgement that the requirement has been communicated. The Document Transmittal Sheet can also be used when circulating new or revised documents after the Operating Authority has been accredited.

Intranet or Internal Network

Any organization with an Intranet or internal document network can post the Operational Plan and all of the relevant components of the documented system (or their location if in hard copy). This allows employee access to the QMS at all times.

Bulletin Boards

Larger organizations may find it useful to produce and distribute some literature describing the QMS. Posting “Did You Know” fact sheets on bulletin boards in common areas is a typical practice.

Meetings

Meetings are an excellent opportunity to introduce and discuss QMS information. Meetings are not necessarily formal settings in the board room, but also include informal discussions at shift changes, or “morning” meetings.

In the Communication Procedure, add a description of how communication of the QMS with Operating Authority personnel is achieved.

Ready for the **Audit**

What do auditors like to see?

The signed endorsement is proof that the QMS has been communicated to the Owner. A Document Transmittal Sheet may be used for future versions.

The auditor will look for proof that the QMS has been communicated to all employees. A signed information session attendance sheet or transmittal sheet will serve that purpose, along with proof of awareness from interviews.

Producing a copy of remittance inserts or billing inserts will constitute evidence that the QMS has been communicated to suppliers and consumers.

5. Supplier Communication

At a minimum, your suppliers should be advised that you have developed and implemented a QMS. You are not required to supply a copy of your Operational Plan to the supplier. But it would be wise to provide suppliers with a copy of your QMS Policy, and perhaps some sort of review of procedures that are relevant to their activities undertaken on your behalf.

For example, for suppliers delivering chemicals to a water treatment plant, you should communicate procedures related to chemical receiving or delivery, spills response, or emergency preparedness, at a minimum.

There are common and simple methods for communicating the QMS to your suppliers. For local suppliers, just as with your employees, you can conduct a “lunch and learn”. For suppliers outside of your region, you can include your QMS Policy and an overview statement with the issuance of Purchase Orders, or upon remission of payment of their invoices.
Another method is to provide QMS information during any on-site safety briefings that you conduct for suppliers.

At a minimum, the QMS should be communicated to all suppliers related to your Essential Supplies and Services List, which is described in “Chapter 14 – Essential Supplies and Services”.

In the Communication Procedure, add a description of how communication of the QMS with suppliers is achieved.

6. Public Communication

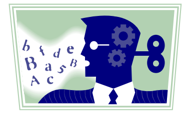
One of the minimum goals for your QMS is “to enhance consumer protection through the effective application and continual improvement of the QMS”.

It is suggested that you include a brief explanation of the QMS (perhaps 4 – 8 lines) and a copy of the QMS Policy as a billing insert. The QMS Policy can also be added as a footnote on customer bills (once existing supplies of blank invoices have been exhausted).

The Operational Plan is a public document.

The Director’s Direction for Operational Plan Submission specifies requirements for Public Disclosure in Sections 17 and 18 as follows:

> 17. The current version of the Operational Plan and its related policies, procedures and documentation shall be made available for review by any member of the public during normal business hours without charge:



Technical **Terms**

The **Public** includes subject system consumers and stakeholders.

a) at the office of the Owner or, if the office of the Owner is not reasonably convenient to the public, at a location that is reasonably convenient to the public; and

b) at an office of the Operating Authority in closest proximity to the office of the Owner if the Owner is not the Operating Authority.

18. Despite Section 17, the Owner or the Operating Authority of a Subject System is not required to make available any information in an Operational Plan or referenced policies, procedures and documents that a municipality is not required to disclose pursuant to sections 10 to 14 of the *Municipal Freedom of Information and Protection of Privacy Act*.

Section 18 above allows components of the Operational Plan not to be made public, in particular to ensure that system vulnerabilities are not exposed and that inappropriate or personal information remains confidential.

You may also wish to post the Operational Plan electronically on your website.

In the Communication Procedure, add a description of how communication of the QMS with the public is achieved. Figure 12.1 shows an example of a Communication Procedure for the Operating Authority of a water distribution system.

7. Implementing Communication Procedures

The final step in this chapter is to ensure all personnel in the Operating Authority are aware of the Communication requirements.

This can be done informally simply by emailing, posting and discussing the information that you prepared in this chapter with all personnel.

Or, this can be performed later in the implementation during the QMS Awareness sessions. In “Chapter 20 – Completing the QMS Cycle”, the task of training personnel in QMS concepts, including QMS communication, will be discussed.

Figure 12.1: Sample communication procedure for the Operating Authority of a water distribution system.

Sample Operating Authority – Communication Procedure

Procedure

1. Reporting to Owner

1.1 The status of the DWQMS and its effectiveness shall be communicated to the Owner during scheduled Owner meetings.

2. Operating Authority Personnel

2.1 The Operating Authority shall ensure that all employees have attended the DWQMS Employee Orientation Session as part of the implementation process.

2.2 Employees hired after implementation of the DWQMS shall have the requirements of the DWQMS communicated to them during new employee orientation.

2.3 The Operational Plan, Procedures and Work Instructions shall be made available to all employees. All employees have electronic access to the QMS folder on the internal network. Hard copies of relevant QMS documents are also available in the Main Office.

3. Public

3.1 **The** Operating Authority has posted the QMS Policy on the utility's website *(insert URL*). The website contains an overview of the QMS.

3.2 If desired, Operating Authority may decide to provide information to the end users through the use of billing inserts.

4. Suppliers

4.1 Where appropriate, discussions, hand-outs or inserts may be provided to suppliers to communicate QMS requirements. The QMS Policy is included on the reverse side of all purchase orders.

Associated Forms/Procedures/Work Instructions

QMS Policy
Employee Orientation Procedure

Records

Water Committee meeting minutes
Employee training records

Complete the Chapter Checklist below, by checking off the items that have been completed. By completing all of the items, you will be ready to move on to the next chapter.

CHAPTER CHECKLIST	*Check When Complete*
Documentation of a communication procedure	
The procedure describes how the relevant aspects of the QMS are communicated to the Owner	
The procedure describes how the relevant aspects of the QMS are communicated to Operating Authority personnel	
The procedure describes how the relevant aspects of the QMS are communicated to suppliers	
The procedure describes how the relevant aspects of the QMS are communicated to the public	

Chapter 14 – Essential Supplies and Services

Key Points in Chapter 14

Supplies and services are goods and people coming in from outside of the drinking-water system, and can introduce risks to the quality and safety of your drinking water.

You must create a list of supplies and services that are essential for the delivery of safe drinking water, from a risk-based perspective, and then ensure that you have the means to ensure the quality of these essential supplies and services.

A documented procedure must be in place to ensure the quality of supplier products and services that may affect the delivery of safe drinking water.

Chapter 14 – Essential Supplies and Services

1. Translating the DWQMS

What the Standard says…

13. Essential Supplies and Services

PLAN – The Operational Plan shall:

a.) identify all supplies and services essential for the delivery of safe drinking water and shall state, for each supply or service, the means to ensure its procurement, and

b.) include a procedure by which the Operating Authority ensures the quality of essential supplies and services, in as much as they may affect drinking water quality.

DO – The Operating Authority shall implement and conform to the procedure.

What does it mean?

This element of the DWQMS is about managing essential supplies and services. Supplies and services, both goods and people coming in from outside of the drinking-water system, can introduce risks. Although you may not have control over their internal processes, you must be aware of which supplies and services are essential, be able to ensure that you have the means to procure those essential supplies and services at all times, and have methods in place to ensure their quality.

By documenting what quality you expect, and by continuing to assess whether or not supplies and services consistently meet your requirements after they have been selected, you help to minimize the risk to drinking water quality.

Finally, you must make sure that your expectations for essential supplies and services are met on a continuous basis.

2. Supplies and Services List

As a first step, compile a list of essential supplies and services. These are supplies and services that can directly affect the delivery of safe drinking water if they are not in place when needed. You can use the CCPs that you have identified in the Risk Assessment as a starting point, but the list does not need to be based on supplies and services associated only with CCPs. Use the template for Supplies and Services found in Appendix H (see Part II of this Guidance Document).

You may need to consult staff that order or schedule supplies and services to complete this task. Figure 14.1 shows an example of some essential supplies and services associated with chlorination, documented using the template for Supplies and Services.

Figure 14.1: Example of essential supplies and services that might be associated with chlorination.

Essential Supply or Service	***Reason***
Chlorine gas supply – quality and availability	*Chlorination CCP*
Calibration service for chlorine scales	*Chlorination CCP*
Laboratory supplies	*Chlorination CCP*
Laboratory testing services	*Chlorination CCP*
O Rings and other spare parts for dosing equipment maintenance	*Chlorination CCP*
Diesel fuel supply for emergency generator	*Emergency preparedness*

Remember to consider all supplies or services that may be essential for the delivery of safe drinking water, even if they are not associated with a CCP. Think about a supply or service that could affect your ability to deliver safe drinking water to the consumer if it is not available, delivered incorrectly, or if it is not what you ordered.

For example, a small water distribution system contracts a company to do emergency pipe repairs. This service is essential for the delivery of safe drinking water, especially if there are no other companies that provide this service in the local area.

3. Ensuring Procurement

Element 13 also requires that for each essential supply or service that you have identified, you must state the means to ensure its procurement. Because these are essential supplies and services, the DWQMS is requiring that you have the means in place to ensure that these essential supplies and services can be put into place immediately, when required, so that the delivery of safe drinking water is not affected.

Using the “Procurement” column in the Supplies and Services table that you’ve started (Appendix H in Part II of this Guidance Document), describe how you ensure each supply or service is made available, when required. This should include regular day to day operations (how you make sure supplies or services are ordered, delivered, offloaded, and secured for everyday operation), and in emergency situations (when you require an emergency or short-notice supply or service).

4. Requirements for Supplies and Services

Now that you have identified your essential supplies and services, the DWQMS requires that you develop and implement a procedure for those supplies and services to ensure their quality. This does not mean you need to control how outside suppliers and services manage their organizations. However, you must decide what quality requirements you have for each supply or service, and then define how you make sure those expectations are met, both during vendor selection, and on an ongoing basis.

For a supply or service to be accepted in the drinking-water system, *it must meet your specified requirements.* Ensuring suppliers and service providers meet quality requirements not only satisfies DWQMS requirements, but can also simplify your vendor selection process.

Quality requirements may be specified in conditions on Licences or Drinking Water Works Permits (e.g. NSF approval for water treatment chemicals), or may be internal to your drinking-water system based on experience, corporate requirements, operations, or preference.

The requirements may be related to:

- The product or service
- The performance of the supplier or service provider
- The method of delivery (e.g. transport requirements)
- On-site activities (e.g. entry or offloading procedures)

For example, a small northern municipality using alum in its water treatment operations could have its alum delivery affected by poor weather or by distribution company shortages. The municipality may have to resort to purchasing available alum from a neighbouring municipality, due to its remote location, in the event of delivery problems, or it may decide to increase its on-site inventory. The means to ensure the procurement of alum in the event of an emergency would be described, along with the means to procure alum on a regular basis.

Document your requirements for suppliers and service providers using the template for Supplies and Services in Appendix H (see Part II of this Guidance Document). Consider starting with the phrase “We expect….” when completing the “Quality Requirements” column in the template.

For example, here are some expectations you may apply to chemical suppliers.

We expect that …

- The supplier’s employees receive regular TDG, WHMIS and other workplace safety training
- Chemicals are NSF approved
- Delivery vehicles are equipped with the appropriate safety and environmental gear in the event of a spill
- The supplier has a program for preventative and regular maintenance of handling equipment
- The supplier has a history of on-time delivery

- The supplier has a method of verifying load contents
- The supplier provides traceability for all products
- The supplier includes a Certificate of Analysis for all shipments
- Basic chemical properties are identified (e.g. pH, concentration)
- Product types are identified (e.g. catalogue number, chemical name)
- The supplier will follow approved procedures when delivering and offloading chemicals
- The supplier is able to respond quickly in the event of an emergency
- If the supplier monitors and refills stock automatically, such as with some carbon dioxide suppliers, the supplier is aware of the minimum quantity required to be available at all times, and that the supplier maintains this quantity

Helpful **Tips**

If the acceptable requirements vary, then specify a range of acceptable criteria. You need to be specific enough that your requirements are clear, but general enough so that you don't have to update the table every week.

Figure 14.2: Example of requirements in place for chlorination supplies and services.

Essential Supply or Service	***Quality Requirements***
Chlorine gas supply	▪ *Chlorine gas catalogue # XX111, delivered in 200kg tonners, NSF approved* ▪ *Employees receive regular TDG & WHMIS training* ▪ *Drivers have clean driving records* ▪ *Delivery vehicles equipped with the appropriate safety and environmental gear in the event of a spill* ▪ *History of on-time delivery* ▪ *Sufficient warehouse stock* ▪ *Documented verification of load contents provided with each shipment* ▪ *Product is NSF approved* ▪ *Certificate of Analysis provided with all shipments* *Must sign in for entry, provide documentation before offloading, and offload under Operator's supervision only*

By asking these types of questions of your suppliers and service providers prior to their selection, and stating that they continue to meet your requirements while providing you supplies and services, you are "exercising control" over them.

Work with the purchasing department when compiling this list. When it is complete, discuss methods for purchasing to ensure these requirements are used as selection criteria when sourcing new vendors.

5. Evaluating Testing Laboratories

In Ontario, legislation requires that laboratories performing drinking water testing be licensed, and Owners and Operating Authorities must use these licensed labs. You should ensure that the Laboratory you use is licensed. There may be other important considerations in deciding whether a laboratory meets your needs, such as the availability of rush analysis and after hours sample reception.

If these requirements are already documented elsewhere, in a purchase agreement for example, don't rewrite them, just reference where they can be found. Figure 14.2 shows an example of requirements documented using the Supplies and Services template found in Appendix H (see Part II of this Guidance Document).

6. Monitoring Supplies and Services

Communicate your requirements directly to the suppliers and service providers. It is likely that some of these requirements are already communicated when you place orders or set up contracts. Do not assume that the suppliers and service providers know what your expectations are.

To ensure quality, you should implement a process to assess whether or not these supplies and services consistently meet requirements after they have been selected. This ongoing assessment closes the "quality requirement" loop. Without periodically checking whether supplies and services consistently meet requirements, you are implementing, but not *maintaining* your QMS supplies and services requirements. Assign the tasks related to monitoring supplies and services to relevant personnel, and inform them of their responsibilities.

Ready for the **Audit**

What do auditors like to see?

- A procedure that describes what the Operating Authority does to ensure the quality of supplies and services
- A controlled list of essential supplies and services
- A list that clearly defines supply and service quality requirements – purchase orders, standing offers, contracts, etc.
- Documented means to ensure that the essential supplies and services are made available, even in the event of a short-notice request or emergency
- A method for evaluating the suppliers ability to meet purchase requirements

The auditor will sample and review purchasing documents to ensure that requirements are communicated.

You can monitor your newer or more important essential suppliers even more closely by periodically evaluating supplier performance. For example, choose a given time period, say one year and evaluate the following:

1. *What percentage of the deliveries have been on-time? (target is 100%)*
2. *Have there been any spills or other on-site incidences attributable to the supplier? (target is 0%)*
3. *Has the product been always acceptable? (target is 100%)*
4. *Has the supplier responded to all inquiries in a timely manner? (Target is 100%)*

Ensure Operators or other relevant personnel in the drinking-water system are informed about your requirements for supplies and services. Monitoring requirements, along with other QMS topics, can be discussed with personnel in the first ‘QMS Awareness’ training session, discussed in “Chapter 20 – Completing the QMS Cycle”.

Reviewing the effectiveness of your supply and service monitoring process is part of the scope of your internal audit, described in “Chapter 18 – Plan for Internal Audit”.

7. Operational Plan: Supplies and Services

Make sure that your Operational Plan is updated to include all of the Supplies and Services documents required to meet DWQMS requirements, which includes your list of supplies and services, the means to ensure procurement for each, and to ensure quality. Insert your Supplies and Services Table, and your Supplies and Services Procedure. If you would rather not insert documents into the Operational Plan binder, then just write down where those documents can be found.

Now that the information is prepared, it must be kept up-to-date. Identify the most effective method for making sure changes are promptly updated in the QMS documentation. Assign specific Operating Authority personnel the responsibility of updating the information prepared under Element 13.

8. Training Personnel

The final step in this chapter is to ensure all personnel in the Operating Authority with related duties are aware of the Supplies and Services requirements.

This can be done informally simply by emailing, posting or discussing the information that you prepared in this chapter with the relevant personnel.

Or, this can be performed later in the implementation during the QMS Awareness sessions. In “Chapter 20 – Completing the QMS Cycle”, the task of training personnel in QMS concepts, including supplies and services, will be discussed.

Complete the Chapter Checklist below, by checking off the items that have been completed. By completing all of the items, you will be ready to move on to the next chapter.

CHAPTER CHECKLIST	*Check When Complete*
Creation of a list of essential supplies and services	
Description of the means to ensure the procurement of essential supplies and services	
Documentation of quality requirements you have for essential services and supplies	
Communication of these requirements to the Purchasing department, if appropriate, to be used as selection criteria for new vendors	
Communication of these requirements to relevant staff	
Communication of these requirements to suppliers and service providers	
Development of a process to monitor if supplies and services are meeting your requirements	

Chapter 15 – Infrastructure

Key Points in Chapter 15

Whether you are a small operator with a single well and a limited distribution system, or a large operator serving hundreds of thousands of consumers, a robust infrastructure is necessary to meet the demand for safe drinking water.

You must ensure that the machinery, equipment, and structures used to produce and to provide safe drinking water are in place, maintained, and improved upon when necessary.

Chapter 15 – Infrastructure

1. Translating the DWQMS

What the Standard says…

14. Review and Provision of Infrastructure

PLAN – The Operational Plan shall document a procedure for the annual review of the adequacy of the infrastructure necessary to operate and maintain the subject system.

DO – The Operating Authority shall implement and conform to the procedure and communicate the findings of the review to the Owner.

What does it mean?

Element 14 of the DWQMS requires a procedure for the annual review of drinking-water system infrastructure. The purpose is to review what infrastructure is necessary to operate and maintain the Subject System, and to determine if that infrastructure is in place as needed. This review helps to ensure that adequate infrastructure is available and planned for.

The DO component of Element 14 requires that the Operating Authority carry out the review procedure, and report what is found to the Owner. This ensures that the Owner is regularly informed of infrastructure needs so that the Owner can plan accordingly.

What the Standard says…

15. Infrastructure Maintenance, Rehabilitation and Renewal

PLAN – The Operational Plan shall document a summary of the Operating Authority's infrastructure maintenance, rehabilitation and renewal programs for the subject system.

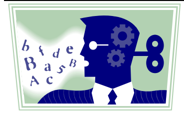
DO – The Operating Authority shall:
a.) keep the summary current,
b.) communicate the programs to the Owner, and
c.) monitor the effectiveness of the maintenance program.

What does it mean?

Continuing from Element 14, Element 15 is about documenting a summary of the maintenance, rehabilitation and renewal programs for your infrastructure. Your Operational Plan must include a summary of the programs you have in place to maintain, rehabilitate and renew the infrastructure of the drinking-water system. These summaries must be updated as changes occur, and must be communicated to the Owner. It is important to note that this element of the standard only applies to the Operating Authority's programs, and not the Owner's programs.

You must also monitor how effective the maintenance program is. This means that you must periodically review the maintenance program to check how well the program is working.

Whether you are a small operator with a single well and a limited distribution system, or a large operator serving thousands and thousands of consumers, a robust infrastructure is necessary to meet the demand for safe drinking water.



Technical **Terms**

Infrastructure – the set of interconnected structural elements that provide the framework for supporting the operation of the drinking-water system, including buildings, workspace, process equipment, hardware and software, and supporting services, such as transport or communication.

Rehabilitation – the process of repairing or refurbishing an infrastructure element.

Renewal – the process of replacing the infrastructure element with new elements.

2. Review and Provision of Infrastructure

The Operating Authority must regularly examine its infrastructure, reviewing what is in place and what is needed to operate the drinking-water system safely and effectively. The parts of the infrastructure in place, including buildings, workspace, associated utilities, process equipment, and supporting services, are examined, to determine if additional or modified infrastructure elements are needed.

Being aware of infrastructure needs and obtaining elements that you require is an inherent activity in the operation of a drinking-water system. Needs must be communicated to those who can provide them. This communication may be achieved in various ways, depending on the structure of and relationship between the Owner and the Operating Authority. If the drinking-water system is operated by the municipality, communication will all be within the same organization. You may already have in place the means to ensure that infrastructure adequacy is reviewed and communicated through, for example, council, budget, planning or other management meetings.

Be aware of how infrastructure review and provision is achieved within your drinking-water system and be familiar with how the use of Owner infrastructure is arranged.

Ensure that the results of the review are communicated to the Owner, and that this communication is documented.

3. Operational Plan – Infrastructure Review and Provision

In your Operational Plan, describe the steps the Operating Authority takes to review the adequacy of the infrastructure. Describe who performs the review, how often, how it is performed, how it is documented, and how decisions, especially needs for additional or modified infrastructure elements, are made and acted upon.

For a private Operating Authority certain infrastructure needs may be the responsibility of the Operating Authority as outlined in its agreement with the Owner. Some agreements may require that the

Owner allocate additional resources. By communicating infrastructure requirements to the Owner, you are taking steps to ensure that they are obtained or provided.

Describe how the review results are communicated to the Owner, and how this communication is documented.

4. Maintenance, Rehabilitation and Renewal Overview

A key part of the DWQMS, and of process control, is ensuring that the infrastructure used to produce and provide safe drinking is obtained and provided where needed, adequately maintained, and where necessary, improved upon. Your maintenance, rehabilitation and renewal program is at the core of this requirement. The DWQMS requires that you summarize your maintenance, rehabilitation and renewal programs, in your Operational Plan.

Maintenance activities can be divided into two distinct categories: Planned and Unplanned.

Planned maintenance activities are "scheduled" or proactive activities required for maintaining or improving infrastructure elements. These activities may include equipment maintenance, main replacements, valve exercising, back-up system tests, GAC replacement, and diffuser kit replacements, for example.

Unplanned maintenance activities are reactive, and may include but not be limited to such things as addressing main breaks, pump failures, sensor failures or clogged screens.

The objective of planned maintenance is to reduce the risk of an unplanned failure of some part of the water system. Unplanned failures draw heavily on resources, may adversely affect the quality of the drinking water, and can reduce both consumer and Owner confidence.

In many organizations, Planned Maintenance is further subdivided into two categories: Preventative Maintenance and Predictive Maintenance. Preventative and Predictive Maintenance Programs are very effective at virtually eliminating unplanned maintenance activities. Preventative Maintenance can be easily integrated into existing operations. Predictive Maintenance requires time, knowledge and financial resources that may be beyond the scope for many Operating Authorities.

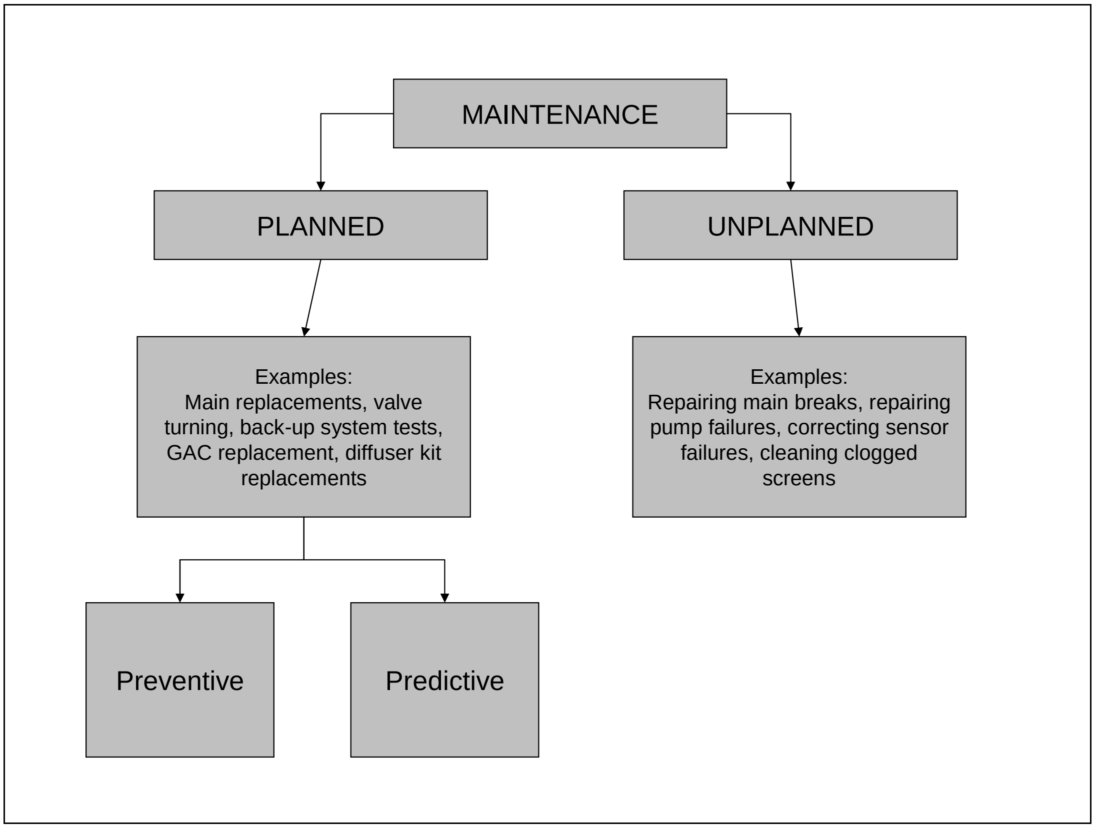
Helpful **Tips**

Unplanned maintenance provides a number of opportunities for improvement.

By tracking or trending unplanned maintenance events, the Operating Authority can begin to identify "hot spots" in the drinking-water system. From an equipment perspective, ongoing repairs to equipment and machinery may be an indicator that a replacement is required to reduce the risk (including financial) of catastrophic failure.

Use the information from unplanned events to identify planned preventative maintenance opportunities.

Figure 15.1: Typical maintenance program for a drinking-water system



5. Establishing Maintenance, Rehabilitation and Renewal Programs

By establishing planned programs for maintenance, rehabilitation and renewal, with a focus upon preventative maintenance activities, an Operating Authority will see cost and time savings and an increase in Owner and consumer confidence.

Although not required in the DWQMS, creation of a work order system to collect all maintenance data, planned and unplanned, can be a very effective means of managing maintenance, rehabilitation and renewal activities. A work order system can track time, materials, type of work and just about anything else an Operating Authority would need to know about its maintenance, rehabilitation and renewal activities.

For smaller systems and Operating Authorities consider simpler options. The system you may now have in place is a perfectly acceptable means of managing your maintenance, rehabilitation and renewal activities. One method could include the use of Microsoft Outlook or other on-line calendar system to automatically schedule and provide reminders of maintenance activities and tasks. A paper system can be used as well, with maintenance activities for that month identified in a file. This file can be used and updated from year to year.

If you have an Asset Management system or process, then the data from the maintenance, rehabilitation and renewal program can be further used to enhance the value of your Asset Management system. Computerized Maintenance Management Systems (CMMS) are excellent means of establishing and maintaining a robust maintenance, rehabilitation and renewal program.

A number of Operating Authorities have developed short and long-term programs for system maintenance, rehabilitation and renewal. Some drinking-water systems have 5 or even 10 year rolling plans in place to address such things as main rehabilitation, upgrades and replacements. The rolling plan may also suggest that there will be a need for additional storage due to increased demand.

These same plans may also take into consideration the projected needs of the water treatment plan. For example, expected population increases over the next 10 years may mean that plant processing capacity has to be increased.

These types of system maintenance requirements are usually tied to the capital budgets of the Operating Authority and those of the Owner when appropriate.

Remember even unplanned activities should be part of your program.

6. Operational Plan – Maintenance, Rehabilitation and Renewal Programs

Your Operational Plan must summarize the maintenance, rehabilitation and renewal programs that you have in place. *Use the Infrastructure checklist to help you prepare this information for the Operational Plan.*

INFRASTRUCTURE CHECKLIST	
Activity	***Possible Considerations***
INFRASTRUCTURE MAINTENANCE Planned	Who plans maintenance?
	Who authorizes planned maintenance activities?
	How is maintenance planned? (inspections, past maintenance, equipment manuals?)
	How is planned maintenance documented, before and after the maintenance activity is performed?
	How is planned maintenance communicated to maintenance personnel?
	How maintenance program needs determined and communicated?
	Is planned maintenance reviewed for trends? How?
INFRASTRUCTURE MAINTENANCE Unplanned	Who authorizes unplanned maintenance activities?
	How is unplanned maintenance responded to?
	How is unplanned maintenance documented?
	Is unplanned maintenance reviewed for trends? How?
INFRASTRUCTURE REHABILITATION	Who plans rehabilitation activities and budget?
	How is rehabilitation capital authorized?
	What is considered when planning rehabilitation activities?
	How are needs for the infrastructure determined and communicated?
	How is projected growth considered in rehabilitation planning?
INFRASTRUCTURE RENEWAL	Who plans renewal activities and budget?
	How is renewal capital authorized?
	What is considered when planning renewal activities?
	How are needs for infrastructure renewal determined and communicated?
	How is projected growth considered in renewal planning?

7. Monitoring the Effectiveness of the Maintenance Program

Once your Maintenance program is in place, you must also have a method to monitor how effective your Maintenance program is. By evaluating key maintenance indicators, you can assess the effectiveness of your Maintenance program. For example, indicators may include:

- Number of completed “work orders” or maintenance activities in a given time period
- Number or percent of overdue planned maintenance activities
- Response time for unplanned maintenance
- Frequency of unplanned maintenance activities
- Costs and cost comparisons, such as the costs of planned to unplanned, or costs per infrastructure element

You can define how you want to monitor your maintenance program. By monitoring such indicators, you can meet the requirements of the DWQMS, and you can experience a more efficient maintenance program.

You must implement the maintenance monitoring program, and generate documents so that you can demonstrate that the program is in place.

For example, a drinking-water system decides to summarize its maintenance activities every quarter in order to monitor the effectiveness of its maintenance program. The costs for supplies, the number of repair hours, and the number of unplanned activities are summarized for each process, based on the process flow chart from Element 6 of the DWQMS. The results are reviewed by the Supervisor and concerns are identified and discussed with the maintenance department.

The summaries and any comments from the Supervisor are filed, and also forwarded to the Owner.

8. Communicating the Maintenance, Rehabilitation and Renewal Programs to the Owner

The summaries of the maintenance, rehabilitation and renewal programs must be communicated to the Owner. Since the summaries are part of the Operational Plan, which is endorsed by the Owner, this requirement of Element 15 can be partially satisfied when you obtain endorsement of the entire Operational Plan.

However, the Operating Authority must keep these summaries current, so be sure to forward changes to the summaries to the Owner also.

The results of the monitoring program for maintenance, that monitors the effectiveness of the maintenance program, must also be communicated to the Owner.

Ensure that you communicate the summaries of the maintenance, rehabilitation and renewal programs to the Owner, and the results of your maintenance monitoring program.

Ready for the **Audit**

Auditors will be looking for:

- A procedure for annually reviewing the adequacy of the infrastructure
- Documents to show this review has been complete, such as meeting minutes
- Documents to show that the review results were communicated to the Owner
- Summaries of the maintenance, rehabilitation and renewal programs in the Operational Plan
- Updates in the programs that have been made as a results of changes in the drinking-water system or operations
- Documents to show the summaries were communicated to the Owner
- Documents to show that you are monitoring the effectiveness of the maintenance program

Complete the Chapter Checklist below, by checking off the items that have been completed. By completing all of the items, you will be ready to move on to the next chapter.

CHAPTER CHECKLIST	*Check When Complete*
Development of a procedure for the review of the adequacy of the infrastructure needed to operate the drinking-water system	
Completion of the infrastructure review as per the procedure	
Communication of the findings of the review to the Owner	
Development of summaries of the maintenance, rehabilitation and renewal programs for the Subject System and inclusion in the Operational Plan	
Communication of these programs to the Owner	
Documentation of Owner communications	
Development of a process to keep these summaries current	
Development of a process to monitor the effectiveness of the maintenance program	
Monitoring of the maintenance program for effectiveness	
Documentation of maintenance monitoring program	
Communication of the results of this monitoring to the Owner	

Chapter 16 – Sampling, Testing and Monitoring

Key Points in Chapter 16

Sampling, testing and monitoring enables staff in the drinking-water system to identify potential problems.

Sampling, testing and monitoring is most important during challenging conditions to ensure that drinking water safety is maintained.

You must know when and where to make adjustments in the drinking-water system in order to prevent situations that may result in a drinking water health risk.

By sampling, testing and monitoring the water at various stages, the Operating Authority can adjust process parameters. By adjusting process parameters, the Operating Authority can assure the production of safe drinking water.

Chapter 16 – Sampling, Testing and Monitoring

Quiz: Test your understanding of Sampling, Testing and Monitoring

Try this quiz now, and then again after you have finished reading this chapter.

Answer TRUE or FALSE	TRUE	FALSE
1. Sampling, testing and monitoring upstream to my drinking-water system should be included in the QMS.		
2. We need procedures which describe how we sample, test and monitor, and how we communicate the results.		
3. Since I do sampling under O. Reg. 170/03, I don’t need to do this chapter.		
4. DWQMS auditors will need to see my laboratory results.		

Answers

1. True – If you rely on upstream sampling, testing or monitoring results to make adjustments in your process, it must be described in your QMS. It is a requirement of the DWQMS.

2. True – The DWQMS procedures require sampling, testing and monitoring procedures that cover how you sample, test and monitor, and how you communicate the results.

3. False –This chapter requires that you document the procedures that you follow to ensure that regulatory sampling is completed. The DWQMS also requires that non-regulatory sampling, testing and monitoring be documented to ensure that your process is controlled under even the most challenging conditions.

4. True – DWQMS auditors will ask to see lab results when reviewing Sampling and Monitoring. However, the auditors are not checking for regulatory compliance. They are checking that you performed sampling, testing and monitoring when and how your Operational Plan indicates, and that you used those results to maintain control in your water system.

1. Translating the DWQMS

What the Standard says…

16. Sampling, Testing and Monitoring

PLAN – The Operational Plan shall document:

a.) a sampling, testing and monitoring procedure for process control and finished drinking water quality including requirements for sampling, testing and monitoring at the conditions most challenging to the subject system,
b.) a description of any relevant sampling, testing or monitoring activities that take place upstream of the subject system, and
c.) a procedure that describes how sampling, testing and monitoring results are recorded and shared between the Operating Authority and the Owner, where applicable.

DO – The Operating Authority shall implement and conform to the procedures.

17. Measurement and Recording Equipment Calibration and Maintenance

PLAN – The Operational Plan shall document a procedure for the calibration and maintenance of measurement and recording equipment.

DO – The Operating Authority shall implement and conform to the procedure.

What does it mean?

The focus of DWQMS Elements 16 and 17 is "measuring" your system to monitor what is happening, your level of control, and the quality of the treated drinking water. Specifically, Elements 16 and 17 require that you establish and implement procedures describing how you sample, test and monitor for process control and finished drinking water quality.

The procedures must include details on the sampling, testing and monitoring that is performed at the conditions most challenging to your drinking-water system. You must also describe relevant sampling, testing and monitoring activities that you perform upstream – before water enters your drinking-water system. If this sampling, testing or monitoring is not performed by you, but provided to you, you must also describe it. You must describe how the Owner and Operating Authority share the sampling, testing and monitoring results.

Element 17 is linked to Element 16 in this chapter since it deals with the equipment used to perform some of the sampling, testing or monitoring activities. Element 17 specifically deals with the calibration and maintenance of this measurement and recording equipment.

The DO components of Elements 16 and 17 require that you implement and conform to the sampling, testing and monitoring procedures.

2. Sampling, Testing and Monitoring Overview

You must know when and where to proactively adjust the operating parameters of the drinking-water system, especially those related to Critical Control Points, in order to prevent situations that may result in a drinking water health risk. Sampling, testing and monitoring activities provide information to monitor challenging raw water conditions and process performance. As well, sampling, testing and monitoring are necessary to verify finished drinking water quality.

By sampling and testing water characteristics and monitoring process parameters at various points in the drinking-water system, you further reduce the probability that something could go wrong by identifying potential problems, and by recognizing actual problems as early as possible.

This is especially crucial for CCPs. After establishing critical control limits for CCPs (see "Chapter 10 – Risk Assessment and Risk Assessment Outcomes"), the sampling, testing and/or monitoring of the water or processes related to that CCP can indicate if the characteristics of the water or the parameters of the process need to be adjusted in order to maintain drinking water quality.

The DWQMS does not prescribe what must be sampled, tested or monitored – drinking-water system legislation and regulations and conditions in licences outline sampling, testing and monitoring requirements to verify the safety of your finished water – in this chapter these requirements will be called regulatory requirements. Instead, the focus of the DWQMS is on ensuring: the reliability of the sampling, testing and monitoring performed to meet legislated requirements; that adequate operational sampling, testing and monitoring are undertaken to maintain your treatment process and identify potential problems early; and that sampling, testing and monitoring activities are planned, performed consistently, documented, and communicated. The operator needs access to accurate and timely sampling, testing and monitoring information to make process adjustments to ensure drinking water safety is maintained.

Note that sampling, testing and monitoring for process control, and under conditions that are most challenging to the drinking-water system, will include operational sampling, testing and monitoring beyond what is required to comply with regulatory requirements. Sampling, testing and monitoring may be performed to respond to changing conditions and optimize treatment.

3. Process Control and Finished Drinking Water Quality

To begin, list all of the sampling and monitoring that takes place in your drinking-water system. It is helpful to use your Process Flow Diagrams, described in "Chapter 9 – Drinking-Water System", as a guide to identify sampling and monitoring parameters. Be sure to include sampling and monitoring related to your CCPs.

Some examples of sampling, testing and monitoring that may take place in a water treatment system:

- Flow measurements at intake, in process, leaving treatment plant
- Water depth in intake well, process units, clear wells and reservoirs
- Water temperature
- Raw, settled water, or treated water turbidity
- Raw water iron and manganese
- Water pressure in mains
- Raw, filtered water or treated water pH
- Raw, filtered water or treated water chlorine (free and total)
- Sampling for laboratory testing (organic and inorganic parameters, nitrate and nitrite, trihalomethanes, sodium, fluoride, lead)

Some examples of sampling and monitoring that may take place in a water distribution system:

- Flow measurements of water coming into the system
- Water depth in reservoirs
- Water temperature
- Water pressure in mains
- pH
- Free and total chlorine
- Sampling for laboratory testing (organic and inorganic parameters, nitrate and nitrite, trihalomethanes, sodium, fluoride, lead)

Figure 16.1 shows a table summarizing the daily water analyses performed in-house for a surface water supply to provide operational control and to verify the measurements provided by on-line measuring devices.

Figure 16.1: Table of daily water analyses for a surface water treatment system

Raw Water	***Process Water***	***Treated Water***
Turbidity	Turbidity	Free Chlorine Residual
Temperature	Temperature	Total Chlorine Residual
pH	Free Chlorine Residual	Turbidity
Colour	Total Chlorine Residual	Temperature
Alkalinity	pH	pH
Taste and Odour compounds	Colour	Colour
	UV transmittance	Alkalinity
		Aluminium

A template for organizing your sampling and monitoring information, called the "Sampling and Monitoring Table", can be found in Appendix I (see Part II of this Guidance Document). When this table is completed, it can form part of a basic sampling and monitoring procedure, if your process is simple, or it can be the starting point for you to expand upon to write more detailed procedures. Figure 16.2 shows a sample section of this table.

Figure 16.2: Sampling, Testing and Monitoring Table

Sampling, Testing or Monitoring Parameter	***Location***	***Quality Targets***

The sampling, testing and monitoring procedures should include, when applicable, the targets for quality or desired attributes necessary for the water at certain points within the process (CCPs and regulatory requirements at a minimum). Typically, the results would dictate whether or not adjustments need to be made to the process. Describe targets for quality or desired attributes in the "Quality Targets" column. This can be an acceptable range of results if applicable.

An exceedance of any such target is an undesirable process monitoring result. The procedures must also contain the methods used to respond to situations when you exceed the targets that you have identified. Under the "Response" column in Appendix I, describe these response methods, or refer to documents where they are already described.

4. Challenging Conditions

It is important to ensure that sampling, testing and monitoring are done under conditions that challenge the system such as after a heavy rainfall or at the farthest ends of the distribution system where the water has the longest residence time.

The weather can have a major influence on source water quality and quantity. Surface water and groundwater under the influence of surface water are particularly susceptible to weather conditions. The quantity, timing, and type of precipitation, changes in wind direction, snow melt, freezing and break-up can all affect water quality. Temperature changes in the raw water may affect your disinfection and coagulation processes, process flow rates, and formation of disinfection by-products, for example. It may be necessary to increase sampling and monitoring in response to these changing conditions to ensure processes are kept in control.

Some examples of the *"conditions most challenging to the drinking-water system"* are:

- Frazil ice in surface water
- Temperature inversions (lake water "flips")
- Extreme spring run-off causing increased turbidity in source water
- High elevation areas in water distribution systems – pressure challenges
- Following a watermain repair
- Algae bloom in source water
- Increased THM formation during warm weather
- Increased THM formation at dead ends with low flow

After a system has operated for several years without any significant water quality issues it is possible to become complacent. Consider changing your sampling locations and times in the distribution system, to make sure that you are capturing the worst case situations.

Document the challenging conditions in your drinking-water system, and describe what steps you take from a sampling, testing and monitoring perspective, to ensure continued process control.

Describe these conditions, or refer to related documents, under the "Challenging Conditions" column in the Sampling, Testing and Monitoring Table (see Appendix I in Part II of this Guidance Document). Of course, not every sampling, testing or monitoring parameter will have a challenging condition associated with it. Figure 16.3 shows a sample section of that table completed.

5. Upstream Monitoring

The DWQMS requires that relevant sampling, testing and monitoring activities upstream of the drinking-water system be documented in the Operational Plan. The relevance of upstream monitoring will vary for each specific system. For example:

- For a self-contained supply and distribution system in a watershed with little development, upstream monitoring may not be relevant at all.
- A stand-alone distribution system may need to make some adjustments to their process in response to both the flow and quality of the water supplied to them from an adjacent municipality. Knowing their supply water quality is important.
- A water treatment plant using a river source may be required to adjust operations in response to an upstream contaminant spill.

It is up to you to define what is "relevant". In general, sampling, testing or monitoring activities would be relevant if the results may cause you to adjust your treatment process or how you operate your system, which in turn may have an affect on water quality. Upstream conditions may also be relevant to existing CCPs.

In your Sampling, Testing and Monitoring Table, list relevant upstream sampling and monitoring activities in your list of parameters.

6. Record-keeping

The DWQMS requires that you have a procedure that describes how sampling, testing and monitoring results are recorded. If you measure or test, then you must record the results, or there is no value to the measurement or test result. Your sampling, testing and monitoring procedures should describe where and how test results are recorded. Describe where and how test results are recorded under the "Records" column in Appendix I. Figure 16.3 shows a sample section of that table completed.

Remember, your records are the most effective way to demonstrate that your QMS has been effectively implemented.

Figure 16.3: Sampling, Testing and Monitoring Table, showing a sample of sampling, testing and monitoring parameter information

Sampling or Monitoring Parameter	***Location***	***Quality Targets***	***Response***	***Challenging Conditions***	***Records***
Water depth – SCADA monitors and alarms	*Intake Well*	*Depth greater than 4 meters*	*Investigate reason for low water levels*	*Intake blockage, frazil ice*	*Record in log book*
Water temperature - daily grab sample	*Intake Well*	*Temperature less than 5°C*	*Add polymer*	*Poor settling floc at low temperatures*	*Record process change in log book*

7. Sharing Results

The DWQMS also requires that you have a procedure that describes how sampling, testing and monitoring results are shared between the Operating Authority and Owner, where applicable. The method of communicating these results must be included in your sampling, testing and monitoring procedures. Results of normal sampling, testing and monitoring need to be communicated, along with abnormal conditions.

These include cases where a system may be reliant on the water quality supplied from another system, or may provide water to another system. The results of relevant sampling, testing and monitoring that are relevant to other connected systems need to be communicated to both the Owner and the other Operating Authorities.

In the “Communication” column, describe what results of sampling, testing and monitoring are communicated between the Operating Authority and the Owner.

Helpful **Tips**

Instead of including this communication information in the sampling and monitoring table, it is also permissible to expand the scope of your Communication Procedure, described in “Chapter 13 – Communications”, to include the reporting of results.

8. Developing Procedures

Completion of the Sampling, Testing and Monitoring Table is meant to help you organize your sampling, testing and monitoring information. Depending on the size and complexity of your system, you will likely need to prepare your own sampling, testing and monitoring procedures using the information you have organized in the table as a starting point.

Figure 16.4 shows an example of a Sampling, Testing and Monitoring procedure, for a large water treatment system. Due to the complexity of the sampling involved, the system would not use the Sampling and Monitoring Table in Appendix I, but could use it as a template to get the procedure-writing started.

If you choose to use the completed table as the basis for the procedures required in Element 16, remember that the information in the table should describe, for each sampling or monitoring parameter:

- who has responsibilities
- what the responsibilities and activities are
- how and when the activities are performed
- how records are kept, and
- any pertinent additional information.

For upstream sampling, testing and monitoring, the DWQMS does not require procedures. The details required above would not be required for the upstream sampling, testing and monitoring you listed in the Sampling, Testing and Monitoring Table.

Figure 16.4: Sampling, Testing and Monitoring Procedure

Sampling Procedure	Procedure ID	Revision Level
Written By	**Reviewed By**	**Approved By**

Purpose

This procedure describes the sampling activities conducted by LUSI to assure compliance to Ontario Regulations in the production of safe drinking water.

Scope

This procedure is applicable to water treatment plant and distribution operations.

References

DWQMS Element 18
Standard Methods for the Examination of Water and Wastewater – 20th Edition

Definitions

None

Procedure

1. Samples are categorised as follows:
   - Samples for on-site analysis (Free Cl2, Turbidity, pH & Al3+)
   - Continuous SCADA sampling (Free Cl2, Turbidity & pH)
   - Microbiological samples (Bacti)
   - Chemical samples (Organics, inorganic, nitrate & nitrite, lead, trihalomethanes, sodium & fluoride)
   - Suspended solids sample (Supernatent)
   - MOE samples (DWSP)

2. Sampling activities include the raw water supply, treatment plant, distribution operations (Towers and Booster Station) and downstream locations (4 locations).

   2.1 At a minimum, samples are taken in compliance with all applicable Ontario Regulations.

   2.2 Physical samples are retrieved from various points in the process by plant and distribution personnel.

   2.3 The SCADA system conducts continuous sampling, however, no samples are retained.

3. A list of all sampling conducted by (Operating Authority) has been documented on the Master List of Sampling.

   3.1 The Master List of Sampling indicates:
   - Type of sample
   - Process sampled
   - Source of sample
   - Sample location
   - Sample frequency
   - Measurement device (Asset #)
   - Ontario Regulation (where applicable)

   3.2 Samples shall be highlighted on the Water Operations Process Map

   3.3 Measurement device calibration records are maintained at the Water Treatment Plant

4. Physical samples shall be collected by certified operators only. Proper care shall be taken to ensure that contaminants are not introduced to the sample during collection by the operator.

4.1 Operators shall follow the sample collection protocol as documented in Section 1 of "Standard Methods for the Examination of Water and Wastewater – 20th Edition".

5. The results of all SCADA sampling shall be printed and filed by WTP personnel on a daily basis (except on weekends and statutory holidays when next working day is acceptable).

5.1 Sampling result trends compiled by SCADA shall be printed monthly and annually and be retained at the water treatment plant. Copies may also be provided to the Water Superintendent.

6. The results of all microbiological and chemical samples (Accredited Laboratory Results) shall be retained by the (Functional Title). All other sampling records are the responsibility of the WTP Foreman and shall be retained at the WTP.

6.1 The (Functional Title) shall ensure that all microbiological and chemical sampling records from accredited laboratories are properly filed and maintained in such a manner as to prevent damage, loss or deterioration and are readily retrievable. See the procedure for Record Control.

6.2 The WTP Foreman shall ensure that all other sampling records other than those stated in 6.1 are properly filed and maintained in such a manner as to prevent damage, loss or deterioration and are readily retrievable. See the procedure for Record Control.

7. The results of all Bacteriological and Chemical sampling shall be provided by (Operating Authority) to the (Owner). The results shall be reviewed during (Descriptor) meetings.

7.1 The (Owner) will post the results on its website (Insert URL if appropriate) as public information.

Associated Forms/Procedures/Work Instructions
Master List of Sampling
Operations Process Map

Records
SCADA Sampling Points
Manual Sampling Records

- Accredited Laboratory Reports – Bacteriological and chemical
- Daily log sheets
- Raw Water Temperature
- Raw Water Turbidity
- Raw Water pH
- Low Lift Turbidity
- Low Lift Chlorine Residual
- Contact Chamber Chlorine Residuals
- Treated Water Aluminum Residual
- Treated Water Chlorine Residual
- Jar Test
- Floc Test
- Calibration cards

Change History

Revision Level	Date	Change	By
Draft	June 1, 2006		

9. Measurement and Recording Equipment

The DWQMS requires that you have procedures for the calibration and maintenance of measurement and recording equipment. Although it is very likely that you have this information documented in equipment manuals and preventative maintenance programs, these procedures must be part of your Operational Plan. Thus, you must summarize them or refer to them in your Operational Plan.

Figure 16.5 presents a table that can be used to summarize your measuring and recording equipment, and calibration requirements.

List the measurement and recording equipment being used in the "Devices" column. Then for each piece of equipment, describe the method of calibration, under the "Calibration Method" column. Also record the frequency of calibration. The method may be specified as a reference to the Manufacturer's Documentation that accompanied the equipment. There is no need to restate the calibration steps. The calibration frequency may also be derived from Manufacturer's documentation, but should be listed here.

If the calibration is performed by a certified subcontractor, ensure that a copy of the subcontractor's certificate is on file. Include them as a critical supplier.

In the "Calibration Schedule" column, record how calibration is scheduled. Under a quality management system, it is not sufficient for the Maintenance Manager to simply "remember" when equipment or devices require calibration.

Under the "Calibration Results" column, describe how you document that a required calibration was performed. Not only is this information important for scheduling future calibrations, but it also serves as proof that the calibration was completed. Figure 16.5 shows a sample section of the "Calibration" portion of the table completed.

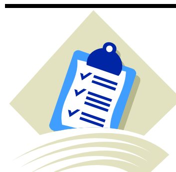
For example, if you use a work order system to plan and document your maintenance activities, then the scheduling and confirmation for the calibration are likely documented in your work order system, and a reference to your work order system in those columns would be sufficient. Others may write in scheduled calibration dates on a calendar which is used to plan work activities.

Figure 16.5: Sampling, Testing and Monitoring Table, showing example calibration information for sampling, testing and monitoring parameters

Helpful **Tips**

"Do not assume" when describing which equipment requires calibration. This is an excellent opportunity to thoroughly review which equipment requires calibration. With Maintenance personnel, review the manuals for the equipment.

You may find that equipment that was assumed to *not* require calibration has a calibration requirement listed.



Ready for the **Audit**

What do auditors like to see for sampling and monitoring?

The auditor will review your sampling, testing and monitoring procedures to verify that they meet the requirements listed in Elements 16 and 17 of the DWQMS.

Auditors will review sampling, testing and monitoring records to verify that you are performing your sampling, testing and monitoring as you have stated in the procedures.

Sampling, Testing or Monitoring Parameter	***Equipment***	***Method***	***Frequency***	***Schedule***	***Results***
Water depth in intake well	*Ultrasonics transducer*	*Instrument Tech uses ACME Ultrasonics equipment manual in control room*	*Quarterly*	*CMMS*	*CMMS, and hard copy in control room*
Raw water Flow meter	*Magmeter*	*Instrument Tech uses manufacturer's manual in O&M Manual 2005 Volume 5*	*Quarterly*	*CMMS*	*CMMS, and hard copy in control room*

Ensure that all of the equipment that requires calibration has an up-to-date record of calibration. Before you are ready for the accreditation audit, you must have all of your calibration up-to-date.

10. Operational Plan: Sampling, Testing and Monitoring

Make sure that your Operational Plan is updated to include all of the Sampling, Testing and Monitoring requirements from the DWQMS, which include the sampling, testing and monitoring procedures and the description of upstream sampling, testing and monitoring. Insert your Sampling, Testing and Monitoring Table, and any procedures that you have prepared. If you would rather not insert documents into the Operational Plan binder, then just write down where those documents can be found.

Now that the information is prepared, it must be kept up-to-date. Identify the most effective method for making sure changes in the system are promptly updated in the QMS documentation. Assign specific Operating Authority personnel the responsibility of updating the information prepared under Elements 16 and 17.

11. Training Personnel

The final step in this chapter is to ensure all personnel in the Operating Authority are aware of the Sampling, Testing and Monitoring requirements.

This can be done informally simply by emailing, posting or discussing the information that you prepared in this chapter with all personnel.

Or, this can be performed later in the implementation during the QMS Awareness sessions. In "Chapter 20 – Completing the QMS Cycle", the task of training personnel in QMS concepts, including sampling, testing and monitoring, will be discussed.

Complete the Chapter Checklist below, by checking off the items that have been completed. By completing all of the items, you will be ready to move on to the next chapter.

CHAPTER CHECKLIST	*Check When Complete*
A list of sampling, testing and monitoring parameters for your drinking-water system has been prepared	
Targets or acceptable ranges have been defined for sampling, testing and monitoring parameters	
Methods for responding when targets or acceptable ranges are exceeded have been included	
Any relevant upstream sampling, testing and monitoring activities are described	
Sampling, testing and monitoring under challenging conditions are described	
How sampling, testing and monitoring results are recorded has been described	
Measurement and recording equipment have been described	
The calibration of measurement and recording equipment, including method, frequency, planning and results has been described	
How the results are shared between the Owner and the Operating Authority has been described	
The calibration of measurement and recording equipment is up-to-date	

Chapter 17 – Emergency Preparedness and Response

Key Points in Chapter 17

An emergency is a potential situation or service interruption that may result in the loss of the ability to maintain a supply of safe drinking water to consumers.

Emergencies may still occur in spite of our best efforts to prevent them. Proper planning for emergencies is necessary to minimize potential health risks.

Emergency procedures should cover how to prepare for emergencies, respond, contact key parties, and restore the system to normal operation.

Chapter 17 – Emergency Preparedness and Response

Quiz: Test your understanding of Emergency Preparedness and Response

Try this quiz now, and then again after you have finished reading this chapter.

Answer TRUE or FALSE	TRUE	FALSE
1. Power outage can be an emergency situation.		
2. Emergency procedures can be tested using tabletop exercises.		
3. Only emergency response staff needs to be trained in emergency procedures.		
4. Emergency response procedures should only be reviewed once per year.		
5. How Owners and Operating Authorities share responsibility in emergency situations is a topic that should be covered in emergency procedures.		

Answers

1. True – A power outage is a situation that could cause a service interruption, and subsequently cause an acute drinking water health risk. The length of time your system can operate in a power outage will vary depending on your system configuration – for systems without a back-up generator, and no elevated system storage, an emergency situation could quickly result.

2. True – For many types of emergencies, staff can meet in a conference room setting to discuss their responsibilities and how they would react to emergency scenarios. This is a cost-effective and efficient way to identify areas of overlap and confusion before conducting more demanding training or testing activities.

3. False - All staff working within the drinking-water system need to know what to do in case of an emergency, especially if they have special emergency response roles. Others who work in the system should also be aware of emergency procedures, especially those that may impact on the emergency or the response. This includes visitors and subcontractors.

4. False – Emergency response procedures should be reviewed once per year, but should also be reviewed when there are significant changes to personnel, operations, equipment, and especially after an emergency or drill has occurred.

5. True – The DWQMS requires that procedures outline specifically how Owner and Operating Authority responsibility is shared in an emergency.

Chapter 17 – Emergency Preparedness and Response

1. Translating the DWQMS

What the Standard says…

18. Emergency Management

PLAN – The Operational Plan shall document a procedure to maintain a state of emergency preparedness that includes:

a.) a list of potential emergency situations or service interruptions,
b.) processes for emergency response and recovery,
c.) emergency response training and testing requirements,
d.) Owner and Operating Authority responsibilities during emergency situations,
e.) references to municipal emergency planning measures as appropriate, and
f.) an emergency communication protocol and an up-to-date list of emergency contacts.

DO – The Operating Authority shall implement and conform to the procedure.

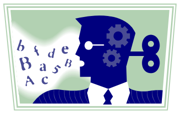
What does it mean?

This element of the DWQMS is all about being prepared for emergency situations that could result in the loss of your ability to maintain the supply of safe drinking water to consumers. Emergency preparedness means identifying what could happen in your system to cause an emergency, and having processes and procedures in-place for how to prepare for and respond to those emergencies. The DWQMS requires that your Operational Plan includes emergency procedures and contact information, which includes information about:

- Communication, response and recovery procedures
- Emergency Training
- Testing your procedures to make sure they make sense
- Responsibilities of personnel, Owner, and Operating Authority
- Municipal emergency planning measures, and
- Up-to-date lists of who to call in an emergency.

The DO component of this Element requires that you implement and conform to these procedures.

The effectiveness of response during emergencies depends on the amount of planning and training performed. Emergency management is a dynamic process. Emergency management should include training, conducting drills, testing equipment and coordinating activities with the community. If you already have emergency procedures in place, use this Guidance Document as a resource to assess and update your own procedures.



Technical **Terms**

An **emergency** – a potential situation or service interruption that may result in the loss of the ability to maintain a supply of safe drinking water to consumers.

Emergency management is a system by which managers and staff explore system vulnerabilities, make improvements and establish procedures to follow in an emergency. Effective emergency management requires effective communication and co-ordination with the Owner and other agencies and authorities such as the Medical Officer of Health and the Ministry of the Environment. In an emergency, everyone needs to know their roles and responsibilities, and how they interact with others. By establishing emergency management procedures, training personnel and testing response procedures periodically, the consequences which result from emergency situations can be reduced.

It should be noted that emergency management referred to in this Guidance Document is in addition to and should compliment the Municipal emergency plan, required by Emergency Measures Ontario.

In Appendix J (see Part II of this Guidance Document), a template for Emergency Procedures can be found, that follows the topics discussed in this chapter.

2. Identifying Potential Emergencies

Before jumping into procedures and contact lists, it is crucial to pay attention to the first requirement of this element – having a procedure that lists potential emergency situations or service interruptions.

There are a variety of reasons emergencies can happen including:

- Natural disasters
- Accidents
- Deliberate acts of vandalism or terrorism
- Pandemics
- System neglect or deferred maintenance.

Helpful **Tips**

Pay special attention to emergencies that may happen during off-hours, or at remote locations within the drinking-water system, as access to information, resources, or physical access may be affected by this timing.

Remember that the emergency may affect the entire drinking-water system or only isolated sections. As well, emergency situations may arise very quickly and with little warning, as in the case of an ice storm causing a power outage, or may evolve slowly as in the case of a drought. All types of emergencies need to be considered.

Every system has its obvious emergency potentials. However, without a proper method of looking objectively at the entire system, potential risk areas may be missed. Reviewing the risk assessment process that was explained in the Chapter 10 is an excellent way of identifying potential situations or service interruptions that could result in the loss of your ability to maintain the supply of safe drinking water. Identifying potential emergencies by using the risk assessment process is especially effective because the DWQMS requires that you keep the risk assessment information up to date. This means that by keeping the risk assessment up to date, you are also staying in touch with potential emergencies that may arise.

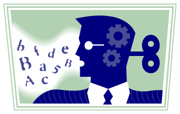
Ministry of the Environment inspections, corporate audits, insurance company reviews, records of past emergencies, news reports about emergencies in other systems, and risk assessments – these are all ways that potential emergency situations may be identified.

A checklist is provided in the Emergency Procedures Template, located in Appendix J (see Part II of this Guidance Document), for you to record the various potential emergencies that may occur in your drinking-water system. Figure 17.1 shows an example of this checklist completed. You may decide to include some emergency response plans, or contingency plans for emergencies that would not result in the loss of your ability to maintain the supply of safe drinking water, but this is not required as part of the DWQMS. These contingency plans can be an excellent means to ensure staff responds appropriately to an event such as a chemical spill contained within your facility.

Figure 17.1: Example of potential emergencies identified

POTENTIAL EMERGENCIES	
Description of Emergency	**Potential Outcome**
Chemical spill in wellhead capture zone	*Health risk, contamination of source water, contamination of environment, service disruption*
Biological contamination of source water due to raw sewage bypass	*Health risk, contamination of treated water or environment, service disruption*
Drought	*Water restrictions, inability to meet demand, service disruption, health risk*
Construction accident in the distribution system	*Loss of system pressure and water supply to area, service disruption, health risk*
Fire / evacuation / explosion	*Health risk, contamination of source water, contamination of treated water, contamination of environment, loss or damage to infrastructure, service disruption, employee injury*
Loss of essential supplier / chemical shortage	*Health risk, service disruption*
Power outage	*Health risk, inability to maintain system pressure and water supply, service disruption*
SCADA failure	*Health risk, service disruption*
Pandemic	*Unavailability of staff for system maintenance and operations, service disruption*
Security breach / vandalism / acts of terrorism	*Health risk, contamination of treated water, loss or damage to infrastructure, service disruption, employee injury*
Severe storm / earthquake / tornado / flood / lightning strike	*Health risk, contamination of source water, contamination of treated water, contamination of environment, loss or damage to infrastructure, service disruption, employee injury*

3. Emergency Response and Recovery



Technical **Terms**

Emergency response – the effort to mitigate the impact of an emergency on consumers.

The DWQMS requires that you document and implement procedures for emergency response and recovery for the potential emergencies that you have identified. The procedures should be developed locally and should be comprehensive enough to deal with each type of emergency you've identified.

Involve the QMS Team or other key staff, to ensure that you have covered the response thoroughly. These procedures can be independent documents, or they can be detailed instructions added to the hazards identified in your Risk Assessment. If you are writing independent procedures, remember to use the procedure format you developed in Chapter 10.

The emergency procedures should spell out how the facility will respond to emergencies. Consider the need for your procedure(s) to identify how to:

- Assess the situation
- Protect consumers, employees, visitors, equipment, vital records and other assets
- Communicate with the community, personnel, and responders
- Shut down and start up operations
- Restore operations

Helpful **Tips**

One way to increase response capabilities is to identify special employee skills, such as medical, engineering, communications including foreign language capability, which might be needed in an emergency.

Whenever possible, write response procedures as a series of checklists that can be quickly accessed by managers, Operators, response personnel and employees.

Note that not all of the above information may be in a single procedure. For example, you may have separate procedures for the shut down and start up of operations, communications, etc.

There are several topics that should be addressed in your emergency response and recovery procedures, which are described below:

Resources and Capabilities

Identify resources and capabilities, both internal and external, which could be needed in an emergency, including:

Personnel -- fire brigade, hazardous materials response team, emergency medical services, police, municipal emergency management team, evacuation team, public information officer

Equipment and supplies– pipe repair equipment, contractor for pipe repair, electrical repair equipment, tanker truck to haul treated water, bottled water rental equipment, fire protection and suppression equipment, communications equipment, first aid supplies, emergency supplies, warning systems, emergency power equipment, decontamination equipment, drawings, plans and maps of the drinking-water system

Facilities -- emergency operating center, media briefing area, shelter areas, first-aid stations, sanitation facilities,

Backup systems -- arrangements with other facilities to provide for:

- Supply of treated water
- Communications
- Trained Operators and other personnel
- Recovery support
- Supply of chemicals, fuel, emergency generators

Responsibilities / Chain of Command

Set up clear responsibilities for managing each emergency. Specifically describe how Owner and Operating Authority responsibility is shared during emergency situations, and identify their role in emergency communications.

Here is an example of the Chain of Command that may be in place at a small drinking-water system.

Name and Title	Responsibilities during emergency
John Smith *Water System Manager*	*Overall management and decision making for the water system on behalf of the Owner and Operating Authority. The lead for managing the emergency, providing information to government agencies, the public and the news media. All external communication is approved by the Water System Manager.*
Mary McCarthy *Clerk-Treasurer*	*Owner representative during the emergency. Chief liaison between the Operating Authority and the Mayor and Council. Authorization of resource requests with input from council. Coordination of activities by municipal personnel.*
Joan Doe *Operator*	*In charge of performing response and recovery activities, including sampling, system operations, inspection and maintenance. Performs duties on behalf of the Owner and Operating Authority.*
Joe Liang *Maintenance*	*In charge of performing response and recovery activities, including system operations, inspection and maintenance. Performs duties on behalf of the Owner and Operating Authority.*

Communication

Establish clear responsibilities and instructions for communicating from the organization's command centre to the Owner, priority consumers, the community, the authorities, (fire, police, hospital, and Medical

Officer of Health, Ministry of the Environment, and other government departments) agencies, personnel, service and repair contractors, neighbouring water systems, and the media.

Include instructions on how to contact specific parties, or add that information to the Contact List prepared in the next section of this chapter.

Ensure that those in charge will be able to talk to each other during an emergency – planning this now can avoid complications later.

Plan how media requests will be handled. A media spokesperson should be designated, and should be instructed in general media guidelines.

Helpful **Tips**

Have a system in place to allow staff to rapidly access information on the system and its piping (system maps), system data (SCADA or other), chemicals used (Material Safety Data Sheets)

Ensure that access to information is possible where needed, when needed (including off-hours), and in challenging situations (during hydro outage, for example)

Sampling Requirements

Depending on the type of emergency one of the first actions you may take is to collect a sample of the source or treated water for specific analyses or to identify contaminants. Sampling may also be required to confirm that the drinking-water is safe to consume as part of emergency recovery operations. Identify when and where sampling is required in your emergency procedures. As required refer to legislated sampling protocols, or include a copy of the protocol.

Response teams

Decide who may be necessary to provide assistance during an emergency, such as piping contractors, equipment suppliers, spill response teams, fire and rescue personnel, medical facilities, trauma counselling services, and other agencies. It is helpful, in advance, to find out how long it will take emergency services to reach your system, and plan around this timing.

Municipal Planning Measures

Part e.) of the PLAN requirement of Element 18 requires that your emergency procedures specifically reference municipal emergency planning measures, as appropriate. Assess the measures in place within the municipality and reference them, or describe them in your own procedures.

Response Actions for Specific Events

Develop detailed response plans for each type of emergency that the system may experience. Figure 17.2 is an example of a specific emergency response procedure for a break in a transmission main.

Figure 17.2: Example of a spill response procedure for a pipeline break.

Response Procedure – PIPELINE BREAK

Indicators of breakage:

- Distribution system reservoirs and pumping station pressures and levels are monitored continuously through the SCADA system.
- A large breakage will be indicated by a sudden and possibly large *drop in normal pressure* that will not correspond to any pump shutdown.
- Pipeline breaks will sometimes cause abnormally *high flow from discharge of pumps* causing *high amperage draw* by pump motor.
- *Reservoir level* will also begin to drop.

In the event of a pipeline break:

1. Operator shall shut down all pumps feeding the broken line immediately.
2. Operator shall close all remotely controlled pipeline isolation valves immediately.
3. Operator shall notify the Project Manager and the Operations Manager of the situation (see Contacts List).
4. Operator shall dispatch maintenance staff to the location
5. Maintenance staff shall assess the situation, for impacts, resources required for repair, and timing estimates
6. Maintenance staff shall report findings to Operator and Operations Manager
7. If the break is on the transmission main, staff shall follow Contingency Plan Procedure.
8. If the break is not on the transmission main, Maintenance shall remain until responders from Distribution System arrive, and proceed to Step 11
9. If the break is on the transmission main, Maintenance shall initiate repair and dispatch for subcontractor assistance as necessary
10. Operator shall dispatch additional maintenance staff to the location if the problem pertains to the transmission main system.
11. Operations Manager shall inform the Municipality (see Contacts List) in the affected area of the situation regardless of whose equipment is affected (pressure losses will generate consumer complaints).
12. Operator shall record the incident in the Operator's Log Book.

Recovery

As the emergency passes and you regain control, the system must prepare to return to normal operating condition. Depending on the nature of the emergency, this could simply mean restoring power and disconnecting a backup generator, or it could involve collecting water samples for analysis to confirm the drinking-water is safe before a health advisory is lifted. The procedures must describe recovery methods for all of the potential emergencies identified.

Documentation

If there are any special follow-up or documentation requirements, describe them. Follow up reporting may be required if the emergency involved notification of government agencies, or may be required as an internal corrective action program.

Helpful **Tips**

Create your contact list as an independent list of information. This way, as numbers and contacts change, you only have to make one edit – in the contact list. If you embed the contact information right into the procedures, it makes updates more complicated.

4. Emergency Contacts

The DWQMS requires that you maintain an emergency communication protocol and an up-to-date list of emergency contacts. This step is essential as in an emergency you must be able to contact key parties quickly. Instructions on how to make that contact, when to contact key parties, and who has the authority/responsibility for making contacts is also important .You may have already described *how* to contact key parties as part of emergency response and recovery procedures (Step 3), and you can then use this as part of your communication protocol. Additional information can be provided in your contact list.

Begin by creating a list of contact information for all of the roles identified in the response and recovery procedures.

The contacts will vary depending upon the emergency, but in general the list should be prioritized. Each emergency procedure may outline a different contact procedure. For example, in a break to a transmission main, contacting a work crew to initiate repairs will be a high priority, whereas this would not be necessary for a power outage. Some of the contacts you may wish to include are listed below:

- System Staff
- System Owner(s)
- Police
- Hospital
- Fire Department
- Hydro Provider
- Design Engineer
- Excavation Services
- Pipe Suppliers
- Critical Equipment Suppliers
- Plumbing Services
- Fuel Suppliers
- MOE – Inspector
- MOE – Spills Action Centre
- Medical Officer of Health
- Connected Water Systems
- Radio Station
- Television Station
- Newspaper
- Adjacent Water Systems
- Bulk Water Hauler
- Bottled Water Supplier
- Treatment Chemical Suppliers
- SCADA

Figure 17.3 shows an example of contact information that could be inserted into emergency procedures. This list also includes columns for the reason for contacting, who contacts and special instructions. The template for this contact information is in Appendix J (see Part II of this Guidance Document).

Figure 17.3: Example of a contact information for a pipeline break.

Contact Name & Affiliation	Contact Information						Reason for Contacting	Who Contacts	Special Instructions
	Work phone	Work Fax	Cell	Pager	E-mail	After Hours phone			

Contact information should be checked before documenting it and should include the fastest, most reliable means of contacting each party. Ensure that a method is in place for the contact information to be regularly checked and updated, at least once per year. This check is listed on the QMS Schedule, available in Appendix N (see Part II of this Guidance Document).

5. Emergency Response Training

You have identified the potential situations that may lead to an acute drinking water health risk, and prepared response and recovery procedures for those situations. Now for each potential emergency, the DWQMS requires that you have documented a procedure to maintain a state of preparedness that includes emergency response training and testing.

By testing response procedures, you help to ensure that they actually work, and that they are effective. You do not want to wait until an actual emergency occurs before you check that your planned response works.

Preparing also means training. The best emergency response procedures are useless if the personnel are not trained in what the procedures require them to do.

All personnel working within the drinking-water system need to know what to do in case of an emergency, especially if they have special response roles. The training expectations that you establish should be documented into your emergency response procedures. Figure 17.4 shows suggestions of who should attend emergency training, what should be covered, and the purpose for that training.

Remember to include back-up and alternate staff in the training sessions, rather than limit training to just the staff directly named in the response procedures.

Figure 17.4 Purpose and content of training for various roles

Who	***Emergency Topic***	***Purpose***
All staff	General emergency awareness	*All* staff should be aware of what general emergency procedures are in place for the drinking-water system.
Staff with response roles	Specific response instructions	Staff with specific detection, response, communication or recovery responsibilities should be trained in your response and recovery procedures. Be sure to cover their specific responsibilities.
Visitors / subcontractors	General emergency awareness	People who aren't staff who work in the drinking-water system may need to be aware of what to do in emergencies. This is especially true for subcontractors, visitors or suppliers on-site whose work could negatively impact the emergency situation. Decide what information personnel who aren't staff need to know and set up a method for getting that response information to them.

Training for all staff should cover:

- Individual roles and responsibilities
- Information about threats, hazards and protective actions
- Notification, warning and communications procedures
- Emergency response and recovery procedures
- Location and use of common emergency equipment, and
- Emergency shutdown procedures.

For training, be sure to record the names of the people who attended training, the dates, the name of the training class, the duration of the class, and any planned refresher training dates. You need this training information when you complete Chapter 12, about Competencies and Personnel Coverage.

6. Emergency Response Testing

The DWQMS requires that you outline how you test your emergency procedures. By incorporating testing of emergency procedures into the training, you are satisfying two areas of the Standard at once. Be creative, and select a form of training and testing that most suits the culture within the drinking-water system. Some common forms of training and testing are described below:

Orientation and Education Sessions

These are regularly scheduled discussion sessions to provide information, answer questions and identify needs and concerns.

Tabletop Exercise

Members of the emergency management group meet in a conference room setting to discuss their responsibilities and how they would react to emergency scenarios. This is a cost-effective and efficient way to identify areas of overlap and confusion before conducting more demanding training activities.

Walk-through Drill

The emergency management group and response teams actually perform their emergency response functions. This activity generally involves more people and is more thorough than a tabletop exercise. Through this task, procedures and contact lists can be improved, additional training areas can be identified, and the adequacy and availability of equipment can be verified.

Functional Drill

These drills test specific functions such as emergency notifications, warning and communications procedures and equipment, though not necessarily at the same time. Personnel are asked to evaluate the systems and identify problem areas.

Ready for the **Audit**

Auditors will like to see Emergency Procedures that include:

- A thorough, sensible list of potential emergency situations and service interruptions
- Response and recovery instructions for potential emergency conditions
- Responsibilities and resources clearly identified
- Training requirements for response procedures
- Description of testing methods
- A contact list that is up-to-date
- Communication protocol that informs staff on how to communicate to key parties, including the contacts listed

Auditors will also review records of emergencies, training and testing, to verify that you are maintaining preparedness as you have stated in your Operational Plan.

Auditors will interview employees to verify awareness of emergency requirements and will ask questions about their response to emergencies or their roles in emergency preparedness.

Helpful **Tips**

If you have a variety of emergency response equipment in place, it is beneficial to create a list of the items you use for response, and where they are located. With this list, assigned staff can periodically check stocked items against the list to ensure all items are available, and to replace missing items.

Full-scale Exercise

A real-life emergency situation is simulated as closely as possible. This exercise involves company emergency response personnel, employees, management, and community response organizations.

Be sure to keep good records of testing, including dates, and what was changed in the QMS as a result of the test.

7. Being Prepared for Emergencies

Being “prepared” may also mean:

- Being able to detect the emergency, as early as possible
- Having equipment that might be needed available, calibrated as needed, and ready.
- Having back-up plans (if trained response people go on vacation).

These are not specific requirements of the DWQMS. However, they are effective processes to have in place for thorough emergency management.

Detection

For each potential emergency, you may wish to assess how you know if the emergency is occurring. If any of these detection methods require calibration, ensure the calibration is updated and recorded. Even if calibration is not required, some detection methods may need to be periodically tested, to ensure they are working properly.

If there are other detection methods available that may help staff know even sooner, consider implementing those methods of detection. When you have determined the detection methods, document them by describing them in the appropriate emergency procedures.

Back-up Plans

For each response procedure, you may wish to ensure that alternates are identified and documented for personnel, equipment or other resources that may not be available at all times. Consider situations such as vacation times, equipment servicing and labour disruption, for example.

Equipment

For each potential emergency, you may wish to assess what response equipment and supplies you may require. For instance how many days supply of treatment chemicals do you have, and where can you access fuel for your stand-by generator during an extended power outage. Ensure the equipment is in place, available at all times (even during power outage or off-hours), and establish a method for regularly checking stock of items. Review what other supplies you may require.

8. Document and Review the Emergency Procedures

The final step in this chapter is to ensure that all of the information and procedures you have put together are included in the Operational Plan, or referred to in the Operational Plan. These should be included in the Operational Plan, or referred to from the Operational Plan.

All of the information in this section of your Operational Plan should be regularly reviewed. One suggestion is to establish a method to have a team of reviewers evaluate the emergency procedures when you implement, after the occurrence of an emergency, or at least once per year. This type of review is listed in the QMS Schedule in Appendix N (see Part II of this Guidance Document).

Issues to consider in emergency review…	***Yes/No***
How can you involve all levels of management in evaluating and updating the plan?	
Are the critical control points identified in the Risk Assessment being addressed?	
Does the plan reflect lessons learned from drills and actual events?	
Have new staff members been trained?	
Do members of the emergency response team understand their respective responsibilities?	
Does the plan reflect changes in the physical layout of the drinking-water system?	
Does it reflect new facility processes?	
Have the hazards and emergency situations changed?	
Are the names, titles and telephone numbers in the plan current?	
Have community agencies and organizations been briefed on the plan? Are they involved in evaluating the plan?	

Describe the review process in the emergency procedures, and include the reasons that a review of the emergency procedures may take place.

9. Distribute the Emergency Procedures

Ensure the Emergency Procedures are available wherever they might be needed, in electronic or paper form. If choosing electronic access, ensure that the procedures are available in a power outage.

You may wish to consider that each individual who receives a paper copy be required to sign for it and be responsible for posting subsequent changes.

Distribute the procedures to:

- Chief executives and senior managers
- Key members of the company's emergency response organization
- Company headquarters
- Community emergency response agencies (appropriate sections – be careful of privacy issues)

Have key personnel keep a copy of the plan in their homes, if they are to be contacted in off-hours during an emergency.

Helpful **Tips**

In addition to a yearly review, emergency procedures should also be reviewed:

- After each training drill or exercise
- After each emergency
- When personnel or their responsibilities change
- When the layout or design of the facility changes
- When policies or procedures change.

Complete the Chapter Checklist below, by checking off the items that have been completed. By completing all of the items, you will be ready to move on to the next chapter.

CHAPTER CHECKLIST	*Check When Complete*
Identification of potential emergency situations or service interruptions	
Documentation of emergency procedures	
Description of the responsibilities of the Owner and the Operating Authority in the procedures	
The procedures describe communication during an emergency	
The procedures describe what sampling is required for response and recovery	
The procedures describe response teams you will utilize	
The procedures refer to municipal planning measures	
The procedures include specific response actions that must be taken	
The procedures include recovery instructions	
The procedures include your requirements for documenting the emergency, and any follow-up reporting required	
Development of an up-to-date contact lists	
Communication protocol included	
Identification and documentation of training requirements for emergency response	
Completion of training in emergency procedures	
Planning and documentation of emergency response testing	
Review, approval and distribution of emergency procedures	

Chapter 18 – Plan for Internal Audit

Key Points in Chapter 18

Internal audits are non-regulatory audits of the QMS.

Results from internal audits add value to the organization by providing feedback about the QMS and its effectiveness.

Internal audits are the Operating Authority's best method of promoting and confirming the value of the DWQMS.

Chapter 18 – Plan for Internal Audit

1. Translating "Internal Audits" in the DWQMS

What the Standard says…

19. Internal Audits

PLAN – The Operational Plan shall document a procedure for internal audits that:

a.) evaluates conformity of the QMS with the requirements of this Standard,
b.) identifies internal audit criteria, frequency, scope, methodology and record-keeping requirements,
c.) considers previous internal and external audit results, and
d.) describes how Quality Management System corrective actions are identified and initiated.

DO – The Operating Authority shall implement and conform to the procedure and shall ensure that internal audits are conducted at least once every twelve months.

What does it mean?

Element 19 of the DWQMS requires you to have a documented procedure for conducting internal audits of your QMS, and to verify conformity of the QMS with the requirements of the DWQMS.

Specifically, the procedure must describe what you are auditing against, how often, what in your QMS is being audited, how it is audited, and what records are created. The audit procedures must also show how the planned audits are influenced by the previous audit results.

When something is found that doesn't conform to the requirements of the DWQMS, the procedure must also describe how you identify what needs to be corrected, and how the correction is initiated.

The DO component of Element 19 requires that audits be performed as described in your Operational Plan, and performed in entirety at least every twelve months.

This chapter provides you with an overview of the internal audit function and its importance to your QMS. You will create an Internal Audit Procedure by following the guidance in this chapter.

"Chapter 21 – Performing an Internal Audit" covers the requirements for actually completing your internal audit. You must complete Chapters 19 and 20 before you are ready to carry out your first internal audit.

2. Internal Auditing Overview

An internal audit is a self-evaluation of your QMS. The internal audit process ensures that the QMS has been implemented and provides proof of its effectiveness on an ongoing basis. Internal audits take a broad and deep look into how well you continue to meet your commitment to quality through the implementation of the requirements of DWQMS.

The best time to conduct your first internal audit is at least several months after you have implemented your QMS, and prior to initiating the accreditation process. This allows for the QMS to begin functioning, and for employees to become familiar with the QMS requirements.

3. Audits vs. Inspects

There is a marked distinction between QMS audits and regulatory inspections.

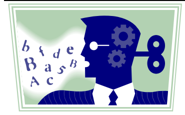
Audits are conducted to verify that the QMS has been effectively implemented, and to identify any opportunities for improvement. Secondly, audits are planned well in advance. There is no such thing as a "surprise audit" or audit on "short notice". Third, should an "opportunity for improvement" be found to exist, it is considered to be a non-conformance (not considered a non-compliance). Non-conformances are not considered to be within the scope of regulatory compliance.

"Chapter 3 – About the DWQMS" covers "Inspections vs. Audits" in more detail.

4. Auditor Qualifications

The DWQMS does not prescribe what training an internal auditor requires to perform internal audits. To compare to typical industry practices, internal auditors usually receive up to 16 hours of classroom training, plus some additional practical experience before undertaking any audits. Choosing the right people to train can improve your results dramatically.

Good auditors can come from any part of your organization. Their work or professional status usually has little bearing on whether or not they will become an effective and respected auditor. Your best auditor may be the administration person who deals with consumers on a day-to-day basis, either in person or on the phone, or a water treatment plant operator.



Technical **Terms**

An **audit** – a systematic and documented verification process that involves objectively obtaining and evaluating evidence to determine whether an Operating Authority's QMS conforms to the requirements of this standard.

Non-conformance – the non-fulfilment of a DWQMS requirement.

Non-compliance – a failure under the *Safe Drinking Water Act, 2002*, the *Ontario Water Resources Act*, or any regulations or instruments under these Acts which are associated with drinking water.

Helpful **Tips**

Large organizations can conduct on-site auditor training that includes role playing and mock audits to help build your auditor's confidence.

Small organizations that cannot support on-site training can take advantage of public auditor training where they share their experiences with, and learn from, participants from other utilities.

Small organizations can take a consortium approach to training and share the costs of an on-site program that would include role playing and audits of the sponsoring facility. The audits conducted by the participants can be included in the sponsoring facility's internal audit program. It may also be helpful to provide audit services for another system, while they audit yours, to ensure an unbiased review.

Volunteer to accompany the Auditor during your accreditation audit. You can observe how a professional auditor conducts interviews and reviews documentation – and this may help you to improve your auditing skills.

Here are some valuable traits for the internal auditor:

- Good communicators (that means listening to the answers to the questions as much as it does the ability to ask them)
- Respected by their peers and valued by their superiors
- Positive people who support the search for solutions
- Understand their role and responsibilities to the organization
- Interested in learning (inquisitive) and are equally interested in sharing their knowledge with others who may benefit
- Comfortable with themselves and with others.

If you would like more information, ISO 19011:2002 "Guidelines for Quality and/or Environmental Management Systems Auditing" is a published standard that outlines useful information about QMS internal audits.

5. Resources

Internal audits are normally conducted by Operating Authority personnel. However, internal auditors cannot objectively audit their own work, or audit processes for which they are responsible. It is difficult for them to remain open-minded when auditing their own work and Top Management cannot be certain that the audit results are accurate. This can present a challenge for you.

> For example, there are many small Operating Authorities that only employ a few full-time staff. It is not unusual for all staff to maintain identical Operator Classifications and have the same responsibility and authority to manage and/or operate all aspects of the works. In cases such as these it may be difficult to assure objectivity when conducting internal audits.

Planning will be required to get internal auditors set up in your system, who can audit objectively.

To address this, internal audits may be conducted by trained auditors from other sources. Other Operating Authorities, industry related associations, or qualified sub-contractors – these are all viable sources for objective internal auditors.

When you have decided who will audit your QMS, create an Internal Audit Procedure using the template provided in Appendix L (see Part II of this Guidance Document). Figure 18.1 shows an example of this section of the Procedure.

Under the "Resources" heading, describe:

- Who will perform internal audits (list them by title, and include the name of the organization if they are from external sources)
- What training you expect them to have completed (usually completion of an "internal audit training" course is suitable
- How much auditing experience you expect them to have

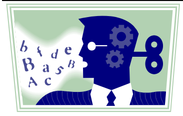
Create a list of your "qualified auditors". Include the list in the procedure, or to make editing easier, refer to the list in the procedure, and keep the list separate.

Figure 18.1: Example of Resources information in the Internal Audit Procedure.

Resources   *Internal audits shall only be conducted by:*   ▪ *ABC Water Operating Authority personnel who have completed internal audit training*   ▪ *Lake Deep Water Works personnel who have completed internal audit training*   ▪ *Personnel from other Operating Authorities who have completed internal audit training and who have completed a minimum of "x" internal audits of their own organizations*   ▪ *Contractors who can provide objective evidence that they possess a minimum of 5 years of relevant auditing experience*   *The QMS Representative shall maintain a list of qualified internal auditors.*

6. Frequency and Scope

Audits are normally planned using a twelve-month rolling schedule to ensure that each requirement of the DWQMS is audited at least once over the course of a year. Some requirements or some processes may need to be addressed semi-annually or even quarterly.



Technical **Terms**

Audit **frequency** – the number of times that an audit occurs per unit 28Htime (e.g. once per year).

Audit **scope** – a description of the extent and boundaries of the audit. Scope usually describes physical locations and organizational activities that are to be covered in the audit.

The frequency and the scope that you choose will depend on your operations, scheduling, and availability of resources. It should also depend on the results of previous audits.

For example, an Operating Authority may find during an annual internal audit that its emergency contact list has not been updated with recent staff changes. As a result, the Operating Authority may audit 'Element 18 – Emergency Management' two times in the coming year, just to check that it is kept up-to-date.

When you have selected a frequency and scope, you should create a basic audit schedule. This will help you plan the resources required for the audit, and indicate what processes are planned to be audited in what month or quarter.

A template for an internal audit schedule is provided in Appendix K (see Part II of this Guidance Documents). Figure 18.2 shows an example of an internal audit schedule.

Figure 18.2: Example of internal audit schedule

Audit Schedule			
Date of Revision:	*June 2006*		
Date	**Process**	**DWQMS Element**	**Auditor(s)**
October 2006	*All processes in scope*	*All elements*	*JM - Lake Ontario Municipality*
October 2007	*All processes in scope*	*All elements*	*JM - Lake Ontario Municipality*

In the Internal Audit Procedure, describe how the frequency and scope are set for internal audits. You should mention here that the planned audit is influenced by the status and importance of the processes and areas to be audited, and previous audit results.

In the procedure, also refer to the audit schedule you have created.

7. Audit Preparation

Typical audit preparation consists of:

- Selection of audit team members (if experts or other auditors are required)
- Review of relevant process and QMS documentation
- Development of an audit checklist(s)

Audit Team Members

In the Internal Audit Procedure, under the "Audit Preparation" section, describe who selects audit team members, how they are selected, and how they are notified.

Review of Information

Auditors should review the DWQMS and any other relevant information in preparation for the audit. Describe this review process in the "Audit Preparation" section.

Audit Checklist

It is suggested that audit checklists be created, to be used as a tool during the audit. As you conduct audits you will be developing checklists and other materials that can be used for other audits, thereby reducing your preparation time. You will also become more familiar with the QMS documentation relating to each of the processes. Hopefully, after one or two complete cycles of internal audits, your preparation time will be reduced.

A template checklist is provided in Appendix M (see Part II of this Guidance Document). In the Internal Audit Procedure, describe who creates the audit checklists, and where they are filed. Figure 18.3 shows an example of the "Audit Preparation" section of the Internal Audit Procedure.

Figure 18.3: Example of audit preparation information

<u>Audit Preparation</u>

Internal auditors shall prepare for scheduled internal audits. Preparation shall include, at a minimum:

- Creating an audit file to be used as a repository for all audit related documentation. The audit file shall be identified by audit date and include a brief description of the area or functions being audited.
- Notifying those responsible for the function(s) to be audited of the upcoming audit at least 5 working days ahead of time.
- Reviewing the appropriate element(s) of the DWQMS and functionally related documentation
- Preparing audit questions (in the form of a checklist). Checklists may be retained for future audits.

Blank audit checklists shall be retained by the QMS Representative and should be made available to the internal auditor as appropriate.

The QMS Representative may review the audit checklist at their discretion.

Helpful **Tips**

Although notification of auditors may seem formal, it is especially important if you are using external resources, such as internal auditors from other Operating Authorities.

Auditors usually have other responsibilities within their own organizations, and may not be available on your planned audit dates. The sooner they are notified, the better.

Failure to complete an internal audit due to poor planning of resources is not acceptable in an audit.

8. Conducting the Audit

This phase of the audit consists of having conversations (some may refer to this as “conducting interviews”) with process owners and reviewing process results (records) to confirm the status of the requirements. The DWQMS requires that your procedures describe how you will conduct the audit (methodology).

In your Internal Audit Procedure, under “Conducting the Audit’, describe how you will use your checklists to collect and record information. Also describe how non-conformances are identified and documented.

Some organizations prefer to have opening or closing meetings for internal audits, as a means to introduce the audit team, and establish the importance of the audit. If you will have opening or closing meetings, describe this in your Internal Audit Procedure.

9. Reporting

This phase of the audit consists of reporting audit findings and communicating the report.

Reporting the audit results to management is typically done twice – once verbally in a closing meeting (if you are conducting closing meetings), and then in a written audit report.

Closing meeting participants should also include all those who participated in the audit. During the meeting, which should only take about 30 minutes, the auditor outlines the positive aspects of the audit and any non-conformances that were discovered. The same information is then provided in a detailed written report.

Decide what information you will include in the audit report, who the report will be issued to, and who will prepare the report. Describe this in your Internal Audit Procedure, under “Audit Report and Follow-Up”.

10. Follow-Up

The audit is not closed until all non-conformances identified in the closing meeting have been corrected and that the corrective action taken has been verified as being effective at eliminating the root cause of the non-conformance.

Your audit procedure should describe how corrective actions will be documented, initiated, and followed up, or refer to a procedure that describes how you will correct QMS non-conformances. “Chapter 23 – Maintenance and Continual Improvement of the QMS” discusses this in more detail.

The procedure should also describe what is required for the audit to be considered “closed”. Target timeframes for response to non-conformances are also wise to include in the procedure. Figure 18.4 shows an example of the “Audit Report and Follow-Up” section of an Internal Audit Procedure.

Figure 18.4: Example of audit report and follow-up information in the Internal Audit Procedure.

Audit Report and Follow-Up

- The auditor shall provide a written report of the findings to the manager of the functional area audited within 7 working days of the audit.
- The audit report should be in narrative form complete with any Corrective Action Reports (if not provided during the closing meeting). A copy of the audit report shall also be provided to the QMS Representative (if he/she is not the manager of the functional area).
- A copy of the audit report, checklist(s), and Corrective Action Reports shall be filed in the audit file maintained by the QMS Representative.
- The Manager assigned in the Corrective Action Report is responsible for the correction of any non-conformities. The Manager shall document corrective actions in the Corrective Action Report.
- The audit shall be considered closed once all corrective actions have been verified as being effective.

11. Procedure Approval

When you have finished preparing your new Internal Audit Procedure, arrange for its review and approval. Provide an approved copy to internal auditors, if they haven't already seen it.

12. Operational Plan: Internal Audit

Make sure that your Operational Plan is updated to include the Internal Audit Procedure. Insert your Internal Audit Procedure, or if you would rather not insert documents into the Operational Plan binder, then just write down where those documents can be found.

Now that the information is prepared, it must be kept up-to-date. Identify the most effective method for making sure that changes in the system are promptly updated in the QMS documentation. Assign specific Operating Authority personnel the responsibility of updating the information prepared under Element 19.

Ready for the **Audit**

What do auditors like to see?

Auditors will expect to see your Internal Audit Procedure that covers the frequency, scope, method, and records for internal audits. The auditor will also expect to review your tools for auditing that are called on in the procedure, such as auditing checklists or an audit schedule, to verify that they meet DWQMS requirements.

The auditor will also request to see your audit schedule, for you to demonstrate that you are planning audits according to your defined frequency. The auditor will verify that the schedule, or your instructions for creating the schedule, takes into consideration the status and importance of the processes and areas to be audited, and the results of previous audits.

13. Training Personnel

The final step in this chapter is to ensure that all relevant personnel in the Operating Authority are aware of the Internal Auditing Procedure requirements.

This can be done informally simply by emailing, posting or discussing the information that you prepared in this chapter with all personnel.

Or, this can be performed later in the implementation during the QMS Awareness sessions. In “Chapter 20 – Completing the QMS Cycle”, the task of training personnel in QMS concepts, including internal auditing, will be discussed.

Complete the Chapter Checklist below, by checking off the items that have been completed. By completing all of the items, you will be ready to move on to the next chapter.

CHAPTER CHECKLIST *Did you make sure…..*	*Check When Complete*
An Internal Audit Procedure has been documented and approved	
The procedure includes a description of who will perform internal audits, including their training and experience requirements	
The procedure includes a description of audit frequency and scope, and how it is planned	
An audit schedule has been created	
The procedure includes a description of audit team member selection in preparation for an audit	
The procedure includes a description of how audit team members review information in preparation for an audit	
The procedure includes a description of how audit checklists are prepared	
The procedure includes a description of how the audit is conducted	
The procedure includes a description of how the audit is reported	
The procedure includes a description of how the audit is followed up	

Chapter 19 – Plan for Management Review

Key Points in Chapter 19

Top Management from the Operating Authority should review the QMS.

Management reviews need not be performed directly by Top Management, particularly for large operating authorities which manage many different systems.

Management reviews ensure top management stay involved in the QMS, and provide direction for continual improvement.

Chapter 19 – Plan for Management Review

1. Translating "Management Review" in the DWQMS

What the Standard says…

20. Management Review

PLAN – The Operational Plan shall document a procedure for management review that evaluates the continuing suitability, adequacy and effectiveness of the Quality Management System and that includes consideration of:

a.) incidents of regulatory non-compliance,
b.) incidents of adverse drinking-water tests,
c.) deviations from critical control point limits and response actions,
d.) the efficacy of the risk assessment process,
e.) internal and third-party audit results,
f.) results of emergency response testing,
g.) operational performance,
h.) raw water supply and drinking water quality trends,
i.) follow-up on action items from previous management reviews,
j.) the status of management action items identified between reviews,
k.) changes that could affect the Quality Management System,
l.) consumer feedback,
m.) the resources needed to maintain the Quality Management System,
n.) the results of the infrastructure review,
o.) Operational Plan currency, content and updates, and
p.) staff suggestions.

DO – Top Management shall implement and conform to the procedure and shall:

a.) ensure that a management review is conducted at least once every twelve months,
b.) consider the results of the management review and identify deficiencies and action items to address the deficiencies,
c.) provide a record of any decisions and action items related to the management review including the personnel responsible for delivering the action items and the proposed timelines for their implementation, and
d.) report the results of the management review, the identified deficiencies, decisions and action items to the Owner.

What does it mean?

The PLAN component of Element 20 requires you to have a procedure for an annual management review, and lists the topics which the management review must cover. A review of these topics, which include compliance, consumer, performance, and audit information, involves management in the QMS cycle.

The DO component of Element 20 requires implementation of and conformance to the procedure. It specifies a maximum twelve month frequency for reviews, and requires that Top Management ensure the review is performed, identifies deficiencies, and reports the results to the Owner. Remember that as a requirement of Element 9 – Organizational Structure, Roles, Responsibilities and Authorities, the person, persons or group of people within the management structure of the organization responsible for undertaking management reviews must be identified.

This chapter provides you with an overview of the management review function and its importance to your QMS. You will create a management review procedure by following the guidance in this chapter.

“Chapter 22 – Performing a Management Review” covers the requirements for actually completing your management review. You must complete Chapters 20 and 21 before you are ready to carry out your first management review.

2. Management Review Overview

Management review is a process where a higher level of managers in the Operating Authority considers various indicators within the QMS. Top Management is responsible for ensuring the review is performed. Delegation of this responsibility may be appropriate for large Operating Authorities with many drinking water systems, but if at all practical, Top Management should perform the review themselves. When effectively implemented, the management review provides Top Management with appropriate and sufficient data to make decisions about the QMS, and record decisions or action items to prompt changes and improvements in the QMS.

These data serve not only as an indicator of QMS performance, but also as input for the decisions that Top Management needs to consider making for ongoing maintenance and continual improvement of the QMS.

The best time to conduct your first management review is at least several months after you have implemented your QMS, prior to initiating the accreditation process, and after you have completed your first internal audit. This allows for the QMS to begin functioning, and for employees to become familiar with the QMS requirements. “Chapter 22 – Performing a Management Review” covers the requirements for actually completing your management review.

3. Assign Management Reviewers

Begin by creating a Management Review Procedure, using the format for procedures that you have established.

Typically, the management review is conducted by Top Management, or other higher levels of management within the Operating Authority – you define the reviewers (Element 9 – Organizational Structure, Roles, Responsibilities and Authorities). You may wish to include other participants who can provide input and insight from an operational perspective that may not be visible to Top Management. The DO component in Element 20 requires that Top Management is responsible for ensuring the review is conducted and conforming to the procedure.

It is always a good idea to include the QMS Representative in the management review. One of the responsibilities of the QMS Representative, from Element 4 of the DWQMS is to “report to Top Management on the performance of the Quality Management System and any need for improvement”. Having the QMS Representative participate in the management review process is one way of satisfying this responsibility. In the procedure, define who will be expected to participate in the management review activities.

4. Frequency

The management review must be conducted at least every twelve months. Depending on the business culture of your operations, and the amount of material to be covered, you may schedule more frequent management reviews (e.g. quarterly) in order to assess QMS indicators within a more relevant time frame.

Remember, looking at data that could be up to one year-old may not be as valuable as looking at data more frequently. Also, a more frequent series of management reviews throughout the year may provide a more realistic view of the condition of your system.

In the management review procedure, define the frequency of management reviews, and how they will be scheduled.

5. What to Consider in Management Reviews

The management review process looks at certain indicators that show how well you have implemented your QMS, and how effectively it is operating.

Management reviewers are required to consider:

- Incidents of regulatory non-compliance,
- Incidents of adverse drinking-water tests,
- Deviations from critical control point limits and response actions,
- The efficacy of the risk assessment process,
- Internal and third-party audit results,
- Results of emergency response testing,
- Operational performance,
- Raw water supply and drinking water quality trends,
- Follow-up on action items from previous management reviews,
- The status of management action items identified between reviews,
- Changes that could affect the Quality Management System,
- Consumer feedback,
- The resources needed to maintain the Quality Management System,
- The results of the infrastructure review,
- Operational Plan currency, content and updates, and
- Staff suggestions.

Other data may be added if you feel it would be valuable for the management review process.

You should have a process in place for collecting and summarizing the data that supports the requirements for management review as not all of this information will be collected as part of the QMS. Assigning this responsibility to the QMS Representative is common, but not necessary.

In the Management Review Procedure, list the information that will be provided to the management reviewers. Describe how this information will be collected, summarized and provided. It is wise to also stipulate a time period within which the information will be provided to the management reviewers. This is a lot of material to review, and sufficient time should be allowed for review.

Ready for the **Audit**

What do auditors like to see?

Auditors will expect to see your Management Review Procedure that shows how you ensure that relevant items are considered during the review.

6. Agenda

As part of your planning for management review, it is worthwhile to create an agenda for the meeting. Although not required under the DWQMS, this will help direct the meeting, and keep discussion on track. There is a considerable amount of information to review, discuss, and make decisions upon, making time management tools very important. The agenda can be part of the procedure, or a separate document.

7. Deficiencies, Decisions and Action Items

During the management review, reviewers discuss the items listed in Step 5. Discussions around resource needs, progress, pitfalls, impending business or operational changes often occur, and should be documented in the minutes. Concerns that are identified should be communicated to Top Management, if Top Management is not directly involved in the management review. Top Management is then responsible for considering these results, and identifying deficiencies in the QMS.

Top Management must also identify action items to address the deficiencies. This can be done at the same management review meeting, if Top Management is part of the management review, or at an alternate meeting, or through email or phone calls. The deficiencies and action items must be documented. Personnel responsible and timelines for delivering action items must also be identified by Top Management, and recorded. All of this information must then be communicated to the Owner.

All of these activities related to deficiencies, decisions and action items, and communication to the Owner, are not performed at this stage, when planning for management review. The DWQMS does not require that you plan these activities, or document the process for these activities in the Management Review Procedure. However, to ensure management reviews are performed consistently, and that the required documentation is in place after a management review, it is wise to outline in the Management Review Procedure, the process for identifying deficiencies, making decisions and identifying action items, and how to communicate them to the Owner.

8. Procedure Approval

When you have completed preparing your Management Review Procedure, arrange for its review and approval. An example of a Management Review Procedure is shown in Figure 19.1. This Operating Authority is responsible for three drinking-water systems, and it has been decided that Top Management will participate directly in management reviews.

Figure 19.1: Example of a Management Review Procedure

Management Review Procedure

1. Frequency

1.1 Top management shall review the QMS on an annual basis to assess and ensure the continuing suitability, adequacy and effectiveness of the QMS.

1.2 Management review(s) shall be included in the internal audit schedule.

2. Reviewers

2.1 Management review participants shall include:

- Operating Authority CEO
- Operating Authority Vice President(s)
- Operating Authority Superintendent
- Water Plant Operations Foreperson
- Water Distribution Operations Foreperson
- QMS Representative

2.2 The CEO may include other personnel at their discretion

2.3 Attendees shall be notified of the management review meeting by email.

3. Process

3.1 The QMS Representative shall provide a summary of the following information in a suitable format to the management review meeting attendees at least 7 days prior to the meeting:

- Incidents of regulatory non-compliance,
- Incidents of adverse drinking-water tests,
- Deviations from critical control point limits and response actions,
- The efficacy of the risk assessment process,
- Internal and third-party audit results,
- Results of emergency response testing,
- Operational performance,
- Raw water supply and drinking water quality trends,
- Follow-up on action items from previous management reviews,
- The status of management action items identified between reviews,
- Changes that could affect the Quality Management System,
- Consumer feedback,
- The resources needed to maintain the Quality Management System,
- The results of the infrastructure review,
- Operational Plan currency, content and updates, and
- Staff suggestions.

3.2 The QMS Representative shall prepare a meeting agenda and distribute the meeting agenda with the management review data.

3.3 The management review participants shall review all data presented, and where necessary, identify deficiencies. These may include deficiencies related to the:

- effectiveness of the QMS and related procedures
- ability of the Operating Authority to implement the QMS
- provision of adequate human and financial resources
- the level of consumer satisfaction.

3.4 For all deficiencies identified, the management review participants shall identify action items, personnel responsible for implementing action items, and timelines for action items.

3.5 Records of management reviews, recommendations, decisions, action items, personnel responsible, and timelines shall be forwarded to the Council Administrator upon completion.

3.6 Records shall be maintained by the QMS Representative. The records shall reflect all new action items and any decisions made by the review team, deficiencies, personnel responsible for action items, and timelines.

9. Operational Plan: Management Review

Make sure that your Operational Plan is updated to include the Management Review Procedure. Insert your Management Review Procedure, or if you would rather not insert documents into the Operational Plan binder, then just write down where those documents can be found.

Now that the information is prepared, it must be kept up-to-date. Identify the most effective method for making sure changes in the system are promptly updated in the QMS documentation. Assign specific Operating Authority personnel the responsibility of updating the information prepared under Element 20.

10. Training Personnel

The final step in this chapter is to ensure all relevant personnel in the Operating Authority are aware of the Management Review Procedure requirements.

This can be done informally, simply by emailing, posting or discussing the information that you prepared in this chapter with all personnel.

Or, this can be performed later in the implementation during the QMS Awareness sessions. In “Chapter 20 – Completing the QMS Cycle”, the task of training personnel in QMS concepts, including management reviews, will be discussed.

Complete the Chapter Checklist below, by checking off the items that have been completed. By completing all of the items, you will be ready to move on to the next chapter.

CHAPTER CHECKLIST	*Check When Complete*
Management reviewers have been designated and a methodology developed	
Items a) to p) in the PLAN component of DWQMS Element 20 have been considered	
Documentation and approval of the Management Review Procedure	

NOTE: Chapters 20 to 23 provide information on what to do to obtain a Certificate of Accreditation (Full Scope).

Depending on the Operational Plan Submission Option chosen by the Owner of the Subject System pursuant to the Director's Direction for Operational Plan Submission, you may not need to follow all of the steps outlined to receive an initial Certificate of Accreditation (Limited Scope).

However, a Certificate of Accreditation (Limited Scope) will only be issued to an Operating Authority on condition that the Operating Authority submits an application for Accreditation (Full Scope) to the Accreditation Body within twelve months of the date of the issuance of the Certificate of Accreditation (Limited Scope).

Chapter 20 – Completing the QMS Cycle

Key Points in Chapter 20

Once you have written your Operational Plan, your work is not done, the QMS cycle is continual.

You must ensure personnel are aware of and using the information in the Operational Plan and supporting documents.

The Operational Plan, the heart of your QMS, must be completed and endorsed by Top Management.

Chapter 20 – Completing the QMS Cycle

1. The QMS Cycle

A cycle is a full rotation through planning, doing, checking and improving your QMS, returning you back to planning activities. So far, by following this Guidance Document, you have completed the "PLAN" and "DO" parts of your QMS cycle. In order to be ready for a full audit, you must have completed at least one full cycle, which means you still must complete the "CHECK" and "IMPROVE" parts. Remaining in your "CHECK" and "IMPROVE" tasks are the requirements laid out in Chapters 21 through 23. However, before you are ready for those chapters, you must have implemented all of the requirements of the DWQMS covered in this Guidance Document to this point, including implementation of all of the steps that have been described.

You must start doing what you say you are doing in the Operational Plan for a short while, in order to generate some records, give personnel experience with their QMS requirements and responsibilities, and test out the effectiveness of the methods that you have implemented.

A good method of ensuring that you have completed the "PLAN" and "DO" parts successfully is to ensure that all of the "Chapter Checklists" have been successfully completed.

This Chapter describes what is involved in completing your QMS cycle.

2. Operational Plan

By following each chapter in this Guidance Document, you have made decisions on how to implement each element of the DWQMS, and completed that implementation. Ensure that the Operational Plan:

- Includes or refers to all of the required documentation for each element of the standard
- Accurately reflects the processes that you have actually implemented (significant changes and adjustments typically occur in your first QMS cycle – those changes must be updated in the Operational Plan accordingly).

3. QMS Awareness Training

Many of the steps that have been described in this Guidance Document require the final task of ensuring personnel are aware of the QMS requirements that are being put into place, especially those related to their specific roles. Depending on their roles, personnel may need to be introduced or refreshed in various QMS procedures and processes. It may be most effective to arrange for training staff grouped by their roles, so that the trainer can focus on role-specific QMS responsibilities.

The table in Figure 20.1 lists some of the key topics that you may want to cover in QMS Awareness training, grouped into trainee roles.

Figure 20.1: QMS Topics that may be covered in role-specific QMS Awareness Training.

Role	***QMS Topic***
Top Management	• QMS Policy • Operational Plan and endorsement • Responsibilities of Top Management • Top Management commitment • Management review • What to expect from internal and third part auditing • Review and provision of infrastructure and resources • Risk assessment and risk assessment outcomes
All Operating Authority staff	• What is a QMS • QMS Policy and Operational Plan • Organizational structure, roles, responsibilities and authorities • Competencies and personnel coverage • QMS communication • Essential supplies and services • Responsibilities of all staff • What to expect from internal and third part auditing • Document and record control • Emergency procedures • The accreditation process • QMS Representative
Operators	• Competencies – awareness of the relevance of their duties and how they affect safe drinking water • Responsibilities of Operators • Risk assessment and risk assessment outcomes • Essential supplies and services – Operator-specific responsibilities • Measurement and recording equipment calibration and maintenance – Operator-specific responsibilities • Sampling and recording – Operator-specific responsibilities • Emergency management - Operator-specific responsibilities
Maintenance	• Risk assessment and risk assessment outcomes • Infrastructure rehabilitation and renewal – maintenance-specific responsibilities • Measurement and recording equipment calibration and maintenance – maintenance-specific responsibilities • Sampling and recording – maintenance-specific responsibilities • Emergency management - maintenance-specific responsibilities
Administration/ Purchasing	• Essential supplies and services – specific responsibilities • Document and records control – administration-specific responsibilities
Emergency Response Teams	• Emergency management – response team responsibilities
Internal Auditors	• Internal auditing - auditor responsibilities

Step 4 in "Chapter 13 – Communications" describes various methods for training personnel. Decide which method of training may be most effective for your drinking-water system.

Remember some helpful goals when planning any training session:

- keep the training material interesting – if the trainer is not interested, the trainees won't be interested
- use examples to help people understand
- be brief, but don't skim through important information
- organize the trainees by similar role, so that everyone can relate to specific examples
- use various media – don't just talk
- make it interactive – if trainees perform group activities or practise using forms right away, they will better retain the information.

Ensure that you record who has received this information, to serve as a training record. If familiarity with this information is a competence requirement for people to perform their roles, add this requirement to your Competencies Requirements Table (described in "Chapter 12 – Competencies and Personnel Coverage").

Before you will be ready for your internal audit, you must ensure that personnel are aware of their new roles and responsibilities, especially related to the topics listed above.

4. Updates to the QMS

As you continue to use the new information in your QMS, ensure that updates are made as required. Updates may be prompted by feedback from personnel, personal observation, or top management, as a result of observing an error, omission, ineffectiveness, or potential improvement.

Updates to the QMS may also come about as a result of changes in your operations, infrastructure, or personnel. Updates may result from reviewing an emergency.

You will also likely update the QMS following an internal audit and management review, which are described in the next few chapters.

5. Completing and Endorsing the Operational Plan

It is now time to complete any missing or unfinished information in your Operational Plan. You created the required information for your Operational Plan in Chapters 8 through 19 – ensure that this information is complete.

When your Operational Plan has been completed, ensure that your document control requirements are applied, including a date of revision.

The Plan must be submitted to Top Management for endorsement, and to the Owner.

6. Document and Record Requirements

At this stage in your implementation, you should check that all of your required documents and records are in place. Check that the following documents are in place, as required:

- Your Operational Plan
- All of the reference documents that are cited in the Operational Plan
- Training records
- Other records, and
- Reports and documents required by legislation

Following your requirements under Document and Records Control (Chapter 8), this information should be easy to locate, and retrievable.

Ready for the **Audit**

What do auditors like to see?

In completing this Chapter and your first QMS cycle, auditors are looking for:

- Operating Authority awareness of the QMS, at all levels (usually by interviewing and asking general questions, they can assess how well the QMS has been communicated)
- Records to show your QMS procedures are being followed
- Documented, approved and implemented QMS Policy, Operational Plan, and procedures
- Updates and edits being made to procedures, forms or other documents, to show that the QMS is improving and changing (It is good to change documents! It shows that the QMS is active)
- An endorsed Operational Plan that Operating Authority personnel are aware of

Complete the Chapter Checklist below, by checking off the items that have been completed. By completing all of the items, you will be ready to move on to the next chapter.

CHAPTER CHECKLIST	*Check When Complete*
Personnel are aware of the QMS requirements that are applicable to their roles and responsibilities	
Personnel are using the information in the Operational Plan and the QMS procedures	
Records have been generated to show that procedures are being followed	
Completion of the Operational Plan	
The Operational Plan has been endorsed by Top Management and by the Owner	
DWQMS required documentation is in place	
The "Ready for the Audit" margin tips for this chapter have been completed	

Chapter 21 – Performing an Internal Audit

Key Points in Chapter 21

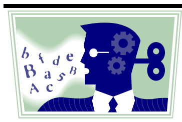
An internal audit must be fully complete before you are eligible for an accreditation audit.

Non-conformances identified in an internal audit are not a reflection of poor performance.

You cannot learn how to conduct internal audits by reading this Guidance Document alone - auditing requires auditing skills, knowledge of the DWQMS, and experience.

Internal audits require time to prepare and time to conduct.

Chapter 21 – Performing an Internal Audit



Technical **Terms**

An **audit** – a systematic and documented verification process that involves objectively obtaining and evaluating documents and processes to determine whether a Quality Management System conforms to the requirements of the DWQMS.

1. Translating "Internal Audits" in the DWQMS

Now that you have completed the first cycle of your QMS, you are ready to arrange for an internal audit. At least one full internal audit must be performed before you are eligible for an accreditation audit.

The audit schedule that was described in "Chapter 18 – Plan for Internal Audit" should reflect that an internal audit is now due.

2. Audit Preparation

Internal auditors should prepare for the audit by following the preparation information in your Internal Audit Procedure. Preparation activities should include selection of audit team members, review of relevant process and QMS documentation, and development of audit checklists.

In the future, when an internal audit has already been completed, part of your audit preparations should be a review of previous audit results. Also, any corrective actions requested or taken for the processes to be audited should also be reviewed. It is very important to ensure that all corrective action requests are addressed in a timely manner.

3. Conducting the Audit

This phase of the audit consists of having conversations (some may refer to this as "conducting interviews") with process owners and reviewing process results (records) to confirm the status of the requirements. As the audit is conducted, if items are found that are missing, incomplete, or ineffective, these will be identified as non-conformances.

Internal auditors should conduct the audit by following the Internal Audit Procedure. When this phase of the audit is complete, the auditors should have completed checklists, and identified non-conformances.

Initiating conversations (conducting interviews) within the context of an internal audit can be a very difficult thing for many people to do. Even with a checklist in hand and knowledge of the process and related documentation a new auditor may experience a great deal of difficulty getting started and then staying on track. Whether you are the auditor, the Operating Authority being audited, or management – be patient.

As the auditor you set the pace of the audit. Take the time you need to make notes. Take the time to review as many records or other documents as necessary to confirm that the process you are auditing has been effectively implemented.

4. Reporting and Follow-Up

Internal auditors must communicate their findings to the Operating Authority by following your Internal Audit Procedure. Ensure a documented audit report is filed, as this is your proof that the internal audit was performed.

Internal auditors must follow up on the internal audit at a later date by reviewing the status of the non-conformances identified. Again, the follow-up instructions in the Internal Audit procedure should be followed.

5. Correcting Non-conformances

Addressing non-conformances is one of the most important parts of your internal audit, and your QMS. This is a crucial step in improving your QMS, and completing the QMS cycle.

Non-conformances identified in the Internal Audit must be addressed. *You should not initiate your accreditation audit until you are certain that you have addressed all non-conformances from your internal audit.*

There are four options here:

1) Accept the corrective action as stated
2) Conduct a follow-up assessment to confirm that the corrective action has been effectively implemented
3) Accept the corrective action as stated – pending confirmation during the next internal audit of that process
4) Reject the corrective action as not being effective (as a result of 1, 2 or 3 above) and request that an additional or different action be taken.

Make sure to document the results of your follow-up activities and report the results to management. If you have rejected the corrective action proposed or taken, then the audit file remains open until acceptable corrective action has been completed.

The effectiveness of the corrective actions should also be checked and documented.

"Chapter 23 – Maintenance and Continual Improvement of the QMS" discusses continual improvement and corrective actions in more detail.

6. Audit Schedule

Ensure the audit schedule has been updated, to reflect the next scheduled audit dates.

Non-conformances identified at this internal audit may influence the audit schedule, as described in “Chapter 18 – Plan for Internal Audit”.

7. Dilemma: Auditing “management review’

In the first cycle of any quality management system, a challenge always arises with completion of the internal audit and management review. You have not yet completed the management review; it is covered in the next chapter. Management review is usually performed after the internal audit, because management review requires the results of the internal audit to be considered.

A “Catch 22” arises due to this - the internal audit requires an audit of the management review portion of the QMS. Since management review is not yet complete, you will only be able to audit the planned review information, and the description of management review in the Operational Plan, but not any actual management review records. The internal audit is thus incomplete, until management review records can be audited.

To overcome this, it is recommended that after the management review is completed, internal auditors review the management records to “complete” the internal audit. Results of the final review can be added to the audit report, or issued as a separate small report.

This could be done in reverse, but scheduling management to re-convene a second time in order to re-review the results of the internal audit, is more challenging.

Ready for the **Audit**

What do auditors like to see?

Auditors will expect to see your internal audit results, such as completed checklists or a report, and the nonconformances identified.

Auditors will be checking that the internal auditors reviewed the conformance of your QMS to the DWQMS requirements, and also checked that the QMS has been implemented and maintained.

Auditors may interview internal auditors, to discuss their audit findings. Auditors may also interview personnel to whom the audit results were reported to, to discuss actions taken.

Auditors may also review your corrective actions made as a result of the nonconformances, how they were documented, and how they were checked to ensure they were effective corrections.

Complete the Chapter Checklist below, by checking off the items that have been completed. By completing all of the items, you will be ready to move on to the next chapter.

CHAPTER CHECKLIST *Did you make sure…..*	*Check When Complete*
An Internal Audit was completed to evaluate conformity of the QMS with the requirements of the DWQMS?	
The Internal audit procedure was followed, including resources, audit preparation, conducting the audit, reporting, and follow-up?	
An audit report was prepared?	
Results of the internal audit were communicated to key personnel?	
Management Review records are scheduled to be reviewed after the Management Review is complete?	
The audit schedule has been updated?	
Corrective actions were made to fix the non-conformances?	
Corrective actions were checked for effectiveness?	
Corrective actions were documented?	

Chapter 22 – Performing a Management Review

Key Points in Chapter 22

A completed management review of the entire QMS is a requirement for accreditation.

Management review is the best method to keep the QMS and Top Management “connected”.

The results of management review can summarize the condition of your QMS.

Chapter 22 – Performing a Management Review

Ready for the
Audit

What do auditors like to see?

Auditors will expect to see your management review records, such as minutes, to review what was discussed, who attended, what material was provided to reviewers, decisions made, action items, and assignment of personnel and timelines for deficiencies.

Auditors will review a sample of the decisions and action items, to investigate if action has actually occurred.

Auditors may also interview managers who attended, to discuss the review process and decisions.

The overall intent of the auditor is to verify that improvement is actually taking place as a result of the management review.

1. Translating the DWQMS

Now that you have completed the first cycle of your QMS, and your first internal audit, you are ready to arrange for a management review of the QMS. At least one management review must be performed before you are eligible for an accreditation audit. Use this information to meet the communication requirements between Operating Authority and the Owner (See “Chapter 13 - Communications”).

2. Preparing for the Review

Staff with assigned responsibilities should prepare for the management review by following the information in your Management Review Procedure, described in “Chapter 19 – Plan for Management Review”. Based on the requirements in your Management Review Procedure, preparation activities should include:

- Scheduling of the meeting
- Invitations to the reviewers
- Collecting and summarizing the required material for review
- Distributing the material to reviewers, and
- Creating the meeting agenda.

3. Performing the Review

Following the agenda and the Management Review Procedure, a management review should be performed. Management reviewers should discuss and consider all of the items from the PLAN component of Element 20. Concerns that are identified should be communicated to Top Management, if Top Management is not directly involved in the management review.

Top Management is responsible for considering these results, and identifying deficiencies in the QMS. Top Management must also identify action items to address the deficiencies. This can be done at the same management review meeting, if Top Management is part of the management review, or at an alternate meeting, or through email or phone calls. The deficiencies and action items must be documented. Personnel responsible and timelines for delivering action items must also be identified by Top Management, and recorded.

All of this information must then be communicated to the Owner. Ensure that the Owner receives the results of the management review, and the decisions, action items, personnel responsible and timelines, identified by Top Management. Figure 22.1 shows an example result of a management review and Top Management decisions and action items.

Remember, the overall intent of management review is to finish the QMS cycle, ensuring Top Management sees how the QMS has performed, and initiates improvements. Continual improvement is also discussed in "Chapter 23 – Maintenance and Continual Improvement of the QMS" in more detail.

Figure 22.1: Sample table of management review results, decisions, action items, personnel responsible, and timelines.

Decision or Deficiency	***Action Item***	***Personnel Responsible***	***Timeline***
Internal auditors don't have sufficient available time to perform complete audit in one year, and need to perform audits more frequently than once per year to 'use' their new audit skills	▪ *Edit job descriptions for internal auditors to include auditor responsibilities.* ▪ *Supervisor, not auditor, must book calendar days for auditing, to block time, one month in advance of scheduled audit* ▪ *Audits in 2006 and 2007 to be quarterly, covering all elements in one year* ▪ *Auditors allowed four hours of prep time before each audit* ▪ *Administrator to update QMS documents to reflect these changes*	▪ *Supervisor* ▪ *Admin (documents only)*	▪ *QMS documents due Nov 2006* ▪ *Audits booked for year by Nov 2006*
2008 expansion will mean new hires, updates to documents to reflect new equipment	▪ *Ensure QMS training for new hires is integrated into the timeline and project task list for the expansion* ▪ *Ensure Supervisor is aware that QMS Rep will require extra time to review and update documents in 2007 and 2008*	▪ *Supervisor*	▪ *Due by Jan 2007*

Note: The above table has been developed to describe concepts and should not be interpreted as being necessarily suggested or required by the Ministry.

Complete the Chapter Checklist below, by checking off the items that have been completed. By completing all of the items, you will be ready to move on to the next chapter.

CHAPTER CHECKLIST	*Check When Complete*
Completion of management review using the Management Review procedure	
Inputs to the management review included all of the items listed in the PLAN requirement of DWQMS Element 20	
The review outcome was documented, including action items and decisions	
Action items and decisions include assignment of personnel and timeframes for completion of tasks	
Action items are being carried out	

Chapter 23 – Maintenance and Continual Improvement of the QMS

Key Points in Chapter 23

The journey isn't over once you are accredited, it is just beginning.

Plan for resources to remain available for the QMS every year.

Chapter 23 – Maintenance & Continual Improvement of the QMS

1. Maintenance and Improvement Overview

You might have already heard someone say… "Anybody can be that good on that day, for that auditor. The real proof that you have a robust QMS is that it delivers positive results year in and year out." Developing and implementing a QMS means that a commitment is also required to maintain and improve it.

Day One for your QMS is the day after being recommended for accreditation. While the work associated with the development and implementation of your QMS has now been successfully completed, the use of your QMS, day in and day out, to manage the activities that provide safe drinking water begins.

To ensure that the QMS delivers positive results year in and year out, the Operating Authority must commit to:

- Keeping QMS documentation current
- Reviewing any changes in employee turnover, sources of purchased supplies and services, and changes/upgrades in equipment and technology that may affect the QMS
- Ensuring that new employees and new suppliers are advised of their responsibilities under the QMS
- Maintaining the internal audit program and responding in a timely manner to all findings
- Continuing to conduct meaningful management reviews
- Closing the loop on all corrective actions and,
- Initiating continual improvement projects

Time and money will also be required for the third party surveillance audits, as well as the re-accreditation of your full QMS.

Water treatment and distribution equipment is maintained in order to prolong its service. If you do not effectively maintain it, you will see decreased performance followed by the eventuality of catastrophic failure. From time to time, you might also "rebuild" a piece of equipment to ensure that it meets ongoing performance requirements. But rarely, if ever, does maintaining a piece of equipment mean doing things to continually improve its ability to exceed the specifications it was originally designed to meet.

Maintenance of a QMS is different. The QMS is flexible enough to meet the needs of a changing organisation, the requirements of a changing infrastructure and even to keep pace with changing technologies. Your QMS is only limited by those who use it. So, if you are effectively maintaining and continually improving your QMS (to reflect changes in infrastructure or improvements in technologies), you are also supporting the processes that give the Owner and consumer the confidence that they are drinking safe water.

2. Continual Improvement

What the Standard says…

21. Continual Improvement

DO - The Operating Authority shall strive to continually improve the effectiveness of its Quality Management System through the use of corrective actions.

What does it mean?

Element 21, the final element of the DWQMS, requires that you follow the QMS cycle – striving to make improvements to your QMS. Specifically, the DWQMS requires that you use corrective actions. A corrective action process helps to identify, document and make these improvements.

Continual Improvement is understanding what you already do well, then finding ways to do it better. Corrective Action is a method of improvement, and the solutions that are generated by those actions are also input to Continual Improvement.

Statistically speaking Continual Improvement addresses common cause, while Corrective Action addresses special cause.

The purpose of your QMS is to reduce and ultimately eliminate the variation in your processes that may lead to nonconformances. During the development and implementation phase you are engaged primarily in corrective action – eliminating the causes or causes of nonconformances in your QMS.

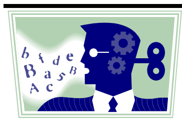
Over time, as those nonconformances decrease, your efforts will shift to Preventative Action – finding ways to eliminate the potential for nonconformances in your QMS, not unlike what you may have done to meet the risk assessment requirements of Elements 7 and 8 of the DWQMS. Ultimately, the goal is to learn and apply continual improvement tools and methodologies to your QMS.

It is recommended that you take a broader approach to continual improvement. There are a lot of data generated by water treatment and distribution processes – especially the sampling and monitoring that occurs within those processes. The analysis of these data for trends and opportunities for improvement should be considered as an integral part of your continual improvement efforts.

Commentary from all stakeholders generated by the publication of the QMS Policy also serves as input – particularly those comments that relate to directly to improving consumer satisfaction. Remember though, having a process for effective handling of consumer complaints is part of your corrective action process.

As your QMS stabilizes, the data providing information related to customer satisfaction, trends of the processes related to the production and distribution of safe drinking water and of supplier performance can be used to identify potential continual improvement opportunities.

3. Corrective Actions



Technical **Terms**

Corrective Action is what we do to "fix" something that's broken – or, in QMS terms – an action to eliminated the cause of a detected non-conformity of the QMS with the requirements of the DWQMS or other undesirable situation.

The most efficient way to improve the effectiveness of the QMS, and to demonstrate that improvements have been made, is to record corrective actions. At a minimum, your process of recording QMS corrective actions should ensure the following information is recorded:

- The date that a quality-related problem, deviation, or nonconformance occurred, or was identified
- A description of the non-conformance
- A description of the corrective actions being taken
- Responsibilities and timelines for corrective actions
- A signoff by the responsible employee once the corrective actions are complete.

A corrective action should also prompt the Operating Authority to investigate, correct and record the root cause of the non-conformance, so that the problem does not recur.

Create a form to record corrective actions, or use an existing process for documenting corrective actions to include QMS corrective actions. Ensure that the above information is recorded for each corrective action. The corrective action form is often used as a 'request form', so that correction is prompted by the initiation of the form. This makes the process of documenting corrective actions better planned.

A sample form is shown in Figure 23.1, and also provided in Appendix O (see Part II of this Guidance Document).

Incorporate your form into your Operational Plan, and describe your general corrective action process.

Figure 23.1: Sample corrective action form

QMS Corrective Action Form

Date:
July 5, 2006

Description:
Taste complaint not followed up properly, as required in Taste Complaint Procedure P101
On July 1/06, a taste complaint was called in to the main switchboard at 6:55pm. The dayshift Operator (Joan) wrote down details of the complaint into the Operator's Log Book. Since the shift ended at 7pm, the Operator left instructions for the nightshift Operator (Tom) to continue the paperwork and follow up. The nightshift Operator read the Operator's Log Book, but did not see the instructions. The complaint was not documented or followed up properly. When the dayshift Operator returned for her next shift on July 5, 2006, she noticed that the complaint hadn't been handled and notified the QMS Representative.

Root Cause:
Personnel error – inattention to detail: When beginning the shift, the Operator did not perform a thorough review of all items listed in the Operator Log Book.
Verbal communication problem: Although written in the Log Book, the Operator did not also verbally discuss issues of significant importance with the next shift Operator, to ensure they were understood and acknowledged.

Corrective Action Taken:
All operators briefed in person by QMS Rep about:
- *receiving and handling taste and odour complaints*
- *the importance of Log Book review, and*
- *the importance of verbal communication between shifts.*

Communication Procedure P102 – modified to include specific instructions about shift change communication. Also training Records were modified to reflect updated training in Taste and Odour complaints

Corrective Action Complete (signature and title):
Joan - Operator

Date Corrective Action Complete:
August 1, 2006

Corrective Action Effective after 90 days:
- Yes
- No communication issues between Operators
- Taste complaint Aug 5/06 handled correctly

Form last revised: November 1, 2005

4. Internal Auditing

Internal auditing is one area that may still require significant resources in your first few years after accreditation. Figure 25.1 shows some example maintenance requirements for internal audits of various systems.

Note: The estimates in Figure 25.2 are only to illustrate audit planning/maintenance requirements. The amount of time required depends upon the specifics of your works.

Figure 25.2: Example maintenance requirements for internal audits of various systems

<u>Small Works – WTP and Distribution -</u> *Approximately 80 - 180 person hours per year*

Frequency:
10 audits per year (covering all elements once per year)

Auditor:
- 6 - 12 hrs per audit (preparation, conducting the audit, reporting)
- 10 audits per year
- totals 60 - 120 hours per year

Operating Authority:
- 2 – 6 hrs per audit (interviews, meetings, corrective action)
- 10 audits per year
- totals 20 – 60 hours per year

<u>Large Works – Multiple Plants/Locations and multiple distribution systems -</u> *Approximately 240 - 720 person hours per year*

Frequency:
10 audits per year (covering all elements once per year)

Auditor:
- 6 - 12 hrs per audit (preparation, conducting the audit, reporting)
- 10 audits per year
- 3 - 4 auditors
- totals 180 - 480 hours per year

Operating Authority:
- 2 – 6 hrs per audit (interviews, meetings, corrective action)
- 10 audits per year
- 3 – 4 auditors
- totals 60 – 240 hours per year

Helpful **Tips**

Reduce costs and improve the effectiveness of your internal audits by focusing on those areas that have historically had the most "opportunity for improvement".

Combine your management review with already scheduled meetings that are intended to address the status of the "business".

Schedule and space your audits. Attempting to conduct internal audits all in one quarter or month of the year will not provide an accurate reflection of your system after implementation.

PART II

Templates for Procedures
And Example

Part II – Template for Procedures and Example

A P P E N D I C E S

List of Templates/Example

Appendix A

DWQMS GAP ANALYSIS CHECKLIST

DWQMS Gap Analysis Checklist

DATE OF GAP ANALYSIS:

REVIEWER NAMES:

AREAS VISITED:

PEOPLE INTERVIEWED:

GAP ANALYSIS CHECKLIST

DWQMS Requirement	Notes	Method in Place?	Documented?	Gap?
1. Quality Management System PLAN – The Operational Plan shall document a Quality Management System that meets the requirements of this Standard.		PL		
DO – The Operating Authority shall establish and maintain the Quality Management System in accordance with the requirements of this Standard and the policies and procedures documented in the Operational Plan.		DO		
2. Quality Management System Policy PLAN – The Operational Plan shall document a Quality Management System Policy that provides the foundation for the Quality Management System, and:		PL		
a.) is appropriate for the size and type of the subject system,		a.)		
b.) includes a commitment to the maintenance and continual improvement of the Quality Management System,		b.)		
c.) includes a commitment to the consumer to provide safe drinking water,		c.)		
d.) includes a commitment to comply with applicable legislation and regulations, and		d.)		
e.) is in a form that provides for ready communication to all Operating Authority personnel, the Owner and the public.		e.)		
DO – The Operating Authority shall establish and maintain a Quality Management System that is consistent with the Policy.		DO		
3. Commitment and Endorsement PLAN – The Operational Plan shall contain a written endorsement of its contents by Top Management and the Owner.		PL		

DWQMS Requirement	Notes	Method in Place?	Documented?	Gap?
DO – Top Management shall provide evidence of its commitment to an effective Quality Management System by:		DO		
a.) ensuring that a Quality Management System is in place that meets the requirements of this Standard,		a.)		
b.) ensuring that the Operating Authority is aware of all applicable legislative and regulatory requirements,		b.)		
c.) communicating the Quality Management System according to the procedure for communications, and		c.)		
d.) determining, obtaining or providing the resources needed to maintain and continually improve the Quality Management System.		d.)		
4. Quality Management System Representative PLAN – The Operational Plan shall identify a Quality Management System representative.		PL		
DO – Top Management shall appoint, and authorize a Quality Management System representative who, irrespective of other responsibilities, shall:		DO		
a.) administer the Quality Management System by ensuring that processes and procedures needed for the Quality Management System are established and maintained,		a.)		
b.) report to Top Management on the performance of the Quality Management System and any need for improvement,		b.)		
c.) ensure that current versions of documents required by the Quality Management System are being used at all times,		c.)		
d.) ensure that personnel are aware of all applicable legislative and regulatory requirements that pertain to their duties for the operation of the subject system, and		d.)		
e.) promote awareness of the Quality Management System throughout the Operating Authority.		e.)		

DWQMS Requirement	Notes	Method in Place?	Documented?	Gap?
5. Document and Records Control PLAN – The Operational Plan shall document a procedure for document and records control that describes how:		PL		
a.) documents required by the Quality Management System are: i. kept current, legible and readily identifiable		i.		
ii. retrievable		ii.		
iii. stored, protected, retained and disposed of, and		iii.		
b.) records required by the Quality Management System are: i. kept legible, and readily identifiable		i.		
ii. retrievable		ii.		
iii. stored, protected, retained and disposed of.		iii.		
DO – The Operating Authority shall implement and conform to the procedure for document and records control and shall ensure that the Quality Management System documentation for the subject system includes:		DO		
a.) the Operational Plan and its associated policies and procedures,		a.)		
b.) documents and records determined by the Operating Authority as being needed to ensure the effective planning, operation and control of its operations, and		b.)		
c.) the results of internal and external audits and management reviews.		c.)		
6. Drinking-Water System PLAN – The Operational Plan shall document, as applicable:		PL		
a.) for the subject system: i. a description of the system including all treatment processes and distribution system components		i.		
ii. the name of the Owner and Operating Authority		ii.		
iii. a process flow chart		iii.		
iv. a description of the water source, including:		iv.		

DWQMS Requirement	Notes	Method in Place?	Documented?	Gap?
i. general characteristics of the raw water supply		i.		
ii. common event-driven fluctuations and		ii.		
iii. any resulting operational challenges and threats		iii.		
v. a description of any critical upstream or downstream processes relied upon to ensure the provision of safe drinking water.		v.		
b.) if the subject system is an operational subsystem, a summary description of the municipal residential drinking-water system it is a part of.		b.)		
c.) if the subject system is connected to one or more other drinking-water systems owned by different owners, a summary description of those systems which:		c.)		
i. indicates whether the subject system obtains water from or supplies water to those systems, and		i.		
ii. names the Owner and Operating Authority of those systems.		ii.		
DO – The Operating Authority shall ensure that the description of the drinking-water system is kept current.		DO		
7. Risk Assessment PLAN – The Operational Plan shall document a risk assessment process that:		PL		
a.) identifies potential hazardous events and associated hazards,		a.)		
b.) assesses the risks associated with the occurrence of hazardous events,		b.)		
c.) ranks the hazardous events according to the associated risk,		c.)		
d.) identifies control measures to address the potential hazards and hazardous events,		d.)		
e.) identifies critical control points,		e.)		
f.) identifies a method to verify at least once a year, the currency of the information and the validity of the assumptions used in the risk assessment,		f.)		

DWQMS Requirement	Notes	Method in Place?	Documented?	Gap?
g.) ensures that a risk assessment is conducted at least once every thirty-six months, and		g.)		
h.) considers the reliability and redundancy of equipment.		h.)		
DO – The Operating Authority shall perform a risk assessment consistent with the documented process.		DO		
8. Risk Assessment Outcomes PLAN – The Operational Plan shall document:		PL		
a) the identified potential hazardous events and associated hazards,		a.)		
b) the assessed risks associated with the occurrence of hazardous events,		b.)		
c) the ranked hazardous events,		c.)		
d) the identified control measures to address the potential hazards and hazardous events,		d.)		
e) the identified critical control points and their respective critical control limits,		e.)		
f) procedures and/or processes to monitor the critical control limits,		f.)		
g) procedures to respond to deviations from the critical control limits, and		g.)		
h) procedures for reporting and recording deviations from the critical control limits.		h.)		
DO – The Operating Authority shall implement and conform to the procedures.		DO		
9. Organizational Structure, Roles, Responsibilities and Authorities PLAN – The Operational Plan shall:		PL		
a) describe the organizational structure of the Operating Authority including respective roles, responsibilities and authorities,		a.)		
b) delineate corporate oversight roles, responsibilities and authorities in the case where the Operating Authority operates multiple subject systems,		b.)		

DWQMS Requirement	Notes	Method in Place?	Documented?	Gap?
c) identify the person, persons or group of people within the management structure of the organization responsible for undertaking the Management Review,		c.)		
d) identify the person, persons or group of people, having Top Management responsibilities required by this Standard, along with their responsibilities, and		d.)		
e) identify the Owner of the subject system.		e.)		
DO – The Operating Authority shall keep current the description of the organizational structure including respective roles, responsibilities and authorities, and shall communicate this information to Operating Authority personnel and the Owner.		DO		
10. Competencies PLAN – The Operational Plan shall document:		PL		
a.) competencies required for personnel performing duties directly affecting drinking water quality,		a.)		
b.) activities to develop and maintain competencies for personnel performing duties directly affecting drinking water quality, and		b.)		
c.) activities to ensure that personnel are aware of the relevance of their duties and how they affect safe drinking water.		c.)		
DO – The Operating Authority shall undertake activities to:		DO		
a.) meet and maintain competencies for personnel directly affecting drinking water quality and shall maintain records of these activities, and		a.)		
b.) ensure that personnel are aware of the relevance of their duties and how they affect safe drinking water, and shall maintain records of these activities.		b.)		

DWQMS Requirement	Notes	Method in Place?	Documented?	Gap?
11. Personnel Coverage PLAN – The Operational Plan shall document a procedure to ensure that sufficient personnel meeting identified competencies are available for duties that directly affect drinking water quality.		PL		
DO – The Operating Authority shall implement and conform to the procedure.		DO		
12. Communications PLAN – The Operational Plan shall document a procedure for communications that describes how the relevant aspects of the Quality Management System are communicated between Top Management and: a.) the Owner, b.) Operating Authority personnel, c.) Suppliers, and d.) the public.		PL		
		a.)		
		b.)		
		c.)		
		d.)		
DO – The Operating Authority shall implement and conform to the procedure.		DO		
13. Essential Supplies and Services PLAN – The Operational Plan shall: a.) identify all supplies and services essential for the delivery of safe drinking water and shall state, for each supply or service, the means to ensure its procurement, and b.) include a procedure by which the Operating Authority ensures the quality of essential supplies and services, in as much as they may affect drinking water quality.		PL		
		a.)		
		b.)		
DO – The Operating Authority shall implement the procedure.		DO		
14. Review and Provision of Infrastructure PLAN – The Operational Plan shall document a procedure for the annual review of the adequacy of the infrastructure necessary to operate and maintain the subject system.		PL		

DWQMS Requirement	Notes	Method in Place?	Documented?	Gap?
DO – The Operating Authority shall implement and conform to the procedure and communicate the findings of the review to the Owner.		DO		
15. Infrastructure Maintenance, Rehabilitation and Renewal PLAN – The Operational Plan shall document a summary of the Operating Authority's infrastructure maintenance, rehabilitation and renewal programs for the subject system.		PL		
DO – The Operating Authority shall: a.) keep the summary current, b.) communicate the programs to the Owner, and c.) monitor the effectiveness of the maintenance program.		PL		
		a.)		
		b.)		
		c.)		
16. Sampling, Testing and Monitoring PLAN – The Operational Plan shall document: a.) a sampling, testing and monitoring procedure for process control and finished drinking water quality including requirements for sampling, testing and monitoring at the conditions most challenging to the subject system, b.) a description of any relevant sampling, testing or monitoring activities that take place upstream of the subject system, and c.) a procedure that describes how sampling, testing and monitoring results are recorded and shared between the Operating Authority and the Owner, where applicable.		PL		
		a.)		
		b.)		
		c.)		
DO – The Operating Authority shall implement and conform to the procedures.		DO		
17. Measurement and Recording Equipment Calibration and Maintenance PLAN – The Operational Plan shall document a procedure for the calibration and maintenance of measurement and recording equipment.		PL		

DWQMS Requirement	Notes	Method in Place?	Documented?	Gap?
DO – The Operating Authority shall implement and conform to the procedure.		DO		
18. Emergency Management PLAN – The Operational Plan shall document a procedure to maintain a state of emergency preparedness that includes:		PL		
a.) a list of potential emergency situations or service interruptions,		a.)		
b.) processes for emergency response and recovery,		b.)		
c.) emergency response training and testing requirements,		c.)		
d.) Owner and Operating Authority responsibilities during emergency situations,		d.)		
e.) references to municipal emergency planning measures as appropriate, and		e.)		
f.) an emergency communication protocol and an up-to-date list of emergency contacts.		f.)		
DO – The Operating Authority shall implement and conform to the procedure.		DO		
19. Internal Audits PLAN – The Operational Plan shall document a procedure for internal audits that:		PL		
a.) evaluates conformity of the QMS with the requirements of this Standard,		a.)		
b.) identifies internal audit criteria, frequency, scope, methodology and record-keeping requirements,		b.)		
c.) considers previous internal and external audit results, and		c.)		
d.) describes how Quality Management System corrective actions are identified and initiated.		d.)		
DO – The Operating Authority shall implement and conform to the procedure and shall ensure that internal audits are conducted at least once every twelve months.		DO		

DWQMS Requirement	Notes	Method in Place?	Documented?	Gap?
20. Management Review PLAN - The Operational Plan shall document a procedure for management review that evaluates the continuing suitability, adequacy and effectiveness of the Quality Management System and that includes consideration of:		PL		
a.) incidents of regulatory non-compliance,		a.)		
b.) incidents of adverse drinking-water tests,		b.)		
c.) deviations from critical control point limits and response actions,		c.)		
d.) the efficacy of the risk assessment process,		d.)		
e.) internal and third-party audit results,		e.)		
f.) results of emergency response testing,		f.)		
g.) operational performance,		g.)		
h.) raw water supply and drinking water quality trends,		h.)		
i.) follow-up on action items from previous management reviews,		i.)		
j.) the status of management action items identified between reviews,		j.)		
k.) changes that could affect the Quality Management System,		k.)		
l.) consumer feedback,		l.)		
m.) the resources needed to maintain the Quality Management System,		m.)		
n.) the results of the infrastructure review,		n.)		
o.) Operational Plan currency, content and updates, and		o.)		
p.) staff suggestions.		p.)		
DO – Top Management shall implement and conform to the procedure and shall:		DO		
a.) ensure that a management review is conducted at least once every twelve months,		a.)		
b.) consider the results of the management review and identify deficiencies and actions items to address the deficiencies,		b.)		
c.) provide a record of any decisions and action items related to the management review including the personnel responsible for delivering the action items and the proposed timelines for their implementation,		c.)		

DWQMS Requirement	Notes	Method in Place?	Documented?	Gap?
d.) report the results of the management review, the identified deficiencies, decisions and action items to the Owner.		d.)		
21. Continual Improvement DO- The Operating Authority shall strive to continually improve the effectiveness of its Quality Management System through the use of corrective actions.		DO		

Appendix B

IMPLEMENTATION ACTION PLAN
Date of Implementation Action Plan:

Implementation Step	Tasks	When	Who
Setting Up the QMS Team and Implementation Resources **(Chapter 4)**	• *A QMS Lead is assigned?* • *QMS team members have been set up if appropriate?* • *Training needs have been identified for the QMS Lead, Team members, and management?* • *Training has been arranged for/provided?* • *The new roles of QMS Lead and QMS Team, and their responsibilities, have been communicated?*		
Getting Started **(Chapter 5)**	• *Top management has been identified?* • *Management commitment has been obtained?* • *The QMS Policy has been created?* • *All of the checkpoints on the Checklist for Creating the QMS Policy have been completed?* • *The QMS Policy has been approved?* • *The Operational Plan includes the QMS Policy?* • *A QMS Representative had been appointed?* • *The QMS Representative has the authority to carry out the listed responsibilities?* • *The Operational Plan identifies the QMS Representative?*		
Gap Analysis and Implementation Action Plan (Chapter 6)	• *Preparations for Gap Analysis were completed?* • *A document review was performed?* • *A review of methods and activities was performed?* • *The Gap Analysis Checklist was completed?*		

Implementation Step	Tasks	When	Who
	• *Gaps were identified?* • *The Gap Analysis findings were discussed with key personnel?* • *An Implementation Action Plan was created?* • *The Implementation Action Plan includes tasks, target dates, and assigns personnel to complete the tasks?* • *The Implementation Action Plan was issued to key personnel?* • *You will keep the Implementation Action Plan updated with changes or delays?*		
"Kick-off" Management Meeting **(Chapter 7)**	• *Key personnel have been invited to the "Kick-off" Management Meeting?* • *An agenda has been prepared?* • *A "Kick-off" Management meeting was held?* • *Minutes of the meeting were recorded?* • *The Implementation Action Plan was reviewed?* • *The timeline for implementation was confirmed?*		
Document and Records Control **(Chapter 8)**	• *You completed the Quiz, to test your understanding of document and records control?* • *Documents and records are retrievable?* • *Documents can only be edited by authorized personnel?* • *A method is in place to keep documents current?* • *A consistent format for documents and records has been established?* • *All "Ready for the Audit" points in this chapter's margins are in place?* • *A method is in place for reviewing and approving documents?* • *A method is in place for issuing updated documents, and removing obsolete ones?*		

Implementation Step	Tasks	When	Who
	• *Documents and records are protected?* • *Retention times for records have been determined?* • *Disposal methods for records have been determined?* • *The Document and Record Control Table is complete?* • *The Document and Record Control Procedure is written and approved?* • *The Document and Record control procedure has been added to the Operational Plan?*		
Drinking-Water System **(Chapter 9)**	• *A description of the drinking-water system including all treatment processes and distribution system components, has been prepared?* • *General characteristics of the raw water supply were included in that description?* • *Common event-driven fluctuations were included in that description?* • *Resulting operational challenges were included in the description?* • *A process flow chart is available?* • *Critical upstream or downstream processes relied upon have been described?* • *If the subject drinking-water system is part of a larger drinking-water system, a summary description of the larger system has been prepared?* • *If the subject drinking-water system is part of a larger drinking-water system, the name of each Owner and Operating Authority has been included?*		
Risk Assessment and Risk Assessment Outcomes **(Chapter 10)**	• *You set up a team to perform the Risk Assessment?* • *You identified hazards and hazardous events?* • *You identified available monitoring control measures for each hazard?* • *You evaluated risks using a consistent*		

Implementation Step	Tasks	When	Who
	method? • *You ranked risks?* • *You identified your critical control points?* • *You have included the minimum CCPs?* • *You have established critical control limits for the CCPs?* • *You have identified monitoring processes for CCPs?* • *You have established response procedures for CCPs?* • *You have completed the Risk Assessment Table?* • *You created a procedure that describes how you performed this risk assessment?* • *The Risk Assessment Procedure covers everything in Element 7?* • *You had all of the documentation created in this chapter reviewed and approved?* • *You released the documentation to relevant personnel?* • *The Operational Plan has all of the required documents from Elements 7 and 8?*		
Organizational Structure, Roles, Responsibilities and Authorities **(Chapter 11)**	• *A QMS Representative has been identified?* • *You completed the Responsibilities Table, including roles, responsibilities and authorities for the Operating Authority?* • *You included roles, responsibilities and authorities for the Operating Authority when operating more than one drinking-water system?* • *You identified the Owner of the drinking-water system?* • *You charted the organizational structure for the Operating Authority?* • *You arranged for Top Management to appoint a QMS Representative?* • *You ensured the QMS Representative was*		

Implementation Step	Tasks	When	Who
	made aware of his/her responsibilities? • *Included the QMS Representative in the Responsibilities Table?* • *Included the QMS Representative in the Organizational Chart?* • *Communicated the information in the Responsibilities Table and in the Organizational Chart throughout the Operating Authority?*		
Competencies and Personnel Coverage (Chapter 12)	• *Required and desired competencies have been identified?* • *A training matrix, or some means of describing how competencies are met, has been prepared?* • *Training methods have been described?* • *Competency requirements that you have described have been met?* • *Personnel coverage procedures have been prepared?*		
Communications **(Chapter 13)**	• *A communication procedure has been documented?* • *The procedure includes a description of how the QMS is communicated with the Owner?* • *The procedure includes a description of how the QMS is communicated with personnel?* • *The procedure includes a description of how the QMS is communicated with suppliers?* • *The procedure includes a description of how the QMS is communicated with the public?*		
Essential Supplies and Service **(Chapter 14)**	• *You created a list of essential supplies and services?* • *The means to ensure the procurement of the essential supplies and services have been described?* • *You documented what quality requirements you have for all of the essential services and supplies?* • *You communicated these requirements to the Purchasing department, to be used as*		

Implementation Step	Tasks	When	Who
	selection criteria for new vendors? • *You communicated these requirements to relevant staff?* • *You communicated these requirements to suppliers and service providers?* • *You have a process to monitor if supplies and services are meeting your requirements?*		
Infrastructure **(Chapter 15)**	• *A procedure for reviewing the adequacy of the infrastructure needed to operate and maintain the drinking-water system has been created?* • *The adequacy of the infrastructure needed to operate the drinking-water system has been reviewed?* • *The findings of the review have been communicated to the Owner?* • *Summaries of the maintenance, rehabilitation and renewal programs for the infrastructure have been created in the Operational Plan?* • *The programs have been communicated to the Owner?* • *This communication was documented?* • *A process is in place to keep these summaries current?* • *A process is in place to monitor the effectiveness of the maintenance program?* • *The maintenance program is being monitored for effectiveness?* • *Documents are being created to show this monitoring?* • *Results of this monitoring are being communicated to the Owner?*		
Sampling and Monitoring **(Chapter 16)**	• *You listed the sampling and monitoring parameters for your drinking-water system?* • *You included targets, or acceptable ranges, for those parameters?* • *You included methods for responding when those targets or acceptable ranges are*		

Implementation Step	Tasks	When	Who
	exceeded? • *You included any upstream sampling and monitoring?* • *You described sampling and monitoring under challenging conditions?* • *You described how sampling and monitoring results are recorded?* • *You listed the measurement and recording equipment?* • *You described the calibration of this equipment, including method, frequency, planning and results?* • *You described how the results are shared between Owners and Operating Authorities?* • *Your calibration of sampling and monitoring equipment is up-to-date?*		
Emergency Management **(Chapter 17)**	• *All potential emergencies have been identified?* • *Emergency Procedures have been documented?* • *The procedures describe responsibilities?* • *The procedures describe communication during an emergency?* • *The procedures describe what sampling is required for response and recovery?* • *The procedures describe response teams you will utilize?* • *The procedures refer to municipal planning measures?* • *The procedures include specific response actions that must be taken?* • *The procedures include recovery instructions?* • *The procedures include your requirements for documenting the emergency, and any follow-up reporting required?* • *Contact lists are included in the procedures?*		

Implementation Step	Tasks	When	Who
	• *A communication protocol is included?* • *Training requirements for emergency procedures are documented?* • *Required training in emergency procedures has been completed?* • *Testing of emergency plans has been planned and documented?* • *Emergency procedures have been reviewed, approved and distributed?*		
Plan for Internal Audit **(Chapter 18)**	• *An Internal Audit Procedure has been documented and approved?* • *The procedure includes a description of who will perform internal audits, including their training/experience requirements?* • *The procedure includes a description of audit frequency and scope, and how it is planned?* • *And audit schedule has been created?* • *The procedure includes a description of audit team member selection, in preparation for an audit?* • *The procedure includes a description of how audit team members review information in preparation for an audit?* • *The procedure includes a description of how audit checklists are prepared?* • *The procedure includes a description of how the audit is conducted?* • *The procedure includes a description of how the audit is reported?* • *The procedure includes a description of how the audit is followed up?*		
Plan for Management Review' **(Chapter 19)**	• *You have designated who will perform the management review, and how?* • *The Management Review Procedure requires items a) to o) in the PLAN component of Element 20 are considered?* • *The management review Procedure has been documented and approved?*		

Implementation Step	Tasks	When	Who
Completing the QMS Cycle **(Chapter 20)**	• *Personnel are aware of the QMS requirements that are applicable to their roles and responsibilities?* • *Personnel are using the information in the Operational Plan and the QMS procedures?* • *Records have been generated to show that procedures are being followed?* • *The Operational Plan is completed?* • *The Operational Plan has been endorsed by top management and by the Owner?* • *DWQMS required documentation is in place?* • *The "Ready for the Audit" margin tips for this chapter are in place?*		
Performing and Internal Audit **(Chapter 21)**	• *An Internal Audit was completed?* • *The Internal audit procedure was followed, including resources, audit preparation, conducting the audit, reporting, and follow-up?* • *An audit report was prepared?* • *Results of the internal audit were communicated to key personnel?* • *Management review records are scheduled to be reviewed after management review is complete?* • *The audit schedule has been updated?* • *Corrective actions were made to fix the non-conformances?* • *Corrective actions were checked for effectiveness?* • *Corrective actions were documented?*		
Performing a Management Review **(Chapter 22)**	• *A management review was completed?* • *The Management Review Procedure was followed?* • *Inputs to the management review included all of those listed in Element 20 of the DWQMS?* • *The review, including action items and*		

Implementation Step	Tasks	When	Who
	decisions, was documented? • *Action items and decisions included assignment of personnel and timeframes for completion of those tasks?* • *Action items are being carried out?*		

Appendix C
DOCUMENT AND RECORD CONTROL TABLE

Document and Record Control Table								**NR = not required**
Date of Revision:		**Document Requirements**				**Record Requirements**		
Document or Record?	**Type of Document**	**File Location (of master)**	**Location of Printed Documents**	**Authorized Editor**	**Reviewers / Approvers**	**File Location**	**Retention Time**	**Disposal Method**
D	*Emergency Response Manual*	*O:/QMS/emerg*	*Control room, QMS office, front lobby, loading dock*	*H&S Committee*	*Senior Managers*	*NR*	*NR*	*NR*
R	*External lab test results*	*NR*	*NR*	*NR*	*NR*	*Control room*	*15 years*	*shred*

Note: The templates and sample entries have been provided to explain concepts and should not be interpreted as necessarily required or suggested by the Ministry of the Environment

Appendix D

RISK ASSESSMENT TABLE

Activity or Process Step	Description of Hazardous Event/ Hazard	Control Measures	Likelihood	Severity	Detectability	Total	CCP?	Critical Control Limits	Monitoring Procedures Processes	Response Procedures
Filt	*Filter turbidity breakthrough* *Biological contamination due to ineffective chemically assisted filtration and pathogen removal*	*Automatic controls stop water production on high turbidity. Backwash initiated, followed by filter to waste cycle.*	*2*	*4*	*1*	*7*	*Yes*	*0.15 NTU – automatic filter backwash sequence initiated* *0.20 NTU – alarm sent out and flow through filter is stopped* *0.5 NTU 95 percent of the time – regulatory limit*	*Continuous on-line monitoring of filtered water turbidity with automatic controls. Alarm if limits exceeded.*	*Automatic controls stop water filtration on high filtered water turbidity. Operator investigates. Performance of other filters and the operation of the chemical feed systems are reviewed. Key raw water parameters and settled water turbidity is checked. If necessary jar tests are completed and the coagulant and polymer addition are adjusted to optimize performance.*

Appendix E

RESPONSIBILITIES TABLE

Responsibilities Table		
Date of Revision:		
Role	**Responsibilities**	**Authorities**
Operating Authority President	- *Ensuring operations are performed as per the Contract between the OA and the Owner* - *Obtaining resources or infrastructure as necessary from the Owner* - *Providing resources or infrastructure as necessary* - *Ensuring that the DWQMS is implemented and maintained, and that the Operating Authority is Accredited*	- *To perform listed responsibilities* - *To recommend improvements or changes, as per the operating Contract* - *To implement improvements or changes, as per the operating Contract*

Appendix F

COMPETENCIES TABLE

Competency Requirements Table		
Role	***Required Competencies***	***Desired Competencies***
WTP Foreman	WTP Class III Certification Distribution Class I Certification Supervision Experience/Training SCADA Training WHMIS Mechanical Aptitude Internal Auditor Training First Aid (Including CPR) MS Word & Excel	Leadership Training Distribution Class III Certification

Note: The templates and sample entries have been provided to explain concepts and should not be interpreted as necessarily required or suggested by the Ministry of the Environment

Appendix G

TRAINING MATRIX

(Operating Authority) Training Matrix: last updated 01/12/2006								
Jan 1 2006 to Dec 31 2008			List training here (duration in hours)	List training here (duration in hours)	List training here (duration in hours)	List training here (duration in hours)	List training here (duration in hours)	Total Hours to Date
Employee	Role	Expiry (years)	add expiry here	add expiry here	add expiry here	add expiry here	add expiry here	--
employee name here	employee role here		add date of training here	add date of training here	add date of training here	add date of training here	add date of training here	sum hours of training here

Note: The templates and sample entries have been provided to explain concepts and should not be interpreted as necessarily required or suggested by the Ministry of the Environment

Appendix H
SUPPLIES AND SERVICES TABLE

ESSENTIAL SUPPLY OR SERVICE	PROCUREMENT	QUALITY REQUIREMENTS
Chlorine gas supply	▪ *Chlorine gas catalogue # XX111, delivered in tonners* ▪ *9 tonners in total at all times, 2 in use. When 2 on scales are emptied, 2 are ordered by Operator, and order is recorded in Op Log book* ▪ *Chlorine Supply Inc. 1-800-555-6224* ▪ *Tonners available at Lake Ontario Municipality water plant if needed in emergency*	▪ *Employees receive regular TDG & WHMIS training* ▪ *Drivers have clean driving records* ▪ *Delivery vehicles equipped with the appropriate safety and environmental gear in the event of a spill* ▪ *Sufficient warehouse stock* ▪ *Documented verification of load contents provided with each shipment* ▪ *Product is NSF approved* ▪ *Certificate of Analysis provided with all shipments* ▪ *Must sign in for entry, provide documentation before offloading, and offload under Operator's supervision only*

Appendix I

SAMPLING AND MONITORING TABLE

Sampling and Monitoring Table										**NR = not required**
Date of Revision:										
PARAMETER						***CALIBRATION***				
Sampling or Monitoring Parameter	**Location**	**Quality Targets**	**Response**	**Challenging Conditions**	**Records**	**Devices**	**Method**	**Frequency**	**Schedule**	**Results**
Water depth – SCADA monitors and alarms	*Intake Well*	*Depth greater than 4 meters*	*Investigate reason for low water levels*	*Intake blockage, frazil ice*	*Record in log book*	*Ultrasonics transducer*	*Instrument Tech uses ACME Ultrasonics equipment manual in control room*	*Quarterly*	*CMMS*	*CMMS, and hard copy in control room*

Note: The templates and sample entries have been provided to explain concepts and should not be interpreted as necessarily required or suggested by the Ministry of the Environment

Appendix J

EMERGENCY PROCEDURES

DRINKING WATER SYSTEM:

REVISION DATE:

REVIEWED BY:

APPROVED BY:

RELEASE COPIES TO:

Appendix J (Cont'd)

POTENTIAL EMERGENCIES

POTENTIAL EMERGENCIES	
Description of Emergency	**Potential Outcome**
Chemical spill in wellhead capture zone	*Health risk, contamination of source water, contamination of environment, service disruption*

Note: The templates and sample entries have been provided to explain concepts and should not be interpreted as necessarily required or suggested by the Ministry of the Environment

Appendix J (Cont'd)

RESPONSIBILITIES (Chain of Command)

Name and Title	***Responsibilities during emergency***
John Smith *Water System Manager*	*Overall management and decision making for the water system, on behalf of the Owner and Operating Authority. The lead for managing the emergency, providing information to government agencies, the public and the news media. All external communication is approved by the Water System Manager.*

RESPONSE and RECOVERY ACTIONS – SPECIFIC EMERGENCIES

Emergency	*Specific Response and Recovery Actions*
Pipeline breakage	**Indicators:** ▪ Distribution system reservoirs and pumping station pressures and levels are monitored continuously through the SCADA system. ▪ A large breakage will be indicated by a sudden and possibly large *drop in normal pressure* that will not correspond to any pump shutdown. ▪ Pipeline breaks will sometimes cause abnormally *high flow from discharge of pumps* causing *high amperage draw* by pump motor. ▪ *Reservoir level* will also begin to drop. **Response:** 1. Operator shall shut down all pumps feeding the broken line immediately. 2. Operator shall close all remotely controlled pipeline isolation valves immediately. 3. Operator shall notify the Project Manager and the Operations Manager of the situation (see Contacts List). 4. Operator shall dispatch maintenance staff to the location 5. Maintenance staff shall assess the situation, for impacts, resources required for repair, and timing estimates 6. Maintenance staff shall report findings to Operator and Operations Manager 7. If the break is on the transmission main, staff shall follow Contingency Plan Procedure. 8. If the break is not on the transmission main, Maintenance shall remain until responders from Distribution System arrive, and proceed to Step 11 9. If the break is in on the transmission main, Maintenance shall initiate repair, and dispatch for subcontractor assistance as necessary 10. Operator shall dispatch additional maintenance staff to the location if the problem pertains to the transmission main System. 11. Operations Manager shall inform the Municipality (see Contacts List) in the affected area of the situation regardless of whose equipment is affected (pressure losses will generate consumer complaints). 12. Operator shall record the incident in the Operator's Log Book. **Recovery:** **1.** **…………** **2.**

Appendix J (Cont'd)

EMERGENCY CONTACT INFORMATION

Contact Name	***Number***	***Reason For Contacting***	***Who Contacts***	***Special Instructions***
System Owner	*(905) 555-4545*	*Any emergency event*	*Water System Manager or designate*	*Record call in Operator Log Book*
Medical Officer of Health	*(905) 555-5656*	*Emergency involving confirmed contamination of treated water*	*Water System Manager or designate*	*Record call in Operator Log Book*

Note: The templates and sample entries have been provided to explain concepts and should not be interpreted as necessarily required or suggested by the Ministry of the Environment

Appendix J (Cont'd)

TRAINING REQUIREMENTS

Who	*Emergency Topic*	*Purpose*
Staff with response roles	Specific response instructions	Staff with specific detection, response, contact or recovery responsibilities should be trained in your response and recovery procedures. Be sure to cover their specific responsibilities

TESTING REQUIREMENTS

Emergency	*Type of Test*	*Frequency*	*Instructions*
Pipeline break	Drill	Every 3 years	All water system staff involved, notice provided, mock pipeline break, professional trainer to coordinate

Appendix K

INTERNAL AUDIT SCHEDULE

Internal Audit Schedule			
Date of Revision:	*September 2006*		
Date	**Process**	**DWQMS Element**	**Auditor(s)**
October 2006	*Treatment plant*	*All DWQMS elements*	*JM*
November 2006	*Distribution*	*All DWQMS elements*	*DF*

Appendix L

INTERNAL AUDIT PROCEDURE

Template – Internal Audit Procedure

Internal audits of the QMS shall be conducted to confirm that the QMS meets or exceeds the requirements of the DWQMS Standard, and that it is effectively implemented and maintained.

Audit Schedule

Internal audits are scheduled throughout the year. The audits are scheduled by Element by month. The assigned auditor's name also appears on the schedule.

The audit schedule is developed and published at the end of February each year for the upcoming fiscal year by the Director of Operations. There are no audits scheduled for July, August or March.

Each element of the Standard is audited at least once during the fiscal year.

Audit Preparation

Conducting the Audit

Audit Report and Follow-Up

Appendix M

INTERNAL AUDIT CHECKLIST

DWQMS Internal Audit Checklist
DATE OF INTERNAL AUDIT:
AUDITOR NAMES:
AREAS VISITED:
PEOPLE INTERVIEWED:
DOCUMENTS VIEWED

INTERNAL AUDIT CHECKLIST

DWQMS Requirement	Notes	Method in Place?	Documented?	Gap?
1. Quality Management System PLAN – The Operational Plan shall document a Quality Management System that meets the requirements of this Standard.		PL		
DO – The Operating Authority shall establish and maintain the Quality Management System in accordance with the requirements of this Standard and the policies and procedures documented in the Operational Plan.		DO		
2. Quality Management System Policy PLAN – The Operational Plan shall document a Quality Management System Policy that provides the foundation for the Quality Management System, and:		PL		
f.) is appropriate for the size and type of the subject system,		a.)		
g.) includes a commitment to the maintenance and continual improvement of the Quality Management System,		b.)		
h.) includes a commitment to the consumer to provide safe drinking water,		c.)		
i.) includes a commitment to comply with applicable legislation and regulations, and		d.)		
j.) is in a form that provides for ready communication to all Operating Authority personnel, the Owner and the public.		e.)		
DO – The Operating Authority shall establish and maintain a Quality Management System that is consistent with the Policy.		DO		
3. Commitment and Endorsement PLAN – The Operational Plan shall contain a written endorsement of its contents by Top Management and the Owner.		PL		

DWQMS Requirement	Notes	Method in Place?	Documented?	Gap?
DO – Top Management shall provide evidence of its commitment to an effective Quality Management System by:		DO		
e.) ensuring that a Quality Management System is in place that meets the requirements of this Standard,		a.)		
f.) ensuring that the Operating Authority is aware of all applicable legislative and regulatory requirements,		b.)		
g.) communicating the Quality Management System according to the procedure for communications, and		c.)		
h.) determining, obtaining or providing the resources needed to maintain and continually improve the Quality Management System.		d.)		
4. Quality Management System Representative PLAN – The Operational Plan shall identify a Quality Management System representative.		PL		
DO – Top Management shall appoint, and authorize a Quality Management System representative who, irrespective of other responsibilities, shall:		DO		
f.) administer the Quality Management System by ensuring that processes and procedures needed for the Quality Management System are established and maintained,		a.)		
g.) report to Top Management on the performance of the Quality Management System and any need for improvement,		b.)		
h.) ensure that current versions of documents required by the Quality Management System are being used at all times,		c.)		
i.) ensure that personnel are aware of all applicable legislative and regulatory requirements that pertain to their duties for the operation of the subject system, and		d.)		
j.) promote awareness of the Quality Management System throughout the Operating Authority.		e.)		

DWQMS Requirement	Notes	Method in Place?	Documented?	Gap?
5. Document and Records Control PLAN – The Operational Plan shall document a procedure for document and records control that describes how:		PL		
c.) documents required by the Quality Management System are: i. kept current, legible and readily identifiable		i.		
ii. retrievable		ii.		
iii. stored, protected, retained and disposed of, and		iii.		
d.) records required by the Quality Management System are: i. kept legible, and readily identifiable		i.		
ii. retrievable		ii.		
iii. stored, protected, retained and disposed of.		iii.		
DO – The Operating Authority shall implement and conform to the procedure for document and records control and shall ensure that the Quality Management System documentation for the subject system includes:		DO		
d.) the Operational Plan and its associated policies and procedures,		a.)		
e.) documents and records determined by the Operating Authority as being needed to ensure the effective planning, operation and control of its operations, and		b.)		
f.) the results of internal and external audits and management reviews.		c.)		
6. Drinking-Water System PLAN – The Operational Plan shall document, as applicable:		PL		
d.) for the subject system: i. a description of the system including all treatment processes and distribution system components		i.		
ii. the name of the Owner and Operating Authority		ii.		
iii. a process flow chart		iii.		
iv. a description of the water source, including:		iv.		

DWQMS Requirement	Notes	Method in Place?	Documented?	Gap?
i. general characteristics of the raw water supply		i.		
ii. common event-driven fluctuations and		ii.		
iii. any resulting operational challenges and threats		iii.		
v. a description of any critical upstream or downstream processes relied upon to ensure the provision of safe drinking water.		v.		
e.) if the subject system is an operational subsystem, a summary description of the municipal residential drinking-water system it is a part of.		b.)		
f.) if the subject system is connected to one or more other drinking-water systems owned by different owners, a summary description of those systems which:		c.)		
i. indicates whether the subject system obtains water from or supplies water to those systems, and		i.		
ii. names the Owner and Operating Authority of those systems.		ii.		
DO – The Operating Authority shall ensure that the description of the drinking-water system is kept current.		DO		
8. Risk Assessment		PL		
PLAN – The Operational Plan shall document a risk assessment process that:		a.)		
i.) identifies potential hazardous events and associated hazards,		b.)		
j.) assesses the risks associated with the occurrence of hazardous events,		c.)		
k.) ranks the hazardous events according to the associated risk,		d.)		
l.) identifies control measures to address the potential hazards and hazardous events,		e.)		
m.) identifies critical control points, n.) identifies a method to verify at least once a year, the currency of the information and the validity of the assumptions used in the risk assessment,		f.)		

DWQMS Requirement	Notes	Method in Place?	Documented?	Gap?
o.) ensures that a risk assessment is conducted at least once every thirty-six months, and p.) considers the reliability and redundancy of equipment.		g.) h.)		
DO – The Operating Authority shall perform a risk assessment consistent with the documented process.		DO		
8. Risk Assessment Outcomes PLAN – The Operational Plan shall document: i) the identified potential hazardous events and associated hazards, j) the assessed risks associated with the occurrence of hazardous events, k) the ranked hazardous events, l) the identified control measures to address the potential hazards and hazardous events, m) the identified critical control points and their respective critical control limits, n) procedures and/or processes to monitor the critical control limits, o) procedures to respond to deviations from the critical control limits, and p) procedures for reporting and recording deviations from the critical control limits.		PL a.) b.) c.) d.) e.) f.) g.) h.)		
DO – The Operating Authority shall implement and conform to the procedures.		DO		
9. Organizational Structure, Roles, Responsibilities and Authorities PLAN – The Operational Plan shall: f) describe the organizational structure of the Operating Authority including respective roles, responsibilities and authorities, g) delineate corporate oversight roles, responsibilities and authorities in the case where the Operating Authority operates multiple subject systems,		PL a.) b.)		

DWQMS Requirement	Notes	Method in Place?	Documented?	Gap?
h) identify the person, persons or group of people within the management structure of the organization responsible for undertaking the Management Review, i) identify the person, persons or group of people, having Top Management responsibilities required by this Standard, along with their responsibilities, and j) identify the Owner of the subject system.		c.) d.) e.)		
DO – The Operating Authority shall keep current the description of the organizational structure including respective roles, responsibilities and authorities, and shall communicate this information to Operating Authority personnel and the Owner.		DO		
10. Competencies PLAN – The Operational Plan shall document: d.) competencies required for personnel performing duties directly affecting drinking water quality, e.) activities to develop and maintain competencies for personnel performing duties directly affecting drinking water quality, and f.) activities to ensure that personnel are aware of the relevance of their duties and how they affect safe drinking water.		PL a.) b.) c.)		
DO – The Operating Authority shall undertake activities to: c.) meet and maintain competencies for personnel directly affecting drinking water quality and shall maintain records of these activities, and d.) ensure that personnel are aware of the relevance of their duties and how they affect safe drinking water, and shall maintain records of these activities.		DO a.) b.)		

DWQMS Requirement	Notes	Method in Place?	Documented?	Gap?
11. Personnel Coverage PLAN – The Operational Plan shall document a procedure to ensure that sufficient personnel meeting identified competencies are available for duties that directly affect drinking water quality.		PL		
DO – The Operating Authority shall implement and conform to the procedure.		DO		
12. Communications PLAN – The Operational Plan shall document a procedure for communications that describes how the relevant aspects of the Quality Management System are communicated between Top Management and: e.) the Owner, f.) Operating Authority personnel, g.) Suppliers, and h.) the public.		PL		
		a.)		
		b.)		
		c.)		
		d.)		
DO – The Operating Authority shall implement and conform to the procedure.		DO		
13. Essential Supplies and Services PLAN – The Operational Plan shall: a.) identify all supplies and services essential for the delivery of safe drinking water and shall state, for each supply or service, the means to ensure its procurement, and b.) include a procedure by which the Operating Authority ensures the quality of essential supplies and services, in as much as they may affect drinking water quality.		PL		
		a.)		
		b.)		
DO – The Operating Authority shall implement the procedure.		DO		
14. Review and Provision of Infrastructure PLAN – The Operational Plan shall document a procedure for the annual review of the adequacy of the infrastructure necessary to operate and maintain the subject system.		PL		

DWQMS Requirement	Notes	Method in Place?	Documented?	Gap?
DO – The Operating Authority shall implement and conform to the procedure and communicate the findings of the review to the Owner.		DO		
15. Infrastructure Maintenance, Rehabilitation and Renewal PLAN – The Operational Plan shall document a summary of the Operating Authority's infrastructure maintenance, rehabilitation and renewal programs for the subject system.		PL		
DO – The Operating Authority shall: d.) keep the summary current, e.) communicate the programs to the Owner, and f.) monitor the effectiveness of the maintenance program.		PL		
		a.)		
		b.)		
		c.)		
16. Sampling, Testing and Monitoring PLAN – The Operational Plan shall document: d.) a sampling, testing and monitoring procedure for process control and finished drinking water quality including requirements for sampling, testing and monitoring at the conditions most challenging to the subject system, e.) a description of any relevant sampling, testing or monitoring activities that take place upstream of the subject system, and f.) a procedure that describes how sampling, testing and monitoring results are recorded and shared between the Operating Authority and the Owner, where applicable.		PL		
		a.)		
		b.)		
		c.)		
DO – The Operating Authority shall implement and conform to the procedures.		DO		
17. Measurement and Recording Equipment Calibration and Maintenance PLAN – The Operational Plan shall document a procedure for the calibration and maintenance of measurement and recording equipment.		PL		

DWQMS Requirement	Notes	Method in Place?	Documented?	Gap?
DO – The Operating Authority shall implement and conform to the procedure.		DO		
18. Emergency Management PLAN – The Operational Plan shall document a procedure to maintain a state of emergency preparedness that includes:		PL		
g.) a list of potential emergency situations or service interruptions,		a.)		
h.) processes for emergency response and recovery,		b.)		
i.) emergency response training and testing requirements,		c.)		
j.) Owner and Operating Authority responsibilities during emergency situations,		d.)		
k.) references to municipal emergency planning measures as appropriate, and		e.)		
l.) an emergency communication protocol and an up-to-date list of emergency contacts.		f.)		
DO – The Operating Authority shall implement and conform to the procedure.		DO		
19. Internal Audits PLAN – The Operational Plan shall document a procedure for internal audits that:		PL		
e.) evaluates conformity of the QMS with the requirements of this Standard,		a.)		
f.) identifies internal audit criteria, frequency, scope, methodology and record-keeping requirements,		b.)		
g.) considers previous internal and external audit results, and		c.)		
h.) describes how Quality Management System corrective actions are identified and initiated.		d.)		
DO – The Operating Authority shall implement and conform to the procedure and shall ensure that internal audits are conducted at least once every twelve months.		DO		

DWQMS Requirement	Notes	Method in Place?	Documented?	Gap?
20. Management Review PLAN - The Operational Plan shall document a procedure for management review that evaluates the continuing suitability, adequacy and effectiveness of the Quality Management System and that includes consideration of: q.) incidents of regulatory non-compliance, r.) incidents of adverse drinking-water tests, s.) deviations from critical control point limits and response actions, t.) the efficacy of the risk assessment process, u.) internal and third-party audit results, v.) results of emergency response testing, w.) operational performance, x.) raw water supply and drinking water quality trends, y.) follow-up on action items from previous management reviews, z.) the status of management action items identified between reviews, aa.) changes that could affect the Quality Management System, bb.) consumer feedback, cc.) the resources needed to maintain the Quality Management System, dd.) the results of the infrastructure review, ee.) Operational Plan currency, content and updates, and ff.) staff suggestions.		PL a.) b.) c.) d.) e.) f.) g.) h.) i.) j.) k.) l.) m.) n.) o.) p.)		
DO – Top Management shall implement and conform to the procedure and shall: e.) ensure that a management review is conducted at least once every twelve months, f.) consider the results of the management review and identify deficiencies and actions items to address the deficiencies, g.) provide a record of any decisions and action items related to the management review including the personnel responsible for delivering the action items and the proposed timelines for their implementation,		DO a.) b.) c.)		

DWQMS Requirement	Notes	Method in Place?	Documented?	Gap?
h.) report the results of the management review, the identified deficiencies, decisions and action items to the Owner.		d.)		
21. Continual Improvement DO- The Operating Authority shall strive to continually improve the effectiveness of its Quality Management System through the use of corrective actions.		DO		

Appendix O

CORRECTIVE ACTION FORM

QMS Corrective Action Form

Date:

Description:
Taste complaint not followed up properly, as required in Taste Complaint Procedure P101
On July 1/06, a taste complaint was called in to the main switchboard at 6:55pm. The dayshift Operator (Joan) wrote down details of the complaint into the Operator's Log Book. Since the shift ended at 7pm, the Operator left instructions for the nightshift Operator (Tom) to continue the paperwork and follow up. The nightshift Operator read the Operator's Log Book, but did not see the instructions. The complaint was not documented or followed up properly. When the dayshift Operator returned for her next shift on July 5, 2006, she noticed that the complaint hadn't been handled and notified the QMS Representative.

Root Cause:

Corrective Action Taken:

Corrective Action Complete (signature and title):

Date Corrective Action Complete:

Corrective Action Effective after 90 days:

Form last revised: November 1, 2005

Appendix P

DOCUMENT and RECORD CONTROL PROCEDURE

This procedure defines the actions and responsibilities that ensure control of all documents affecting the Quality Management System (QMS). This procedure also defines the mechanism for maintaining records generated by ABC Water Company.

Reason For Procedure

Creating, revising, approving and releasing documents must be performed in a consistent manner, so that documents can be easily retrieved, stay current and accurate, and are available to the user. All obsolete documents must be promptly removed from use.

Records are the best way to demonstrate:
- Conformance to the Drinking Water Quality Management Standard
- Compliance to legal and other requirements, and
- Suitability, adequacy and effectiveness of the QMS.

Thus, maintaining proper records is critical, and must be performed consistently.

Background

The following QMS documents are controlled under this procedure:
Internal QMS documents:
- QMS manual
- QMS procedures, forms, checklists
- Hazard Analysis and Critical Control Points
- Other documents as identified by the Quality Coordinator

External QMS documents:
- Material Safety Data Sheets (MSDS)
- Permits, licenses, approvals or other legal documents filed at the ABC Water Company
- Relevant applicable legislation

A record is a 'snapshot' of the conditions of the ABC Water Company. QMS records include:
- Completed forms and checklists
- Process data spreadsheets
- Logbooks
- Records that track critical control points (analyzer data, calibration documents)
- Contractor and supplier information, lists of critical supplies and services, inventories of these
- Inspection and maintenance records, work orders
- Key outputs (flow data, chemical parameters)
- Monitoring and measurement data
- Audit results
- Communication records
- Minutes of meetings
- Training records and certificates
- Records of adverse drinking water occurrences and conditions
- Other records as identified by the Quality Coordinator

Responsibilities
- The Quality Coordinator (QC) creates, edits, releases QMS documents, and controls obsolete documents
- The District Director approves all newly created and edited QMS documents prior to their release.
- Operators complete and file records related to test results and inspections, and record unscheduled occurrences in the Operator Log Book

- The Maintenance Manager completes and files records related to preventive and unscheduled maintenance, through the Maintenance Management System
- The QC files QMS records

Reviewing/Approving Documents

- At least once per year, or as noted on the document header, the QC reviews QMS documents for any required updates or modifications
- The QC may delegate document modifications to the Administrative Assistant
- The QC forwards edited or newly created documents electronically to the District Director, for review and approval
- The District Director reviews the content, format, and intent of the document, and approves if satisfactory
- If approved, the District Director returns the document electronically to the QC, with comments if required
- If not approved, the District Director notes concerns and clearly notifies QC in the email that document is not approved
- Edits to the document are summarized on the revision block located within the body of the document

Format of Documents

The QC creates internal QMS documents, or makes appropriate edits
The format of the procedures shall cover the following:

- the ‘who’, ‘what’, and ‘how’
- related documentation
- how documents are filed
- purpose and reason
- a QMS header, including document name, revision date, and number
- page number and total pages
- Three digit document numbers are allocated by the Administrative Assistant

Format of forms shall include the document name, form number and revision date

Releasing of Documents

- All internal QMS documents are electronically controlled, with only the District Director, QC or Administrative Assistant having electronic access to modify them
- All printed versions of QMS documents are marked ‘uncontrolled’
- Printed versions of QMS procedures and forms are available in the QC office or in the Control Room
- All external QMS documents are filed in the QC office or in the Control Room
- External documents of a legal nature, including C of A’s and other permits, are controlled by the Owner, and copied to the QC
- Printed legislation is uncontrolled. When referring to legislation, the QC refers to the online legislation

Obsolete Documents

- Obsolete electronic documents and obsolete legislation is not retained
- Printed QMS documents that are obsolete are promptly removed from use by QC and replaced by current printed versions
- QC writes or stamps ‘obsolete’ on hard copies of obsolete QMS documents and files in QC office or in the Plan Room, as designated by the QC
- After approximately two years in the QC Office or Plan Room, QC may move obsolete documents to a designated storage area for archiving
- Currently, obsolete QMS documents are retained indefinitely

Protecting Documents From Damage

- Hard copies of documents are stored in file cabinets or in banker’s boxes, in allocated file storage areas
- All electronic QMS documents reside on the central network drive
- Network is automatically backed up at the Plant and centrally at the headquarters of the Operating Authority
- Backup is performed daily and the backups maintained for a period of approximately four weeks less one day

MSDS Documents

- MSDSs are controlled under the QMS due to their importance in Emergency Preparedness
- MSDSs are forwarded to the QC
- The QC files MSDSs in the master binder located outside of the control room, and copies relevant MSDSs to other workstations as required

- QC is responsible for ensuring the proper maintenance of MSDSs
- Obsolete MSDSs are not retained

Filing of Records
- Hard copies of Operator's records, excluding log books, are filed by Operators in appropriate file cabinet in Control Room
- Monthly, the QC moves operators records to the Plan Room (except Log Books – they remain in the Control Room indefinitely)
- Records of government Compliance reports are filed at the Plant
- Records of Engineer's reports are filed with the Owner
- Training records are filed by the Administrative Assistant at Plant in personnel files
- Relevant training certificates are posted in the control room
- Results of QMS audits or compliance audits are filed with the District Director and copied to the QC
- Work orders, which are records of maintenance, are filed electronically in the maintenance system
- All other QMS records are filed in the QC's office
- All paper copies are properly stored (clean, dry, organized)

Special Requirements For Log Books
- Logs and other record-keeping mechanisms must be used according to requirements in O.Reg. 128/04 – Certification of Drinking-Water System Operators and Water Quality Analysts, including:
- Making chronological entries
- Ensuring entries are only made by authorized personnel
- Authorized personnel identifying themselves as the maker of the entry
- Recording information concerning dates, times, shifts, operator on duty, departures from procedures, special instructions, abnormal conditions, and equipment taken out of service
- Filing of log books, by Operators in appropriate file cabinet in Control Room

Retention Of Records
- QMS Records are retained indefinitely
- In case of future changes, the following records have ***minimum legislated retention*** times, which are the responsibility of the Owner of the LHPWSS to maintain:

Record Minimum Retention Time
- Annual reports prepared by the Owner - 5 years
- Log books and other record-keeping mechanisms as per O.Reg. 128/04 - 5 years
- Owner's Operations Reports to MOE - 5 years
- Owner's Engineer's Reports to MOE - 5 years
- Lab analyses of water samples for aluminum, chloramine, chlorine residual, fluoride, turbidity, or accredited lab reports - 15 years
- Waste Manifests - 2 years

Electronic Records
- Electronic QMS records reside on the central network drive
- Electronic Maintenance records reside on the maintenance system
- Network is automatically backed up at the Plant
- Network backup and maintenance system backup is performed daily and is archived for a period of approximately four weeks less a day

SCADA Records
- The data collected through the SCADA system is backed up electronically
- The SCADA data is backed up through the Owner's server
- The SCADA electronic backup records are retained on the server for at least one year

Table of Revisions
Date, Description of Revision
October 6, 2006 - Initial Issue of Document

PART III

MODEL OPERATIONAL PLANS

Please note that the model operational plans provided are a guide providing examples of types of documents that may be submitted. Some model operational plans refer to procedures that are not included in the Operational Plan document; however examples of all procedures referred to in the DWQMS are included amongst the four model plans.

The four draft Model Operational Plans have been developed to provide stakeholders with guidance on what may be included in their Operational Plan. These draft documents are for discussion purposes only during the EBR posting and are subject to change based on stakeholder feedback.

The four plans provided are:

Model Operational Plan A
A surface water treatment plant and transmission main serving four municipally owned drinking-water systems. The system is operated by a Contracted Private operator and the Ownership of the system is a Joint Board of Management with representatives from the four municipalities.

Model Operational Plan B1
A surface water treatment plant serving 5,000 persons. The treatment and distribution systems are owned by the municipality; however the treatment system operation is contracted out to a separate organization. This model operational plan is for the treatment system and a separate model operational plan (B2) is for the distribution system.

Model Operational Plan B2
for the above-noted distribution system, owned and operated by the municipality.

Model Operational Plan C
Groundwater supply treatment (multiple wells) and distribution system receiving supplementary water from the distribution system of an adjacent municipality. The municipality is the operating authority.

Model Operational Plan - A

Lake Joseph Water Supply System

Description

- Surface water treatment plant
- ~ 300 million litre/day
- 50 km trunk water main serving 4 municipally owned drinking water systems

Ownership

Joint Board of Management with representatives from the four municipalities receiving water from the treatment/trunk system

Operating Authority

Contracted Private Company

Note: For the purposes of this EBR posting of the draft guidance materials, some procedures referenced in the following Operational Plan may not be available.

Operational Plan
Lake St. Joseph Water Supply System

Prepared by:
Canadian Utility Operations Inc.
(Operating Authority)

On Behalf of:
Lake St. Joseph Board of Management
(Owner)

Table of Contents

Included Procedures

PLEASE NOTE THAT FOR THE PURPOSES OF THIS EBR POSTING OF THE DRAFT GUIDANCE MATERIALS ALL PROCEDURES MENTIONED IN THE OPERATIONAL PLAN MAY NOT BE INCLUDED.

Preface

This Operational Plan describes the contents of the drinking water Quality Management System for the Lake St. Joseph Water Supply System. The contents of this Operational Plan meet or exceed the requirements of the DWQMS Standard.

This Operational Plan was developed and documented by the Operating Authority (Canadian Utility Operations Inc.) and has been reviewed and approved by the owner (Lake St. Joseph Board of Management) prior to issue. See also **Endorsement**.

QMS Policy

Canadian Utility Operations Inc. (Operating Authority of the Lake St. Joseph Water Supply System) shall provide safe drinking water to all end users. CUO Inc. also commits to:

- complying with all relevant legislation and regulations for the supply of drinking water in the Province of Ontario,
- continual improvement of the Quality Management System
- communicating, on a regular basis, pertinent operational and water quality information to the owner, consumers and the public.
- *providing a working environment that allows and encourages our employees to proactively seek solutions to potential process and end user concerns.*[1]
- *promoting the use of water conservation methods.*[1]

VP Water Operations
CUO Inc.

13/Apr/2006

Note:
1 The italicized commitments in the policy statement go beyond the requirements of the DWQMS, and are not further addressed in this Operational Plan. The third party auditor will check that these commitments are being met.

Commitment and Endorsement

This Operational Plan has been reviewed and approved by the Lake St. Joseph Board of Management and Canadian Utility Operations Inc. The signatories of CUO Inc. further commit to ensuring that the Quality Management System is regularly assessed to confirm its ongoing applicability and relevance.

Signature
Chair - LSJ BoM

Signature
President & CEO
Canadian Utility Operations Inc.

Signature
Member – LSJ BoM
Vankleek Township

Signature
Water Superintendent
Canadian Utility Operations Inc.

Signature
Member – LSJ BoM
Municipality of Perthshire

Signature
WTP Foreman
Canadian Utility Operations Inc.

Signature
Member – LSJ BoM
Municipality of Munster

Signature
Member – LSJ BoM
City of Dalkeith

Quality Management System Representative

The QMS representative is the Water Superintendent of Canadian Water Operations Inc. As the QMS Representative, the Water Superintendent has the both the responsibility and authority to:

- ensure that the processes required by the QMS are established, implemented and maintained,
- ensure that the most current version of documents required by the QMS are in use at all times,
- ensure that all personnel are aware of applicable current regulatory requirements within the operation of the drinking water system,
- ensure the promotion of awareness and the effectiveness of the QMS throughout the operating authority, and
- report to top management on the performance of the QMS and any need for improvement.

Document and Records Control

Procedures are in place for Document Control and Record Control. These procedures describe how documents and records are controlled.

The document control procedure describes the activities required to ensure that all documents (except records) are maintained and controlled. Documents that are in the scope of the procedure are:

- Operational Plan
- Procedures
- Work Instructions (includes equipment manuals, training materials)
- Forms
- Templates
- Standards
- Operator Certificates
- Applicable Regulations
- Plant Operations Process flowchart
- “As Built” Drawings
- Trunk Distribution Map

The record control procedure has been established and maintained to identify the controls needed for the identification, storage, protection, retention time and disposition of records. Records shall remain legible, readily identifiable and retrievable. Records that are in the scope of this procedure are those required by the DWQMS Standard.

The Document and Record Control Procedures is not included in this draft document.

Drinking-Water System

The Water Treatment Plant (WTP) is located approximately 50 Km east of the City of Dalkeith, on the south shore of Lake St. Joseph. The WTP has an estimated gross capacity of 400.5 million litres/day and a current rated capacity of 300 million litres/day.

Average daily production (2005) is 138.5 million litres/day. Maximum daily production peaked in August/2005 at just over 234 million litres. The facility has 9 full-time staff. See also **Coverage**.

The Lake St. Joseph Regional Water Supply System draws raw water from Lake St. Joseph. Lake St. Joseph is a large body of water approximately 70kms in length and an average width of approximately 9.5kms. The lake does not support commercial traffic, however there are industrial activities taking place along the shoreline in both Perthshire and Vankleek Townships.

A 1200mm water intake is located 800M offshore from the pump-house at a depth of 7.2M.

The treatment process consists of:

- Pre-chlorination
- Raw water screening (stationary and travelling)
- Chemically assisted filtration
    - Coagulation (alum)
    - Flocculation
    - Clarification
    - Filtration (GAC/sand)
- Primary disinfection with sodium hypochlorite to meet chlorine contact time
- Secondary disinfection (sodium hypochlorite)

Lake St. Joseph Regional Water Supply System includes 50Km of trunk water main that serves six municipalities. A terminal reservoir is located to the north of the City of Dalkeith. Each municipality owns and operates the water distribution system connected to the Lake St. Joseph Regional Water Supply System.

Municipalities that receive water from the Lake St. Joseph Water System and that make up the Lake St. Joseph Water Suply System Board of Management are:
Vankleek Township
Municipality of Perthshire
Municipality of Munster
City of Dalkeith

The drinking water system is monitored at various locations and controlled using a SCADA (Supervisory Control and Data Acquisition) system.

Water Source

The water source, Lake St. Joseph, is a large body of water that is the source of the Kanata and Katimavik rivers.

Watershed boundaries include Porcupine Creek, the Albany river and its tributaries which flow from west to east across the Canadian Shield into Lake St. Joseph, and the Mer Bleu swamplands located just south of the westernmost point of the lake. Overall, the watershed encompasses approximately 1,340 square kilometres. The lake itself takes in approximately 665 square kilometres.

Due to the size of the lake, the volume of water it contains, and the low amount of development along the shoreline lake chemistry is considered to be stable. Raw water characteristics are provided in the following table.

Water Characteristics of Lake St. Joseph
* based upon raw water at intake

Characteristic	***2005 Minimum***	***2005 Maximum***	***Annual Average***
Temperature (ºC)	.4	22.2	9.8
Turbidity (NTU)	.4	24	6.9
pH	7.44	8.08	7.87
Colour (TCU)	19	166	49
Conductivity (µohms/m)	148.9	221.2	198.7

Common Fluctuations
Lake St. Joseph is subject to “flipping” (vertical turnover due to temperature inversions) in the spring and fall of the year. These events result in rapid increases in raw water turbidity and colour. Treatment performance is maintained during these events by on-line monitoring of raw water turbidity and adjusting the alum dosages. See Risk Assessment Outcomes (Element 1.8). Turbidity can also be affected by high winds which are prevalent during humid summers.

Operational Challenges
At this time, the main operational challenge related to raw water quality is maintaining treatment performance during spring and fall turnover events when turbidity and colour increase. On-line monitoring of turbidity is alarmed to provide an indication that related to the water source. Jar testing is completed to optimize performance.

Description of Drinking Water System
As previously stated, the treatment facility for the Lake St. Joseph Water Supply System is situated on the south shore of Lake St. Joseph, approximately 50 km east of the City of Dalkeith on Highway 322.

Water is drawn from Lake St. Joseph. Alum is added at the low-lift header for flocculation. Clarified water then flows through four dual media filters, is treated with chlorine post-filtration prior to entering one of two contact chambers. High lift pumps pressurize the water into the distribution system which in turn feeds four different municipalities. System storage is provided in two underground reservoirs. One is located at the junctions of Hwy 322 and County Road 44) between the WTP and the City of Dalkeith, and the other just west of the City of Dalkeith. A booster pumping station with back-up diesel generator and a booster chlorinator is also located mid-way (at the Hwy 322 and County Road 44 reservoir).

Potential Risks to the Water Source

The most likely risk of contamination of the water source comes from:

a) agricultural run-off (there are two large hog operations and numerous other operating farms that are within the watershed of Lake St. Joseph),
b) Canadian Interprovincial Railways main line is within 1.5 km of the northern shoreline for a distance of approximately 9 km. This line typically carries chemicals and other liquids used in the pulp & paper making industries.
c) one pulp and paper processing facility (includes waste treatment),
d) three saw mills,
e) one calcium-carbonate open pit mine with processing capability of slurry grade calcium carbonate for the pulp & paper industry.

Treatment System

The treatment system consists of:

Intake

- 1200mm diameter, 800M offshore at a depth of 7.2M. Includes a
- Protected by a crib
- Supply piping protected by Gabion baskets.

Note: The crib and baskets inspected annually for structural integrity.

Low Lift Pumping Station

- Stationary and travelling screens in pump-well.
- Pre-chlorination capability at the pump-well.
- Variable Speed Pumps X 3,
- Alum is added after low-lift header prior to up-flow clarifiers

Flocculation

- Hydraulic flocculation tank

Clarification

- Rectangular sedimentation tank X 2

Filtration

- GAC/Silica filter beds X 4

- Filtration flow is monitored/controlled through SCADA

Chlorination

- Chlorine added at entry to the reservoir
- The reservoirs are operated in parallel and provide the required chlorine contact time
- Normal operating storage for each contact chamber is 5,285 M^3

Solids processing

- Accumulated materials from screens are trucked to landfill
- Settled solids from filter backwashes and sedimentation tanks are clarified then are centrifuged and trucked to landfill.
- Clarified supernatant is monitored to ensure it meets CofA requirements, and pumped into Lake St. Joseph

Transmission System

The transmission system consists of:

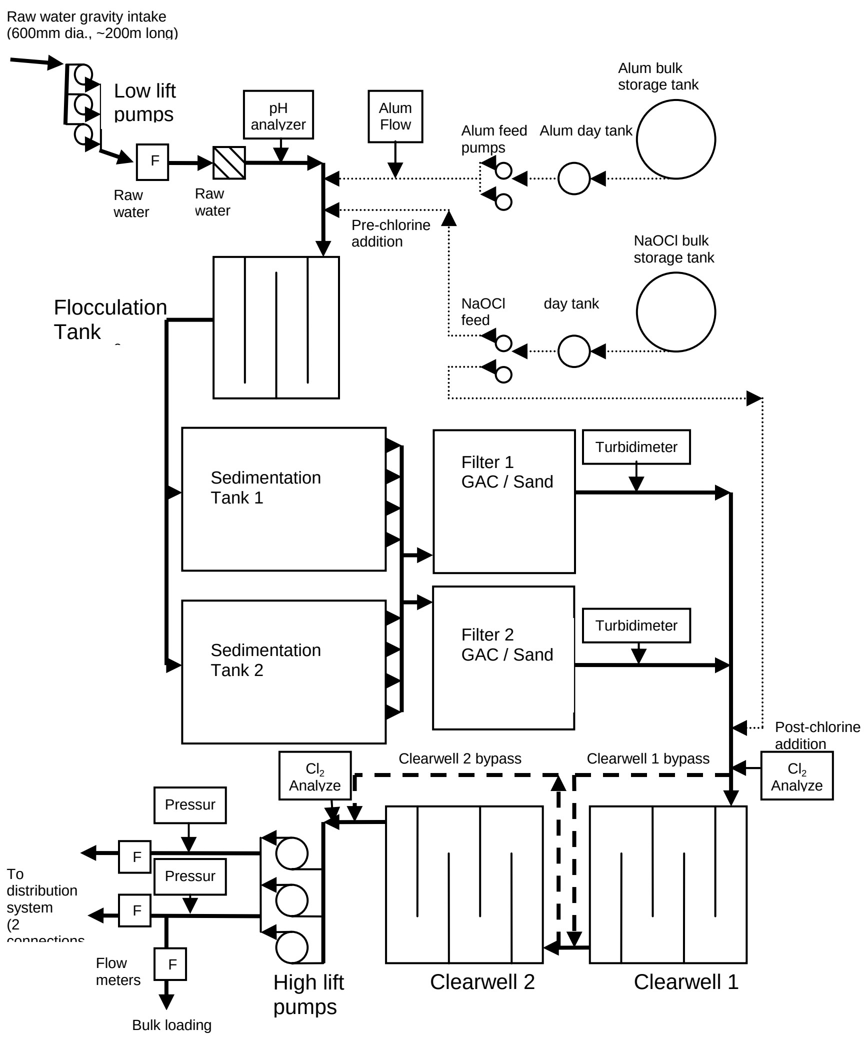
Transmission Main

- 50.24 Km of trunk main

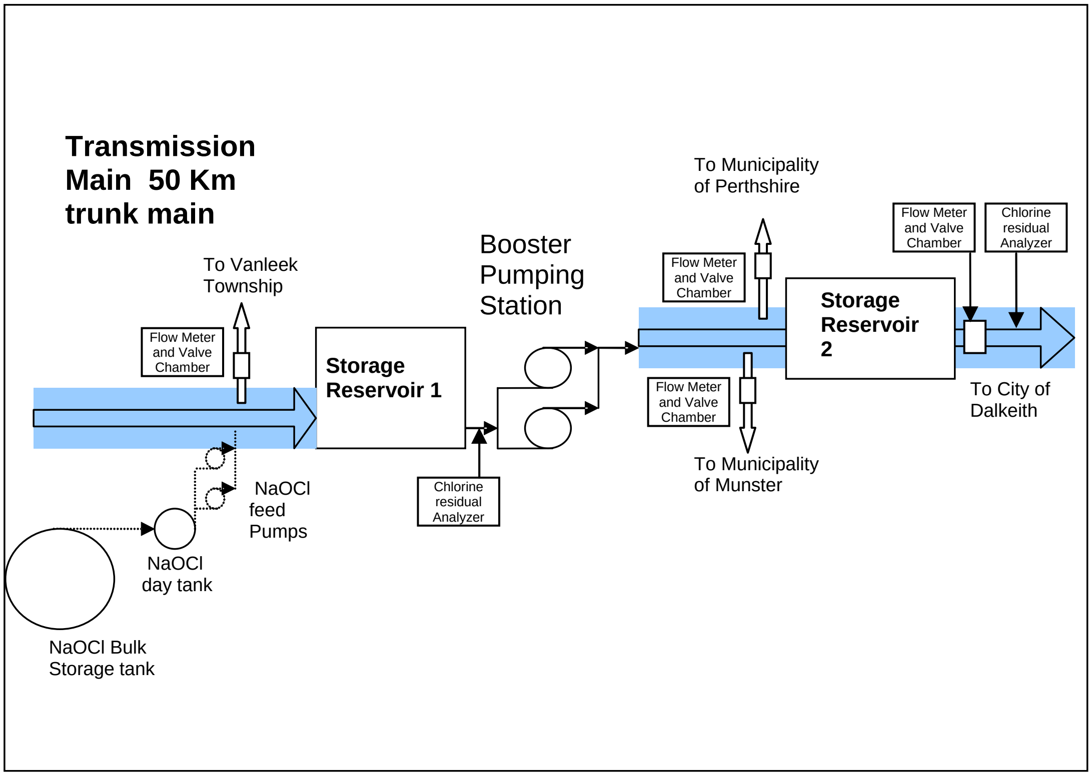
Storage

- Intermediate reservoir with booster pumping station, chlorine residual analyzer and booster chlorinator, standby diesel generator
- Terminal reservoir with chlorine residual analyzer.

Process Schematic – Treatment System



Process Schematic - Transmission System



Risk Assessment

CUO Inc. has developed and implemented a risk assessment procedure. The procedure identifies and ranks potential hazards (including events) to the Lake St. Joseph Water Supply System. Where appropriate, control measures are defined (including control and monitoring measures for all Critical Control Points [CCPs]). These measures may include but are not limited to:

- Sampling and monitoring
- Reliability and redundancy of equipment,
- Specific procedures and/or instructions
- Maintenance of machinery and equipment

The procedure for Risk Assessment can be found in this draft Model Operational Plan.

Risk Assessment Outcomes

The results of the Risk Assessment are documented in the Risk Assessment spreadsheet. The spreadsheet identifies:

- Hazards and hazardous events
- Ranking
- Control measures to address hazards
- CCPs and control limits
- Processes to monitor CCP limits
- Responses to out of control conditions (outside of control limits but within regulation)

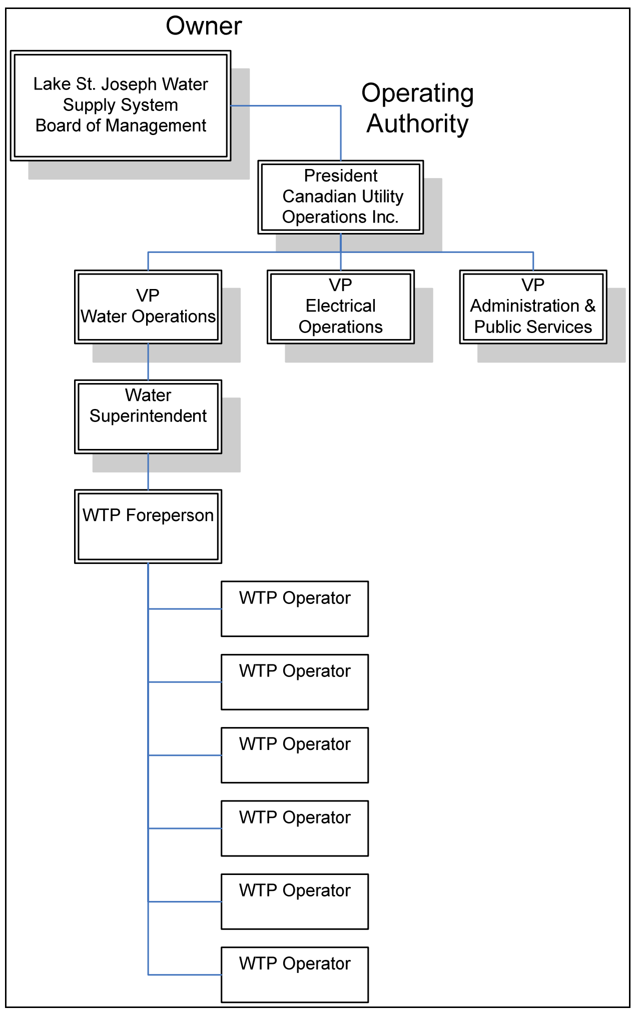
Out-of-control conditions are noted in the daily log.

Organizational Structure, Roles, Responsibilities and Authorities

Both the Water Operations and Electrical Operations share the services of the administration group. None of the administration group employee's work has a direct affect on water quality or the overall operation of the WTP. Top Management is defined as the following CUO Inc. employees:

- President
- VP Water Operations
- Water Superintendent
- WTP Foreperson

Organization Chart - April 2006 Canadian Utility Operations Inc.



LSJWSS Responsibility & Authority Matrix

Position	***Responsibilities***	***Authorities***
Board of Management **Owner**	• Prescribe requirements and monitor operations of the LSJWSS • Provide resources and system infrastructure, as necessary • Represent the LSJWSS to end users and the public	• To prescribe contractual requirements and obligations for the operation of the LSJWSS • To act on the behalf of the member municipalities to ensure a continual supply of safe drinking water
President Canadian Utility Operations Inc	• Reporting to the Board of Management • Ensuring conformance to all contractual obligations and legislative and regulatory requirements • Provide or obtain resources or infrastructure as necessary	• To ensure that prescribed (Contractual, Legislative) duties are performed • To recommend and implement improvements to the LSJWSS as per the contract
VP Water Operations Canadian Utility Operations Inc.	• Overall responsibility for the operation of the WTP • Compiling/Reporting WTP performance and operations data to President and CEO • Attend meetings with the Board of Management • Development of rolling 5 Year Strategic Plan	• Hiring of all WTP Personnel • Allocation of provided resources • Administration of labour agreement(s) • Sign-off of all expenditures above $ 5,000
Water Superintendent Canadian Utility Operations Inc. (1)	• Maintain regulatory compliance • Monitor water quality & demand • Supervision of Foreperson and operating staff in the absence of the foreperson • Schedule work assignments • Assist in selecting staff • Training and development • Work safety program • Report issues to the V.P. Water Utility as necessary • ORO (when present during business hours)	• All operations of the WTP • Direct supervisors and staff • Reporting of adverse water quality incidences to Top Management • Develop/improve departmental practices • Ensure training of supervisors and staff meets requirements • Schedule construction activities as they affect the WTP operations • Expenditures up to $5,000
WTP Foreperson Canadian Utility Operations Inc. (1)	• Supervise day to day staff activities • Reporting of deviation from critical limits to the Superintendent • ORO when Superintendent is absent/unavailable during business hours	• Direct staff in day-to-day operations and maintenance activities • Recommend to the Superintendent ways to improve operational effectiveness • Expenditures up to $2500 without supervisor approval
WTP Operators Canadian Utility Operations Inc. (6)	• Perform specified duties as per training and/or direction of superiors • Maintain operational parameters of the WTP • Maintain and repair machinery and equipment where qualified • OIC as designated • ORO as assigned (non-business hours)	• Operation and maintenance of the WTP under the direction of the WTP Foreperson

Competencies

The following table illustrates the competencies required by CUO personnel whose duties directly affect drinking water quality. The identified competencies consist of those required by regulation, by LSJ BoM (contractually specified) and CUO Inc.

Function	***Required Competencies***	***Desired Competencies***
VP Water Operations	• WTP Class III Certification • Distribution Class III Certification • Minimum 15 Yrs utility management experience • 5 Yrs Financial Management experience • Development of Capital Plans • Post Secondary Education	• Degree in Civil Engineering
Water Superintendent	• WTP Class III Certification • Distribution Class III Certification • Min. 10 Yrs Class III operations experience • Min. 5 Yrs Class III operations supervision experience • Leadership Training • Internal Auditor Training	• Development of Capital Plans • QMS Lead Auditor Certification
WTP Foreperson	• WTP Class III Certification • Distribution OIT Certification • Supervision Experience/Training • SCADA Training • WHMIS • Mechanical Aptitude • Basic Laboratory Skills • Internal Auditor Training • First Aid (Incl'g CPR) • MS Word & Excel	• Leadership Training • Distribution Class III Certification
WTP Operator	• WTP Class III Certification • SCADA Training • WHMIS • Confined space training • Mechanical Aptitude • Basic Laboratory Skills • Internal Auditor Training • First Aid (Including CPR) • MS Word & Excel	• Distribution OIT Certification

CUO Inc. has developed and maintains a training plan for each Water Department employee that identifies the training requirements for all personnel whose duties directly affect drinking water quality, and identifies training requirements for maintaining operator certification. Records of training are maintained as proof that the required training has been successfully completed and that, when required, proficiency has been assessed. Maintaining the Training Matrix and ensuring that all identified training is completed is the responsibility of the Water Superintendent, and all records are retained in the Water Superintendent's office.

Personnel Coverage

The water treatment plant is staffed from Monday to Thursday from 7:00am until 12:00pm and on Friday from 7:00am to 7:00pm. At all other times the water treatment plant is controlled and monitored by the SCADA system. When present during normal work hours the Water Superintendent is the system ORO. If absent during normal hours the WTP Foreperson is typically designated as the ORO. Other qualified operators may be designated as the system ORO.

There is an assigned Operator On-Call during off-hours. The on-call operator is designated as the ORO in the log book. The Operator On-Call shall conduct a physical verification of conditions at the plant once per day during weekends, on statutory holidays or any other times as may be required. The normal on-call schedule for water treatment plant operators shall be from quitting time on Monday to start time the following Monday. The WTP foreperson establishes and maintains the on-call schedule. The on-call schedule is a rolling six-month schedule and is provided to the all employees and the contracted call-centre at the end of each month.

At the end of each working day the WTP foreperson, or his/her designate, shall "arm" the SCADA system auto-dialler function. The SCADA system auto-dialler is programmed to contact a contracted call-centre operator whenever conditions warrant (i.e. a SCADA alarm condition). The call-centre then contacts (pages) CUO personnel based upon a prioritised call list beginning with the Operator On-Call. The Operator On-Call contacts the call-centre to obtain the details of the alarm to determine the level of response urgency.

The SCADA system auto-dialler is "disarmed" at the beginning of each scheduled work day.

Coverage requirements are also included as part of the Collective Agreement.

In the event of a labour disruption, the Water Superintendent shall assume operational responsibility for the WTP. CUO Inc. and LSJ BoM have entered into a mutual aid agreement with neighbouring operating authorities for the provision of trained and certified WTP Operators in the event of a labour disruption affecting the WTP Operators of CUO Inc.

Communications

A documented procedure has been established and maintained that describes the methods used to describe how the DWQMS is communicated between top management and:
a) Lake St. Joseph Board of Management,
b) CUO Water Department Personnel,
c) Suppliers, and
d) Public

The procedure makes reference to Quarterly Water Committee meetings between CUO and the LSJWSS Board of Management, DWQMS awareness sessions, supplier DWQMS awareness materials as well as the methods used to communicate the activities of CUO and the LSJ Board of Management with respect to the DWQMS to the public, as necessary.

The referenced Communication Procedure is not available in this draft Model Operational Plan.

Essential Supplies and Services

A list of all supplies and services deemed essential to the delivery of safe drinking water is provided below. The list includes the means to ensure the procurement of critical supplies and services.

Supply/Service	***Vendor***	***Control Method***
Sodium hypochlorite*	Bonneville Chemical 19 St. Andrews Rd Cornwall, ON (613) 555 - 4331	Reorder point : minimum 8 days supply on-hand at all times
Aluminum Sulphate*	General Chemical 24428 Aeroplast Rd Etobicoke, ON (416) 555 - 9144	Reorder point: minimum 8 days supply on-hand at all times
Water Sample Testing Services	MSG Bayfield 444 Lake St Bayfield, ON (705) 555 - 2345	Accredited Lab
	Maxxam 89A Fieldrow St Ferguson Rapids, ON (705) 555 - 8990	Accredited Lab
Alarm Monitoring/Call Centre	Via Security 905 Front Street	Annual contract performance review

Supply/Service	***Vendor***	***Control Method***
	Munster, ON (705) 555 - 4299	
Calibration Services	Nevins Calibration Services 12 Maple Ave Munster, ON (705) 555 - 4656	ISO 17025 Registered 2nd Source: Newton Instrument Services
	Newton Instrument Services 443 Hwy 717 Munster, ON (705) 555 - 4201	ISO 17025 Registered
Diesel Fuel	Raymond Fuels Junction Road Perthshire, ON (705) 555 - 6732	2nd Source: UltraFuels
	UltraFuels Hwy 77 and 717 Munster, ON (705) 555 - 4409	
Excavation/Pipeline Installation and Repair	MacLaren Excavation 2486 McVeigh Road Perthshire, ON (705) 555 - 9874	2nd Source: Modern Construction
	Modern Construction Services 55 Church Street Pierces Corners, ON (705) 555 - 7777	

** - Chemicals also available, on an emergency basis only, from Port Bernie Water Works*

CUO Inc. takes the following steps to assure purchased product/service quality:

- The requirements for purchased products and services shall be clearly described by CUO personnel at the time of order. Where applicable, reference Standards (i.e. AWWA, NSF) and/or information or other quality criteria are specified when product is ordered or services are contracted. Specifications, descriptions (i.e. manufacturer, model or catalogue #...) and performance criteria are confirmed at the time of order and maintained in the product file.

- All suppliers shall be selected on their ability to consistently meet CUO Inc. requirements. Performance (delivery, acceptance rate, responsiveness) is evaluated on a periodic basis to ensure adherence to CUO Inc. purchasing policies.

- All chemicals shall be ANSI/NSF Certified.

- Water testing services shall be provided by accredited laboratories only.

- Calibration services (contracted only) shall be provided by certified technicians using fully traceable standards and equipment.
- All excavation/construction services shall be provided by licensed, bonded and insured organisations. Disinfection of new/repaired watermain shall be completed following AWWA procedures.
- All tradespersons shall possess a valid journeyman certificate, as appropriate. Welders shall be CWB certified.
- Upon receipt, the product and/or accompanying documentation shall be inspected to confirm that the product received is the product that was ordered.

See all the Purchasing Procedure included in this Operational Plan.

Review and Provision of Infrastructure
Infrastructure Maintenance, Rehabilitation and Renewal

CUO Inc., under contract with the owner, maintains a scheduled program of inspection and maintenance for works machinery, equipment and distribution components for which it is operationally responsible. Machinery and equipment maintenance is as per the manufacturer recommendations – this includes calibrations.

Machinery and equipment manuals are controlled and retained in the WTP to support maintenance activities.

All maintenance, planned or unplanned, is recorded on a CUO Inc. work order. Work order data is then transferred to the Asset Management database where it is retained for analysis and historical purposes. This data is summarised on a quarterly basis and becomes the key input to an annual review of the infrastructure conducted by CUO Inc. top management. Records of the Infrastructure Review are maintained by the VP of Water Operations. Results of the review are communicated to the owner, and when appropriate, system maintenance, rehabilitation and renewal activities are added to the five-year rolling plan in conjunction with the Lake St. Joseph Board of Management capital works program. Consideration is also given to the reliability and redundancy of equipment during the Infrastructure Review.

Regular maintenance parts that cannot be sourced locally are kept in stock.

Consideration is also given to potential and projected residential, commercial and industrial growth and demand. Each participating Municipality provides an annual estimate of the following years anticipated demand for water which includes an estimated increase for planned growth.

Every year the water department superintendent and the VP of Operations review the water system infrastructure to ensure it is adequate for the operation and maintenance of the system. The findings of this review shall be summarized in a report. Additional infrastructure requirements for the operation and maintenance of the system, which are outside of the responsibility of the CUO under the terms of their agreement with the LSJ Board of Management, shall be identified and a rationale as to why they are needed documented

See also the Infrastructure Review Procedure included in this Operational Plan.

Sampling and Monitoring

CUO Inc. has documented separate sampling and monitoring procedures.

Key process parameters are monitored by SCADA. The WTP operator is notified by an alarm when readings are outside of the pre-programmed acceptable ranges.

Daily sampling and monitoring results are available to the owner, LSJ BoM, at their request. All sampling and monitoring data are compiled and trended monthly, quarterly and annually. Quarterly summary reports and annual reports are provided to the owner per the terms of the contract.

The referenced procedures for sampling and monitoring are not available in this draft Model Operational Plan.

Measurement and Recording Equipment Calibration and Maintenance

All measurement and recording equipment is calibrated and maintained at the frequency prescribed by the Original Equipment Manufacturer's manuals and/or printed instructions. Calibrations for all equipment (except flowmeters) are conducted by CUO Inc. personnel.

Equipment specific calibration records are maintained as part of the work order system and included as part of the asset management database.

Flowmeters are calibrated by a certified technician - please see Essential Supplies and Services. Hardcopy Certificates of Calibration are retained by the Water Foreperson.

Emergency Management

CUO Inc. has identified contingencies (outlined procedures) to maintain overall emergency preparedness in the event of an emergency situation that may result in an acute drinking water health risk. The contingencies may be proactive or reactive – depending upon the potential emergency.

The table below illustrates the identified potential emergencies situations.

Potential Emergency Situations		***EFFECTS***
NATURAL CAUSES Tornadoes Blizzards / Ice storms Thunder / lightning storms Earthquakes	High winds Heavy rain / snowfalls Electrical Earth movement	Structural damage, Flooding Power outage Process malfunction Equipment failure Injury Contamination to water Environmental damage
POWER INTERUPTIONS Storms System / Grid Failure	Power outages Electrical	Quantity of supply Equipment Failure
TREATMENT PROCESS MALFUNCTION	Per Risk Analysis Outcomes – see Element 1.8	Water Quality Water Supply
TRANSMISSION SYSTEM PROBLEMS (Downstream) Backflow /Siphonage Pressure Loss Main Breaks	Contamination	Water Quality Water Supply
CHEMICAL SPILLS / LEAKS a) On-Site Chemicals NaOCl, Alum, Diesel, Oils, Greases... b) Off-site Lake Freighters Accidents	On-site Contamination Fires / Explosions Source Contamination Air Quality	Injury Illness, health risk Water Quality Environmental damage
TERRORISM / VANDALISM	Contamination Fires / explosions Structural Damage System / Equipment Failure	Disease, sickness Injury Water Quality Water Supply

The table below identifies the contingencies in place to address the effects of potential emergency situations.

Type of Emergency	***Contingency in Place***
Natural Causes	Diesel Power – Backup generator tested monthly Standby Personnel – additional personnel are available (on call) during inclement weather conditions SCADA Alarm System – battery back up Public Emergency Notification Plan (Loss of service)
Distribution Related	SCADA – monitors pressure off the high lift and at each reservoir, monitors cl2 at the reservoir. Procedures for pressure loss and watermain repair
Power Interruptions / Failures	Standby Power for Pumphouse, Plant and SCADA operations
Treatment Process Malfunction	Redundancies – see Risk Analysis Outcomes
Chemical Spills / Leaks	<u>On-site</u> Containment - Training – confined space, WHMIS, SCBA Safety Procedures Follow actions recommended/contained in MSDS <u>Off-site</u> Contamination of raw water – communication with MNR & MOE, system monitoring, possible shutdown
Terrorism / Vandalism	Security Measures – Card Lock Doors, Cameras, Lighting

Contingency Plans are documented and included in the CUO Inc. Emergency Plan. The CUO Inc. Emergency Pan has been reviewed and approved by the LSJ Board of Management.

CUO Inc. water department employees (full-time, part time and students) take part in an annual Contingency Plan overview. New or updated plans, when required, are rolled out to the organisation during formal training sessions. Contingency plans are also included in the new employee orientation.

Contingency plans are tested (through the use of a table-top exercise) at a minimum of once every three years. Results of the test are maintained and included in the Management Review process.

Contingency plans are not included in this operational plan.

Emergency Contact List	
EMERGENCY	
Police Services	911 or 807-555-5553
Ambulance	911 or 807-555-5554
Fire department	911 or 807-555-5555
WATER QUALITY	
Health Unit (Medical Officer of Health)	807-555-1200
Ministry of Environment (Dryden)	807-555-1212
Spills Action Centre	800-268-6060
EQUIPMENT	
Municipal Engineer	807-555-1201
Pumps – Ashton Mechanical	613-555-1202
Chlorinators – Almonte Filter	613-555-1203
Tatlock Mechanical	613-555-1204
INSTRUMENTATION & COMMUNICATION	
Middleville Engineering	613-555-1205
Bristol Babcock	416-555-1206
Bell Canada	611
CHEMICAL	
Chlorine – Brenntag	705-555-1207
Alum – General Chemical	905-555-1208
Sodium Hypochlorite – Clear Tech	416-555-1209
Diesel Fuel – Maberly Fuels	807-555-1210
ELECTRICAL	
CUO Inc. – Office	807-555-1211
CUO Inc. – Electrical Dept. – Bob Robertson	807-555-1212
Ontario Hydro	800-434-1235
C & C Electric	888-555-1213
Ainsworth	905-555-1214
Cutler Hammer	905-555-1215
EXCAVATION SERVICES	
NH Reid Construction	555-555-1216
LSJ Public Works	555-555-1217
WATER SUPPLIERS (Bulk & Bottled)	
Town of Clayton Waterworks - Bulk	807-555-1218
Redden Water	807-555-1219
Clear Choice	807-555-1220

The Emergency contact list is posted in the Pump-House, the Filtration Building and in Administration Offices. Employees receive training in emergency procedures, including contacts, as part of their initial hire orientation. Emergency procedures are also reviewed annually as part of the employee Health & Safety training.

Owner
Vankleek Township 807-555-6929
Municipality of Perthshire 807-555-6828

Municipality of Munster	807-555-3541
City of Dalkeith	807-555-6262

The Water Superintendent shall be contacted in the case of all potential or actual emergencies. The Water Superintendent shall provide direction to the appropriate personnel, and advise the Vice President of Water Operations. The VP Water Operations shall advise the President of CUO Inc., owner and the appropriate agencies and organisations of the emergency. In the absence of the VP Water Operations, the Water Superintendent shall assume these responsibilities. In the absence of both the VP Water Operations and the Water Department Superintendent the WTP Foreman shall assume reporting the responsibilities stated above.

Internal Audits

The top management of CUO Inc. has, in accordance with the requirements of the DWQMS Standard, developed and implemented a procedure for Internal Audits

The Internal Audit procedure is included in Appendix “B” of this Operational Plan.

Management Review

A Management Review procedure has been developed and implemented in accordance with the requirements of the Drinking Water Quality Management Standard.

The Management Review procedure is included in Appendix “B” of this Operational Plan.

Continual Improvement

CUO Inc. attempts to continually improve the Quality Management System through the use of the Quality Policy, Internal Audits, Corrective Actions, Management Review, Customer Feedback, Preventive Action and the Analysis of Process Data.

When appropriate, CUO Inc. will modify/update/adjust processes and procedures (while remaining in compliance with applicable regulations) to better improve operational results and overall customer satisfaction.

Document Title: Purchasing Procedure
Approved By: Ted Harvey, Water Superintendent
Issue Date: February 16th, 2006
Revision: 2

Purpose: The purpose of this draft sample procedure defines the processes for assuring the quality of supplier products and services.

Scope: This procedure is applicable to all products, services and providers of the same listed on the Critical Supplies and Services List contained in the Operational Plan.

Procedure:

Applicability

1. This procedure is applicable to all products, services and providers listed in the Essential Supplies and Services List contained in the Operational Plan.

Supplier Selection

2. All suppliers have been selected based upon their ability to consistently meet CUO Inc. requirements.
   a. Supplier Performance Criteria are assessed on an annual basis by the Water Superintendent. Performance criteria include:
      - On-time delivery ,
      - Acceptance rate,
      - Responsiveness (inquiries and complaints),
      - Invoicing accuracy
      - Quality of product or service provided
   b. Supplier performance is included in the 3rd quarter Management Review.
   c. CUO Inc. attempts to have two approved suppliers for a products and services.

Product and Service Selection

3. All products and services must meet industry standards and those required by the legislation and regulations regarding the operation of water treatment facilities in the Province of Ontario.
   a. The quality criteria for each product and service are provided in each product file.

Verification of Purchased Product

4. Upon receipt, but prior to use, the product and/or accompanying documentation is to be inspected to confirm that the product received is the product that was ordered.

Verification of Purchased Service

5. Water department must personnel supervise contracted work or be otherwise assured that contracted work is being conducted in accordance with the agreement between CUO and service provider.

a. Contracted work must be inspected by CUO personnel upon completion. Results of the inspection are to be recorded and forwarded to the Water Superintendent.

Essential Supplies and Services

6. A list of essential supplies and services can be found in the Operational Plan.

Document Title: Infrastructure Review
Approved by: Ted Harvey, Water Superintendent
Issue Date: August 19, 2006
Revision: 1

Purpose: This draft sample procedure defines the infrastructure review process.

Procedure:

1. Water department personnel shall record all machinery, equipment and other related system maintenance using the CUO Inc. Work Order system.

2. The water department superintendent shall summarise all maintenance activities on a quarterly basis and provide the summary to the VP of Water Operations.

3. A summary of the water system infrastructure shall be maintained up-to-date by the water department superintendent.

4. Every year, in the 3rd quarter, the water department superintendent and the VP of Operations shall review the water system infrastructure to ensure it is adequate for the operation and maintenance of the system. The findings of this review shall be summarized in a report.
   - The summary shall be provided to the President of CUO Inc. and all members of CUO Inc. top management.
   - The summary shall serve as input to an infrastructure review by CUO Inc. top management to be held not later than the end of the 4th quarter, annually.

5. The VP of Operations shall compile detailed summary of the previous year 4th quarter and current year 1st three quarters of maintenance data.
   - The summary shall be provided to the President of CUO Inc. and all members of CUO Inc. top management.
   - The summary shall serve as input to an infrastructure review by CUO Inc. top management to be held not later than the end of the 4th quarter, annually.

6. When it is determined that the infrastructure requires rehabilitation or renewal, the requirement(s) shall be added to the five-year rolling plan. Consideration shall also be given to the reliability and redundancy of equipment when updating the five-year rolling plan.

7. Additional infrastructure requirements for the operation and maintenance of the system, which are outside of the responsibility of the CUO under the terms of their agreement with the LSJ Board of Management, shall be identified and a rationale as to why they are needed documented.

8. Records of the Infrastructure Review shall be maintained and forwarded to the LSJ Board of Management. The record shall include any requests for additional infrastructure as determined in Item 7 above.

9. Records shall be maintained of all communications with the LSJ Board of Management in with respect to infrastructure needs.

Document Title: QMS Management Review
Approved by: Ted Harvey, Water Superintendent
Issue Date: February 16th, 2006
Revision: 2

Purpose: This draft sample procedure describes the CUO Inc. Management Review process.

Procedure:

Applicability

1. This procedure is applicable to the Top Management of CUO Inc. For the purpose of this procedure, Top Management is defined as:
   - President
   - VP Water Operations
   - Water Superintendent

Frequency

2. Management Reviews are conducted at the end of the 1st and 3rd quarters of each fiscal year.
   2.1 The Water Superintendent (QMS Representative) schedules a Management Review for the third week of the third month of the 1st and 3rd quarters.
   2.2 The Management Review dates and times are posted in corporate event calendar. Email reminders are automatically sent to participants one week prior to the review.

Participants

3. Two of the three representatives are required to participate in the Management Review activity.
   3.1 The QMS representative may invite other employees to participate in the review. All other invitees require the approval of the President to participate.
   3.2 The President may extend an invitation to the members of the Lake St. Joseph Board of Management to view the Management Review of the QMS.

Management Review Input

4. The QMS representative collects and compiles data and information related to the performance of the QMS and the operation of the works. At a minimum, the Management Review activity reviews:
   - Incidents of regulatory non-compliance
   - Incidents of adverse drinking water tests
   - The efficacy of the risk assessment process(3rd quarter review only)
   - Results of internal and third party audits
   - Results of emergency response tests
   - Operational performance

- Supplier performance (3rd quarter review only)
- Deviation(s) from CCP limits and response actions
- Raw water and treated water quality trends
- Resources required to maintain the QMS
- Results of the infrastructure review
- Output and follow-up of action items from previous management reviews
- Operational Plan content and updates
- Potential changes in technology, process, personnel, legislation and regulations that may effect the QMS
- Consumer feedback
- Employee, supplier and owner feedback and suggestions

4.1 The information and data is summarised and presented to the Review Team.

<u>Management Review Output</u>

5. The QMS Representative documents the recommendations and action items resulting from the management review. Specific personnel shall be assigned to each action item. The recommendations and actions items are, at a minimum related to:
   - Improvements of the QMS (including timelines for implementation)
   - Improvements to the consistent implementation and application of the QMS
   - Human and financial resources required to maintain and improve the QMS

5.1 Minutes of the Management Review, including action items, are maintained by the QMS representative and posted in the QMS Folder on the Intranet.

5.2 Results of the Management Review shall be reported to the LSJ Board of Management.

Document Title: Risk Assessment Procedure
Approved by: Ted Harvey, Water Superintendent
Issue Date: February 8th, 2006
Revision: 2

Purpose: This draft sample procedure describes the steps to be taken to conduct, and document the results of, a drinking water system risk assessment.

Procedure:

Applicability

1. This procedure is to be followed by CUO Inc. personnel when conducting a drinking water system risk assessment.

Hazard Identification

2. The Water Superintendent leads a team of water department employees in the review of each step of the water treatment process from Intake to Storage. The risk assessment process is conducted in three stages.

Stage 1 – Risk Identification

2.1 The team includes the WTP Foreman, 3 Operators and 2 ownership representatives.
2.2 The team discusses and then documents actual and potential hazards for each process area.
2.3 The results are compiled in an Excel spreadsheet by the Water Superintendent.
2.4 Consideration shall be given to the reliability and redundancy of process, measuring and testing equipment, as appropriate.

Stage 2 – Ranking the Risks

2.5 The team reconvenes to review the compiled Risk Assessment spreadsheet in order to discuss and document the ranking of each identified risk.
2.6 When ranking the risks, the team is to give consideration to the reliability of machinery and equipment.
2.7 The Ranking criteria are in the table on page 2.
2.8 The risk ranking is determined by multiplying the probability and severity numbers.
2.9 The ranking is recorded on the Spreadsheet.
2.10 The team shall also give consideration to the identification of Critical Control Points within the drinking water system. At a minimum the following are to be designated as Critical Control Points:
   - Chemical feed
   - Post-filtration turbidity
   - Primary disinfection

- Secondary disinfection
- System pressure

Stage 3 – Identifying Mitigation Procedures

2.11 The last activity involves discussions of and the documenting of risk mitigation methods and procedures of identified risks. These methods and procedures are added to risk assessment spreadsheet.

2.12 The team also identifies and documents critical limits and response procedures for Critical Control Points.

Risk Assessment Ranking Table

Probability of Occurrence		Severity of Impact	
1	**Rare** – requires exceptional circumstances, has not occurred in the past	**1**	**Insignificant** – little public exposure, little or no health risk
2	**Unlikely** – Could occur, has occurred only once in past 5 years	**2**	**Minor** – limited public exposure, very limited health risk
3	**Possible** – has occurred in the past year	**3**	**Moderate** – Minor public exposure, health impact on small segment of service population
4	**Probable** – will occur at least every three months	**4**	**Major** – Large segment of service population at risk
5	**Certain** – will occur once a month or more frequently	**5**	**Catastrophic** – Major impact o large segment of the population, complete system failure

<u>Risk Assessment Review</u>

3. The Water Superintendent convenes a hazard review meeting on an annual basis.
   - 3.1 Participants review the current version of the Risk Assessment spreadsheet to determine if it needs to be updated.
   - 3.2 If updating is required (due to equipment, process, DWQMS or regulatory changes) then the entire team will be reconvened.
   - 3.3 The Risk Assessment spreadsheet will be amended. Any new mitigation methods or procedures resulting from the review are to be documented.

Model Operational Plan - B1

Description

- Surface water treatment plant
- Serving 5,000 persons
- Distribution system is operated by the municipality and has a separate Operational Plan (B2)

Ownership

Municipality

Operating Authority

Private operation of the treatment system in contract with Municipality

Note: For the purposes of this EBR posting of the draft guidance materials, some procedures referenced in the following Operational Plan may not included in this Operational Plan.

Dokken Utility Services Inc.

For

The Municipality of West Chester

Water Treatment System Operational Plan May/2006

Table of Contents

Purpose

The purpose of this operational plan is to describe the comprehensive Drinking Water Quality Management System developed and implemented by Dokken Utilities for the operation of the water treatment plant owned by the Municipality of West Chester.

This DWQMS Operational Plan includes references to all components of the DWQMS.

Scope

This Operational Plan covers the activities and personnel associated with all operational aspects of the production of safe drinking water for the Municipality of West Chester. The "subject system" is limited to the drinking water treatment plant and associated facilities. Dokken Utilities does not monitor or report upon process parameters relating to the distribution system and does not have responsibility for the operation and maintenance of distribution system components. The distribution system is operated directly by the Municipality of West Chester.

This Operational Plan, the procedures, work instructions and other DWQMS documentation that are referenced herein are complementary to the legislated requirements for safe drinking water in the Province of Ontario.

References

DWQMS Standard
The Safe Drinking Water Act

Definitions

Distribution System	Mains and related items (i.e. Hydrants, valves), booster station and storage
DUSI	Dokken Utility Services Inc.
DWQMS	Drinking Water Quality Management Standard
PM	Preventive maintenance
QMS	Quality Management System
SCADA	Supervisory Control and Data Acquisition
WTP	Water Treatment Plant
Water Plant	The buildings, structures and equipment

DWQMS Specific Requirements

Introduction - Quality Management System

Incorporated in 1998, Dokken Utility Services Inc. (DUSI) is the contracted operator (Operating Authority) of the Municipality of West Chester water treatment facilities. Facilities include the low-lift pump-house, treatment plant and high lift pumping station.

The Municipality of West Chester operates the water distribution system for which it has developed a separate QMS and Operational Plan.

The water treatment plant is located at 6 Water Street in West Chester on the shore of the Fall River. Raw water is drawn from the Fall River through a single intake pipe that is located approximately 30 m from the shoreline at a depth of 5.5 m (a marker buoy and protective crib are in place).

The raw water is screen filtered to remove debris, coagulated, flocculated, clarified, filtered (dual media) and disinfected with chlorined (chlorine gas.). From the high lift pumps the treated water enters the distribution network (owned and operated by the Municipality of West Chester) for end users.

The Permit to Take Water (09-PP-77787) is for 9,090,000 litres per day.

To support the operations, DUSI has installed a Supervisory Control and Data Acquisition (SCADA) system that continuously monitors process parameters and water quality characteristics at numerous points.

2. Quality Management System Policy

Quality Policy

Dokken Utility Services Inc. shall provide safe drinking water to consumers and other end users on behalf of the Municipality of West Chester. DUSI shall implement this policy through the development and application of processes and procedures that meet the requirements of all relevant legislation, regulations and the Drinking Water Quality Management Standard.

We, the management and the staff of DUSI commit to continually improving the QMS and to communicating the results with the public.

As well as being a part of this Operational Plan, this Quality Policy is posted in several locations the Water Plant. The Owner has reviewed the policy and endorsed it as part of their endorsement of the Operational Plan (see 3). It has been communicated to the public through the use of a billing insert, and is done so at least annually. Changes to the Policy, should they occur, will be communicated to all employees, the Owner, consumers and other stakeholders. Please refer to the Document Control procedure.

3. Endorsement

This Operational Plan complete with referenced procedures, work instructions, forms, templates and records is endorsed by the Owner and the Top Management of the Operating Authority).

Peter Delahunt
Mayor
Municipality of West Chester
12/January/2005

Mansard Dokken
President
Dokken Utility Services Inc.
14/January/2005

Michael Hicks
Water Committee Chair
Municipality of West Chester
12/January/2005

James MacFarland
Water Superintendent
Dokken Utility Services - Town of West Chester Water Treatment
14/January/2005

4. Quality Management System Representative

The Manager of Operations is appointed to the role of Management Representative for the DUSI QMS.

The Management Representative shall:

- develop, implement and maintain the QMS,
- report on the effectiveness of the QMS to Top Management
- ensure that the current versions of documents required by the QMS are in use at all times,
- ensure that all personnel are aware of all current legislation and regulatory requirements that pertain to their duties within the operation of the drinking-water system
- promote the QMS throughout DUSI.

Appointed by:

Mansard Dokken
President
Dokken Utility Services Inc.

5. Document and Records Control

Documented separate procedures have been develop and maintained for Document Control and Record Control. The procedures are included in this draft Model Operational Plan.

6. Drinking-Water System

General

Incorporated in 1998, Dokken Utility Services Inc. (DUSI) is the contracted operator (Operating Authority) of the Municipality of West Chester (Owner) water treatment facilities. Facilities include the low-lift pump-house, treatment plant and high lift pumping station.

The water treatment plant is located at 6 Water Street in West Chester on the shore of the Fall River. Raw water is drawn from the Fall River through a single intake pipe that is located approximately 30m from the shoreline at a depth of 5.5 m (a marker buoy and protective crib are in place).

The raw water is screened to remove debris, coagulated, flocculated, clarified, filtered (dual media), chlorinated (chlorine gas). From the high lift pumps the treated water enters the distribution network (owned and operated by the Municipality of West Chester) for end users.

The Permit to Take Water (09-PP-77787) is for 9,090,000 litres per day. The rated capacity of the plant is 8,000 m^3/day. The average day flow for 2004 was 3,250 m^3/day, and the maximum day flow was 6,380 m^3/day.

To support the operations, DUSI has installed a Supervisory Control and Data Acquisition (SCADA) system that continuously monitors process parameters and water Quality characteristics at numerous points.

The distribution system is operated by the Municipality of West Chester.

Water Source

General

The primary raw water source for the treatment plant is the Fall River. The Fall River originates in Bennett Lake and flows into Haley Lake. It is 37 km in length, has 14 tributaries and drains an area of approximately 715 square kilometres.

There is one dam 7.5 Km upstream from the water treatment plant. The dam regulates and controls the flow in the River.

The water in Fall River is relatively high in turbidity and colour. The water temperature ranges from 1.0º C in the winter to as high as 26º C in the summer. Analysis of the raw water shows it to be of relatively good quality.

Raw Water Characteristics – 2005					
DATA	**Temperature - °C**	**Turbidity - NTU**	**Colour TCU**	**E. Coli Cfu/100 ml**	**Total Coliform Cfu/100 ml**
Range	1.0º - 26º C	0.2 – 33	9-132	0-12	0- 110
Annual Average	14.8º C	12	35	3	25
High Month Avg.	July -24	April - 27	April – 98	August - 8	August - 75
Low Month Avg.	January 1.4	February 0.5	January - 7	Jan, Feb, Mar - 0	Jan, Feb, - 0

Event-driven fluctuations and Operational Challenges

- During spring run-off both colour and turbidity in the raw water increase rapidly. Jar testing is performed and dosages of alum, polymer and lime adjusted as necessary to optimize the removal of colour and ensure the THM concentrations in the finished water remain low.
- Frazil ice may occur during late fall/early winter before the river ices over. Frazil ice has the potential to clog the intake pipe. The ice dissipates as the morning progresses. During this time of year the reservoir is maintained at its highest operational level so that the system supply can be maintained even if treated water production is interrupted.
- Following significant rainfall events the raw water quality becomes poorer for a period of time. Turbidity and bacteria counts typically increase. As the watershed is primarily agricultural land, the risk of biological and/or chemical contamination due to run-off does increase. The treatment process is carefully monitored during and after these events to ensure that the treated water quality remains high. Jar testing may be performed and chemical dosages adjusted as necessary to maintain water quality. Typically the treatment process is not adversely affected.
- Water temperature changes significantly from winter to summer. Warm summer temperatures may result in an increase of taste and odour concerns for some consumers. Chemical dosages are changed seasonally in response to changing water temperatures.

Plant Operations

Raw Water Intake

Raw water is delivered for processing through a 450 mm diameter HDPE (high density polyethylene) pipe located 30m from the shoreline at a depth of 5.5m. The intake structure has a coarse screen and there is a 5 mm traveling screen at the low lift pump house. The fine screen and low lift pump station are inspected by WTP operators on a daily basis.

Low Lift Pump House and Raw Water Main

In the Low Lift Pump House there are three vertical turbine low-lift pumps (2- duty and 1-backup) each with a capacity of 80 L/s, and one 100 hp diesel emergency pump with a capacity of 80 L/s. Any two of the three pumps operating in parallel are capable of meeting the rated capacity of the treatment plant. The raw water is pumped to the Water Treatment Plant through approximately 2 kilometers of 400 mm diameter, class 150 asbestos-cement pipe.

Coagulation/Flocculation/Clarification

Water is pumped to the water treatment plant where alum (hydrated aluminium sulphate) is added for coagulation. The alum is injected into the raw water line just beyond the low-lift header. An in-line static mixer is used to rapid mix the solution. The flow is measured in a venturi meter, and then equally distributed to two solids contact clarifiers. As it enters the central hood polymer is added to weight and strengthen the floc. The mixture of water and floc is lifted up through the central hood by a variable speed impeller and discharged into the main mixing chamber where reactions are brought to completion. Some water and suspended particulate enter the lower end of the central hood for recirculation and contact with incoming raw water. New floc formation is encouraged by contact with these previously formed flocculates. The rest of the water enters the outer settling section. The lighter floc is kept suspended and clarified water rises to the outlet flume above. The heavier floc settles and is carried along the bottom by a rotating scraper to sludge pits, where it is drained off through automatic blowdown valves to the sanitary sewer.

Before the clarified water leaves the unit it is mixed with Hydrated Lime to bring the pH back up to the desired level.

Filtration

The WTP has four parallel dual media filters. The top layer of each media filter is 600mm in thickness and consists of anthracite, with a 200 mm layer of sand underneath. The filtration process is monitored by the SCADA system (water level, turbidity, head loss, effluent valve and filter to waste valve). The operation of the filters and backwashing are not automated, however the SCADA system will alarm if the critical control limit for filtered water turbidity is reached. The operator monitors filter conditions to determine when backwashing is required. Filtered water passes through the filter under-drain into the treated water clear-wells (550 ML).

Primary Disinfection

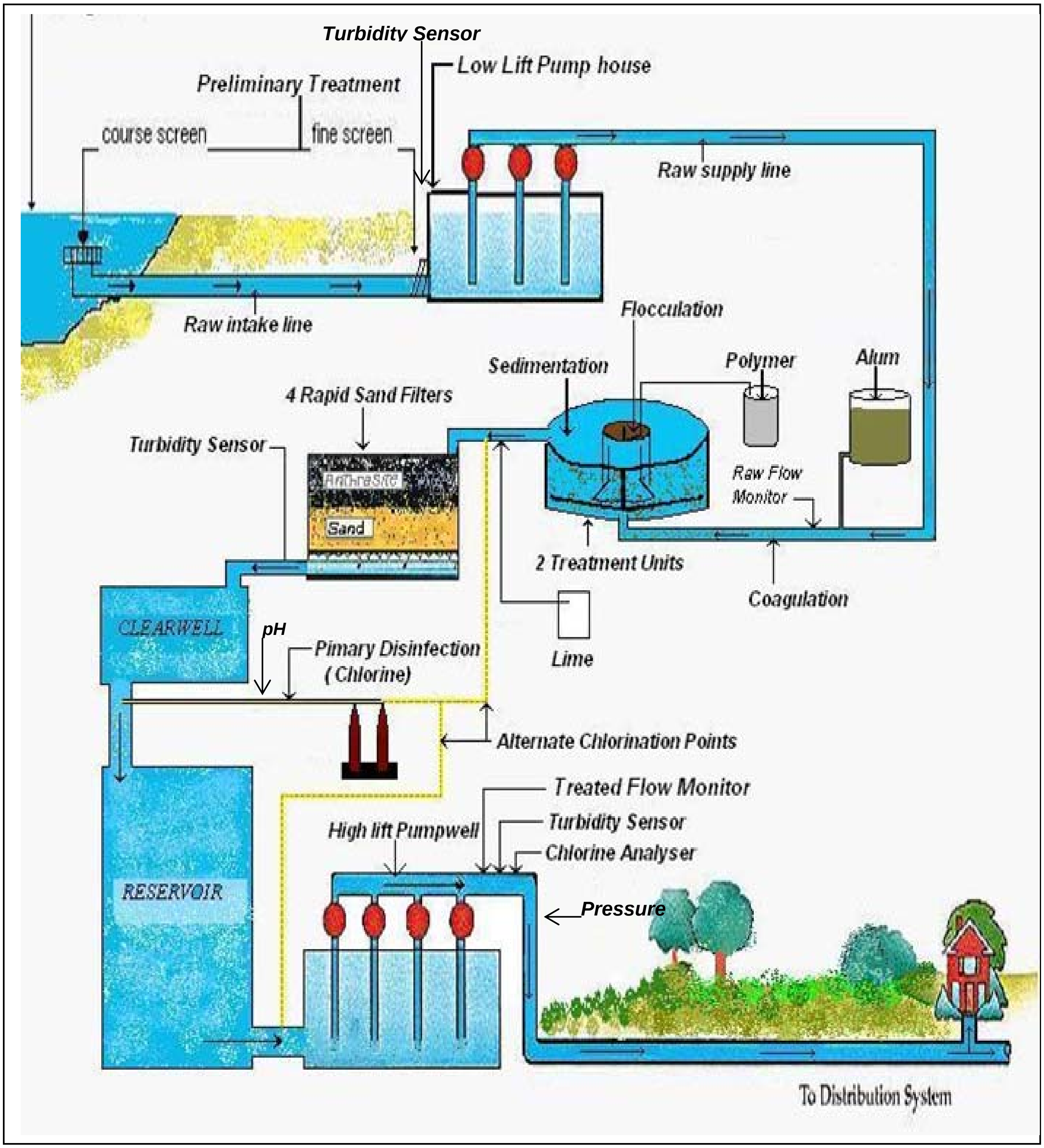
Chlorine in the gas form is used for primary and secondary disinfection. It is added to the treated water through a diffuser between the clearwell and the reservoir (6,500 ML). The reservoir is divided into two cells. The time it takes the water to flow through the clear-wells ensures sufficient contact time (CT) for disinfection of the filtered water (see primary disinfection procedure and CT calculations in Operations Manual).

Chlorine can also be added to the head of the filters if necessary to control biological growth.

Secondary Disinfection
Chlorine may also be if necessary through a diffuser at the high-lift header to boost the chlorine residual for secondary disinfection and to ensure that there is sufficient chlorine residual throughout the distribution system.

High Lift Pumps
Treated water flows from the reservoir to the pump well. The pump well is equipped with 4 – 50 hp vertical turbine pumps, each with a capacity of 68L/s. The pumping strategy consists of one variable speed drive pump continuously running to provide a system pressure of 42 – 45psi in the distribution system at the treatment plant. A constant speed pump activates when the variable speed pump cannot sustain the target pressure. A third pump provides redundant capacity, and there is also a fourth diesel driven emergency pump on standby. Prior to the water leaving the plant, the chlorine residual and turbidity levels are measured through on line analyzers.

Town of West Chester – Water Treatment Process Schematic



7 Risk Assessment

A procedure has been developed and implemented that describes the processes for identifying and ranking potential hazardous events and hazards, and for identifying Critical Control Points (CCPs) and critical limits.

All Critical Control Points have a corresponding procedure that shall be used when the designated Critical Control Limits are reached.

The reliability and redundancy of equipment is addressed in the process of ranking risks.

8 Risk Assessment Outcomes

The Risk Assessment outcomes have been documented in the tables on the following pages. The attached table Summary and Classification of Identified Hazardous Events lists all the Hazardous Events that were considered, identifies whether control can be achieved by Operational procedures and/or whether there is an associated Emergency procedure, and how is monitoring is achieved. The attached table Summary of Critical Control Point Determination, provides information on the identified CCPs. Where there is an identified CCP, a control procedure has been developed and implemented that identifies the action(s) to be taken in response to deviations from the CCPs.

The CCP Control Table illustrates the Control Limits of the identified CCPs. All deviations from Critical Control Limits shall be recorded in the Daily Log and reported to the Operations Manager using email.

Summary and Classification of Identified Hazardous Events

Potential Hazardous Event	Emergency	Operational	Monitored (Yes/No)	Control Measures
Spill of biological or chemical material into Fall River	X	X	Y	Continuous monitoring of raw water quality (turbidity), visual monitoring of water quality. Shut down treatment, intake valve, supply from storage
Breakage/Blockage of single intake pipe	X		Y	Water level in low lift pump well, inspections of intake by diver every 5 years
Low lift pump failure – mechanical		X	Y	Redundancy / maintenance
Low lift pump failure – loss of power		X	Y	Diesel Pump
Failure of bulk alum storage tank	X		-	Daily inspections, spill containment
Failure of coagulant pump/ polymer pump – electrical/mechanical		X	Y	Back-up equipment
Overdosing/under dosing coagulant/ polymer		X	Y	Daily inspections
Break in coagulant feed line		X	Y	If flow signal lost, water production shut down to allow repair
Blockage of static mixer	X		-	Maintenance
Failure of sludge scraper arm – electrical/mechanical		X		Daily inspection, spare parts, maintenance
Failure of sludge blowdown valve		X	Y	Valve position monitored through SCADA, manual operation
Turbidimeter malfunction		X	-	Calibration, Shelf spare
Filter underdrain failure		X	-	Filter inspections and maintenance
Failure of backwash pump – electrical/mechanical		X	Y	Redundancy - standby backwash pump
Failure of filter valves – electrical/mechanical		X	Y	Valve position monitored through SCADA, shelf valve, multiple filters
Filter breakthrough		X	Y	Monitoring of filtered water turbidity through SCADA, Filter Backwash procedure
Failure of chlorinator – electrical/mechanical		X	Y	Redundancy (Stand-by unit)
Break in post chlorine lines		X	Y	On-line monitoring of chlorine flow Alternate feed points,
Failure of chlorinator electrical controls		X	Y	Redundancy (spare chlorinator)
Overdosing/under dosing post chlorine		X	Y	Control limits, chlorination procedure
High lift pump failure (x1) – electrical/mechanical		X	Y	Redundancy
Air locked high lift pump		X	Y	Redundancy
Pressure relief valve failure		X	N	
Security – vandalism, tampering		X	Y	Security alarms at WTP
Failure to receive a critical supply		X	Y	Minimum on-site inventory, back-up suppliers,
General power outage	X		-	Diesel generators
SCADA failure	X		-	Operator oversight, Manual Operation

Summary of Critical Control Point Determination

Process Step	Description of Hazard	Result	Available monitoring and Control Measures	Detectability	Severity	Likelihood	Total	Critical
Source/Intake	Spill of biological or chemical material into Fall River	Potential for contamination of source water, depending on type of contaminant and concentration, treatment may not be adequate	Raw water monitoring notification of spills. Shut off intake valve and cease water production. Supply from storage. See associated procedure to respond to Source Water Spill and Emergency Procedures.	3	4	2	24	Yes
Clarifier	Alum Feed Failure	Ineffective removal of pathogens – (minimum treatment requirements not met)	On-line monitoring of alum pump operation, flow signal, Daily inspections (tank levels, calculate dosage); redundancy (standby pump)	3	3	2	18	Yes
Filtration	Filter breakthrough	In creased turbidity, ineffective removal of pathogens	On-line monitoring of turbidity, alarm on high turbidity. Redundancy (4 filters), regular backwashes	3	3	2	18	Yes
	Filter valve failure (mech. or elec.)	Valves must be operated manually to filter water	Spare valve, Redundancy (4 filters)	2	2	2	8	No
Primary Disinfection	High chlorine concentration	Maximum Acceptable Concentration 4.0 mg/L chlorine residual Customer complaints	Chlorination control procedure, on-line monitoring Daily inspections (calculate dosage and analyze residual)	1	3	2	6	No
	Low chlorine concentration	Inadequate disinfection and inactivation of pathogens	Chlorination control procedure, on-line monitoring, Daily inspections (calculate dosage and analyze residual)	1	4	3	12	Yes
Secondary Disinfection	Low Chlorine Concentration	Inability to maintain water quality and chlorine residual in distribution system	Chlorination control procedure, on-line monitoring of residual as water enters the distribution system, communication with distribution system operators Daily inspections (calculate dosage and analyze residual)	2	4	2	16	Yes
High Lift pumps	Low System Pressure Infiltration/backflow	Potential for contamination of distribution system water.	On-Line pressure monitoring. CCP response system pressure	2	3	2	12	Yes

CCP Control Table

CCP	Control Limit (High)	Control Limit (Low)	Response Procedure
Alum Feed	100 mg/L summer 80 mg/L winter	50 0 mg/L summer 50 mg/L winter	Alum Feed CCP Response Procedure
Raw water contamination	Notification of spill.	N/A	Source water spill procedure. Stop water production – emergency response procedure.*
Turbidity – each filter	0.25 NTU	N/A	Turbidity CCP Response Procedure
Primary Disinfection	.80 mg/l Cl2 Free	.60 mg/l free chlorine	CT Procedure for Primary Disinfection CCP Response Procedure
Secondary Disinfection	1.50 mg/l Cl2 Free	.65 mg/l Cl2 free chlorine	Secondary Disinfection Response Procedure
High lift pumps pressure	N/A	30 psi	CCP response: System pressure.

****(not included in Model Operational Plan)**

9. Organizational Structure, Roles, Responsibility and Authorities

Municipality of West Chester (Owner)

Responsibilities	Authorities
Oversight of the Operating Authority to ensure the provision of safe drinking water Endorse the development and implementation and continual improvement of the QMS	Selection of Operating Authority Approval of major infrastructure maintenance, rehabilitation or renewal

Dokken Utility Services Inc. (Operating Authority)

Responsibilities	Authorities
Contracted responsibility for constant provision of safe drinking water for the Municipality of West Chester Compliance with applicable legislation and regulations (the Safe Drinking Water Act and the Ontario Water Resources act, and all regulations issued under these acts which are associated with drinking water). Provide information and data on the operations and performance of the WTP to the Municipality of West Chester	Approval of expenditures and user fees Provide / review / approve administrative policy direction Hire and manage utility staff To perform its required operative duties To provide resources as per the operating Contract

Establish and maintain QMS and other processes/procedures necessary for the effective operation of the WTP Endorse the ongoing development of the QMS	

President (Top Management)

Responsibilities	Authorities
Safe, reliable, and compliant supply of municipal water Budget preparation and presentation to Municipality (owner). Quarterly reporting of WTP performance to the owner. Provide required information and data to the public, regulatory authorities, other utilities, and various professional organizations on behalf of the owner. Direct supervision of all utility management staff Participate in management reviews of the QMS	Evaluate and prioritize long-term water treatment facility needs in conjunction with Municipality of West Chester's Official Plan. Review and approve design specifications for any upgrades or changes to the infrastructure or system components. Develop and implement administrative and technical policy Hire management staff Primary management negotiator for collective agreements Liaison with media when required

Manager of Operations (Top Management)

Responsibilities	Authorities
Evaluate and optimize treatment process operations Fulfill all regulatory reporting requirements Provide input for budgeting and long-term planning Report operating conditions and activities to the President Scheduling of staff to ensure coverage by competent personnel Provide supervision and technical direction to operations staff. Prepare and supervise contracts for WTP maintenance Respond to public inquiries and complaints Maintain provincial operator licensing at certification level of plant Arrange for and coordinate training Designated QMS representative Represent the President when delegated	Develop, approve, and direct implementation of standard safety and operating policies and procedures, as well as the Operational Plan and other documentation for the QMS. To communicate to regulatory agencies, public, and owner on behalf of the Operating Authority Evaluate and prioritize long term treatment process resource and infrastructure needs Hiring of operational staff Review and provide comment on technical reports and proposals, Evaluate and select appropriate process equipment and treatment chemicals. Select contractors May assign designates to perform any of the above duties

Participate in collective agreement negotiations Participant in management reviews QMS internal auditor or other	
Overall responsibility for Communication with Owner, regulatory agencies and the public during an emergency	Designated overall responsible operator.

Lead Operator

Responsibilities	Authorities
Execution of standard operational procedures, Monitor and maintain WTP processes to meet or exceed regulatory and internal performance requirements Act on and report any incidents of non-compliance and non-conformance Collect data, and provide reports of operating conditions to the Manager of Operations Designated Overall Responsible Operator (ORO) - direct and review activities of all operators Maintain provincial certification as a Class III Water Treatment System Operator	Adjust WTP processes as required to maintain a safe and reliable drinking water supply Purchase WTP related supplies and services Assign and oversee activities of WTP Operators Oversee activities of contractors while on site Initiate and conduct corrective actions / contingency plans if control is lost of CCPs and during emergencies and incidents of non-compliance Receive and document public inquiries and complaints

WTP Operator/Documentation Technician

Responsibilities	Authorities

WTP Operator

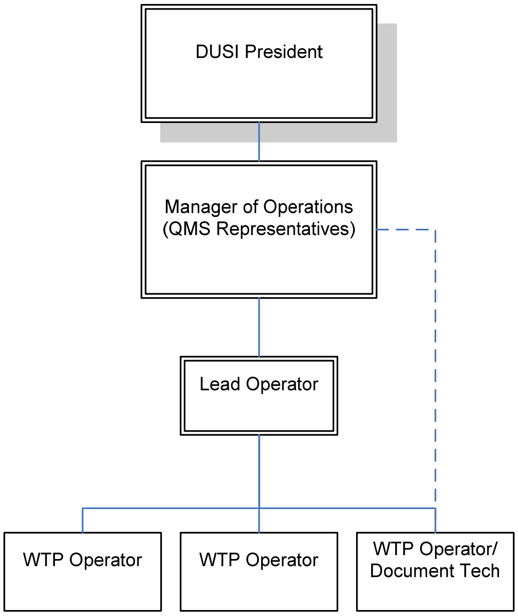
Responsibilities	**Authorities**
Monitor, maintain, and operate the WTP in accordance with established standard procedures Maintain regulatory compliance Achieve internal performance objectives and goals Report and act on incidents of non-compliance and non-conformance Report any abnormal conditions to the Head Operator or Manager of Operations Maintain provincial certification as a Water Treatment and Water Distribution Subsystems Operator Document all operating activities in facility log in accordance with provincial legislation	Perform required process adjustments to provide a continuous supply of safe drinking water (if granted OIC status by DUSI) Initiate and conduct corrective actions / contingency plans during emergencies and incidents of non-compliance Receive and document public inquiries and complaints

Responsibilities and authorities are also defined within the text of the procedures referred to in this Operational Plan and by the prevailing Ontario Regulations.

A review of each employee's responsibilities and authorities is conducted upon initial hire, and on an annual basis, as appropriate.

The president and manager of operations for DWSI are designated as the top management.

The organisational structure of DUSI is illustrated below:



10. Competencies

DUSI has developed a "competency table" that identifies the required competencies for personnel performing duties directly affecting water quality. This table is reviewed annually , or, when there are changes in:

- responsibility/authority of the OA,
- technology,
- legislation or regulations,
- QMS
- DWQMS

The review is conducted to ensure that the competencies of OA personnel are in line with the requirements for the safe and effective operation of the WTP.

Table Legend
0 - competency not required
1 - basic level of competence
2 - intermediate level of competence
3 - advanced level of competence

Required Competencies	President	Operations Manager	Lead Operator	Operator/ Doc. Tech	Operator
OETC WT Certification	NR	III	III	I	I
OETC WD Certification	NR	II	I	I	I
Supervisory Skills	3	3	2	0	0
Presentations / Training	3	3	2	2	0
Verbal Communications	3	3	2	2	1
Written Communications	3	3	2	2	1
Technical Writing	3	3	2	2	1
Research Skills	3	3	1	2	1
Budget Preparation / Analysis	3	2	1	0	0
Long-term Planning	3	2	1	0	0
Scheduling / Work Planning	3	3	2	1	1
Contract Management	3	2	1	0	0
Record Keeping	3	3	2	2	2
Regulatory Requirements	3	3	2	2	2
Emergency Procedures	3	3	2	2	2
Water Treatment Unit Processes	2	3	2	2	1
Process troubleshooting	2	3	2	2	2
Technical mathematics	3	3	2	2	2
Chemistry	3	3	2	2	1
Biology	3	3	2	2	1
Fluid Mechanics	3	3	2	2	2
Laboratory techniques	2	2	2	2	1
Sampling / preservation	1	2	2	2	2
Pumps / valves / piping maintenance	2	2	2	1	2
Electrical instrumentation / controls	2	2	2	1	2
Motor controls	2	2	2	1	2
Interpreting plans / blue-prints	3	3	2	2	2
Computer - spreadsheets and word processing	2	2	2	2	1
Computer aided design	2	2	1	1	0
SCADA	2	2	2	2	2

Identified competency requirements for DUSI staff are satisfied by the following:

- Potential employees shall submit proof of relevant post-secondary education.
- Potential employees who are selected for an interview must be prepared to demonstrate technical competency and communications skills
- Newly hired employees undergo a “New Hire Orientation”. This orientation consists of a review of the following:

1. Safety Policy and Procedures
2. QMS Policy and Procedures
3. Operational Overview
4. Responsibilities and authorities

- Once hired, the employee undergoes comprehensive on-the-job training commensurate with their level of skill, experience and education.
- Training documentation is signed by the employee and trainer, acknowledging successful information transfer. Training files are maintained for all DUSI staff.
- All employees receive a minimum of 40 hours training in various topics including safety, treatment process operations, contingency plans, regulatory requirements, equipment operation, and new technologies. The training may be provided by senior utility staff, technical experts and academics, or contracted professional trainers. Training provision and certification levels meet or exceed those required by Ontario Regulation 128/04.

11. Personnel Coverage

See DUSI DWQMS Procedure DPro 11.

12. Communications

A documented communication procedure has been included with this drat Model Operational Plan. The procedure describes the methods used to communicate the QMS between top management and:

a) Owner
b) Operating Authority Personnel
c) Suppliers
d) Consumers

13. Essential Supplies and Services

A Critical Supplies and Services List has been developed and is being maintained. The appropriate method for ensuring procurement of critical supplies and services is shown in the Product/Service section of the list. With the exception of Alum, all critical supplies and services are second sourced. The list is reviewed annually, to ensure that it is up-to-date.

		Supplier/Contact Info	
Category	**Product/Service**	**Primary**	**Secondary**
Chemicals	Chlorine (Reorder point: 5 days supply on-hand 2Nd Source: Chemco Inc.)	Chemical Depot 456 7th Avenue Prospect, ON (613) 555-1515	See Below Left
	Alum (Reorder point: 5 days supply on-hand)	Chemco Inc. 234 Maple Street Clayton, On (613) 555-0505	None
Laboratories	Bio Testing (2nd Source: Bayfield Labs)	Beakerworks Inc. 567 Wellington Avenue Richmond, ON (613) 555 - 2525	Bayfield Labs 2486 Burton Road Harper, ON (613) 555-8489
Calibration	Calibration (2nd Source: BPI Instrument Services)	Metro Metrology 12 Mann Avenue Ottawa, ON (613) 555 - 3535	BPI Instrument Services 74 Colonnade Road Ottawa, ON (613) 555-8909
Engineering Services	Civil	Spartan Engineering 77 Innes Road Ottawa, ON (613) 555-3455	Water Tech 2200 Merivale Road Ottawa, ON (613) 555-5565
Construction	General Contractor	Behan Ltd. 789 10th Avenue West Chester, ON (613) 555 - 4545	LNL Engineering 124 Seaway Ave. Brockville, ON (613) 555-5016
Excavation	Excavation Services	Davidson Excavations Point Road West Chester, ON (613) 555-6565	Acme Equipment 2228 McVeigh Road West Chester, ON (613) 555-5666
Mechanical Services	Pump/Motor Service	Marchand Mechanical 101 King Street W. West Chester, ON (613) 555-7575	The Pump House 44A Maitland Ave. Ottawa, ON (613) 555-2341
Electrical Services	Power	Hydro One Regional Office West Chester, ON (613) 555-8585	
	Electrician (2nd Source: C&M Electric)	Regional Electric 94 Division Street West Chester, ON	C,M & A Electric 7 King Street W. West Chester, ON

		(613) 555-9595	(613) 555-8889

There are a small number of suppliers that provide goods or services that may affect drinking water Quality. These suppliers provide chemicals, equipment and equipment maintenance, parts, consulting engineering, calibration, excavation and construction services.

A Purchasing Procedure has been established, implemented and maintained that ensures the quality of supplier products and services. It is included in this draft Model Operational Plan

14. Review and Provision of Infrastructure

DUSI, in conjunction with the Municipality of Chester (Owner), conducts a review of the status of the water treatment plant infrastructure including its current and future ability to service the needs/demands of the municipality.

The review is conducted annually during the third quarter of the fiscal year. The participants of the review may include, but not be limited to:

- DUSI Manager of Operations
- DUSI Lead Operator
- Manager of Public Works - Municipality of West Chester (Owner)
- Water Department Manager – Municipality of West Chester (OA – Distribution System).

Minutes of the Infrastructure Review are maintained and distributed to all participants. The output of the review is a summary of identified infrastructure needs and a timeline for their implementation. The infrastructure needs are identified as being the responsibility of the Operating Authority or the Owner.

The results of the review are included as input to the Management Review process.

15. Infrastructure Maintenance, Rehabilitation and Renewal

DUSI maintains a robust maintenance, rehabilitation and renewal program. Along with an annual infrastructure review (see Element 14), DUSI has implemented a regular inspection and preventive maintenance program for water treatment works machinery and equipment.

When appropriate, upgrades and system rehabilitation are considered and added to the program. Typically, the condition of the system is assessed on an ongoing basis, with a five-year rolling plan in place for the scheduling of upgrades and rehabilitation in conjunction with the owner.

Please refer to the Maintenance Procedure for detailed description of infrastructure maintenance and planning activities.

16. Sampling and Monitoring

Procedures have been developed, implemented and maintained for the following:

1. Sampling
2. Monitoring

Please refer to DUSI Procedures DPro 9 Sampling and DPro 10 Monitoring for details.

17. Measurement and Recording Equipment Calibration and Maintenance

A procedure has been developed, implemented and maintained for the calibration and maintenance of measurement and recording equipment.

Please see DUSI Procedure DPro 6 Calibration for details. See also DUSI Procedure DPro 19 Maintenance.

18. Emergency Management

DUSI has established, implemented and maintained an Emergency Planning Procedure. The Emergency Planning Procedure meets the requirements of, and is in co-ordination with, those of the Owner.

The Emergency Management Procedure is evaluated for suitability and applicability on an annual basis, or when there are changes to the organizations requirements or related emergency response regulations or techniques/technologies.

Copies of the Emergency Procedure and the Emergency Plan are maintained in the following locations:
President's Office
Manager of Operation's Office
WTP - Operations Office

Copies of the Emergency Plan are provided to the Municipality of West Chester for distribution at their discretion.

Communications

A list of Emergency Contacts is posted in each functional area of the WTP along with the list of Critical Supplies and Services. Keeping the List of Emergency Contacts up-to-date is the responsibility of the QMS Representative.

During an emergency situation the Manager of Operations is responsible for communications on behalf of the Operating Authority and will contact the Owner and regulatory agencies as necessary. Communications with media will be co-ordinated with the Owner.

The Owner will be represented by the Emergency Management Co-ordinator who will communicate with the Mayor and Council, and co-ordinate necessary communications with municipal staff and the public.

All emergency situations and response and recovery operations are communicated by the Lead Operator or designate to the Manager of Operations. If unavailable the President assumes this role.

Communication protocols for the Operator(s) responding to an emergency are outlined in the individual Emergency Response and Recovery procedures.

Emergency Contact List

President	Mansard Dokken	555-2257(home) / 555-7083(cell)
Operation Manager	Rod Carver	555-1732(home) / 555-2941(cell)
Overall Responsible Operator	Shawn Grant	555-0397(home) / 555-1832(cell)
MOE Spills Action Centre		1-800-268-6060
MOE Office, Kingston		555-4000
Municipality of West Chester (Owner)		555-3351
Emergency Management Co-ordinator (Owner)		555-9488(cell)
West Chester Fire Services		911
West Chester Police Services		911
West Chester Paramedic Services		911
Southumberland Regional Hospital		555-3616
Radio		555-5300
Television		555-1666
Newspaper		555-3232

See DUSI Procedure DPro 12 Emergency Planning for additional details

19. Internal Audits

An Internal Audit Procedure has been established, implemented and maintained. Please refer to DUSI Procedure DPro 5 Internal Audits for details.

A rolling twelve month internal audit schedule has been prepared and the audits contained therein are conducted by trained Internal Auditors.

Records of Internal Audits are maintained and are an integral input to management review.

20. Management Review

A Management Review Procedure has been established, implemented and maintained. Results of management review activities are recorded. Please refer to DUSI Procedure DPro 4 Management Review for details.

21. Continual Improvement

DUSI has committed to the continual improvement of the Drinking Water Quality Management System. To meet this commitment, DUSI has developed, implemented and maintained DUSI Procedure DPro 20. This procedure provides details of DUSI's continual improvement activities.

Document History

Rev. Level	Date	Change	By
Draft	February 2006		
Revised	August 2006		

Title: **Control of Documents**	Control No: **DPro 1**	Rev: **1** Effective: **25/Apr/2006**
Author: **Megan Loomis**	Reviewer: **Rick Bright**	Approver: **Mansard Dokken**

1.0 Purpose

The purpose of this procedure is to describe the process for the control of QMS related documentation.

2.0 Scope

The Control of Documents procedure is applicable to all DUSI employees who manage or perform work related to the water plant and distribution operations.

3.0 References

DWQMS Element 5

4.0 Definitions

DWQMS	Drinking Water Quality Management Standard
QMS	Quality Management System
Operational Plan (the "Plan")	Documentation of an operating authority's QMS, relevant to operating a subject works
DCR:	Document Change Request

5.0 Procedure

5.1 The QMS consists of the following documentation:

- Operational Plan
- System-Level Procedures
- Work Instructions
- Forms
- Documents of External Origin:
  - a) Applicable federal, provincial and local regulations
  - b) Equipment manuals from the manufacturer
  - c) Applicable standards and test procedures

Please note that the Control of QMS Records is covered by a separate procedure .

5.2 Controlled copies of the operational plan and procedures are bound and maintained at the following locations:

Copy #	Assigned To	Location
1	Mansard Dokken, President	President's Office
2	Michael Ricks	Committee Chair Office
3	Rick Bright	Operations Manager Office
4	Plant Operations	Plant Office
5	Clerk, Municipality of West Chester	Municipal Office

The cover of each binder indicates the control #, assignee and date of issue.

5.3 Controlled copies of work instructions are maintained in the following locations:

Type	Location
Plant Operations and associated equipment manuals (Including copies of all applicable Regulations)	Water Plant
Infrastructure Drawings – i.e. as built drawings for Plant, Booster Station and Towers	Water Plant, Water Superintendents Office
Emergency Plan	President's Office, Operations Manager Office, WTP Office

5.4 A Master List of Documents is maintained by the Management Representative for all system-level QMS documentation (Plan, Procedures, Work Instructions and Forms). The Master Lists contain the Document Title, Alpha-numeric designation, Current Revision, Location and a reference to the applicable DWQMS Element or Clause.

5.4.1The Plan, procedures, work instructions and forms all contain a header and/or a footer that, at a minimum, indicate document title, date issued and revision level. The revision level shown on the face of all documents subject to this procedure shall match that indicated on the Master List of Documents (except for obsolete documents that are identified as being retained for legal or other purposes).

5.4.2 The alpha-numeric designation for procedures, work instructions and forms is simple and progressive:

Procedures – DPro1, DPro2, DPro3 and so on.

Work Instructions – DW1, W2, W3 and so on.

Forms – DF1, DF2, DF3… and so on

5.4.3 All equipment manuals are maintained, in binders, in the appropriate facility (see 5.3). Each binder contains a list of contents – by equipment type, by manufacturer.

Internal Document Creation/Changes

5.5 A DUSI employee may request the creation of a new document, or changes to an existing one. The employee shall obtain a DCR (Document Change Request) from the Management Representative. The employee shall complete the form and return it along with a sample copy (when practical) of the new or changed document. The Management Representative shall take the following action upon receipt of the DCR:

5.5.1 Review the DCR, and if accepted:

a) create the new document using the appropriate template, or
b) change the current controlled document to incorporate the change(s) requested.

If not accepted the DCR and related material(s) shall be returned to the originator with an explanation.

5.5.2 File the DCR in the QMS files and advise all personnel by email that a change has been made to a system-level document.

5.5.3 The Management Representative shall update the Master List of Documents.

5.5.4 Grammatical and spelling changes/corrections may be made at any time by the Management Representative. These changes are not subject to the use of a DCR or the document review and approval process.

5.6 Where applicable, the Management Representative shall advise affected employees/departments/sub-consultants and critical suppliers of changes to procedures, work instructions and forms. The Management Representative may use, but not be limited to, one or more of the following methods as evidence that changes have been communicated: email (read receipt required), one-on-one consultation (initialed hard copy required) or briefing (sign in sheet required). All evidence shall be filed with the DCR in the QMS files.

External Documents

5.7 Documents of external origin may include, but not be limited to customer-supplied standards, specifications, technical bulletins, drawings, instructions and other project related documents and regulatory documents.

5.7.1 Standards, specifications and technical bulletins may also be retained in the Library. Library filing and distribution procedures are in place to control these documents.

Obsolete Documents

5.8 When a document is superseded, the obsolete document shall be removed from its location, tagged “Obsolete” in red, and forwarded to the Management Representative for disposal.

5.9 In cases where an obsolete document needs to be retained for knowledge or other purposes, the Management Representative shall file the retained copy with the DCR in the Obsolete QMS files. All obsolete documents shall be marked as such, in red by the Management Representative as appropriate.

QMS Documentation Review

5.10 QMS documentation is reviewed for evidence of control during each Internal Audit, regardless of process and/or element. Please refer to the procedure for Internal Audit.

6.0 Associated Forms/Procedures/Work Instructions

7.0 Records

Master List of Documents

DCR

8.0 Change History

Rev. Level	Date	Change	By
1	24/Apr/2006	New Procedure	

DWQMS Procedure

Title: **Control of Records**	Control No: **DPro 2**	Rev: **1** Effective: **22/Apr/2006**
Author: **Megan Loomis**	Reviewer: **Rick Bright**	Approver: **Mansard Dokken**

1.0 Purpose

The purpose of this procedure is to describe the methods for identification, storage, protection, retrieval, retention time and disposition of records.

2.0 Scope

This procedure is applicable to all DUSI employees who manage or perform work related to the water plant and distribution operations and covers all Quality records identified in the implemented QMS.

3.0 References

DWQMS: Element 5
Ontario Regulation 128/04
Ontario Regulation 170/03
SDWA, 2002 Section 17, Clause (2)

4.0 Definitions

Soft Copy	a record that is generated or retained in electronic format
Current Record	a record that has not yet exceeded its specified minimum retention time.
DWQMS	Drinking Water Quality Management Standard
QMS	Quality Management System

5.0 Procedure

5.1 Records are maintained as objective evidence that the requirements of the Ontario Ministry of Environment Regulations and the DWQMS are being effectively addressed.

5.2 Records may be retained in hard copy (i.e. test reports, lab results, equipment maintenance and calibration…) or in soft copy (i.e. SCADA, excel…).

Records Required by MOE Regulations

5.3 All records required by the MOE regulations (referenced above) to demonstrate compliance and/or conformance shall be maintained per the regulations.

5.4 Minimum retention times for all MOE required records are as follows:

5 Years
Test Records Per
Schedules 6, 7, 8, 10, 23 and 24 of O. Reg. 170/03
Schedule 3 of O. Reg. 169/03

Training Records per
Certification of Operators – O. Reg. 128/04

Reports per
Annual Reports, Section 11 of O.Reg. 170/03
Summary Reports for Municipalities, Schedule 22 of 170/03

All other records where a minimum retention time is not specified by the applicable regulation. This includes records required by the CSA DWQMS Standard and those required by ISO 9001:2000.

15 Years
Test Records per
Schedule 13 and17, (Sections 17-10 through 17-13) of O. Reg 170/03
Reports per
Schedule 21 of O. Reg 170/03
Engineers Report

5.5 All records required to demonstrate conformance to the requirements of the DWQMS shall be retained for the following minimum time periods:

5 Years
Corrective Action Requests
Preventive Action Requests
Internal QMS Audit Reports
Management Review Minutes

Calibration Results
Consumer Enquiries (Relating to Drinking Water Quality)
Service Requests
Water Committee Minutes
Supplier Evaluations

5.6 All logs, records and reports that demonstrate compliance and/or conformance shall be retained/filed chronologically [O. Reg. 128/04 27 (2)] by type and in such a manner as to make them accessible. Additionally, data/information entered into all logs, records and reports shall clearly identify the individual responsible for making the entry.

5.7 All records and reports that demonstrate compliance and/or conformance shall be stored in a manner that protects them from damage or deterioration. Care shall be taken to ensure that no records, hard or soft copy, are exposed to elements or conditions that may damage the integrity of the information contained therein.

5.8 All records generated by the SCADA system may be retained in either hard or soft copy per the retention times indicated in section 5.4.

5.9 Records that have exceeded the minimum retention times prescribed by regulation or this procedure shall be disposed of in a manner appropriate to the nature of the information contained therein. Any records that are retained for knowledge, legal or other purposes beyond the specified minimum retention time shall be stored separate from those records that are deemed to be current.

5.10 Where required by regulation, records shall be made available to the public through the DUSI website, or upon request.

5.11 All records shall be readily retrievable for the purposes of the utility owner or for inspection by a regulatory body.

6.0 Associated Forms/Procedures/Work Instructions

7.0 Records

8.0 Change History

Rev. Level	Date	Change	By
1	22/Apr/2006	New Procedure	

		DWQMS Procedure

Title: **Procedure for the Review and Updating of Risk Assessment Process**	Control No: **DPro 3**	Rev: **1** Effective: **19/Mar/2006**
Author: **Rick Bright**	Reviewer: **Megan Loomis**	Approver: **Mansard Dokken**

1.0 Purpose

This procedure identifies the process for the review and updating of the Risk Assessment process and the determination of the Critical Control Points.

2.0 Scope

This procedure is applicable to all water plant operations.

3.0 References

DWQMS: Element 7

4.0 Definitions

Critical Control Point (CCP) - a step or point in a drinking water system at which control can is applied by the operating authority to prevent or eliminate a drinking water health hazard or reduce it to an acceptable level.

5.0 Procedure

5.1 The Manager of Operations convenes a team to perform the risk assessment. The initial team included the Manager of Operations, Lead Operator, and one other operator and the operator/document technician.

5.2 The hazardous Events, associated hazards and CCPs were initially identified through the risk analysis and activities as part of the development of the overall DWQMS.

5.3 Critical Control Points are summarized in the Critical Control Point Analysis.

5.4 At a minimum of once a year the Lead Operator reviews the risk assessment to ensure that the information used remains current and that assumptions remain valid.

5.31 Examples of what may affect the risk assessment and the Critical Control Point Analysis are:

- Changes to applicable regulations
- Changes to the water treatment process equipment and/or infrastructure
- Changes in land uses, point or non-point sources of pollution in the watershed
- Changes in water quality

5.32 The Lead Operator summarizes the findings of his review in a memo to the Manager of Operations and includes a recommendation as to whether the risk assessment needs to be redone or updated.

5.5 The memo in 5.3 becomes one of the input items to the Management Review.

5.6 A minimum of once every three years, or earlier if the Management Review reveals a need, Top Management shall direct the Management Systems Representative to update or redo, or cause to be updated or redone, the risk assessment and Critical Control Point Analysis.

5.7 The changed documents shall be submitted to Top Management for review and approval.

6.0 Associated Procedures/Forms/Work Instructions

Risk Assess Procedure – DPro 13

7.0 Records

Risk Assessment DR 2
Critical Control Point Analysis DR 3

8.0 Change History

Rev. Level	Date	Change	By
1	19/Mar/2006	New Procedure	

Title: **Management Review**	Control No: **DPro 4**	Rev: **1** Effective: **24/Apr/2006**
Author: **Megan Loomis**	Reviewer: **Rick Bright**	Approver: **Mansard Dokken**

1.0 Purpose

This procedure defines the process for the review of the effectiveness of the DWQMS by Top Management.

2.0 Scope

Management review includes management activities, plant operations and distribution activities identified in the Operational Plan.

3.0 References

DWQMS: Elements 20

4.0 Definitions

DWQMS	Drinking Water Quality Management Standard
QMS	Quality Management System

5.0 Procedure

5.1 Top management of DUSI shall review the DWQMS on an annual basis, at a minimum, to assess and ensure its continuing suitability, adequacy and effectiveness. A formal management review shall be included in the internal audit schedule and be conducted on or before the end of the third quarter of each fiscal year.

5.1.1 For the purposes of this procedure, Top Management consists of:
- DUSI President
- Operations Manager

5.1.2 The President may include other DUSI personnel at his discretion

5.1.3 Attendees shall be notified using the planning function in Outlook

5.2 A minimum of one week prior to the scheduled meeting the Management Representative shall provide to the management review meeting attendees a summary of the following information in a suitable format (statistical, written narrative, graphical, etc…), where applicable:
- Detailed listing of incidents of regulatory non-compliance including adverse drinking water conditions
- Results of internal and third party DWQMS audits
- Results of MOE or other regulatory body compliance audits
- The efficacy of the risk assessment process

- Results of actual or simulated emergency response activities
- Listing of corrective and preventive actions requested between reporting periods and the status of all corrective action requests and preventative action requests. (Open, Pending Approval or Closed)
- Summary and status of consumer and customer complaints
- Summary of operational performance – noting any deficiencies or below optimum results
- Water quality trends
- Status of action-items from last Management Review
- Results of Water Committee meetings
- Potential changes in process or management that may affect drinking water Quality
- Recommendations for improvement from internal sources and other interested parties
- Resources required to maintain and improve the QMS
- Results of Infrastructure Review

5.3 The Management Representative shall prepare a meeting agenda and distribute the meeting agenda with the Management Review data.

5.4 The management review participants shall review all data presented, and where necessary make recommendations and initiate action, as appropriate, for the:

- Improvement of the effectiveness of the QMS and related procedures
- Improvement of DUSIs ability to implement the QMS
- Provision of human and financial resources
- Improvement in the level of consumer and customer satisfaction

5.5 Records of management review shall be maintained by the Management Representative. The records shall reflect all new action items and any decisions made by the review team.

5.5.1 Records of Management Review shall be provided to the Town of West Chester (Owner)

6.0 Associated Forms/Procedures/Work Instructions

Corrective Action Procedure DPro 7
Preventive Action Procedure DPro 8
Improvement Procedure DPro 22

7.0 Records

Management Review Agenda
Management Review Meeting Minutes

8.0 Change History

Rev. Level	Date	Change	By
1	24/Apr/2006	New Procedure	

Title: **Internal Audit**	Control No: **DPro 5**	Rev: **2** Effective: **8/May/2006**
Author: **Megan Loomis**	Reviewer: **Rick Bright**	Approver: **Mansard Dokken**

1.0 Purpose

The purpose of this procedure is to define the process used by DUSI personnel and/or its contractors to conduct internal QMS audits.

2.0 Scope

This procedure is applicable to DUSI Water Utility management and plant operations that fall under the scope of the DWQMS.

3.0 References

DWQMS Elements 19

4.0 Definitions

Auditee — Individual or group of individuals conducting or owning the activities and/or requirements being audited

5.0 Procedure

5.1 Internal audits of the QMS shall be conducted to confirm that the QMS meets or exceeds the requirements of the DWQMS and that it is effectively implemented and maintained.

5.2 Internal audits shall only be conducted by:

- DUSI personnel who have completed internal audit training,
- Internal auditors from other water systems, or contractors who can provide objective evidence that they possess internal auditor training.

5.2.1 The Management Representative shall maintain a list of qualified internal auditors.

Audit Schedule

5.3 The number and frequency of the audits shall be identified in the internal audit schedule.

5.3.1 The Management Representative shall establish and maintain a rolling 12-month internal audit schedule.

5.3.2 The audit schedule shall ensure that all requirements of the Standard and components of the QMS are assessed within a twelve-month period.

5.3.3 The Management Representative shall issue all audit assignments at least 60 days prior to the scheduled audit. Audit assignments shall be documented. An email sent to the assigned auditor is acceptable.

Audit Preparation

5.4 The internal auditors shall prepare for scheduled internal audits. Preparation shall include, at a minimum:

- The creation of an audit file as a repository for all audit related documentation. The audit file shall be identified by audit date and include a brief description of the area or functions being audited.
- Notifying those responsible for the function(s) to be audited of the upcoming audit at least 5 working days ahead of time.
- Review of the appropriate element(s) and functionally related documentation
- Preparing audit questions (in the form of a checklist). Blank checklists may be retained for future audits. In time, there will be sufficient checklists for all internal audit scenarios. Blank audit checklists shall be retained by the Management Representative and be made available to the internal auditor as appropriate.

5.4.1 The Management Representative may review the audit checklist at his discretion.

Conducting the Audit

5.5 The auditor may conduct an opening meeting to review the purpose and scope of the audit. The auditor may also confirm the date and location of the closing meeting at this time. While not mandatory, the opening meeting gives the auditee an opportunity to confirm the availability of personnel, or to advise of any changes to the functional area.

5.5.1 Should an opening meeting be conducted, a record of attendance shall be retained for the audit file.

5.6 The auditor shall review records of, and conduct interviews with the personnel responsible for the functional area in order to determine conformance of the QMS to the requirements of the DWQMS.

5.7 The auditor shall note instances of conformance and non-conformance.

5.7.1 The question or checklist shall be annotated simply with "C" when conformance is determined.

5.7.2 The question or checklist shall be annotated with an "N/C" when a non-conformance is discovered. Additionally, the auditor shall record the non-conformance information in the following manner:

- State the requirement – identify and paraphrase the requirement, either from the Standard or the procedure, etc…
- State the non-conformance
- State the objective evidence

5.7.3 The auditor shall note the number and type of records reviewed and record the names of the personnel interviewed during the course of the audit.

5.8 The auditor shall advise the auditee of any non-conformances discovered during the course of the interviews. This is done to help the auditee understand the requirement - especially if the QMS has been newly implemented.

5.8 Upon completion of the review of documentation, and the collection of objective evidence and the interviews the auditor shall conduct a closing meeting. During the closing meeting the auditor shall identify the strengths and any weaknesses of the portion of the QMS audited.

5.8.1 If non-conformances have been discovered they shall be presented to the auditee at this time.

5.8.2 The auditor may provide the auditee with CARs at this time, or wait and provide them with the audit report.

5.8.3 A record of closing meeting attendance shall be retained

Audit Report

5.9 The auditor shall provide a written report of the findings to the manager of the functional area audited within 7 working days of the audit. The audit report should be in narrative form complete with any CARs (if not provided during the closing meeting). A copy of the audit report shall also be provided to the Management Representative (if the he/she is not the manager of the functional area).

5.10 A copy of the audit report, checklist(s), attendance report(s) and CARs shall be filed in the audit file maintained by the Management Representative.

Audit Follow-Up

5.12 The audit will be considered closed once all corrective actions have been verified as being effective.

6 Associated Forms/Procedures/Work Instructions

Audit Schedule
Qualified Internal Auditor List
Internal Audit Checklist
Management Review Procedure DPro 4

7 Records

Opening Meeting Attendance (optional)
Internal Audit Report
Corrective Action Report
Closing Meeting Attendance

8 Change History

Rev. Level	Date	Change	By
1	19/Mar/2006	New Procedure	
2	8/May/2006	Added Corrective Action details	Megan Loomis

Title: **Calibration**	Control No: **DPro 6**	Rev: **1** Effective: **22/Apr/2006**
Author: **Megan Loomis**	Reviewer: **Rick Bright**	Approver: **Rick Bright**

1.0 Purpose

To identify the process for the calibration of on-line measuring and recording devices.

2.0 Scope

This procedure is applicable to measuring and recording devices used by DUSI for monitoring and parameters of raw, in-process and potable drinking water from the intake well, through processing and pumping (before discharge into distribution system).

3.0 References

DWQMS Element 17

4.0 Definitions

None

5.0 Procedure

5.1 The calibration of on-line measurement and recording devices is divided into two categories:

a) devices calibrated by the operator

b) devices calibrated by a certified contractor

Devices Calibrated by Operator

5.2 All devices calibrated by the operator are to manufacturer's specifications. Current manuals are maintained at the plant or appropriate distribution facility. See Asset Management Procedure.

5.2.1 Each device is uniquely identified with an asset number.

5.2.2 Calibration frequency for each device has been documented in the Calibration Process Equipment Listing.

5.2.3 Calibration records are maintained at the plant

5.2.3.1 All calibration results shall be recorded using the Calibration Record Form # DF 9a. The completed record is assigned an identifying number starting with the letters DR, and is further identified by the unique asset number of the device.

5.3 Devices that are suspect, or no longer capable, shall be removed from service and replaced.

Devices Calibrated by Certified Contractor

5.4 The certified contractor shall provide evidence of qualification to DUSI.

5.5 Records/certificates are provided for all devices calibrated by a certified contractor.

5.5.1 Records of calibration from certified contractors are retained at the Water Treatment Plant.

5.5.2 The name(s) of certified contractor(s) for calibration shall appear on the Critical Supplies and Suppliers list.

6.0 Associated Forms/Procedures/Work Instructions

Calibrated Process Equipment Listing

Operator Calibration Form DF 9a

7.0 Records

Critical Supplies and Suppliers List
Record of Calibration R9
Record/Certificate of Calibration (Certified Contractor)

8.0 Change History

Rev. Level	Date	Change	By
1	22/Apr/2006	New Procedure	

1.0 Purpose

The purpose of this procedure is to identify the method for communicating the Quality Management System to all stakeholders.

2.0 Scope

This procedure is applicable to top management of the water department at DUSI. Top management shall ensure the requirements of this procedure are maintained.

3.0 References

DWQMS Element 12

4.0 Definitions

5.0 Procedure

5.1 The Operational Plan and procedures of the QMS are available in electronic, read only, format to all DUSI employees on the intranet. The Quality Policy is conspicuously displayed throughout DUSI facilities.

5.1.1 All current employees of the DUSI Water Department will have attended a QMS Overview. The QMS Overview is also available on the intranet in PowerPoint format.

5.1.2 Any new employees are required to review the PowerPoint QMS Overview as part of their orientation. This review is conducted by the DUSI Water Department Safety Officer.

5.2 The structure and status of the QMS (suitability and continuing effectiveness) is communicated to top management by following the Management Review process. Records of management review are maintained.

5.2.1 Top management may, from time to time, request additional information regarding the QMS. Typically, these requests would be made when there has been a change in the documented requirements (i.e. revisions to the legislative and regulatory requirements or the DWQMS) or when a new process has been introduced to the plant or the distribution system.

5.3 The structure and status of the QMS is communicated to the owner (Municipality of West Chester) during the monthly Water Committee Meetings, as appropriate. Minutes of the meetings are maintained. The QMS Representative is responsible for ensuring that the Owner is always in possession of a current copy of the Operational Plan.

5.4 Essential suppliers receive information regarding the QMS from the purchaser if and when necessary.

5.5 Information regarding the QMS is available on both the DUSI website (wyw.dusiwater.org) and the Municipality of West Chester website (wyw.westcest.on.org.gov). All billing information that is mailed to the end user includes the websites.

5.5.1 The public is also encouraged to visit the DUSI website through the use of newsprint ads and billing inserts.

5.5.2 A copy of the Operational Plan is available for viewing at the DUSI office and at the Municipal Office.

6.0 Associated Forms/Procedures/Work Instructions

DWQMS Overview
Management Review Procedure DPro 4
Quality Policy

7.0 Records

Management Review Meeting Minutes
Water Committee Meeting Minutes

8.0 Change History

Rev. Level	Date	Change	By
1	22/Apr/22		

Title: **Purchasing Procedure**	Control No: **DPro 8**	Rev: **1** Effective: **22/Apr/2006**
Author: **Megan Loomis**	Reviewer: **Rick Bright**	Approver: **Mansard Dokken**

1.0 Purpose

The purpose of this procedure is to define the processes for:

- the selection of suppliers
- how purchased product requirements are communicated to suppliers
- how purchased product is verified

2.0 Scope

This procedure is applicable to all personnel who purchase products and services that may affect drinking water Quality. This product is defined as:

- Chemical additives
- Filter chamber media
- Test, measuring and metering equipment
- Process and other equipment
- Contractor services
- Engineering services
- Testing services
- Calibration services

3.0 References

DWQMS Elements 1.15 & 1.16

4.0 Definitions

Planned Purchase	The purchase of a product or service that is not required immediately by the Water Treatment Plant in order to support the continual supply of safe drinking water.
Unplanned Purchase	The purchase of a product or service that is required immediately by the Water Treatment Plant in order to support the continual supply of safe drinking water.

5.0 **Procedure**

Supplier Control

5.1 All suppliers are selected upon their ability to meet and maintain DUSI requirements for purchased product and services. Performance is periodically evaluated for those suppliers whose product or service may have an affect on the Quality of the drinking water.

5.1.1 Purchased product requirements are clearly described at the time of purchase by DUSI personnel. Standards are referenced when applicable (i.e., AWWA, NSF Standards for chemical additives.)

5.1.2 Product specifications, standards and/or descriptions, and performance criteria are indicated on the purchasing documentation as appropriate. Note: Supplier packing slips, Bill of Lading and Certificates of Analysis are acceptable purchasing documentation in lieu of a Purchase Order.

5.1.3 A Master List of approved suppliers is maintained by the Manager of Operations.

5.2 Suppliers whose product or service may affect drinking water quality are required to provide evidence that their product or service meets specified, industry (i.e. AWWA, NSF, ANSI, CSA, UL , etc…) MOE Standards.

5.2.1 Chlorine, alum and filter media shall be to AWWA/NSF Standards.

5.2.2 Calibration services shall be performed by certified calibration technicians using fully traceable equipment, standards, and/or instrumentation (preferably traceable to NIST, as applicable).

5.2.3 Only MOE accredited laboratories shall be contracted to provide analysis of drinking water samples.

5.2.4 All engineering firms shall provide an engineer’s seal with any reports, plans or drawings relating to construction at, or performance of the drinking water plant and associated distribution system.

5.2.5 Contractors are informed about the QMS and specific requirements related to the service they are providing, where the service could affect drinking water quality (i.e. disinfection of equipment or structures, need to maintain continuity of treatment processes, etc.).

Planned Purchases

5.3 A Purchase Requisition shall be completed by personnel for all planned purchases of goods or services that have a unit price in excess of $100.00, or a total price in excess of $250.00.

5.3.1 The requisition shall clearly describe the product or service being requested complete with a reference to applicable specifications, standards, Quality requirements or regulations as appropriate.

5.3.2 The completed requisition shall be forwarded to the Manager of Operations for approval. The Manager of Operations may approve the purchase request, direct the employee to obtain an alternate source/product/price, or, not approve the request.

5.3.2.1 Should the employee be directed to obtain pricing for an alternate product, or from an alternate source – the alternate product or source must meet all DUSI criteria.

5.3.2.2 The revised requisition shall be forwarded to the Manager of Operations for approval.

5.3.2.3 The approved requisition shall be returned to the employee to be acted upon.

5.4 The employee shall contact an approved supplier and request the product or service. The employee shall describe the product or service and provide any additional details that are relevant – such as expected delivery date, transport method – and provide a Purchase Order number.

5.4.1 The Purchase Order number shall be recorded on the P/O log along with the supplier's name, a brief description of the product, the order date and the expected delivery date.

5.4.2 The Purchase Order number shall also be recorded on the approved requisition. Whenever practical, the employee shall also record the supplier's contact name with whom the order was placed on the face of the requisition.

5.4.3 A written purchase order shall be issued for all planned purchases that have a unit price in excess of $100.00, or where the total for goods or services purchased exceeds $250.00.

5.5 A copy of the purchase order and approved requisition shall be forwarded to the accounting department for retention.

5.6 Upon receipt and acceptance of goods or services ordered, the employee shall mark any Packing Slips, Bills of Lading, Work Orders etc… with the corresponding Purchase Order number.

5.5.1 Supplier provided documentation (other than Chemical Certifications) shall be forwarded to the accounting department for processing and matching with the P/O and/or requisition. Chemical certifications shall be retained by the Manager of Operations.

Unplanned Purchases

5.7 Unplanned or emergency purchases may be made using the corporate credit card, or through approved sources where credit has been made available. The credit card receipt and/or the supplier's documentation (sales slip, etc…) shall contain an accurate description of the goods or services purchased.

5.7.1 The water treatment Manager of Operations shall be made aware of the need for an unplanned purchase whenever practical.

5.7.2 Credit card receipts and/or sales slip shall be initialled by the purchaser and include a brief description of the product or service. A separate piece of paper may be used.

5.7.3 Credit card receipts and sales slips shall be forwarded to accounting for processing.

Product Verification

5.8 All purchased product (see 2.0 Scope for guidance) shall be verified prior to use or application when practical. Verification activities may include one more of the following:

- Visual inspection of the product
- Review of documentation accompanying the product
- Acceptance of a Certificate of Analysis
- Testing of the product

6.0 Associated Forms/Procedures/Work Instructions

Chemical Receiving Procedure DPro 25
Communication Procedure DPro 7

7.0 Records

Approved Supplier List

8.0 Change History

Rev. Level	Date	Change	By

1	22/Apr/2006		

Title: **Sampling**	Control No: **DPro 9**	Rev: **1** Effective: **22/Apr/2006**
Author: **Megan Loomis**	Reviewer: **Rick Bright**	Approver: **Mansard Dokken**

1.0 Purpose

This procedure describes the sampling activities conducted by DUSI to assure compliance to Ontario Regulations in the production of safe drinking water.

2.0 Scope

This procedure is applicable to water treatment plant operations.

3.0 References

DWQMS Elements 16

Standard Methods for the Examination of Water and Wastewater – 20th Edition

4.0 Definitions

DWQMS	Drinking Water Quality Management Standard
QMS	Quality Management System
WTP	Water Treatment Plant

5.0 Procedure

5.1 Samples are categorised as follows:

- Samples for on-site analysis (Free chlorine, Turbidity, pH colour, etc.)
- Continuous SCADA sampling (Free chlorine, Turbidity & pH, flow monitoring, water well levels)
- Microbiological samples (total coliform, E. Coli and HPC)
- Chemical samples (Organics, inorganic, nitrate & nitrite, lead, trihalomethanes, sodium & fluoride, etc.)
- Suspended solids sample (Supernatant)
- MOE samples (DWSP)

5.2 Sampling activities include the raw water supply and treatment plant operations.

5.2.1 Physical samples are retrieved from various points in the process by plant personnel.

5.2.2 The SCADA system conducts continuous sampling.

5.2.3 At a minimum, samples are taken in compliance with all applicable Ontario Regulations. See the Regulatory Reporting Register (DUSI document DW 2) for all that apply.

5.2.4 Samples are collected at three points in the treatment process; raw water, process water and treated water as listed in the following table. Raw water and treated water are sampled from taps located in the laboratory, while process water is obtained as a grab sample from the top of the filters. These samples are collected a minimum of three days a week.

Required On-site Analysis – 3 days a week

Raw Water	Process Water	Treated Water
Turbidity	Turbidity	Free Chlorine Residual
Temperature	pH	Turbidity
pH	Colour	Temperature
Colour		pH
Alkalinity		Colour
		Alkalinity
		Aluminum

5.3 Physical samples shall be collected by certified operators only. Proper care shall be taken to ensure that contaminants are not introduced to the sample during collection by the operator.

5.3.1 Operators shall follow the sample collection protocol as documented in Section 1 of “Standard Methods for the Examination of Water and Wastewater – 20^{th} Edition”.

5.4 The results of all SCADA sampling shall be printed and filed by WTP personnel on a daily basis (except on weekends and statutory holidays – first working day afterward is acceptable). Sampling result trends compiled by SCADA shall be printed monthly and annually and be retained at the water treatment plant. Copies may also be provided to the Water Superintendent.

5.5 The results of all microbiological and chemical samples (Accredited Laboratory Results) shall be retained by the Operations Manager. All other sampling records are the responsibility of the Lead Operator and shall be retained at the Water Treatment Plant.

5.5.1 The Operations Manager shall ensure that all microbiological and chemical sampling records from accredited laboratories are properly filed and maintained in such a manner as to prevent damage, loss or deterioration and be readily retrievable.

5.5.2 The Lead Operator shall ensure that all other sampling records other than those stated in 5.6.1 are properly filed and maintained in such a manner as to prevent damage, loss or deterioration and be readily retrievable.

5.6 The results of all Bacteriological and Chemical sampling shall be provided by DUSI to the Municipality of West Chester. The results shall be reviewed during monthly Water Committee meetings.

5.6.1 The Municipality of West Chester posts the results on their website (www.MoWC.org) as public information.

5.6.2 The Municipality of West Chester is immediately informed of any adverse water samples and corrective actions.

5.7 The Municipality of West Chester operates the distribution system and is responsible for sampling and monitoring. The Municipality informs DUSI of any problems maintaining water quality in the distribution system so that adjustments to the treatment process can be made.

5.8 Under challenging conditions, additional sampling may be taken at the plant.

5.8.1 If the filter runs are less than 12 hours, the clarifier supernatant will be sampled for turbidity to assess clarifier performance.

5.8.2 If conditions are changing in the raw water as a result of changing seasons, or if raw water quality deteriorates as indicated by raw water turbidity due to weather conditions, jar testing will be completed to optimize coagulation. Jar testing will be performed following the jar test work instruction. Grab samples will also be taken throughout the process to monitor for pH and turbidity to ensure the process is under control.

6.0 Associated Forms/Procedures/Work Instructions

Master List of Sampling DW3

7.0 Records

SCADA Based Sampling Records

PRIMARY SCADA SAMPLINF POINTS					
SAMPLE	**PROCESS**	**SCADA ID #**	**DAILY REPORT**	**MONTHLY REPORT**	**ANNUAL REPORT**
Water Level (m)	Low Lift Well	AIT2040	Yes	Yes	Yes
Water Temperature	Raw Water	AIT2125	Yes	Yes	Yes
Raw water flow (L/s)	Inlet to Solids Contact clarifier	AIT2140	Yes	Yes	Yes
Alum Flow signal	Alum	AIT2530	Yes	Yes	Yes
Polymer Flow signal	Polymer	AIT 2540	Yes	Yes	Yes
Turbidity (NTU)	Raw water -Low Lift Pump House	DIT2301	Yes	Yes	Yes
Turbidity (NTU)	Filter #1, 2, 3, 4	DIT2311 to DIT 2314	Yes	Yes	Yes
Water Level (m)	Clearwell	AIT 2050	Yes	Yes	Yes
Water Level (m)	Reservoir	AIT 2060	Yes	Yes	Yes
Treated water flow (L/s)	High Lift Discharge Header	AIT2240	Yes	Yes	Yes
Chlorine Residual (mg/L)	High Lift Discharge Header	AIT2240	Yes	Yes	Yes
Turbidity (NTU)	High Lift Discharge Header	DIT2324	Yes	Yes	Yes
Pressure (KPa)	High Lift Discharge Header	DIT2610	Yes	Yes	Yes

Manual Sampling Records

Accredited Laboratory Reports – Bacteriological and chemical

Daily log sheets (Form 501)

Raw Water Temperature (Form 511)

Raw Water Turbidity (Form 512)

Raw Water pH (Form 513)

Raw Water Colour and Alkanity (form 514)

Process Water Colour, pH, turbidity (form 515)

Contact Chamber Chlorine Residuals (Form 516)

Treated Water Aluminum Residual (Form 517)

Treated Water Chlorine Residual, turbidity, temperature, pH, colour and alkanity (Form 518)

Jar Test (Form 520)

JFloc Test (Form 521)

Calibration cards

8.0 Change History

Rev. Level	Date	Change	By
1	22/Apr/2006	New Procedure	

Title: **Monitoring**	Control No: **DPro 10**	Rev: **2** Effective: **5/May/2006**
Author: **Megan Loomis**	Reviewer: **Rick Bright**	Approver: **Mansard Dokken**

1.0 Purpose

This procedure describes the monitoring activities for the water treatment and distribution activities of DUSI – Water Department.

2.0 Scope

This procedure is applicable to plant and distribution operations.

3.0 References

DWQMS	Element 16

4.0 Definitions

DWQMS	Drinking Water Quality Management Standard
QMS	Quality Management System
WTP	Water Treatment Plant
SCADA	Supervisory Control and Data Acquisition

5.0 Procedure

5.1 DUSI plant and distribution personnel shall monitor WTP and various points in order to ensure that operational parameters are being maintained.

5.2 Monitoring methods include:

- SCADA
- Visual confirmation of monitoring equipment readings.

5.3 The WTP operators shall monitor SCADA displayed data and conduct visual equipment/process/product monitoring during normal working hours (7:00am to 12:30pm – Monday to Friday, excluding Statutory Holidays and personnel vacation [2nd shift only])

5.4 The SCADA system monitors process parameters and/or water quality characteristics at all points identified on the Operations Schematic (except Travelling Screen).

5.4.1 The SCADA system has been programmed with warning thresholds to advise operators of a declining condition in advance of failure to meet minimum requirements.

5.4.2 The SCADA system monitors process parameters and/or water quality in the following locations:

- Low lift
- Filters
- Backwash well
- Waste water tanks #1 & #2
- Reservoir
- High lift

In all, a total of 41 instruments are used to monitor the above process areas and equipment. The SCADA Monitoring List documents the Process, Instrument Asset # and description, area monitored and unit of monitoring measurement.

5.4.3 The SCADA system is equipped with an automatic dialler to alert DUSI personnel of declining conditions during off-shift hours. Refer to the Coverage Procedure for additional information.

5.5 WTP operators shall also monitor process parameters and product characteristics that may be indicators of a potential change to process or product Quality that are not included in SCADA.

5.5.1 Daily visual verification shall be made of the following:

- Pumping equipment
- Travelling screen
- Raw water
- Quantity of chemicals on-hand, chemical usage
- Clarifier
- Filters

5.5.1.1 In the event that maintenance is required, the operator shall take the necessary action to ensure the maintenance requirements are reported and that the on-going supply of safe drinking water is maintained.

6 Associated Forms/Procedures/Work Instructions

Coverage Procedure DPro 11

7 Records

Daily Log

SCADA Monitoring Results (Daily, Monthly & Quarterly)

8 Change History

Rev. Level	Date	Change	By
1	19/Apr/2006	New Procedure	
2	5/May/2006	Updated 5.4	Rick Bright

Title: **Coverage**	Control No: **DPro 11**	Rev: **1** Effective: **19/Apr/2006**
Author: **Megan Loomis**	Reviewer: **Rick Bright**	Approver: **Mansard Dokken**

1.0 Purpose

This procedure describes the Operational Coverage of the water treatment plant by DUSI Water Department personnel.

2.0 Scope

This procedure is applicable to plant and distribution operations.

3.0 References

DWQMS	Element 1.14

4.0 Definitions

DWQMS	Drinking Water Quality Management Standard
QMS	Quality Management System
WTP	Water Treatment Plant
SCADA	Supervisory Control and Data Acquisition

5.0 Procedure

5.1 The water treatment plant is staffed by DUSI personnel as follows:

Normal Working Hours (Shift Overlap)

7:00am to 12:30pm – Monday to Thursday

7:00am to 6:00pm – Friday

5.2 The Manager of Operations shall assign an on-call operator for the time that the WTP is un-staffed. The on-call operator shall provide shall be assigned on a weekly basis, covering from 6:00pm Friday to 7:00am the following Friday.

5.3 The on-call operator is responsible for all un-staffed hours during the work week, the weekends and any Statutory Holidays.

5.4 The on-call operator shall inspect the WTP at least once during each weekend day and on Statutory holidays. The time of the inspection shall be entered into the daily log, as well as any out-of-the-ordinary circumstances.

5.5 The WTP SCADA system is equipped with an auto-dialler that contacts a contracted call service whenever there is an alarm condition during off-hours. The contracted call service contacts the on-call operator.

5.6.1 The on-call operator shall determine the nature of the alarm and respond accordingly.

5.7 The on-call operator shall be required to respond to all alarm conditions within 20 minutes of receiving the call.

5.8 The operations manager is the normal designated ORO. The lead operator is the alternate designated system ORO. The ORO will respond as necessary within 2 hours of being notified. If the ORO is unable to act for an extended period of time, an alternate ORO will be designated in the daily log book.

5.9 All reported alarms and the resulting action taken shall be recorded in the daily log.

9 Associated Forms/Procedures/Work Instructions

10 Records

Daily Log

SCADA Monitoring Results

11 Change History

Rev. Level	Date	Change	By
1	19/Apr/2006	New Procedure	

	DWQMS Procedure	

Title: **Emergency Management**		Control No: **DPro 12**	Rev: **1** Effective: **19/Apr/2006**
Author: **Megan Loomis**	Reviewer: **Rick Bright**		Approver: **Mansard Dokken**

1.0 Purpose

This procedure identifies documented procedures for emergency conditions as well as contact procedures.

2.0 Scope

The procedures shall include all employees who work within the Water treatment and distribution systems.

3.0 References

DWQMS Elements 18

4.0 Definitions

DWQMS	Drinking Water Quality Management Standard
QMS	Quality Management System

5.0 Procedure

Emergency Procedures

5.1 The Municipality of West Chester Emergency Plan and the procedures contained therein shall be followed in the case of emergency conditions.

Potential Emergency Situations

5.2 The following table identifies potential emergency situations and their effects.

TRIGGER EVENTS	POTENTIAL EFFECTS

WEATHER RELATED Tornadoes Blizzards / Ice storms Thunder / lightning storms Earthquakes	High winds Heavy rain / snowfalls	Structural damage, Flooding Power outage Process malfunction Equipment failure Injury Contamination to water Environmental damage
POOR SOURCE WATER QUALITY Water Degradation Water Contamination	High Turbidity, Temp, pH Chemical Spills, Leaks Pathogens Waterborne Disease	Disease, sickness
WATER BORNE DISEASE	Pathogenic Organisms	Sickness Health Effects
POWER INTERUPTIONS Storms System / Grid Failure	Power outages Electrical	Quantity/Quality of supply Equipment Failure
TREATMENT PROCESS MALFUNCTION	Refer to Risk Analysis	Water Quality Water Supply
CHEMICAL SPILLS / LEAKS a) On-Site Chemicals Cl2, Alum, Diesel, CO2, Oils, Greases... b) Off-site Lake Freighters Accidents	On-site Contamination Fires / Explosions Source Contamination Air Quality	Injury Illness, health risk Water Quality Environmental damage
TERRORISM / VANDALISM	Contamination Fires / explosions Structural Damage System / Equipment Failure	Disease, sickness Injury Water Quality Water Supply

Emergency Preparedness, response and recovery

5.3 The following table lists contingencies in place for each type of emergency.

Type of Emergency	***Contingency in Place***	***Estimated Probability*** ***(high, medium, low)***	***Category of Emergency*** ***(minor, major, disaster)***
Weather Related	Diesel Power Generator Low Lift Diesel Pump Standby Personnel SCADA Alarm System	Medium	Minor Emergency to Disaster
	Sampling / Monitoring	Low	Minor Emergency to

Water Quality Degradation	Program SCADA		Disaster
Waterborne Disease	Sampling	Low	Minor Emergency to Disaster
Power Interruptions / Failures	Standby Power	Low	Minor Emergency to Major Emergency
Treatment Process Malfunction	Redundancies	Low	Minor Emergency to Major Emergency
Chemical Spills / Leaks	Containment Training Safety Procedures Spill Response Procedure	Low	Minor Emergency to Disaster
Terrorism / Vandalism	Security Measures Doors, Cameras, Lighting	Low	Minor Emergency to Disaster

5.4 This procedure shall be reviewed as part of the Management Review process. The Emergency Plan shall be updated to reflect changes in technology, responsibility or personnel.

5.5 Emergency Response and Recovery Procedures are included in the Emergency Plan.

5.6 Training and testing of Emergency responses and recovery procedures shall occur annually. Training shall consist of presentations to water system staff on emergency procedures. Testing shall consist, at a minimum, of a desk top run through of emergency procedures. Records of all training and testing shall be maintained by the Manager of Operations.

6.0 Associated Forms/Procedures/Work Instructions

Emergency Contacts List – Operational Plan

Emergency Response and Recovery Procedures – Emergency Plan (not included in this draft model operational plan.)

7.0 Records

8.0 Change History

Rev. Level	Date	Change	By
1	19/Apr/2006	New Procedure	

Title: **Risk Assessment Procedure**	Control No: **DPro 13**	Rev: **1** Effective: **22/Apr/2006**
Author: **Megan Loomis**	Reviewer: **Rick Bright**	Approver: **Mansard Dokken**

1.0 Purpose

This procedure defines the method used for identifying hazardous events and associated hazards, ranking hazardous events, identifying critical control points, and control limits. The outcome of this task is presented in the Operational Plan and the associated CCP procedures.

2.0 Scope

This procedure is applicable to the entire works.

3.0 References

DWQMS Elements 7 and 8

4.0 Definitions

CCP Critical Control Point: A step or point in a drinking water system at which control can be applied by the operating authority and is essential to prevent or eliminate a drinking water health hazard or reduce it to an acceptable level.

5.0 Procedure

5.1 DUSI shall identify hazardous events and associated hazards, rank them according to risk, determine CCPs and critical limits, and outline processes/procedures for monitoring, controlling and responding to deviations from these control limits.

5.1.1 The Manager of Operations assembled a team to complete the Risk Assessment. The team included the Lead Operator, the President, and 2 operators.

5.1.2 As a first step the team identified potential hazardous events that could affect the supply of safe drinking water. For each hazardous event control measures were identified, along with associated operational/emergency procedures. The outcome of this task is included in the Operational Plan as the Summary and Classification of Identified Hazardous Events.

5.1.3 For each hazardous event the Probability of Occurrence, Severity of the Hazard Occurring and Detectability were determined on a scale of 1 to 5. The values for each of these factors were multiplied together to give a risk priority number.

5.1.4 The following tables summarize the rating system used.

Likelihood is probability/likelihood of a hazard or hazardous event occurring.
Severity or Consequence is the potential impact to health or impact on operations if the risk is not controlled (assumes control measures do not work).
Detectability is a measure of the ability to detect the presence of certain hazards. Hazards which could be easily and quickly detected were given a low value. Hazards that are hard to detect or undetectable are given a high value. The risk is greater as appropriate responses cannot be taken to control or mitigate the risk.

Description	Likelihood of Hazard Occurring	Rating
Rare	May occur in exceptional circumstances, or has not occurred	1
Unlikely	Could occur at some time, historically has occurred annually or less than annually.	2
Possible	Has occurred once or more per year.	3
Likely	Has occurred on a monthly to quarterly basis.	4
Very Likely	One or more occurrences on a monthly or more frequent basis	5

Description	Severity of Hazard Occurring	Rating
Insignificant	Insignificant impact, little disruption to normal operation.	1
Minor	Minor impact for small population, some manageable operation disruption, some increase in operational requirements.	2
Moderate	Minor impact for small population, significant modification to normal operation but manageable. Increased monitoring and operational requirements.	3
Major	Major impact for small population, systems significantly compromised and abnormal operation if at all.	4
Catastrophic	Major impact for large population, complete failure of all systems.	5

Description	Detectability of Hazard	Rating
Instantly detectable	Very easy to detect, instantaneous, SCADA monitored	1
	Moderately detectable, alarm present but not in SCADA, may require operator to walk by and notice alarm; problem is indicated promptly by lab test results.	2
	No alarm present, visually detectable on rounds or regular maintenance.	3
	Poorly detectable, visually detectable but not inspected on a regular basis; would not be detected before a problem was evident; lab tests that are not done on a regular basis.	4
Not-detectable	Undetectable, cannot detect.	5

5.2 CCPs were identified as applying to hazardous events with a total risk number of 12 or greater, for which control is available.

5.3 For hazardous events with a total risk number of 12 or greater which were not CCPs due to lack of control, DUSI identified associated emergency procedures and responses, and as appropriate included measures in long-term facility plans to help eliminate or mitigate identified risks.

5.4 The Risk Assessment shall be updated or redone according to the Procedure for Review and Updating of Risk Assessment Process.

5.4.1 The risk analysis shall be updated, as appropriate. (See DPro 3 – Procedure for the review and updating of Risk Assessment Process).

5.4.2 Records of any updates shall be maintained.

5.5 Critical Control limits have been established for each identified CCP and are identified in the corresponding CCP procedure.

5.5.1 The recording of a deviation from critical control limits is automatic in SCADA if on-line monitoring is used. Deviations from critical control points may also be determined by visual observation, grab sampling and monitoring, etc.

5.5.2 All deviations from CCPs shall be recorded in the Daily Log.

5.5.3 All deviations from CCPs shall be reported to the Manager of Operations.

5.6 Any deviation from the Critical Control Limit shall require corrective action. At a minimum, the root cause of the deviation shall be identified and eliminated. All corrective actions shall be documented as per the requirements of the DUSI Corrective Action Procedure DPro 20*.

*Note: **A sample procedure is provided for corrective action, however a corrective action procedure is not a requirement of the DWQMS .**

6.0 Associated Forms/Procedures/Work Instructions

DUSI Corrective Action Procedure DPro 20

Procedure for Review and Updating of Risk Assessment Process DPro 13

7.0 Records

Critical Control Point Listing

8.0 Change History

Rev. Level	Date	Change	By
1	19/Apr/2006	New Procedure	

Title: **CCP Response: Chemical Feed (Alum)**		Control No: **DPro14**	Rev: **1** Effective: **19/Mar/06**
Author: **Megan Loomis**	Reviewer: **Rick Bright**		Approver: **Mansard Dokken**

1.0 Purpose

This procedure defines the steps to be taken in response to a failure of the chemical (alum) feed system.

2.0 Scope

This procedure is applicable to all WTP personnel.

3.0 References

DWQMS	Element 8

4.0 Definitions

DWQMS	Drinking Water Quality Management Standard
QMS	Quality Management System
WTP	Water Treatment Plant
Aluminium Sulphate	Coagulating chemical causing particles to clump together forming floc.
MSDS	Material Safety Data Sheet

5.0 Procedure

5.1 *Feed Pump:*

In the event of a coagulant feed alarm (SCADA) the Operator shall check alum pump performance. The treatment process is automatically shut down following an alarm on the aluminium feed. Upon confirming a pump problem, the operator shall start the in-line backup pump and then take necessary corrective action.

5.1.1 Possible corrective actions may include:

- prime pump
- change/tighten belt
- replace diaphragm
- service/replace failed pump.
- transfer alum to day tank.

Note: see maintenance manual for troubleshooting and parts list.

5.1.2 Once the pump problem has been resolved, the pump shall be returned to service.

5.2 ***Feed Line:***

Check supply line from tanks to pumps for blockage and leaks and take necessary corrective action. Upon determining a feed line problem, an alternate source of feed or coagulant will be necessary as there is only one suction line and repairs will take time.

- Clean out suction line
- Repair leaks
- Replace suction line

Chemical Feed System Process Mitigations and Redundancies

Source Supply:

5.3 After restoring the alum feed system, reset system controls and bring treatment system back on line.

5.4 Chemco Inc. is the primary aluminium sulphate (alum) supplier. Alternate source information is available in the event of a delivery problem. See MSDS for information.

Storage:

5.5 Alum is stored in one of two fibreglass storage tanks, each with its own ball valve for isolation. Each tank has a capacity of 9.5 cu m. (18 days supply at average dosage rate).

5.6 Each tank is fitted with a volume gage so that an operator may observe the fill level.

5.7 If one tank fails/leaks the operator shall switch to the second tank. (Containment area is provided for retention of spills)

5.8 Steps shall then be taken to fix or replace the unusable tank.

Feed:

5.9 The alum injection system consists of two equal sized, variable speed pumps used to inject alum. Pumps may be set automatically, manually or locally in the SCADA system.

5.10 Pump rotation and pump fault alarms are automatically provided through SCADA. Pump rotation is performed weekly.

5.11 If a duty pump fails the operator shall rotate pumps. The failed pump shall then be repaired or, if necessary, replaced.

Dosage:

5.12 Alum is injected based on flow pacing to raw water flow controlled by SCADA. Automatic shut-off occurs when flow stops. The operator can override the SCADA if required.

5.13 Operators set the feed rate of in mg/l based on current plant operating conditions.

5.14 If clarifier turbidity or sludge blanket level starts to rise, a jar test shall be performed to determine optimum dosage.

5.15 If floc size, raw water turbidity or raw water temperatures vary, then the operators may carry out a jar test to determine if the optimum dosage rate needs revision.

Immediate action shall be taken to restore the alum feed system. The lead operator and/or manager of operations shall be notified of the condition and all pertinent date recorded on the daily log.

6 Associated Forms/Procedures/Work Instructions

DW16 Jar Test
MSDS Aluminium Sulphate (Liquid Alum)

7.0 Records

DR 105 Daily Log
DR 520 Jar Test

8.0 Change History

Rev. Level	Date	Change	By
1	19/Mar/06	New Procedure	

Title: **CCP Response: Filter Turbidity**	Control No: **DPro 15**	Rev: **1** Effective: **19/Mar/2006**
Author: **Megan Loomis**	Reviewer: **Rick Bright**	Approver: **Mansard Dokken**

1.0 Purpose

This procedure identifies the steps to be taken in response to a high turbidity critical limit alarm off the filters.

2.0 Scope

This procedure is applicable to all WTP personnel.

3.0 References

DWQMS Element 8

4.0 Definitions

DWQMS	Drinking Water Quality Management Standard
QMS	Quality Management System
WTP	Water Treatment Plant
NTU	Nephelometric Turbidity Unit
MAC	Maximum Acceptable Concentration

5.0 Procedure

5.1 The critical limit for turbidity off each filter is set at 0.25 NTU. Individual monitoring of NTUs shall be continuous (SCADA) for each filter.

5.2 In the event of an alarm:

Turbidimeter:

5.2.1 Check the turbidimeter performance and accuracy.

- check effluent feed line for leaks/air
- calibration of the unit
- troubleshoot unit as per maintenance manual
- service/replace unit

Confirm Reading:

5.2.2 Confirm accuracy of the reading by:

- obtaining a grab sample from the appropriate filter source
- analyze sample using the WTP lab Turbidimeter

Coagulation & Floculation:

5.2.3 Analyse the clarifier process for effectiveness. The operator shall address:

- clarifier turbidity
- floc size, density
- mixing
- desludging and timing
- sludge blanket level

If any of the above prove to be a problem, then a jar test should be performed.

Filter:

5.2.4 Analyse the filter process. The operator should look for conditions that may result in:

- excessive head loss or shorter filter runs
- filter media deterioration (i.e., cracks, shrinkage, boils, loss)
- mudballs
- turbidity breakthrough

Immediate action shall be taken if any of the above conditions exist.

The lead operator and/or manager of operations shall be notified of the condition and all pertinent data recorded on the daily log.

5.3 The operator shall backwash the appropriate filter. Following the filter-to-waste cycle, the operator shall monitor the turbidity levels during the ripening period to ensure the turbidity levels are acceptable.

5.4 If filtrate turbidity is still unacceptable, the operator shall allow backwash tank to recover to an acceptable level. After recovering, the operator shall repeat filter backwash and filter-to-waste. If turbiditiy is still unacceptable a more comprehensive analysis of the filter and its media may be required. At this point, the operator shall advise the operations manager of the problem for direction.

5.5 Filters shall be taken out of service if the filtered water turbidity exceeds 0.3 NTU.

6.0 <u>Associated Forms/Procedures/Work Instructions</u>

DW11 Chemical (Alum) Feed
DW 16 Jar Test

7.0 <u>Records</u>

DR105 Daily Log

8.0 Change History

Rev. Level	Date	Change	By
1	19/Mar/06	New Procedure	

Title: **CCP Response: Primary Disinfection**	Control No: **DPro 16**	Rev: **1** Effective: **19/Mar/2006**
Author: **Megan Loomis**	Reviewer: **Rick Bright**	Approver: **Mansard Dokken**

1.0 Purpose

This procedure identifies the steps to be taken in response to a primary disinfection critical low limit alarm.

2.0 Scope

This procedure is applicable to all WTP personnel.

3.0 References

DWQMS Element 8

4.0 Definitions

DWQMS	Drinking Water Quality Management Standard
QMS	Quality Management System
WTP	Water Treatment Plant
Primary Disinfection	The introduction of Chlorine into the Contact Chamber to kill micro-organisms and pathogenic bacteria.
Duty	Term used within the SCADA system to describe Primary chlorination and equipment. Interchangeable with the term Primary.

5.0 Procedure

5.1 The lower critical limit alarm on primary disinfection varies from season to season. CT values are affected by water temperature, pH, free Cl2 residual.

5.2 When there is a primary disinfection critical low limit alarm, the operator shall immediately increase the dosage rate by 0.2 mg/L, if possible, then analyse each of the disinfection system components.

Sample Line:

5.2.1 Check for obvious leaks/damage to the sample line.

- Repair/replace sample line
- Grab samples shall be taken until line is repaired

Sample Pump:

5.2.2 Check the effluent analyzer sample pump, pump head and hose.

- change/adjust hose

- check tube loading
- adjust occlusion setting
- replace rotor, brushes
- fix pump or send for repair
- replace with influent pump as alternate
- refer to pump head and pump manuals for details/parts

Analyzer:

5.2.3 Chlorine demand: The operator shall collect a sample of treated water prior to the point of chlorine addition and determine the chlorine demand. If the chlorine demand has increased, increase the chlorine dose as required.

5.2.4 Collect a sample from the analyzer.

- calibrate analyzer
- check fault conditions (refer to maintenance manual – troubleshooting)
- use influent analyzer as alternate

Grab Samples:

5.2.5 Confirm low chlorine by sampling.

Chlorinatior:

5.2.6 Check duty chlorinator performance.

- increase pacing
- switch to standby chlorinator
- refer to maintenance manual to troubleshoot chlorinator

Chlorine:

5.2.7 Check source for available chlorine supply.

- Ensure cylinder is not empty
- Check for leaks
- Check vacuum regulator
- Switch cylinders

<u>Primary Disinfection System Process Mitigations and Redundancies</u>

Source Supply

5.3 Chemical Depot provides Cl2 in two tonne cylinders. Alternate source information is available in the event of delivery problems.

5.4 4 containers are on site at all times. When 2 are empty 2 more are ordered.

5.5 2 tonners are always connected to the chlorination system. Each is equipped with a Vacuum Regulator Check Unit for automatic switch over when one cylinder is depleted.

Feed

5.6 Primary disinfection is introduced at the clear wells.

5.7 There are two chlorinators. One is thes duty (primary) chlorinator and the other is the stand-by chlorinator.

5.8 Both chlorinators have feed valves and use a common 32 mm line.

Dosage

5.9 The chlorine is fed to the diffuser bars at outlet pipes from the backwash tank to the clear wells.

5.10 The duty chlorination is paced to total filter flow only when the backwash well is full and filtered water is flowing to the clear wells.

Immediate action shall be taken if any of the above conditions exist. The lead operator and/or manager of operations shall be notified of the condition and all pertinent data recorded on the daily log.

6.0 Associated Forms/Procedures/Work Instructions

Equipment maintenance manuals
WTP Operations Manual
SCADA System Operational Manual

7.0 Records

F501 Daily Log

8.0 Change History

Rev. Level	Date	Change	By
1	19/Mar/06	New Procedure	

DWQMS Procedure

Title: **CCP Response: System Pressure**	Control No: **DPro 18**	Rev: **1** Effective: **19/Mar/2006**
Author: **Megan Loomis**	Reviewer: **Rick Bright**	Approver: **Mansard Dokken**

1.0 Purpose

This procedure identifies the steps to be taken in response to a system pressure low limit alarm.

2.0 Scope

This procedure is applicable to all WTP personnel.

3.0 References

DWQMS	Element 8

4.0 Definitions

DWQMS	Drinking Water Quality Management Standard
QMS	Quality Management System
WTP	Water Treatment Plant .

5.0 Procedure

5.1 Typically, a low pressure alarm is an indicator of a break or serious leak in the piping of the distribution system, or of a major fire. The minimum system pressure critical limit is indicated in the operational plan.

5.2 The SCADA system monitors pressure off of the high-lift header. A sudden or continual decline in pressure indicates that a problem exists within the distribution system.

5.2.1 The operator will manually start the standby low lift pump in an attempt to restore system pressure. The flow through the treatment process shall also be increased, as appropriated.

5.2.2 The operator shall contact the Water Department Manager (Distribution system) of Municipality of West Chester to report the situation and request that distribution personnel identify and isolate the source of the leak or break. If the high flow is due to fighting a fire, the supply is to be maintained as feasible.

5.2.2.1 The operator shall monitor the situation in the distribution system by frequent contact with the Municipality of West Chester.

5.2.3 The operator shall notify the DUSI Operations Manager of the drop in system pressure, and keep them informed.

5.2.3.1 The operator shall act upon the directions of the DUSI Operations Manager.

5.3 The operator shall record all details of the alarm and ensuing action taken in the Daily Log.

6.0 Associated Forms/Procedures/Work Instructions

WTP Operations Manual
SCADA System Operational Manual

7.0 Records

DR 501 Daily Log

8.0 Change History

Rev. Level	Date	Change	By
1	19/Mar/06	New Procedure	

Title: **Continual Improvement**	Control No: **DPro 20**	Rev: **2** Effective: **22/May/2006**
Author: **Megan Loomis**	Reviewer: **Rick Bright**	Approver: **Mansard Dokken**

1.0 Purpose

The purpose of this procedure is to describe the activities undertaken for the Continual Improvement of the drinking water quality management system.

2.0 Scope

The procedure is applicable to all DUSI employees who manage or perform work related to the production of safe drinking water.

3.0 References

DWQMS Element 21

4.0 Definitions

CAR Corrective Action Request

5.0 Procedure

5.1 Continual Improvement opportunities may be the result employee suggestions or ideas, corrective actions, preventive maintenance activities, management and infrastructure reviews, customer comments, changes in process technology and owner input.

5.1.1 Corrective actions shall be documented on the CAR (see DUSI Procedure DPro 21 Corrective Action

5.1.2 Preventive maintenance activities shall be documented on the Work Order (DUSI Procedure DPro 19 Miantenance)

5.1.3 Management and Infrastructure Review results are documented in the meeting minutes for each.

5.1.4 Owner input is welcomed at any time. Owner input shall be documented by the Manager of Operations and presented to the President for consideration during weekly operational review meetings.

5.2 Employees may submit written suggestions and ideas to the QMS representative.

5.2.1 Improvement suggestions and ideas may be submitted in any written format at any time during normal operational hours.

5.2.2 Each suggestion or idea will be reviewed for its value adding applicability.
5.2.3 Those that are initially accepted will be divided into one of two categories:
a) process improvement opportunity
b) infrastructure improvement opportunity

5.3 Each accepted suggestion or idea will then be assigned a “champion” (may or may not be the original suggestion or idea provider). The “champion” shall provide, in written format:

Process and Infrastructure Improvement Opportunities
a) estimate the costs associated with the improvement
b) identify the potential return on the investment
c) provide a basic project timeline for the implementation and verification of the effectiveness of the implementation

5.4 The QMS Representative shall, along with the champion (and suggestion or idea provider if different from the champion), present the opportunity to the President. The presentation may be in the form of a discussion, or a more formal presentation method. The information generated in step 5.2 of this procedure shall form the basis of the presentation.

5.5 Process improvement ideas, if accepted by the President, shall be implemented and verified as effective per the timeline provided.

5.6 Infrastructure improvement ideas, if accepted by the President, shall be raised during the annual Infrastructure Review Meeting. If however, the suggestion or idea merits more immediate consideration, the President may choose to immediately approve the Improvement Opportunity if within budgetary, operational and contract boundaries.

5.6.1 The President shall advise the QMS Representative of all approved Improvement Opportunities
5.6.2 The QMS representative shall maintain a list of all accepted improvement opportunities complete with assigned champion, start, projected end dates and actual completion dated.

5.7 The Continual Improvement opportunity shall be audited within 12 months of implementation to determine its overall effectiveness.

6.0 Associated Forms/Procedures/Work Instructions

DPro 4 Management Review

DPro 5 Internal Audits

DPro 19 Maintenance

DPro 21 Corrective Action

7.0 Records

Improvement Opportunities Master List

8.0 Change History

Rev. Level	Date	Change	By
1	24/Apr/2006	New Procedure	M. Loomis
2	22/May/2006	Added C/A	M. Loomis

Title: **Corrective Action**	Control No: **DPro 21**	Rev: **1** Effective: **24/May/2006**
Author: **Megan Loomis**	Reviewer: **Rick Bright**	Approver: **Mansard Dokken**

1.0 Purpose

The purpose of this procedure is to describe the Corrective Action process.

2.0 Scope

This procedure is applicable to all DUSI employees who undertake corrective action resulting from non-conformances incurred during internal and registrar audits, and some customer complaints.

3.0 References

DWQMS	Elements 19 and 21

4.0 Definitions

C/A	Corrective Action – action taken to eliminate the cause or causes of actual non-conformances
CAR	Corrective Action Request
Auditee	individual or group of individuals conducting or owning the process(es) and/or requirements being audited.
Customer	Municipality of West Chester

5.0 Procedure

5.1 Corrective Action Requests (CARs) shall be issued for the following:

- Customer complaints concerning failure to provide service as planned (does not include Water Quality complaints)
- All non-conformances resulting from Internal Audits
- Failure to meet compliance related requirements where there is no specified method of corrective action prescribed by regulation (i.e. failure to provide water Quality test results in a timely manner).

5.11 CARs for customer complaints are to issued by the Manager of Operations.

5.12 Controlled CARs for non-conformances identified during an Internal Audit shall be issued by the auditor, or the QMS Representative.

5.13 CARs for compliance related issues shall be issued by the QMS Representative.

5.14 A CAR Log is maintained by the QMS Representative. Issuers of CARs shall obtain a CAR number from the log. The issuer shall provide the following information for inclusion in the Car Log:

- Issue Date
- Issued To
- Type of CAR (QMS Audit, Complaint, Compliance)
- If audit related: Process or Element

5.15 The individual initiating the CR shall complete Section 1: Details of Non-Conformance/Complaint. The CAR shall then be forwarded to the individual identified as being responsible for taking corrective action.

5.16 Upon receipt of a CAR, the DUSI employee shall review it and complete the appropriate sections.

5.16.1 In some cases the employee may be requested to provide a corrective action plan. The plan is then forwarded to the CAR issuer for approval.

5.16.2 The CAR issuer shall review the Corrective Action Plan to ensure that it addresses the root cause of the non-conformance, complaint or non-compliance. When the root cause is not being addressed, the CAR be returned with a request for an alternative solution.

5.16.3 Approved Corrective Action Plans will be returned with permission to proceed with the proposed Corrective Action.

5.17 The employee shall undertake Correct Action, complete the the CAR and forward the completed CAR to the issuer.

5.18 Upon receipt of the completed CAR, the issuer shall select one of the following options:

a) Review and accept the corrective action without follow-up. Mark the CAR as “Closed” in the CAR Log.
b) Review the corrective action taken (as described on the CAR) and schedule the verification of the action taken for the next internal audit.
c) Review the corrective action taken and schedule the verification of the action taken within five working days.

5.18.1 Accepted Corrective Actions shall be marked as “Closed” in the CAR Log.

5.18.2 Corrective actions that are not found to be effective after the verification activity shall not be reissued. Instead they shall remain “Open”. The employee shall be informed, in writing, that the corrective action taken was not effective.

5.19 Results of corrective actions shall be maintained and reported during management reviews.

5.20 Corrective actions shall also be considered when addressing the requirements for Continual Improvement.

Note: At no time shall the CAR issuer prescribe what corrective action is to be taken.

6.0 Associated Forms/Procedures/Work Instructions

CAR

DPo 4 Management Review

DPro 5 Internal Audits

DPro 20 Continual Improvement

7.0 Records

CAR

CAR Log

8.0 Change History

Rev. Level	Date	Change	By
1	24/May/06	New Procedure	

Model Operational Plan – B2

Description
Distribution system serving 5,000 persons that receives treated water from the drinking water system described in Operational Plan B1. There is one elevated storage tank and no booster station.

Ownership
The distribution system is owned by the same municipality as the WTP described in Model Operational Plan B1

Operating Authority
The distribution system is operated by the municipality.

Note: For the purposes of this EBR posting of the draft guidance materials, some procedures referenced in the following Operational Plan may not be included in this document.

The Municipality of West Chester

Distribution System Operational Plan May/2006

Table of Contents

Purpose

The purpose of this operational plan is to describe the comprehensive Drinking Water Quality Management System developed and implemented by the Municipality of West Chester for the operation and maintenance the water distribution system.

This DWQMS Operational Plan includes references to all components of the DWQMS.

Scope

This Operational Plan covers the activities and personnel associated with all operational aspects of the drinking water distribution system for the Municipality of West Chester.

This Operational Plan, the procedures, work instructions and other DWQMS documentation that are referenced herein are complementary to the legislated requirements for safe drinking water in the Province of Ontario.

References

DWQMS Standard
Bill 195 – A Safe Drinking Water Act

Definitions

QMS	Quality Management System
DWQMS	Drinking Water Quality Management Standard
DUSI	Dokken Utility Services Inc.
WTP	Water Treatment Plant
Distribution	Mains and related items (i.e. Hydrants, valves), and elevated storage tank

DWQMS Specific Requirements

1 Quality Management System

This Operational Plan documents the contents and activities of the Quality Management System in accordance with the requirements of the Drinking Water Quality Management Standard.

2. Quality Management System Policy

This Quality Policy is applicable to all water department employees and is displayed in public areas of the Municipal Administration offices and on the Municipal website. The Policy is also printed on the back of each Water Department employee security swipe card.

Quality Policy

The Municipality of West Chester and its water distribution system shall comply all relevant legislation and regulations for the consistent delivery of safe drinking water. The Municipality shall also:

- continuously review and improve the Quality Management System,
- communicate openly and effectively with the public concerning matters of drinking water quality.

Drinking Water System

This Operational Plan covers the drinking water distribution system that is owned and operated by the Municipality of West Chester. The distribution system consists of:

- 41km of pipe
- An elevated storage tank
- 184 hydrants
- 323 valves

As of January, 2006 the distribution system serves 1,526 residential customers, 226 commercial customers and 1 industrial customer. An additional 47 residential and 6 commercial customers will be added by the end of the year with the completion of the South Ridge development.

The Fall River is the water source for the Municipality of West Chester water system. The water treatment facility located at 6 Water Street in West Chester. This facility is also owned by the Municipality, but is operated by Dokken Utility Services Inc. (DUSI). A separate operational plan has been developed by DUSI to describe the comprehensive Drinking Water Quality Management System for the treatment facility.

3. Commitment and Endorsement

A resolution was unanimously passed by council on the April 25th, 2006 endorsing the Operational Plan and its contents. The Operational Plan documents the drinking water quality management system for the West Chester distribution system. Council and Top Management also endorsed the contents of the Operational Plan on September 7th, 2006. A copy of these resolutions are on file in the Clerk's office.

Peter Delahunt
Mayor
Municipality of West Chester

Jason MacNeely
Water Department Manager
Municipality of West Chester

4 Quality Management System Representative

The Water Department Manager is appointed to the role of Quality Management System Representative for the Municipality of West Chester drinking water distribution system QMS.

The Management Representative shall:

- develop, implement and maintain the QMS,
- report on the effectiveness of the QMS to Top Management, *including the need for improvement*

- ensure that the current versions of documents required by the QMS are in use at all times,
- ensure that all personnel are aware of all current legislation and regulatory requirements that are relevant to the operation of the works
- promote the QMS throughout the Municipal Water Department

Appointed by:	Approved by:
Jim MacFarland Manager of Public Works Municipality of West Chester April 25th, 2006	Peter Delahunt Mayor Municipality of West Chester April 25th, 2006

5. Document and Records Control

A procedure that describes how QMS documents are controlled has been developed. A separate Record control procedure has also been developed and implemented. Both are filed separately and not included in this draft Model Operational Plan.

6 Drinking-Water System

General
Potable drinking water is supplied to the distribution system from the Municipality of West Chester Water Treatment facility, The water treatment plant is owned by the Municipality of West Chester and operated by Dokken Utility Services Inc.

A of the Operational Plan for the Water Treatment facility is retained in the offices of the Director of Public Works and t Water Department Manager.

Drinking Water System
This Operational Plan covers the drinking water distribution system that is owned and operated by the Municipality of West Chester.

As of January, 2006 the distribution system serves 1,526 residential customers, 226 commercial customers and 1 industrial customer. An additional 47 residential and 6 commercial customers will be added by the end of the year with the completion of the South Ridge development.

The Fall River is the water source for the Municipality of West Chester water system. The water is treatment facility located at 6 Water Street in West Chester This facility is also owned by the Municipality, but is operated by Dokken Utility Services Inc. (DUSI). A separate operational plan has been developed by DUSI to describe the comprehensive Drinking Water Quality Management System for the treatment facility.

The pipes range is age from 54 years to less than 1 year. The pipe is of mixed construction: concrete, asbestos-concrete, ductile iron, cast iron and PVC.

The piping system includes 184 hydrants and 323 valves. The distribution maintenance program includes hydrant flushing, valve exercising and pipe swabbing.

There are 4 sampling sites for chlorine residual in the distribution system:
Moreside Assisted Living Residence on Harper Road
West Chester Hospital on Hwy 599
137 Eastdale Drive
449 Division Street North
Please see the sampling procedure for more information.

Elevated Storage Tank

The purpose of the elevated tank is two-fold:

1. To store water volumes for daily supply/demand requirements ("equalization"), fire events and emergency conditions, and
2. To regulate system pressure. The equalization volume represents a change in level of 13.4m, or 19psi differential at the pressure gauge at the base of the tank.

The elevated storage tank consists of a welded steel tank within and supported by a concrete structure. The tank has an inner diameter of 10. 8m. The total height of the tank is 39.4m. The tank has a rated capacity of 900m^3. The usable volume of water stored in the upper third of the tower.

There are low and high water level alarms. The high level setpoint is 36.5m (51psi). The low level setpoint is 31m (42psi). The setpoints can be adjusted through the operator interface at the tank.

The storage tank is also equipped with a recirculation pump to help prevent short circuiting and freezing in winter. There is a chlorine residual analyzer on the tank outlet that continuously monitors the free chlorine concentration. A signal is sent from the analyzer to both the Water Distribution office and the Water Treatment Plant if the residual is beginning to trend towards the lower critical limit. There is a standby Sodium Hypochlorite feed system that can be activated by the WTP operator when a request or permission is received from the Water Distribution Foreman. To date, there has only been one instance when this was required since the analyzer and injector were installed and brought on-line in 1997.

7. Risk Assessment

The complete Risk Assessment Procedure is filed separately and not included as part of this draft Model Operational Plan. Hazards/hazardous events were identified and are listed in the Distribution system risk analysis table. Each hazard/hazardous event was assessed in terms of Likelihood, Severity and Detectability. The ranking scheme is shown in the Ranking the Hazards table, which follows. The risk priority number of each hazard/hazardous event was determined by adding the Likelihood, Severity and Detectability factors. CCPs were defined as those with a risk ranking of 10 or more, and /or those identified by the MOE – “recommended minimum CCPs”.

8 Risk Assessment Outcomes

The Distribution System Risk Analysis table follows this section.

Chlorine residual was identified as a CCP. System pressure is controlled and monitored by the WTP

	Ranking The Hazards		
Rank	**Likelihood**	**Severity**	**Detectability**
1	**Rare** - exceptional circumstances or not at all	**Insignificant** - little to no product or operational impact	**Obvious** - Easy to detect, instantaneous (SCADA)
2	**Unlikely** - historically has occurred annually or less than annually	**Minor** - small population effect, manageable service disruption	**Easy** - Lab results or WTP/consumer input
3	**Possible** - has occurred once or more per annum	**Moderate** - small population effect, modify operating parameters	**Moderate** - No alarm, Visually detectable
4	**Likely** - is expected to occur on a monthly to quarterly basis	**Major** - significant impact on small population, operations challenged	**Difficult** - Visually detectable, but not part of regular inspection routine
5	**Certain** - will occur on a frequent basis	**Catastrophic** - major impact on population, system failure	**Impossible** - Undetectable

All three values are added together to provide a **R**isk **P**riority **N**umber

RPN Rating

0 – 5	None to minimal potential or actual impact
6 –9	Moderate potential or actual impact
10 – 15	CCP: Significant potential or actual impact (Critical Control Point)

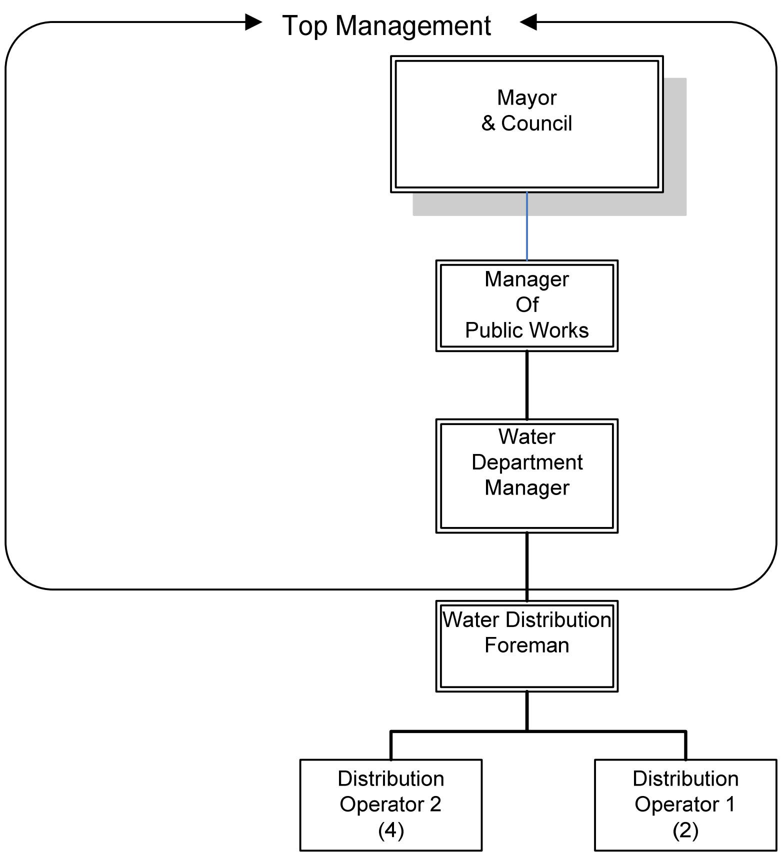
Municipality of West Chester
Distribution System Risk Analysis

Description of Hazard	Possible Outcome	Comments	Existing Monitoring & Control	Likelihood	Severity	Detectable	RPN	CCP	Control Procedure
Main/pipe break	Reduced flow Contamination	Isolate main	Pressure indicators at storage tank	2	3	3	8	No	Watermain Maintenace and Repair
Loss of Chlorine residual	Biological contamination	Per O. Reg. 170/03	On-line analyzer at elevated tank System wide residual testing	3	4	3	10	Yes	Maintenance of secondary disinfection - O. Reg 170/03 requirements for C /A Communicate with WTP to increase dosages
Cross Connection	Biological/Chemical contamination	Backflow preventers	Municipal By-law xxx requires the installation of approved backflow preventers at commercial and industrial facilities, annual Inspections	3	2	3	8	No	Watermain Maintenance and Repair
Storage Tank Analyzer Failure	Residual level unknown Biological contamination		System wide residual testing Alarm if signal lost	2	1	1	4	No	Repair/Place per Mfg. Recommendation
Storage Tank NaOCl Feed System Failure	Biological contamination		On-line analyzer at elevated tank System wide residual testing	2	1	1	4	No	Repair/Place per Mfg. Recommendation
Storage Tank Leak	Inability to meet water demand	Drain and by-pass tank to repair	Inspections of tank every 5 years	1	3	3	7	No	Inspect and repair

9. Organizational Structure, Roles, Responsibilities, Authorities

Organisation

Water Distribution Organisation Chart



Responsibility and Authority

Mayor/Council (Owner/Top Management of Operating Authority)

Responsibilities	Authorities
Complete oversight of the entire distribution system and the QMS Ultimate responsibility for the provision of safe drinking-water to West Chester Ensure compliance with applicable legislation and regulations	Financial, administrative and technical authority related to the distribution of safe drinking water to the Municipality of West Chester.

Public Works Manager (Top Management of Operating Authority)

Responsibilities	**Authorities**
Complete oversight of the entire distribution system Endorse and lead the development and implementation and maintenance of the QMS Provide and/or obtain resources for the QMS and necessary infrastructure and resources to operate and maintain the drinking water system safely and effectively Ensure the system is operated in accordance with all applicable legislation and regulations Lead for Management Reviews Communication with Mayor and Council about the QMS and the water distribution system Communications lead during emergencies	Financial, administrative and technical authority related to the distribution of safe drinking water to the Municipality of West Chester.

Water Department Manager (Top Management)

Responsibilities	**Authorities**
Carry out the activities and manage programs related to the water distribution system – as directed by the Manager of Public Works Preparation of budget and planning materials Assessment of distribution personnel performance (annual) Recommendation of system improvements Develop procedures and processes for assuring water quality Emergency response planning, training ORO and QMS Representative	Staffing - within the guidelines of the Municipality and any in-force collective agreements Operational capital purchases Activity/program scheduling within the department Oversee adverse water quality incidences and responses Identify and oversee staff training needs Make changes to the QMS

Water Distribution Foreman

Responsibilities	**Authorities**
Schedule and oversee the day-to-day activities relating the water distribution system Communication/liaison with WTP Foreman Act on and report any incidents of non-compliance Reporting of distribution system performance to the Water Department Manager ORO (in the absence of the Water Department Manager)	Direct operators in day-to-day operation and maintenance of water distribution system Operational non-capital purchases Recommend changes to the QMS

Distribution Operator 2

Responsibilities	**Authorities**
Monitor, maintain and operate the distribution system in accordance with established standard procedures. Document all operating activities in facility log in accordance with provincial legislation and established procedures. Report and act on incidents of non-compliance Report any abnormal conditions to the Water Distribution Foreman Carry-out duties and tasks as assigned by the Water Distribution Foreman and as per established water distribution policies and procedures	Monitor process and recommend corrective actions Recommend changes to the QMS Respond to and document public complaints

10. Competencies

Competency requirements are listed in the Competencies List Table. The table is reviewed/updated on an annual basis to reflect operational and regulatory changes, and competencies gained by staff.

Competency Ratings
3 - advanced knowledge skill experience
2 - intermediate knowledge/skill/experience
1 - basic knowledge/skill/experience
0 - knowledge/skill/experience not required

Competencies List	Manager Public Works	Water Dept. Mgr	Dist. System Foreman	Operator 2	Operator 1
OETC WD Certification	NR	III	III	II	I
OETC WT Certification	NR	II	I	I	0
Supervisory Skills	3	3	2	0	0
Written Communications	3	3	2	2	1
Technical Writing	3	3	2	2	1
Research Skills	3	3	1	2	1
Budget Preparation / Analysis	3	2	1	0	0
Long-term Planning	3	2	1	0	0
Scheduling / Work Planning	3	3	2	1	1
Contract Management	3	2	1	0	0
Record Keeping	3	3	2	2	2
Regulatory Requirements	3	3	3	2	2
Emergency Procedures	3	3	2	2	2
Process troubleshooting	2	3	2	2	2
Technical mathematics	3	3	2	2	2
Chemistry	3	3	2	1	1
Biology	3	3	2	1	1
Fluid Mechanics	3	3	2	2	2
Laboratory techniques	2	2	2	2	1
Sampling	1	2	2	2	2
Valves / piping maintenance	2	2	2	3	2
Electrical instrumentation / controls	2	2	2	1	1
Motor controls	2	2	2	1	1
Interpreting plans / blue-prints	3	3	3	2	1
Spreadsheets and word processing	2	2	2	2	1
Computer aided design	2	1	0	0	0
SCADA	2	2	2	2	2

All Municipality of West Chester operations departments provide for training in their annual budget process. At a minimum, the training budget includes funding for legislated and required training to maintain Operator Certification in accordance with O.Reg. 128/03.

Also, all Municipality of West Chester employees participate in an annual review of training/knowledge needs with their department manager. The Department Manager then compiles a list of recommended training based upon discussions with the employee and a review of any applicable legislation or regulations.

The Department Manager then summarises and prioritises the training/knowledge needs for all departmental employees. Training is then scheduled.

Training or knowledge gain may take the form of on or off-site training sessions and seminars, on-the-job training, distance learning or courses of study. Where appropriate, proof of participation or proficiency will be required as proof of competency.

11. Coverage

The water department office is staffed from Monday to Friday, 8:00am to 4:30pm. The scheduled hours of work for the Water Department Manager, Distribution System Foreman, and Distribution System Operations staff are from 8:00 am to 4:30 pm Monday to Friday.

An on-call operator is assigned by the Water Department Manager on a weekly basis to respond to after-hours and weekend emergencies. A security check of the water tower is made once daily during normal working hours. The on-call operator conducts security checks on weekends and statutory holidays. When on-call, the operator is required to remain within a 30 km radius of the Municipal Building.

The Overall-Responsible-Operator (ORO) is the Water Department Manager. In the event of the absence of the Water Department Manager, the Distribution System Foreman assumes the role of ORO, and is identified in the logbook.

Water levels in the elevated tank and the chlorine residual at the discharge from the tank are monitored by SCADA. Alarms are sent for high or low levels in the tank, low chlorine residual, or in the event of unauthorized access to the water tower. During normal working hours the alarm signal is received at the Water department Office. For off-hour emergencies, an automatic dialler contacts an answering service, and the call is directed to the on-call operator. Alarms can also be initiated by the WTP (operated by DUSI), in the event that system pressure or chlorine residual deviate from control limits at the point of entry to the distribution system. The municipality maintains an after-hours number for emergencies. Customer complaints related to the distribution system which require immediate attention (extreme low pressure and watermain breaks) are directed to the on-call operator.

Response to alarms must be within 30 minutes of receiving the call, in accordance with the collective agreement.

The majority of off-hour emergencies can be addressed by a single operator following standard operational procedures. If the nature of the emergency requires additional staff, the on-call operator can request assistance from any of the other licensed operators. Contact information for all operators is documented in the on-call binder, readily accessible to the on-call operator.

12. Communication

The Communication Procedure is filed separately and not included as part of this draft Model Operational Plan.

13. Essential Supplies and Services

A Critical Supplies and Services List has been developed and is being maintained. The appropriate method for ensuring procurement of critical supplies and services is shown in the Product/Service section of the list. All essentials supplies and services are second sourced. The list is reviewed annually, to ensure that it is up-to-date.

Category	Product/Service	Supplier/Contact Info
Distribution Components	Piping, fittings, etc	Brooklin Concrete 567 Wellington Avenue Richmond, ON (613) 555 - 2525
		Concave Inc 144 Woodward Ave Ottawa, ON (613) 555-6768
Engineering Services	Civil	Spartan Engineering 77 Innes Road Ottawa, ON (613) 555-3455
Chemicals	NaOCL	Chemical Depot 456 7th Avenue Prospect, ON (613) 555-1515
		Chemco Inc. 234 Maple Street Clayton, On (613) 555-0505
Main/Pipe Maintenance	Vacuum/Swabbing	Watson Services 2200 Merivale Road Ottawa, ON (613) 555-5565
Construction/Excavation	General Contractor	Behan Ltd. 789 10th Avenue West Chester, ON (613) 555 - 4545
		Davidson Excavations Point Road West Chester, ON (613) 555-6565
	General Contractor	LNL Engineering 124 Seaway Ave. Brockville, ON (613) 555-5016
Electrical Services	Power	Hydro One Regional Office West Chester, ON (613) 555-8585
	Electrician	Regional Electric 94 Division Street West Chester, ON (613) 555-9595
Laboratories	Bio Testing	Beakerworks Inc. 567 Wellington Avenue Richmond, ON (613) 555 - 2525
		Bayfield Labs 2486 Burton Road Harper, ON (613) 555-8489

All suppliers of products and services that may affect drinking water quality are selected on their ability to meet and sustain Municipality of West Chester Water Department criteria.

Supplier approvals are based upon the following:

- Financials
- Insurance (where appropriate)
- Bonding (where appropriate)
- Reference checks
- Industry reputation
- Ability to meet product quality specifications

Ongoing supplier assessments (annual) are based upon:

- Performance to requirements (contractors)
- Accept/reject (product suppliers)
- On-time delivery (product suppliers)
- Responsiveness to inquiries and complaints

Supplier performance is tracked by the Water Department Manager.

14. Review and Provision of Infrastructure

Under Review

15. Infrastructure Maintenance, Rehabilitation and Renewal

When appropriate, upgrades and system rehabilitation are considered and added to the program. The condition of the system is assessed on an ongoing basis, with a five-year rolling plan in place for the scheduling of upgrades and rehabilitation in conjunction with other Town of West Chester Public Works Departments and the WTP operating authority (DUSI).

Expansion of the distribution system is a coordinated effort between the Municipal Planning Office and Public Works. The Public Works department advises the Water Department Manager whenever a building permit is issued, or a Plan of Subdivision is approved.

The Water Department has a regular inspection and maintenance program for the drinking water distribution network. On an annual basis the planned maintenance and unplanned maintenance activities are summarized during the annual budgeting process. The results of this summary will be compared from year to year to provide an indication of effectiveness, and determine whether additional resources are necessary for system maintenance.

16 Sampling and Monitoring

Sampling and monitoring procedures are filed separately and not included in this draft Model Operational Plan.

17. Measurement and Recording Equipment Calibration and Maintenance

The calibration of the chlorine analyzer and SCADA software is contracted to qualified suppliers. The portable chlorine analyzer is calibrated according to the manufacturer's procedure. See the list of essential supplies and suppliers.

18. Emergency Management

The Municipality of West Chester has an emergency plan in accordance to the prevailing legislation and regulations.

The Water Department Emergency Plan (which is referenced in the Municipal Plan) addresses specific emergency conditions relating to the water distribution system. The plan can be found in Section 3 (filed separately) and is not included as part of this model operational plan.

A list of Emergency Contacts is posted in Water Department Public areas and is included in the glove compartment of all service vehicles. Keeping the List of Emergency Contacts up-to-date is the responsibility of the QMS Representative.

Mayor	Peter Delahunt	555-2616
Manager of Public Works	Jim MacFarland	555-1732(home) 555-2941(cell)
Water Distribution foreman		555-0397(home) 555-1832(cell)
MOE Spills Action Centre		1-800-268-6060
MOE Office, Ottawa		555-4000
Municipality of West Chester		555-3351
Dokken Utility Services Inc.		555-9688
Emergency Management Co-ordinator		555-9488(cell)
Fire Dept	Administration	555-3233
	Emergency	911
Police	Administration	555 – 3244
	Emergency	911
Paramedic		911

Also see list of essential supplies and services for contractor services, power, etc., for emergency repair.
The Water Department Emergency Plan also contains a copy of this list.

19. Internal Audits

The Internal Audit Procedure is filed separately and not included in this draft Model Operational Plan.

20. Management Review

The Management Review Procedure is filed separately and not included in this draft Model Operational Plan.

21. Continual Improvement

The process for continual improvement is filed separately and not included in this draft Model Operational Plan.

Model Operational Plan - C

Description
Groundwater supply treatment (multiple wells) and distribution system receiving supplementary water from the distribution system of an adjacent municipality

Ownership
The drinking water system is owned by the municipality. The supplemental water source is owned by a separate and adjacent municipality.

Operating Authority
The municipality is the operating authority.

Note: For the purposes of this EBR posting of the draft guidance materials, some procedures referenced in the following Operational Plan may not be included in this model plan.

Town of Mountain Grove
Waterworks Department

Operational Plan

Prepared By:
Martin Aston
Water System Operator

Approved By:
Bill Craigson
Director of Operations

Issued:

Overview

The Mountain Grove water system is owned and operated by the Town of Mountain Grove. The drinking-water system is not connected to any other drinking-water system.

Two groundwater wells with submersible pumps supply the Mountain Grove water system. Under normal circumstances, water is only pumped from Well No. 2 which is capable of meeting peak system demands. Well No. 1 serves as a back-up, and is also required to meet fire flows.

The raw water is disinfected with sodium hypochlorite and discharged to a clear well sized to meet CT requirements for 2-log disinfection of viruses. From the chlorine contact tank the water flows into the pump well in which two jockey pumps, two high lift pumps and one fire pump are located. One of the jockey pumps and one of the high lift pumps are standby in case the duty pump fails or is out of service for maintenance.

There is no storage in the Mountain Grove distribution system. During periods of low demand the jockey pump output exceeds system demand causing system pressure to build-up and the pressure relief valve to open. The pressure relief valve discharges back to the pump well.

The chlorine residual entering the clearwell is monitored by an on-line analyzer to ensure the chlorination system is working properly. Chlorine addition is paced to the flow of the well pumps. A second, regulatory chlorine residual analyzer monitors the free chlorine residual entering the distribution system. Both chlorine residual analyzers will alarm if their low or high setpoints are reached and the on-call operator will respond.

The chlorine residual can be “topped up” if necessary to maintain secondary disinfection. The dosage rate for these feed pumps are set manually by the operator.

The complete system including raw and treated water flow, chlorine residuals, system pressure, water levels, pump operation, building security, and electrical power are monitored and as appropriate controlled by a SCADA system. The SCADA system is equipped with an uninterrupted power supply (UPS). The SCADA system is located at the Dale Road Pumphouse/Treatment facility. A standby diesel generator and fuel tank is also located at the pumphouse and will start automatically on loss of grid power.

The SCADA system is programmed to alarm for conditions such as low chlorine residual, low system pressure, pump failure (well, high lift, or sodium hypochlorite), security breaches, etc. The on-call operator determines the need for immediate response based on the nature of the alarm.

Quality Policy

Through this policy, the Town of Mountain Grove commits to:

- the provision of safe drinking water
- continual improvement of the QMS and the water works
- complying with relevant legislation and regulations
- *conducting business in an environmentally responsible manner (check note below)*

This policy shall serve as the foundation of our drinking water quality management system. It will be communicated to all employees through orientation sessions (QMS and New Hire), internal posting and on all security swipe cards. It will be communicated to the public through posting of the policy in public areas of the Town Hall, on the Town of Mountain Grove web-site and through occasional mailings.

Note: This commitment goes beyond the requirements of the DWQMS and is not addressed further in this operational plan. The auditor however, will check that this commitment is being met.

Endorsement

This Operational Plan is endorsed and supported by the Town of Mountain Grove Mayor, Councillors and Director of Operations.

Charlotte Whitton
Mayor

Bill Craigson
Director of Operations

Don Reid
Councillor – Ward #1
(Water Committee Chairperson)

James Durrell
Councillor – Ward #2

Marion Dewar
Councillor – Ward #3

Dated this day, 13/May/2005.

Quality Management System Representative – Please see Human Resources: Organisational Structure and Responsibilities, authorities and competencies

Document and records control – Please see Document and Record Control Procedure

Drinking-Water System

Water Source

The Town of Mountain Grove obtains its raw water from two drilled wells. The hydrogeological study completed for the First Engineers report confirmed that the wells are “true” groundwater and not under the influence of surface water. The wells penetrate a sand/gravel aquifer of glacial origin. The aquifer has a relatively short flow path that is typical of local flow systems. Characterization of the aquifer can be found as part of the Town of Mountain Grove’s Ground Water Source Protection Program.

The capture zone or recharge area is approximately 290 km^2. The aquifer itself is estimated to extend over an area of approximately 52.5 km^2. The outflow, or discharge, is to several streams and the Ardoch Wetlands that in turn feed into the Crow River. The maximum saturated thickness of the sand and gravel beds of the aquifer is just over 55 m, but generally ranges in depths from 32 m to 53 m. At present it is estimated that the aquifer can continuously produce up to 2,860 l/s of water.

The Town of Mountain Grove’s Ground Water Source Protection Program contains maps showing the 5, 10 and 20 year capture zones for the wells, and also contains detailed mapping of the potential “threats” to source water quality. Agricultural and forests are the primary land uses in the 20 year well capture zone. The Town of Mountain Grove, which uses private sewage disposal systems, is not situated in the capture zone. The source water is generally considered to be well protected.

Raw Water Characteristics

The chemistry of the water makes it highly suitable as a source for drinking water with all parameters well below the Ontario Drinking Water Quality Standards. Iron and manganese are present, but not in sufficient quantity to warrant filtration. Because of the depth and structure of the aquifer the water temperature is relatively constant, and the hydraulic conductivity is high, turbidity is low and pH is considered normal for groundwater systems.

The raw water consistently tests negative for total coliform and E. coli bacteria, confirming that the water is not under the influence of surface water.

	Temperature	pH	Turbidity
Average	7°C	7.4	.09
Range	5.4°C to 9.2°C	7.1 – 7.6	.06 - .15

Data collected over the last 15 years indicates that the water source is stable and consistent in terms of both quality and quantity. Other than private residential wells, there are no other users taking water from the aquifer. There have been no challenges encountered, and none are anticipated.

Water Treatment

Dale Road Pumphouse/Treatment Facility

The Dale Road pumphouse/treatment facility is located adjacent to the supply wells. The original facility was constructed in 1968 with one 200mm supply well (Well No. 1). In 1994 the facility was upgraded and a second 300 mm well (Well No. 2) was constructed. Both wells are founded at a depth of 41m. The last upgrade was completed in 2003 to address issues raised in the First Engineers Report for the system. This upgrade included the addition of a second cell to the contact tank to ensure that the required chlorine contact times could be met under all flow conditions, upgrades to the SCADA systems, the addition of a standby diesel generator and the addition of a second on-line chlorine residual analyzer.

Well No. 2 (300mm) is the normal duty well. Well No.1 serves as a back-up in the event of maintenance or a mechanical or other failure in the duty well. Well No. 1 will also start-up if the fire pump goes into service.

The raw water is metered, chlorinated, mixed (static mixer) and analyzed for free chlorine residual before entering the clear well. Chlorine is added in the form of sodium hypochlorite. The feed system consists of a day tank with two chemical feed pumps (one duty and one standby).

As water in the clear well is depleted, a level indicator signals the well pump to refill the clear well. Once the well pump starts, the primary disinfection sodium hypochlorite pump also starts. The dosage is paced to the flow signal from the raw water flow meter. If both wells are operating, the dosage rate will automatically increase to account for the reduced contact time available in the clear well. The chlorine contact tank provides the necessary contact time for primary disinfection to achieve 2-log disinfection of viruses.

Water flows from the clear well into the pump well. There are five high lift pumps; two submersible jockey pumps (duty and standby), two vertical turbine high lift pumps (duty and standby) and one fire pump.

Water is pumped to the discharge header. The discharge header contains a pressure relief valve which, when activated, diverts processed water back to the clear well.

On-line equipment monitors and records treated water flow, turbidity, pressure and chlorine residual prior to entry to the distribution system. There is a an auxiliary sodium hypochlorite addition point located after the chlorine residual analyzer where if necessary additional chlorine can be added to maintain secondary disinfection in the distribution system. The sodium hypochlorite feed system consists of a duty and standby feed pump and a day tank

The standby diesel generator is sized to run both well pumps, the high lift pumps and all essential station equipment. The SCADA system monitors the incoming power supply and will start the generator and trip the transfer switch if the loss of grid power is detected.

Water Distribution

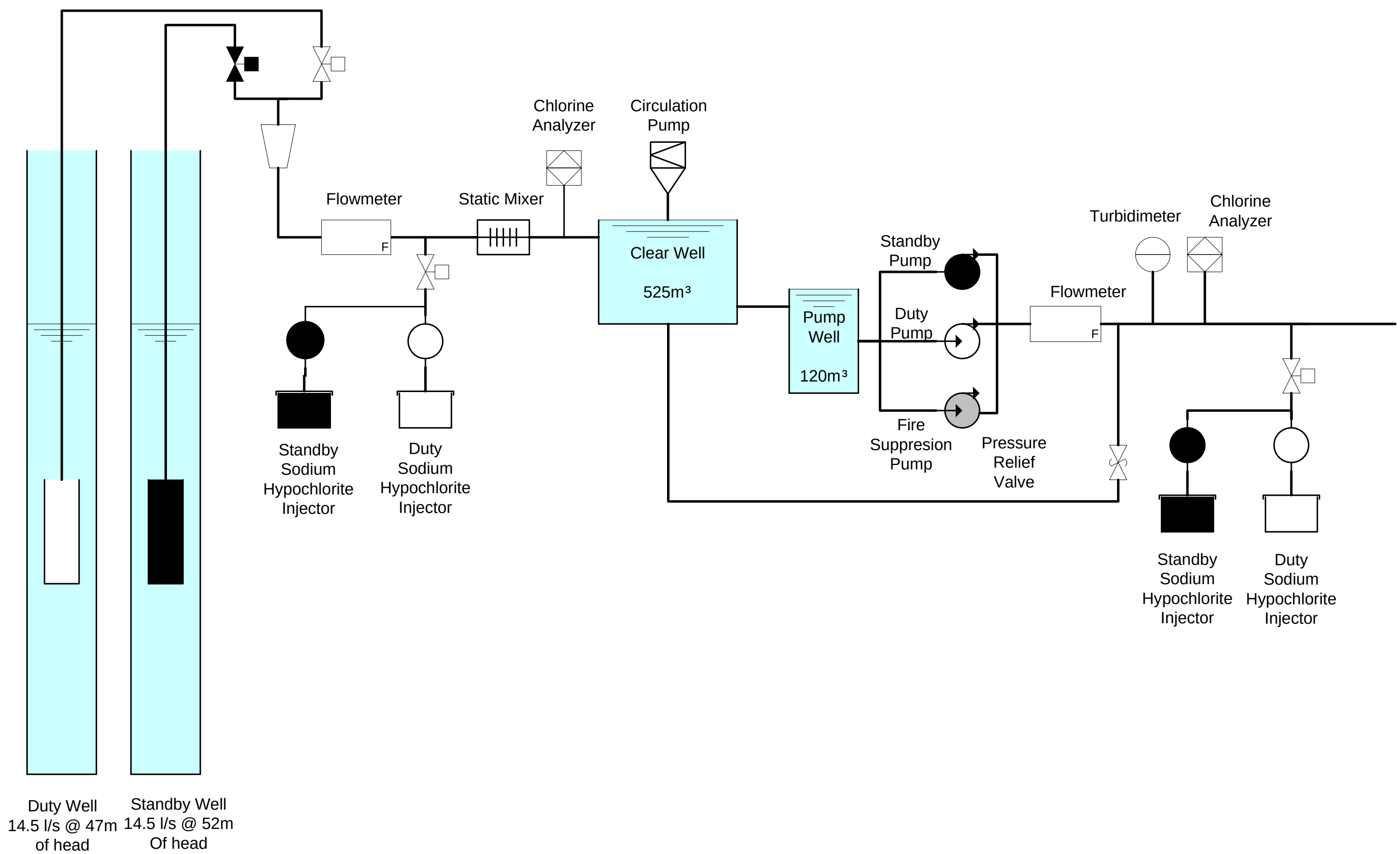
Processed water is pumped through 4.1km of 150mm mains to 166 service connections (153 Residential, 13 Commercial). The distribution system also includes 6 fire hydrants. Distribution system pressure is provided by the high lift pumps at the Dale Road facility.

There are 4 backflow prevention valves located within the distribution system at commercial/industrial facilities. Backflow preventers were added over the last 8 years purely as a preventive measure. The backflow prevention equipment is included in the regular maintenance/inspection program.

The pressure entering the distribution system typically varies from 50 to 70 psi, and is capable of maintaining pressure in the distribution system above 40 psi at all locations under peak flow conditions. During fire flows, system pressure may drop to 25 psi.

A process flow chart for the system is shown on the next page.

Process Flow Chart



Risk Assessment and Risk Management – See also Risk Assessment Procedure (attached)

Risk Assessment Outcomes

Hazard Ranking and Critical Control Point Determination				Detectable	Severity	Probable	Rank	Critical	
Process Step	**Hazardous event**	**Result**	**Control Measure(s)**						**Associated Procedure(s)**
Raw Water/Well	Well casing collapse	Loss of raw water	Back-up well and pump	1	1	3	3	No	Maintenance
	Well pump failure	Loss of raw water	Back-up well and pump	1	1	3	3	No	Maintenance
	Chemical spill	Contamination of aquifer	Monitor and sample Well Head Protection Plan	4	3	1	12	No	Monitoring and Sampling
	Agricultural run-off	Contamination of aquifer	Monitor and sample Well Head Protection Plan	3	3	2	18	No	Monitoring and Sampling
Primary Disinfection	Chemical feed pump failure	Loss of disinfection	Back-up feed system On-line monitoring and controls	1	5	3	15	Yes	Maintaining Primary Disinfection Recommended minimum CCP
	Static Mixer failure	Improper disinfection	Regular maintenance inspections	2	2	1	4	No	Maintenance
Clear Well	Clear well out of service for maintenance, repair	Inadequate contact time for primary disinfection	Two cell clear well, increase dosage rate	1	3	1	3	No	Maintenance Maintaining Primary & Secondary Disinfection
Pump Well	Pump failure	Loss of treated water	Back-up pumps	1	3	2	6	No	Maintenance
	Pump failure	Loss of system	Back-up pumps	1	4	3	12	Yes	Maintenance

		pressure							Pressure Loss Response
Secondary Disinfection	Chemical feed pump failure	Inadequate disinfection	Back-up feed system On-line monitoring and controls Primary disinfection	1	5	2	10	No	Maintaining Primary and Secondary Disinfection
Distribution	Watermain break	Loss of system pressure Contamination of distributed water	Inventory of pipes, valves, etc. for repair	2	5	4	40	Yes	Watermain repair and disinfection procedures Emergency Procedure Competencies
Distribution	Loss of chlorine residual	Contamination of distributed water	Distribution system maintenance Sampling and Monitoring	3	5	2	30	Yes	Maintaining Primary and Secondary disinfection
Control Systems	Power failure	Loss of SCADA	UPS and back-up diesel generator set, system discs	1	4	2	8	No	Maintenance
Entire system	Power failure	Loss of treated water supply	Diesel generator set, automatic transfer switch	1	5	3	15	No	Maintenance Emergency Procedures
Facility Security	Vandalism Introduction of contaminant	Damage to equipment – inability to produce water Potential contamination	Locks, alarms, fence	1	3	1	3	No	Monday to Friday Security Checks

Loss of primary disinfection was included as a CCP despite having a rank less than 20, as it is a Minimum recommended CCP (MOE Guidance document).

Critical Control Limits

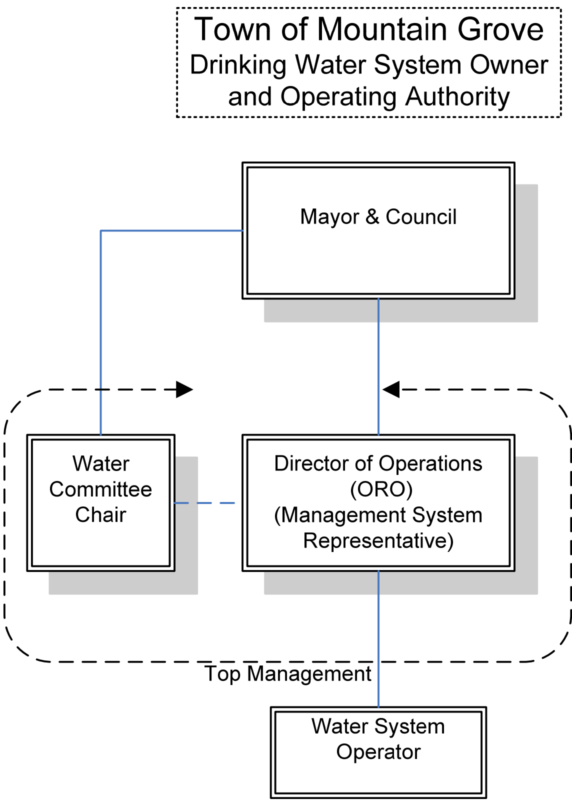
Critical control limits have been set for the identified CCPs. The limits are:

CCP	Condition	High Limit	Low Limit
Chlorination system – primary and secondary disinfection			
Entry to Clear well		**1.25 mg/L**	**1.0 mg/L**
Minimum for CT	Both clearwell cells in service		0.6 mg/L
	One clearwell cell in service		0.8 mg/L
Entry to distribution system		1.0	0.6 mg/L
System Pressure – grab sample in distribution system			0.3 mg/L
At point of entry to distribution system	Normal Operating Conditions	**80 psi**	**50 psi**
	Fire Pump running	**80 psi**	**25 psi**
In distribution system	Normal Operating Conditions	N/A	**40 psi**
	Fire Pump Running	N/A	**20 psi**

The chlorine analyzers are programmed to alarm if the critical limits are reached. The alarm and the value are recorded in the digital SCADA files. The water treatment operator shall also record the alarm and the results in the daily log, and then adjust the process as necessary to eliminate any potential risk to the drinking water. All deviations shall be reported to the Director of Operations.

Human Resources

Town of Mountain Grove – Water Quality Organizational Structure



Responsibility, authority and competencies

Mayor and Council
The Mayor and Council have the overall responsibility and authority to ensure that the Town of Mountain Grove waterworks meet all legislation and regulatory requirements. They further have the responsibility and authority to allocate the necessary resources for the safe operation of the works based upon the recommendations of the Water Committee Chair and the Director of Operations (Chief Operator).

Water Committee Chair (Top Management)
The Water Committee Chair is a member of council and is responsible for the reporting of the performance of the waterworks to the Mayor and Council. The Water Committee Chair is authorized to make recommendations to the council concerning the works based upon the input of the Director of Operations(Chief Operator) and other interested parties.

Chief Operator (Top Management)
The Chief Plant Operator, as the ORO, has the responsibility and authority to:
1. direct the operations of the waterworks,
2. establish policies relating to the operation of the works and its employees and contractors,
3. provide input into the development of operating budgets,
4. make recommendations to the Superintendent, Clerk-Treasurer and council regarding water department operations
5. communicate infrastructure and resource requirements to the Superintendent, the clerk-Treasurer and council

The Chief Operator is the QMS Representative. The QMS Representative shall be responsible for:

a) ensuring that processes needed for the QMS are established, implemented and maintained,

b) reporting to Town Council on the performance of the QMS and any need for improvement,

c) ensuring that the most current versions of documents required by the QMS are being used at all times,

d) ensuring that personnel are aware of all current regulatory requirements that pertain to their duties within the operation of the drinking water system, and

e) ensuring the promotion of awareness and effectiveness of the QMS throughout the operating authority.

Core Competencies: Post Secondary Education, 10 Years of municipal operations experience (water & wastewater), 5 Years Experience as Chief Operator, Current Class II WTP Operator certificate, Class I distribution Operator Certificate.

Part-time Water Systems Operator (2 positions)
The Water Systems Operator is responsible for monitoring and maintaining processed water quality, the maintenance of treatment and the maintenance of the distribution system including valves and hydrants and flushing. The Water Systems Operator shall comply with all relevant legislation and regulations, and undertake activities at the request of the Chief Operator.

Core Competencies: Current Class I WTP Operator Certificate, Current Class I Distribution Operator Certificate, 2 Years as Water Treatment Operator , mechanical aptitude, ability proficiency with word processing and spreadsheet software, WHMIS training, SCADA Training, Training on the NAOCl disinfection, Basic Workplace Safety Orientation, drivers licence.

Satisfying Competencies
The Town of Mountain Grove may administer certain tests, conduct interviews, verify references and/or request specific documentation as part of the hiring process in order to verify skills, experience and knowledge.

In order to meet the ongoing changes to technology, software, the applicable Ontario MOE Regulations and Water Department processes, the Chief Operator and the Water Systems Operator shall receive a minimum of 35 hours training in relevant areas. The training may be provided on or off site by qualified employees or contracted subject matter experts. Training effectiveness is evaluated when appropriate through testing, or a demonstration of knowledge gained.

Training records are maintained by the Director of Operations (Chief Operator).

Coverage – Please see procedure

Communications – Please see procedure

Essential Supplies and Services – Please see Purchasing procedure

Water Works Maintenance

Infrastructure Planning

The Town of Mountain Grove maintains a rolling ten year infrastructure maintenance program.

In the third quarter of the fiscal year, the Director of Operations (Chief Operator) shall submit a program plan and cost estimate for any infrastructure work that is being proposed.

The program plan shall include the following:

Buildings, storage and distribution

1. New infrastructure required in the upcoming year (due to regulation, growth or unforeseen circumstances).
2. Recommended infrastructure maintenance for the upcoming fiscal year and looking forward five years.
3. Recommended infrastructure rehabilitation or renewal for the upcoming year and looking forward for ten years.
4. Recommended infrastructure upgrading or replacement for the upcoming year and looking forward for ten years.

Machinery, equipment, software

5. New machinery, equipment (includes tools and vehicles), computers, and software required in the upcoming year and looking forward for three years.
6. Planned and unplanned machinery and equipment maintenance and replacement parts for the upcoming fiscal year.
    - Machinery and equipment planned maintenance costs (based upon the original manufacturer's recommended maintenance frequency)
    - Machinery and equipment planned maintenance costs (based upon normal operating life and past planned and unplanned maintenance history)

The Program Plan shall be presented to the Chair of the Water Committee for comment, and then forwarded to council during budget deliberations. The Director of Operations and Water Systems Operator may be called upon to provide additional details.

Upon approval of the Program Plan, the Director of Operations (Chief Operator) shall begin the process of implementing the approved recommendations over the course of the fiscal year. Progress to the Plan shall be reported quarterly by the Director of Operations (Chief Operator) to the Water Committee Chair.

Planned Maintenance: Buildings and distribution system
New construction or planned work to be done to existing structures shall be in conjunction/coordination with other operations departments whenever practical (i.e. sewer, power distribution, roads…).

All new construction and work to existing structures shall comply with all relevant legislation and regulations. Typically, this work is subcontracted in accordance with Town of Mountain Grove policies and procedures. The Director of Operations (Chief Operator) shall ensure that contracted work is monitored as appropriate.

If the Planned maintenance can be conducted by the Town of Mountain Grove personnel then the Director of Operations (Chief Operator) shall issue a work order describing the work. Details of the work completed shall be recorded on the face of the work and returned to the Director of Operations (Chief Operator) for review and filing.

Unplanned maintenance: distribution system
Unplanned maintenance typically consists of main leaks/breaks, valve, hydrant and meter replacements. This work is contracted by the Director of Operations (Chief Operator). It may or may not be inspected by the Water Systems Operator. A list of acceptable contractors is contained within the purchasing procedure.

Planned Maintenance: Machinery and equipment
Planned maintenance includes visual inspections, lubrication, fluid changes and other activities as recommended by the OE Manufacturer. Planned maintenance conducted by Water Systems Operator shall be scheduled and require a work order. A planned maintenance schedule is maintained by the Water Systems Operator. Details of the work shall be recorded on the face of the work order and forwarded to the Director of Operations (Chief Operator) for review and filing.

Unplanned Maintenance: Machinery and equipment – Water Treatment
The Water Systems Operator is responsible for the maintenance of the machinery and equipment associated with the pumphouse/treatment facility. The Water Treatment Operator has the authority to contract unplanned maintenance work to a qualified contractor (see Essential Products and Services List).

All unplanned maintenance work shall be recorded on a work order and forwarded to the Director of Operations.

Planned and unplanned maintenance: Computers, software, SCADA
The Town of Mountain Grove has an annual service contract for all maintenance of computers, software and the SCADA system. The appropriate personnel are notified prior to planned maintenance activities taking place. For unplanned maintenance please contact: CompuAid – (888) 555 - 3337 ext. #666.

Sampling, Monitoring and Calibration – Please see procedure

Emergency Management – Please see procedure and contact list

Continual Improvement of the QMS – Please see Internal Audit and Management Review procedures

Internal Audits

Internal audits are conducted to ensure that the QMS conforms to the requirements of the Town of Mountain Grove and of the DWQMS. These requirements include ensuring that the QMS has been effectively implemented and properly maintained.

The Town of Mountain Grove may, from time-to-time, request that internal audits be conducted by trained auditors from a neighbouring municipality. In turn, the Town of Mountain Grove may provide the same to other municipalities as the case arises.

Audits Conducted by Town of Mountain Grove

Auditors

- All internal auditors must have successfully completed a recognised 16 hour Internal Auditor workshop

Internal Audit Schedule

- Internal audits are scheduled throughout the year. The audits are scheduled by Element by month. The assigned auditor's name also appears on the schedule.

- The audit schedule is developed and published at the end of February each year for the upcoming fiscal year by the Director of Operations (Chief Operator). There are no audits scheduled for July, August or March.

- Each element of the Standard is audited at least once during the fiscal year.

Audit Planning

- The auditor shall review all related QMS documentation and develop or obtain a checklist at least one week prior to the audit.

Conducting the Audit

- The auditor shall observe activities, review records and interview personnel as necessary to ensure that the status of the audited element of the QMS has been effectively covered.

Reporting the Results

- The auditor shall submit a completed checklist and report to the Director of Operations (Chief Operator).

- The report shall include any requirement for corrective actions. Corrective actions shall be communicated to the responsible individual and included as part of Management Review input.

Audits Conducted by Another Municipality

Auditors

- Outside auditors must provide proof of competency prior to conducting an audit.

Audit Schedule

- Audits are to be conducted per the Town of Mountain Grove schedule.

Planning and Conducting the Audit and Reporting the Results

- Audits may be planned and conducted per the procedures of the auditing Municipality. Prior approval by the Director of Operations (Chief Operator) is required.

- Audit results may be reported per the procedures of the auditing municipality as long as the results are documented. Requirements for corrective action must be indicated.

Water Works Procedure

Management Review

This procedure defines the Management Review process to ensure the continuing suitability, adequacy and effectiveness of the QMS.

<u>Review Frequency</u>

- Management Reviews shall be conducted on an annual basis prior to completion of the annual budget process

<u>Review Participants</u>

- The management review is convened by the Water Committee Chair. Attendees shall include the Director of Operations (Chief Operator) and the water system operator. Invitees may include council members.

<u>Review Input</u>

- The Director of Operations (Chief Operator) shall provide information and data concerning the following categories, for the review:
  - incidents of regulatory non-compliance
  - incidents of adverse drinking water tests
  - results of internal and 3rd party audits
  - results of relevant emergency response testing
  - operational performance and water quality trends
  - follow-up on actions items from previous management reviews
  - effectiveness of contracted coverage
  - status of action items 9(f any) identified between reviews
  - changes in resource requirements, infrastructure, process, personnel, Drinking Water Quality Management Standard or regulations that could affect the QMS
  - consumer feedback, and
  - staff suggestions

<u>Review Process</u>

- The Management Review shall be a planned event. A minimum of four hours shall be set aside by the participants to ensure a thorough review of the QMS is conducted.

- Each input category shall be reviewed in order to identify if, where and when improvements to the QMS and its procedures are required.

- The Director of Operations shall make note of any changes or action items required during the course of the review.

Review Output

- A list of changes required to be made to procedures or other QMS based documentation.

- A list of “action” items. All action items shall identify an individual responsible.

- Recommendation(s) for any human or financial resources needed for maintenance of improvement of the QMS.

- Minutes of management review shall be maintained by the Director of Operations. These minutes shall include the date and time of the review activity and the name of participants and attendees.

Water Works Procedure
Risk Assessment

This procedure is divided into two sections.

Section 1 describes the steps taken by water works personnel to:

- identify and rank potential hazards to the water system
- identify control measures to address hazards
- identify Critical Control Points (CCPs) and associated methods of monitoring and controlling them

Section 2 describes the results of the activities described in Section 1. The results include:

- List of ranked hazards complete with
    1. control measures where appropriate
    2. CCPs
    3. Control limits for CCPs
    4. Monitoring methods for CCPs
- Method for reporting and recording deviations from CCP limits.

Section 1
A team was assembled to discuss and identify all potential hazards to the water works. The team members were:
Bill Craigson – Director of Operations (Chief Operator)
Martin Aston – WTP Operator
Jim Durrell – Water Committee Chair
James Oberlon – Oberlon Construction (Maintenance Contractor for Town of Mountain Grove)
Wayne Christie – WTP Foreman, P. Saltzman Water Treatment Plant, Town of White Lake (Neighbouring municipality)

The water works were broken down into “process” areas. Each area was reviewed to identify hazards.
Raw Water/Well
Primary Disinfection System
Clear well
Pump well (including pumps)
Secondary Disinfection System
Distribution
Control systems
Entire systems
Facility security

The hazards were then “ranked” by the team as to their probability of actually occurring and if they did, what the impact would be upon the raw water, the works and the processed water.

The total risk rank was determined by multiplying the individual scores for probability, severity and detectability.

Ranking Table

Probability		Severity		Dectability	
1	**Rare** - requires exceptional circumstances to occur	**1**	**Insignificant** - little operational disruption	**1**	**High** - immediately detectable, SCADA alarms
2	**Unlikely** - Could occur at some point	**2**	**Minor** - impact of small portion of population, easily managed operationally	**2**	**Moderate -** indicated by alarm or lab results
3	**Possible** - Will occur at some point	**3**	**Moderate** - minor impact on large population, managed operationally	**3**	**Detectable** - visually detectable, rounds or maintenance
4	**LIkely** - Will occur during normal circumstances	**4**	**Major** - significant impact on population, difficult to manage	**4**	**Poor** - would not be detected until problem occurred
5	**Certain** - Expected to occur in most circumstances	**5**	Catastrophic - major impact on population, complete systems failure	**5**	**Undetectable** - cannot be detected under any circumstances

Once the rankings were determined the team then identified the control measures, the critical control points and methods to monitor all, and where procedures are needed to respond to any deviations from established critical control limits.

The WTP Operator then drafted the response procedures for deviations to the critical response limits.

Section 2

The following were determined to be Critical Control Points in the Town of Mountain Grove drinking water system:
Primary Disinfection
Secondary Disinfection
System Pressure

Control Limits have been established for Critical Control Points. These Control Limits are within the limits set by the M.O.E. The control limits act a warning that adjustments to the treatment process may be required to prevent an adverse water condition incident.

Primary and Secondary Disinfection

Primary Disinfection Critical Control Limits (After Static Mix))
Low treated water SCADA alarm – 1.0 mg/L
High treated water SCADA alarm – 1.25 mg/L
(see procedure for primary disinfection and contact time in Operations Manual – not included in this draft Model Operational Plan)

Secondary Disinfection Critical Control Limits – (Off discharge header)
Low treated water SCADA alarm – 0.6 mg/L
Distribution system grab sample – 0.3 mg/L
High treated water SCADA alarm – 1.50 mg/L

System Pressure
Low pressure SCADA alarm – 750k

Any deviation from the limits shall be recorded in the Operator's Daily Log and be reported to the Director of Operations (Chief Operator). The on-call Operator shall respond to any of these alarm conditions and investigate the cause. CCP Response Procedures follow:

Hazard Summary and Ranking

Process	Hazard	Result	Detecable	Severity	Probable	Rank	Control
Raw Water/Well	Well casing collapse	Loss of raw water	1	1	3	3	Back-up well and pump
	Well pump Failure	Loss of raw water	1	1	3	3	Back-up well and pump
	Chemical spill	Contamination of aquifer	4	3	1	8	Monitor and sample Well head protection plan
	Agricultural run-off	Contamination of acquifer	3	3	2	8	Monitor and sample Well head protection plan
Primary Disinfection	Chemical feed pump failure	No disinfection	1	5	3	15	Back-up feed system On-line monitoring and controls
	Static mixer failure	Improper disinfection	2	2	1	5	Maintenance
Clear Well	Clear well out of service for maintenance, repair	inadequate contact time for primary disinfection	1	3	1	5	Two cell clear well, increase dosage rate
	Pump Failure	Loss of treated water	1	3	2	6	Back-up pumps
		Loss of system pressure	1	4	3	12	Back-up pumps
Secondary Disinfection	Chemical feed pump failure	Inadequate disinfection	1	5	2	8	Maintenance. Manual test
Distribution	Watermain break	Loss of system pressure	2	5	4	11	Maintenance, routine inspections, consumer notification

<u>Low Limit Disinfection Response Procedure</u>

- The operator shall determine if the alarm is the result of an analyzer failure, or is actually due to a Low Chlorine reading. Test water in the clear well for residual.
- If the chlorine is low, the Operator shall then switch over the sodium hypochlorite pump to the standby unit.
- Increase chlorination rate by 5 – 10% until level in clear well returns to acceptable levels. Reduce flow by the same amount.

- Repair or replace the failed unit.
- The secondary disinfection Chlorine Analyzer will signal the secondary disinfection system to add sodium hypochlorite if water from the pump is below the critical limit residual.
- The Secondary Disinfection System will alarm in the event of a duty pump failure. The operator shall switch to the standby pump to ensure ongoing secondary disinfection capability.

Low Distribution System Residual

- Operator shall re-test. If results confirm low residual follow next steps.
- Chlorine residual leaving plan shall be increased by 10%.
- Results to be recorded in log book. The Director of Operations (Chief Operator) shall be notified of situation.
- Operator to take action as instructed by the Chief Operator (Director of Operations). Actions shall include:
    - Determining chlorine demand
    - Retesting at problem location
    - Testing at adjacent sampling sites
    - Flushing of mains
    - Etc.

Low Pressure Response Procedure

If the pressure drops below 750kPa while the duty pump is running and the flow is remaining steady or increasing, the Operator shall:

- Immediately contact the Director of Operations
- Attempt to identify the location or source of the pressure drop and isolate the problem
- Continue to monitor pressure and flow.
- If pressure drops below 650kPa the SCADA system is programmed to shut down the duty pump
- If piping is in need of repair or replacement, it shall be super-chlorinated being returned to service.

Water Works Procedure

Sampling and Monitoring Procedure

This procedure describes the sampling and monitoring activities for the Town of Mountain Grove water works. All sampling is in accordance with O. Reg 170/03.

Sampling

On-site Sample Analysis

Sample Type	Source	Frequency
Free Cl_2	Entry to clearwell	Daily
Free Cl_2	Discharge header	2 X Daily
pH	Intake	Weekly
Free Cl_2	Discharge header	Weekly (co-ordinated with Bacti)
Free Cl_2	Distribution – 221b Baker Street	Weekly (co-ordinated with Bacti)
Free Cl_2	Distribution – 24 Austin Ave	Weekly (co-ordinated with Bacti)

SCADA Continuous Sampling

Sample Type	Source	Device	Asset #
Free Cl_2	Entry to clearwell	Pre Cl_2 Analyzer	G2-A
Free Cl_2	Discharge header	Post Cl_2 Analyzer	G2-B

Accredited Lab

Sample Type	Source	Frequency
Bacti	Raw Water	Weekly
Bacti	Treated Water	Weekly
Bacti	Distribution – 221b Baker Street	Weekly
Bacti	Distribution – 24 Austin Ave	Weekly
Organics	Treated Water	Once every 3 years
Inorganics	Treated Water	Once every 3 years
Nitrate & Nitrite	Treated Water	Quarterly
Lead	Treated Water	Annually
Sodium	Treated Water	Five Years
Floride	Treated Water	Five Years
Trihalomethanes	Distribution – 221b Baker Street	Quarterly

- All sampling is in accordance with O. Reg 170/03
- The date, time and results of all in-house samples taken are recorded on the corresponding Test Sheet.

Monitoring

SCADA

- The SCADA system is programmed to monitor process parameters and/or water characteristics in several locations – including raw water and treated water flow.
- Well levels, pumps, flow meters, analyzers, feed pumps, pressure and chlorine supplies (by tank levels) are all monitored by SCADA. Please refer to the SCADA manual for detailed information.
- The operator may adjust processes affecting water quality based upon the information and data provided by SCADA
- Any adjustments made to process parameters shall be recorded in the Daily Log
- Chlorine residuals are monitored at the entry to the clearwell and on the treated water. All parameters may be trended.
-

Visual

- The operator shall conduct a visual inspection ("rounds") of the treatment facility twice daily: upon start of shift and one hour before the end of shift.
- Results shall be recorded in the daily log.
- Equipment and building conditions, if deteriorating, shall be noted in the daily log and reported to the Director of Operations (Chief Operator)

Calibration

- On-line chlorine analyzers and the turbidimeter shall be calibrated at the frequency and using the method specified by the manufacturer. Results of these calibrations shall be recorded on the Instrument Calibration Sheet and retained at the WTP.
- The in-house lab analyzer shall be calibrated prior to each use.
- Flow meters shall be calibrated by a qualified subcontractor. Records of flow meter calibration shall be retained by the Operations Director.

Water Works Procedure

Purchasing

This procedure identifies the supplies and services deemed essential to the delivery of safe drinking water.

The following products and services are deemed to be essential to the delivery of safe drinking water:

Essential Supplies and Services List		
Product / Service	**Primary Source**	**Secondary Source**
Sodium hypochlorite	Bretzlaff Pools & Spas 124 Boundary Road Mountain Grove, ON (613) 555 – 0011 Emergency: 555 - 0911	Clean Tech 2400 Overland Blvd. Ardoch, ON (613) 555 - 2022
Water testing	Bonnechere Laboratories 18 Main Street Eganville, ON (613) 555 – 7348 www.bonlabs.org/egan	Accurate Testing Services 44 Mullins Court Carleton Place, ON (613) 555 - 2114
Calibration	Metro Metrology 116 Hemlo Crescent Kanata, ON (613) 555 - 8909	Bob Harris Enterprises 6566A Concert Lane Ardoch, ON (613) 555 - 1219
Instrumentation parts	Sumter Sales & Service 150 Foxfield Drive, Unit 22 Ottawa, ON (613) 555-4959	Beaton Engineering 115 Deerwood Drive Ottawa, ON (613) 555 - 3125
Operations Emergency and Vacation coverage	Twp. Of North Williams Water Department Operations 24 Queen Street Marytown, On (613) 555-2839 After hours (613) 555-2223	
Contracting services	Oberlon Construction 4 Otterburn Street Mountain Grove, ON (613) 555 – 8219 After Hours: (613) 555 - 9110	Dashwood Contracting 137 Dale Road Mountain Grove, ON (613) 555 – 6643 After Hours: (613) 555 – 8646 ext. 12

- Each of these products or services is available from more than one source that is approved by the Water Department.
- With three treatment facilities, chemicals can be moved from one facility to another in the event of a shortage or an emergency
- A minimum five day supply of chemicals is maintained at all times.
- Instrumentation parts kits, per the manufacturer's recommendations, are maintained at each facility.

The Chief Operator (Director of Operations) is responsible for the maintenance of chemical and instrumentation parts inventories.

All essential products and services are blanket orders covering the 12 month period from April 1st to March 31st.

For all other purchases, Chief Operator (Director of Operations) shall be forwarded a completed requisition to the Water Department Manager for approval prior to the purchase of goods and services.

Water Works Procedure

Communications

This procedure describes how the Town of Mountain Grove communicates the QMS between Town Council and its employees, suppliers and the public.

Employees

- The QMS was initially rolled out to employees during two scheduled “lunch and learn” sessions sponsored by the Water Committee Chair. An overview of the QMS was presented by the Director of Operations (Chief Operator).
- The Operational Plan was circulated to all employees with a Transmittal Sheet that required each employee to sign that they had read the Operational Plan.
- Procedures were also circulated with a Transmittal Sheet.

Suppliers

- All essential suppliers (for a list see the Purchasing Procedure) were provided with a handout describing the QMS.

Consumers

- The Town of Mountain Grove has included a billing insert that describes the QMS.
- The Quality Policy is posted in public areas of the Town Hall.

Water Works Procedure

Coverage

This procedure describes the coverage provided for the Town of Mountain Grove water works.

On-site Coverage

- The water treatment plant is staffed 5 days a week, 4 hours a day.

- All distribution system maintenance is contracted.

After-hours/Weekend/Stat Holiday Coverage

- The drinking water system is controlled and monitored by call. Any alarm condition is routed to a call centre that in turn contacts the WTP operator.

- The operator shall take the necessary action to investigate and address the alarm condition.

- The Chief Operator is the system overall responsible operator (ORO).

- A qualified system operator of the contract operating authority may at times be designated as the system ORO. Alternate ORO's are to be idenfieid in the logbook.

- The system ORO shall be available to respond within 2 hours of notification.

Emergency and Vacation Coverage

- The Director of Operations (Chief Operator) shall contract an outside operating authority to provide Emergency and Vacation Coverage for the Town of Mountain Grove water works, as needed.
- Contact information for contract operating authority services are included in the list of essential services.

- The contract shall be negotiated annually.

Note: The Town of Mountain Grove will hire a second qualified WTP Operator should the costs of contracting become prohibitive. The effectiveness of the method of coverage is evaluated during the annual Management Review.

Water Works Procedure

Document and Record Control

QMS Document Control (Other than Records)
This procedure is applicable to the following QMS documents:

- Operational Plan
- Quality Policy
- Procedures
- Instructions
- Audit Checklists
- Forms
- Equipment Manuals
- As Built Drawings

<u>Creating New or Updating Existing Documents</u>

- Any employee of the Water Department may request the creation of a new QMS document or a change to an existing QMS. The request must be made in writing and submitted to the Chief Operator (Director of Operations). The need for new or updated documents may also be identified by audits or management review. The Chief Operator (Director of Operations) will be assigned the task of creating of revising these documents. The request must include the following information:

    1. Reason for new or changed document - must belong in one or more of these categories:
        - Required by the DWQMS
        - Enhances process control
        - Eliminates risk
        - Supports regulatory requirements
        - May improve operational efficiency

    2. Outline of document change or new document content
        - Narrative format is acceptable

- If approved, the requester shall develop the new/changed document and submit it to the Operations Manager for Approval

- The procedure template is available on-line. Please go to the Admin folder, select Templates and then click on QMS Procedure Template. The Template is “locked” so that it cannot be changed.

<u>Approving Documents</u>

- All QMS related documents created by the Town of Mountain Grove Water Department shall be approved by the Operations Director before release.

- The Operations Manager shall be responsible for ensuring that copies of the new or changed document are distributed. Obsolete documents (due to changes) shall be collected and destroyed by the Operations Manager.

Reviewing Documents

- The Operational Plan and procedures shall be reviewed annually for applicability and relevance.

Document Availability

- All procedures, instructions, forms and checklists are retained in the QMS binders at the Water Treatment Plant and at the office of the Operations Manager.

- Water treatment machinery and equipment manuals are retained at the treatment plant. They are stored alphabetically by equipment type in binders. Each binder contains a table of contents. The binders are kept in the top two drawers of the grey, locking four-drawer file cabinets.

- Distribution drawings, specifications and manuals are retained by the Operations Manager. These documents are filed in the appropriate cabinets (flat and vertical)

QMS Record Control

This procedure is applicable to all records that demonstrate conformance to DWQMS requirements. All records that demonstrate compliance are covered by Ontario Regulations 170/03 and 128/04.

Manual Records

- All manual records shall only use approved QMS forms

- The record title shall be clearly visible and legible

- Manual records shall be legible. Pencil or any other erasable marker shall not be used to record process or product information or data.

- QMS records shall be filed by type by date

- QMS related Water treatment and distribution records shall be stored and available at the water treatment plant.

- QMS records shall be stored in such a manner as to prevent deterioration.

- All manual records shall show the name or initials of the recorder and the date (and time if appropriate) the record was generated.

SCADA Records

- QMS SCADA records are backed up each day

- Electronic copies of the QMS SCADA records are compiled monthly and stored in the Town safe for a minimum of five years. If a QMS SCADA record is also a requirement of O. Reg 128/04 and/or 170/03, then the retention time shall be as per the regulation.

- Printed copies of the SCADA monthly summaries may be circulated for management and management review purposes. These summaries shall be filed by the Operations Director if being retained for knowledge purposes.

Water Works Procedure

Water Works Emergency Procedure

This procedure provides the steps to taken to respond to a major emergency involving the water works.

List of potential emergency situations is not included in this model emergency plan but can be found in a separate document.

Unsafe Water In Well (Adverse Water Quality)

- Ensure all concerned are notified (see Emergency Contact List).
- Shutdown pump in affected well
- Increase chlorine dosage to ensure a minimum of 1.0 mg/l total or 0.2 mg/l free residual in the distribution system
- Sample both water sources and three points in the distribution system
- Re-sample and maintain operating on back-up well until two consecutive sets of samples are of acceptable quality (requires M.O.H permission to resume normal operations)
- Await direction of M.O.H.

Unsafe Water In Distribution System (Adverse Water Quality)

- Ensure all concerned are notified (see Emergency Contact List)
- Raise chlorine levels in the distribution system to a minimum of 1.0 mg/l total or 0.2 mg/l free residual chlorine
- If boil water advisory is issued by M.O.H. inform public (Operations Director to contact local media and post notice on Town of Mountain Grove home page (website)
- Collect special samples at the both sites and both wells
- Begin line flushing at affected site
- Collect a set of special samples
- If results negative from second set of samples continue and expand flushing. Check for leaks or main breaks in the area.
- If results positive from second set of samples, collect third set of samples
- If third results positive consult M.O.H. for further direction

Power Failure

- Diesel gen-set automatically kicks-in on power failure
- Operator or on-call operator shall contact local power authority to determine extent of failure and estimate of time gen-set will be running.
- Operator shall monitor gen-set performance during power failure.

Emergency Contact List

Mayor – Charlotte Whitton Office: 555-1666
Home: 555 -1210

Chief Operator (Director of Operations) Bill Craigson Office: 555-2400
Home: 555-1210

Bonnechere Labs (613) 555-3748
After Hours (613) 555-6667

M.O.H.
Eastern Ontario Dr. Shruti Prakash (613) 555-9111
Cell (613) 555-7002
Fax (613) 555-9820
24 Hr. Emergency Line (877) 555-1999

M.O.E. Kara (613) 555-2327
Ed (613) 555-2328
Ottawa: Main Office (888) 555-7622

See also Essential Supplies and Services List

Town of Mountain Grove

Water System Process Schematic