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Request for Decision

Drinking Water Backflow By-Law

Recommendation

THAT the City of Greater Sudbury directs staff to develop an appropriate by-law (Drinking Water Backflow Prevention By-law) to regulate and protect safe and clean water delivery to the citizens of Greater Sudbury including an implementation plan, communication plan, and financial consideration, for further consideration at Operations Committee.

Signed By

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Background

The purpose of this report is to enhance Water/Wastewater Services commitment to maintain the delivery of safe, clean water to the residents of the City of Greater Sudbury (CGS). The development of a new by-law is required to oversee the appropriate installation and regular maintenance of devices which are designed to protect the CGS water systems from the risk of backflow contamination events.

In recognition of the potential risks involved with backflow contamination, the Ministry of Municipal Affairs and Housing amended the Ontario Building Code in 2014 to require the installation of backflow prevention devices in all new Industrial, Commercial and Institutional buildings. The Ontario Building Code is not retroactive and therefore cannot insist on backflow prevention device installations in existing facilities.

To address the existing facilities which may pose a threat to municipal drinking water, over 18 other municipalities in Ontario, including Toronto, Ottawa, London, Hamilton and Guelph, presently have Backflow By-laws in effect. Staff is recommending that a Backflow Prevention By-law for the City of Greater Sudbury be introduced to prevent contamination from entering our City drinking water systems.

What is Backflow?

In municipal drinking water systems, backflow is the undesired reversal of water flow against normal direction, which can cause contaminants to enter into the drinking water supply system. There are two causes for backflow: Back-pressure and Back-siphonage. Back-pressure occurs when the pressure in a

private water system is greater than the pressure in the City's water supply system. If this happens, water from a private water system can force its way into the City water supply system. This can be caused by a pump, elevated tank, temperature increase in boiler systems, or other events causing an increase in local pressure.

Back-siphonage is the reversal of normal flow. This is caused by a reduction in the pressure in the local water supply system which can result from nearby fire-fighting water consumption or a water-main break. Back-siphonage can cause contaminated water to be pulled into the municipal water supply system. Both situations pose risks to the integrity of the water supply and the safety of the water supply system.

Key Elements

The City of Greater Sudbury W/WW Services delivers safe and clean drinking water through our distribution systems. The Safe Drinking Water Act and Ontario Ministry of the Environment and Climate Change (MOECC) regulations mandate water purveyors to protect the water supply to the point of delivery. The proposed program would involve the isolation of private plumbing systems from the public waterworks in situations which present a risk to the municipal water supply. This is typically done through the installation of a backflow prevention device connected immediately after the water meter. This is called premise isolation.

The Safe Drinking Water Act places expectations upon everyone involved with the production and distribution of the municipal drinking water supply. Due to the fact that there have been documented backflow incidents in Ontario, staff recommends firm action to mitigate these backflow risks in our community.

The proposed Drinking Water Backflow Prevention By-law will require the installation and maintenance of backflow prevention devices in existing facilities that present risks to the drinking water supply. Also, the proposed by-law will monitor and confirm that the required annual maintenance on all existing backflow prevention devices within the City of Greater Sudbury is completed.

Recently staff has consulted with local stakeholders, such as the local office of the Ministry of The Environment and Climate Change and the Sudbury District Health Unit, concerning the need for a Drinking Water Backflow Prevention By-law. All parties agree that the development of this by-law would be beneficial in protecting our municipal drinking water supplies.

Who will be affected by this bylaw?

The proposed by-law will affect customers whose activities pose a backflow risk to the municipal water supply. This could include various Industrial, Commercial and Institutional customers as well as specific residential customers (i.e. with swimming pools and/or irrigation systems) where there is a greater potential for backflow and contamination to the drinking water supply.

The proposed program would commence with a focus on Education and Outreach and voluntary compliance with the by-law. This would be followed by a prioritized implementation of the by-law according to levels of risk, (highest to lowest) once the by-law receives approval.

Conclusion

That the City of Greater Sudbury support and approve the development of a Drinking Water Backflow

Prevention By-law and implementation program to protect our City's drinking water systems.

Staff will then draft a proposed by-law and implementation program which will be presented for Council's review in early 2016 at the Operations Committee. The implementation program will include the following:

- communications plan
- financial plan / new business plan
- information on cost to community

A Guide for Drinking Water System Owners Seeking To Undertake a Backflow Prevention Program

MINISTRY OF THE ENVIRONMENT AND CLIMATE CHANGE

PIBS #9676e

Ontario

Disclaimer:

This guide is for information purposes only and is intended to provide suggested parameters for the development and implementation of backflow prevention programs should a drinking water system owner decide it wishes to undertake such a program. It is not intended to provide specific advice or recommendations in any circumstances. Moreover, this guide is not, and should not be construed as, legal advice. It is intended for information and educational purposes only and must be read in light of any applicable Acts, regulations and other provincial publications related to backflow prevention programs that are currently in use or as may be published from time to time. If you have any questions about the application or interpretation of referenced legislation or regulations or have other legal questions, including authority for backflow prevention programs, you should consult a lawyer.

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1.0 Background

Backflow incidents have caused contamination of drinking water distribution systems around the world and have not only resulted in a loss of confidence by the public as to the safety of the water that comes from their taps, but also numerous health-related issues. Justice O'Connor also considered their impacts during the Walkerton Inquiry. On pages 236 and 237 of Part Two - Report of the Walkerton Inquiry, he noted that "In addition, as part of their comprehensive distribution program, water providers should have active programs, working together with building inspectors and public health agencies, to detect and deter cross-contamination" and "Distribution systems should have regularly tested backflow prevention valves that can prevent or at least isolate incursions."

Ontario is recognized by many as being a world leader in issues pertaining to drinking water. Stakeholders have consistently highlighted the need for backflow prevention programs. On March 7, 2005 a drinking water advisory was issued to the 30,000 residents of the City of Stratford after a red, foamy substance from a car wash was discovered in the drinking water system. Businesses and schools shut down and some residents were unable to drink the water that came from their taps for a number of days. Upon investigation it was discovered that a properly installed and functioning backflow prevention device could have prevented this event from happening. This incident is just one of many that have occurred in Ontario over the last twenty years that have been reported.

The ministry, responding to the Stratford incident, established a multi-stakeholder working group which included staff and representatives from the Ministry of Municipal Affairs and Housing, the Ontario Water Works Association (OWWA) and the Ontario Municipal Water Association (OMWA). Membership within the working group grew to include representatives from a number of other ministries, building/plumbing associations/organizations, training groups and municipalities which have direct experience with cross-connection control/backflow prevention. The working group was tasked with reviewing existing information and developing ideas/concepts for reducing the frequency and risk of cross-connection/backflow incidents and the impacts they have on drinking water systems.

The working group and many other jurisdictions have recognized that backflow prevention programs are needed. They have also recognized that the prevention of backflow is a critical component in ensuring the safety of the drinking water supply and ultimately public health.

To proactively assist our ministry program partners and regulatory stakeholders in understanding and adapting to issues raised by the working group and in response to requests from stakeholders, the ministry's Chief Drinking Water Inspector requested the development of a document which could serve as a

guide for those partners seeking to develop or implement backflow prevention programs.

The efforts of the working group resulted in the development of this document. It provides technical guidance to the owners of drinking water systems who have moderate and severe hazard facilities (as defined within the Canadian Standards Association (CSA) B64.10-11) connected to their drinking water systems. Though primarily focused on owners/operators of municipal drinking water systems, the information contained within this guide can be used by any owner of a drinking water system seeking to develop and implement a backflow prevention program.

This guide is not intended to be a detailed engineering or procedural manual. However, it is intended to address aspects pertinent to the design of water treatment units, as well as cross-connection control considerations that may help protect drinking water consumers in a more standardized and consistent manner.

2.0 Introduction

Cross-connections are present in every drinking water supply system and, depending on the size of the system, hundreds or thousands of potential cross-connections can exist. Cross-connections that are not protected against backflow are potentially a dangerous source of contamination. When backflow occurs through an unprotected cross-connection, pollutants and contaminants can enter the private plumbing system and the municipal water distribution system and be delivered to other consumers or locations. The task of eliminating, mitigating or reducing the risks created by cross-connections is enormous.

Water typically flows within a drinking water system in one direction. If the water within the system begins to flow in the opposite direction as a result of back pressure (pressure greater than water supply pressure) or back-siphonage (caused by negative pressure within a water system), there is a possibility for contamination as a result of a backflow. This possibility can be increased if there are potential cross-connections within/to the system. These can occur in any building, structure or property - whether industrial, commercial, institutional, multi-residential or residential - connected to the drinking (potable) water supply distribution system. Problems can be caused by breaks or repairs to watermains, fire fighting activities or reductions to or stoppages of the main water supply pressure.

Backflow as a result of actual or potential cross-connections between a drinking water system and any source of pollution or contamination (such as pathogens or chemicals) has the potential to impact the users of the drinking water system. The purpose of backflow prevention programs is to ensure that the drinking water supply is protected against the entry of contaminants, pollutants, infectious agents (pathogens) and other materials and substances from cross-connections which could harm users and negatively impact the water supply distribution network.

> ***NOTE:*** *The terms cross-connection control and backflow prevention are often used interchangeably.*

It is important to understand that for a drinking water supply to become contaminated via a cross-connection three things need to happen simultaneously:

1. an open source of drinking water supply piping must be unprotected (or improperly protected) from a cross-connection;
2. a physical cross-connection must be made between the drinking water supply piping and a contaminant source; and
3. hydraulic event/backflow conditions must occur.

In general terms, plumbing codes attempt to address backflow prevention. They do so in various ways. The method can be as simple as the provision of an air gap or as complex as requiring the installation of a backflow prevention device. Within any building, it is possible to have interconnections between the drinking water supply and any fixture, appliance, system, or process which has a drinking water supply. These connections are defined as cross-connections and some form of backflow prevention device should be in place to prevent backflow (including back-siphonage and back pressure) from impacting the drinking water supply.

Regulatory requirements under the Building Code are supplemented by good engineering practices as outlined in CSA B64.10- 11/ CSA B64.10.1-11 as amended, the AWWA M14 Manual and the AWWA – Canadian Cross Connection Control Manual, as amended. In the case of a conflict between the provisions of the Building Code and a standard referenced in the Building Code, the provisions of the Building Code prevail (Division A, Article 1.5.1.2, Ontario Regulation 332/12).

2.1 Methods for Backflow Prevention

Water distribution systems - due to their size, complexity and variety of users - are often exposed to potential health risks. Sources of such health risks include cross-connections and backflow. Implementing a backflow prevention program is one way in which a drinking water system owner can minimize water quality degradation from a source connected to the distribution system.

There are several ways to mitigate the potential for backflow:

- provide a physical separation between drinking and non-drinking water systems
- install backflow prevention devices and assemblies
  - ***NOTE:*** *The choice depends on the health hazard of the actual or potential cross-connection and the plumbing hydraulics using a risk based approach.*
- maintain positive pressures in the distribution system
- implement backflow prevention programs

Three primary methods (individual [point of use], zone/area, and premise) are available to protect the drinking water supply. The method used is dependent upon the degree of the hazard. Through the incorporation of the available protection methods the property owner is able to implement a multi-barrier approach that is designed to not only protect the drinking water supply but also the users within the building.

Individual (Point of Use) Protection

Individual (point of use) protection is a means by where backflow devices are installed on each potential source of backflow within the piping of a building/facility in order to protect the rest of the piping within that building/facility from potential contamination.

Zone/Area Protection

Zone or area protection is practiced within buildings/facilities where there exist both drinking and non-drinking water piping systems. This type of protection may also be practised within the distribution system of a drinking water system in order to protect individual zones or areas from possible contamination from another zone or area within the distribution system.

Premise Isolation

Backflow preventers in this instance are typically installed within the facility on the service line connection to the drinking water supply.

NOTE: *Overall, water distribution system operations, including maintaining chlorine residuals, maintaining positive pressures, performing appropriate levels of distribution system maintenance and procedures for responding to customer complaints about water aesthetics, should be covered under a municipality's or drinking water system owner's total water quality management program. A backflow prevention program complements these other aspects of the multi-barrier approach to providing safe drinking water.*

Based on the number of actual and potential cross-connections in a drinking water system, and the potential resulting health hazards, it is important that effective cross-connection control measures be in place. This guide sets out some comprehensive measures that can be adopted into any backflow prevention program established by a drinking water system owner. These include:

- Establishing the need;
- Reviewing regulations and standards;
- Establishing program policy and authority;
  - Obtaining legal advice on what is authorized if the program will be established through a by-law or involves measures that are more than merely voluntary for owners of pre-existing buildings;
- Assessing hazards and classifying them;
- Fire Protection Systems
- Conducting a review of records to identify hazards;
- Establishing a budget and a source of funding;
- Establishing program requirements – including roles and responsibilities

for the drinking water system owner and property owners; and
- Implementing and maintaining the program.

These measures are detailed further under individual headings within the body of this guide.

2.2 Establishing Need

Drinking water system owners/operators need to review the types of facilities that are connected to the drinking water supply and the potential hazard that each one presents in order to determine if and what kind of a backflow prevention program is needed. Each type of facility (industrial, commercial, institutional) and residential building (multi-tenant vs. single family) presents different hazards. For example, a single family residential property presents a different set of potential hazards compared to those typically associated with an industrial connection to the drinking water supply. Backflow prevention programs should be flexible enough to address the hazard present rather than treating all connections in the same manner.

2.3 Reviewing Regulations and Standards

When undertaking the task of establishing a backflow prevention program, drinking water system owners should consider the following legislation and standards.

- *Building Code Act, 1992*
  - Ontario Regulation 332/12, Building Code
    - Canadian Standards Association (CSA) (B64 Series Standards) – *standard referenced in the Code for the selection and installation of backflow prevention devices*
- *Safe Drinking Water Act, 2002*
  - Ontario Regulation 170/03 Drinking Water Systems Regulation,
  - Ontario Regulation 248/03 Drinking Water Testing Services,
  - Ontario Regulation 169/03 Ontario Drinking Water Quality Standards,
- *Municipal Act, 2001*
- *Fire Protection and Prevention Act, 1997*
  - Ontario Regulation 213/07, Fire Code

The Building Code includes provisions to prevent the contamination of the drinking water in plumbing. The Building Code is a regulation made under the *Building Code Act, 1992* and sets out technical and administrative requirements that must be met when a building is constructed, renovated or undergoes a change of use.

The Building Code contains objectives and provisions to limit the probability that, as a result of the design or construction of *a* building:

- a person in or adjacent to the building will be exposed to an unacceptable risk of injury,
- a person will be exposed to an unacceptable risk of illness,
- a person in the building will be exposed to an unacceptable risk of illness due to unsanitary conditions caused by consumption of contaminated water; or
- the public will be exposed to an unacceptable risk of illness due to the release of hazardous substances from the building.

Part 7 of the Building Code specifically deals with plumbing and requirements associated with plumbing. Section 7.6 of Part 7 addresses the requirements for potable water systems and includes provisions to protect potable water systems from contamination. This includes the requirements that potable water systems be designed, fabricated and installed in accordance with good engineering practices (Article 7.6.3.1.), and that connections to potable water systems be designed and installed so that non-potable water or substances that may render the water non-potable cannot enter the system (Article 7.6.2.1.).

The Building Code also generally requires backflow preventers where either backflow or back-siphonage may occur from a source of potential contamination (e.g. Articles 7.6.2.2. and 7.6.2.3.). Premise isolation is covered in Article 7.6.2.6. of the Building Code. Article 7.6.2.4. deals with backflow from fire protection systems.

Section 20 of the *Safe Drinking Water Act, 2002* expressly prohibits any person from causing or permitting any thing to enter a drinking water system if it could result in,

- a drinking water health hazard;
- a contravention of a prescribed standard; or
- interference with the normal operation of the system.

Persons who allow contaminants to enter a municipal drinking water system and interfere with its normal operation have been successfully prosecuted under section 20 of the *Act*.

The CSA B64 standards require that the cross-connection control requirements meet all local, provincial and national building permit and code requirements. In Ontario, this includes the Building Code and local by-laws.

> ***NOTE:*** *There are a number of reference manuals also available to assist with program development. These include the InfraGuide Methodology for Setting a Cross Connection Control Program, AWWA M-14 and the AWWA Canadian Cross Connection Control Manual.*

2.4 Establishing Program Policy and Authority

In the event a drinking water system owner (e.g. a municipality) decides to implement a backflow prevention program, the drinking water system owner may wish to develop policies containing detailed information about the program and its goals and make them available to all parties involved in the program (drinking water system owner staff, customers, installers and testers, engineers, mayor and council, and other interested parties).

> ***NOTE:*** *The terms backflow prevention device tester and cross-connection control specialist are often used interchangeably.*

Drinking water system owners/operators may also want to consider developing a separate policy document detailing an education and outreach campaign designed to increase the level of awareness around the issue and the potential impacts to the drinking water supply.

Stakeholders that have developed backflow prevention programs have raised questions about the legal authority for certain aspects of programs which may go beyond Building Code requirements for new construction or changes in use, or may involve more than voluntary actions on the part of owners of existing buildings. Section 35 of the *Building Code Act, 1992* provides that the Act and the Building Code supersede all municipal by-laws respecting the construction or demolition of buildings. Legal advice should be sought in respect of questions associated with more comprehensive backflow prevention programs, including those that are proposed to be established by municipal by-law in light of Section 35 of the Act.

2.5 Assessing and Classifying Hazards

A backflow prevention program should include a method to assess the risk or "hazard" of each potential cross-connection to the drinking water supply and whether the property owner has implemented the appropriate protections for that category of risk. The CSA B64.10-11 standard defines hazards to the drinking water system in three categories; Severe, Moderate and Minor.

- Minor is nuisance to the water supply and results in a reduction in only the aesthetic quality of the water.
- Moderate is any minor hazard connection that has a low probability of being a severe hazard.
- Severe is any type of cross-connection or potential cross-connection involving water that has additives or substances that, under any concentration, can create a danger to health.

Each type of facility (industrial, commercial, institutional) and residential building (multi-tenant vs. single family) connected to a drinking water system presents

different hazards. For each hazard category, the backflow prevention program should be explicit about the kinds of protections needed. For example, a fulsome program may require protection at the fixture as well as zone/area and premise isolation, plus monitoring and tracking of backflow devices and assemblies. A more minimal program may only require premise isolation and monitoring, leaving other requirements up to the owner of the facility.

> ***NOTE:*** *There are a variety of backflow prevention assemblies and devices designed to protect the levels of hazard. The CSA B64.10-11 standard and the Canadian Cross Connection Control Manual provide a guide for the assessment of hazards and the selection of backflow preventers for both internal and premise protection.*

The hazards present within industrial, commercial and institutional facilities are well known but it is also important to consider the hazard that multi-tenant residential buildings may present. Policies may be developed to address multi-tenant residential building connections and the potential for backflow from such buildings. However, it is important to note that the Building Code states "*Buildings of residential occupancy within the scope of Part 9 are not required to be isolated unless they have access to an auxiliary water supply.*" In most cases residential connections would fall in the moderate or minor categories.

2.6 Conducting a Records Review to Identify Hazards

Once the categorization of hazards and level of protection required has been established the owner of the drinking water system can begin the process of identifying sites that may present a hazard to the drinking water system. This process can begin with an internal review of records associated with water billings, building permits, business licences, and planning and zoning.

> ***NOTE:*** *Other local officials (e.g., works, local fire department) may also have information as to the hazard potential that a site may present which could be useful in the identification of sites.*

The list of sites that is compiled as a result of this process should also be divided into specific categories associated with industrial, commercial, and institutional connections and then by the level of potential hazard that each may present. The adoption of such an approach allows the drinking water system owner to focus its resources on those facilities which present the highest hazard.

> ***NOTE:*** *Protecting all services the same way may have hidden costs – For drinking water system owners who choose to protect all services (industrial, commercial, institutional and residential) at the service connection/meter, inspection costs for their program may be higher than necessary. By treating all facilities in the same manner, regardless of the level of hazard presented by the cross-connection, inspections cannot be tailored to best*

meet the risks posed.

2.7 Establishing a Budget

A backflow prevention program requires an established budget. Costs associated with program development, implementation and maintenance (including adequate staff time and resources) should be defined, and any additional funding requirements identified. Typical budget costs include:

- survey and hazard assessment
- records/data management
- education and outreach
- training

The drinking water system owner should also budget for implementation of the backflow prevention program requirements for its own facilities at the initial phase of the program. This would demonstrate to affected facility and property owners that the drinking water system owner is supportive of and committed to the success of the program.

The cost of implementing a successful backflow prevention program can vary significantly depending on the type of program the municipality decides to implement and the number of identified potential hazard connections. A municipality's historical cost for water quality incident responses associated with potential backflow events could be applied to the implementation costs of a backflow prevention program, since hazards are now being assessed, controlled, and reduced (assuming the municipality can tabulate these historical costs).

2.8 Fire Protection Systems

Devices installed in fire suppression systems, as required by the Fire Code, should be maintained and tested in accordance with the requirements of the associated Fire Code standards.

- Fire suppression systems, as required by the Fire Code, should have check valve(s) or equivalent installed to ensure that the system is "charged" and ready for use. If this assembly is determined to be functioning as designed, no additional device would be required.
- If a hazard from the fire suppression system is identified during the survey of the facility, an assessment of the fire suppression system should be conducted by a qualified person, prior to the installation of a device.
- Any devices that are found to be non-functional should be replaced with a similar device by a qualified person.

When implementing a backflow prevention program, the drinking water system owner should be aware of requirements for backflow preventers on certain types

of fire protection systems. These are outlined in CSA B64.10–11, CSA B64.10.1–11 and Article 7.6.2.4. of the Building Code.

It is recommended that retrofitting older fire protection systems to apply backflow prevention devices be done only with a comprehensive evaluation of each system by a qualified, competent person (such as a professional engineer). This qualified person will be able to ensure adequate flow and pressure through the device(s) to meet fire protection needs, and to address the thermal expansion issues associated with installing backflow prevention devices on sections of the fire protection system that include anti-freeze.

> ***NOTE:*** *AWWA Research Foundation (AwwaRF), Impact of Wet-Pipe Fire Sprinkler Systems on Drinking Water Quality (AwwaRF, 1998) provides more information on the application of backflow preventers to new fire protection systems, as well as possible hydraulic problems associated with retrofitting existing wet-pipe fire sprinkler systems.*

3.0 Establishing Program Requirements

Backflow prevention programs should set out the roles and responsibilities of the drinking water system owner and the property owner.

3.1 - Drinking Water System Owners - Roles and Responsibilities

Drinking water system owner responsibilities would typically include:

- providing safe water to all drinking water users, including facilities that may present a risk through cross-connections
- providing staff to administer the backflow prevention program
- providing resources to assess facilities connected to the drinking water supply
- reporting back to the property owner the results of the assessment and recommended actions for the protection, installation and ongoing testing of the backflow prevention assemblies and devices (see 3.1.7); and
- developing an education and outreach awareness program (see 3.1.1)

3.1.1 - Education and Outreach / Awareness

Raising awareness of the issues associated with cross-connections and the potential for contaminating and damaging the drinking water supply and public health is critical to the success of the backflow prevention program. Support for and credibility of the program depends on the participation of those implementing the program as well as those affected by it (e.g., industry, plumbers, design engineers, suppliers and other related agencies).

The public relations and education components of a backflow prevention program are also essential to its success. Many groups should be targeted, including municipal staff (e.g., works, fire department), councillors, the mayor, and administrators; residential, commercial, and industrial consumers; and stakeholders such as professional, trade, and technical groups including private house/business inspection firms.

Municipal staff, councillors, the mayor, and administrators should be educated about the drinking water system and backflow prevention program so they can communicate effectively with consumers and the public.

Awareness can happen through personal contact and presentations as well as written letters, brochures and bill stuffers to customers. To date some very successful approaches have included:

- presentations;
- advertising;

- displays;
- brochures;
- bill stuffers;
- letters;
- articles in newspapers and electronic publications; and
- information on the drinking water system owner's web page.

Presentations made at related organizational conferences and seminars as well as advertising in print, radio and TV media can be used as a way to get the message out to a large number of customers in a relatively short time. Displays at fairs, malls, hardware stores or home shows are another venue to publicize the program. A key message to share in the materials generated and distributed is that the program is designed to protect the drinking water supply from potential contamination and the health of all users.

Stakeholders are an important part of a successful program, since they are directly involved with the piping systems where cross-connections can occur. Architects, engineers, contractors, builders and trades associated with the installation/maintenance of irrigation systems, sprinkler systems, fire protection systems, HVAC (heating, ventilation and air conditioning) and plumbing should all be educated about the drinking water system owner's requirements for cross-connection control. Trade associations can be an effective venue through which to educate these stakeholders.

Establishing a backflow prevention committee and having stakeholders as members of the committee will increase awareness of the program and enable more groups to be reached. Representatives for a backflow prevention committee could include a drinking water system owner's staff, building/plumbing inspectors, bylaw/legal representatives, health department representatives, plumbing contractors, cross-connection control instructors from local accredited schools, and other interested parties (e.g., industrial, commercial, institutional, multi-unit residential, etc.).

Approaches such as these will foster a greater level of buy-in from these stakeholders, as they will feel some ownership in the process and become champions of the program within their respective local community, organizations and associations.

3.1.2 - Supporting Documentation Currently Available

Information concerning explanations of cross connection control and backflow prevention can be found on:

ABPA video, (2010) available on YouTube or through www.abpa.org;

ABPA Michigan Chapter video, "Mission: Educating the Public", available on YouTube or by contacting the Michigan Chapter through www.abpa.org;

AWWA video, "Backflow Prevention and Cross-Connection Control" (AWWA, 2003).

> ***NOTE:*** *Each video presents the concepts of how backflow can occur, methods to prevent backflow, and elements of a cross-connection control program. It should be noted that these videos use American terminology, which in some cases is different than Canadian terminology.*

3.1.3 - Records Management

A document and record control system should be developed to track the facilities assessed/inspected, assessment/inspection records and requirements, the devices and assemblies installed and the testing requirements of those assemblies.

> ***NOTE:*** *Municipal drinking water system owners should use Ontario's Drinking Water Quality Management Standard - Pocket Guide (Element 5) to develop this system.*

Drinking water system owners/operators should also consider requiring that property owners make documentation associated with backflow prevention program requirements available for inspection by the system owner or its agent.

As part of a backflow prevention program, a drinking water system owner may need to track licensed testers and equipment, and be able to develop and generate standard templates, letters and notifications. To help with these tracking activities, manual and/or computerized systems could be developed internally or available data management packages used.

> ***NOTE:*** *The drinking water system owner should assess its end requirements at the start of the program to develop a tracking system that will meet its needs and will be flexible enough to evolve as the program develops.*

3.1.4 - Qualified Persons

The program should outline not only the requirements for hazard assessment and device inspection and testing, but who can perform such activities. In most cases, the property owner will retain a registered or licensed tester who meets the requirements established by the drinking water system owner.

Many tasks associated with cross-connection control and backflow prevention require training. These include program administration, survey and hazard

assessment, device selection and installation, inspection, testing, repair and potentially enforcement. While a drinking water system owner may wish to conduct its own in-house training for some elements, especially for administration of its program, an increasing number of accredited schools and colleges are offering cross-connection control survey courses, and backflow prevention device tester certification and re-certification courses.

> ***NOTE:*** *The requirements for the selection and installation of backflow preventers for new construction or changes in use are set out in the Building Code and this work should be conducted by persons qualified for those purposes. The working group has identified that the testing of backflow preventers should also be carried out by qualified persons, as identified within the CSA B64 standards.*

Backflow prevention device testers can obtain certification through an accredited school or college, and will have to attend a recertification course within the period specified by the certification body after the issuance of the certificate. In addition to certification, a municipality registering or licensing the tester should require a calibration certificate for its testing equipment, another trade or professional qualification (e.g., plumbing certificate), and current liability insurance coverage (CSA B64.10.1-11).

Testers of backflow prevention devices/cross-connection control equipment should meet the requirements outlined within the CSA B64.10.1-11 standard; which states that a tester should be a journeyman/apprentice plumber, pipefitter or equal professional and certified cross connection control specialist from an accredited school. The testing equipment used should be verified and calibrated on an annual basis to maintain and confirm its accuracy.
The regular testing and inspection of the backflow prevention assemblies should be carried out by journeyman/apprentice plumbers registered/licensed by the drinking water system owner (typically the municipality) to perform that work. Licensed testers should be certified by a recognized training institution, in the proper testing and maintenance of backflow prevention assemblies. In Ontario that training is available through commercial training organizations.

> ***NOTE:*** *Proper training of staff in the area of cross-connection control/backflow prevention and experience/knowledge of plumbing principles and systems would be an asset.Cross-connection control courses, offered by accredited schools or colleges, also provide guidance on hazard assessment.*

When undertaking a backflow prevention program it would be helpful to provide a central contact for any inquiries that may arise (e.g., who the drinking water system owner accepts as "qualified persons").

Representatives of the drinking water system owner involved with a cross-connection survey and hazard assessment, inspection, and testing should also be trained in safety procedures, including access issues associated with entry into private buildings, dealing with difficult customers, use of special tools to inspect and test backflow preventers, and access to hazardous locations for both municipal and private property applications. They should also be familiar with relevant Occupational Health and Safety Act requirements.

> ***NOTE:*** *The AWWA has implemented a Cross Connection Control Specialist course and facilitates its delivery through accredited teaching institutions. In Ontario, this and other accredited courses are provided through third party training providers and local colleges. It is up to the drinking water system owner to ensure that testers working in the system owner's jurisdiction are qualified and that the testers' test equipment is verified and/or calibrated on a regular basis. The drinking water system owner could maintain a list of qualified testers and make it available to those customers installing and/or testing backflow prevention assemblies.*

3.1.5 - Registering / Licensing Device Testers

When making application to the drinking water system owner for licensing or registration as a backflow prevention device tester, the applicant should have the following qualifications:

- a certificate as a backflow prevention device tester that has been issued by an accredited organization or association or renewed by that organization or association following completion by the applicant of a re-certification course;
- a current calibration certificate for test equipment (dated within the 12 months before the date of application for licensing or registration);
- another trade or professional qualification (i.e., as per the authorized functions list within the CSA standard); and
- current liability insurance coverage (with an expiry date no less than 6 months after the date of application for licensing or registration).

> ***NOTE:*** *The regulatory authority administering the cross-connection control program should license or register backflow prevention device testers who have the above-noted qualifications.*

3.1.6 - Survey and Hazard Criteria

Although the Building Code mandates that a drinking water supply be protected from cross-connections, backflow incidents still occur both within the internal plumbing of buildings and externally into the drinking water supply. A cross-connection survey and hazard assessment can identify any actual or potential cross-connections, the potential risk of contamination, the probability that backflow could occur, and a determination of the appropriate backflow preventer

to use.

The drinking water system owner, or an acceptable third party, would conduct this assessment to ensure appropriate backflow preventers are identified, and to satisfy itself that adequate protection of the drinking water supply has been provided.

The primary focus of the assessment should be based on the hazards that a facility may pose to the drinking water supply. A systematic approach needs to be taken. Typically, the municipality would identify each facility to determine the types of industrial, commercial and institutional uses that exist, and conduct a cross-connection survey and hazard assessment, focusing first on the types of uses with the highest potential for contamination. Connection size may also be a consideration when deciding which facilities to assess first as this can impact whether a service connection needs be isolated.

> ***NOTE:*** *The drinking water system owner is normally responsible for preparing the survey and hazard assessment templates to be used and accepting the templates completed by those authorized in the program. Using templates is desirable in order to maintain consistency of information and ensure the proper protection of drinking water systems.*

The drinking water system owner, or its representative conducting the assessment, would begin by contacting the property/building owner either directly or in writing to make arrangements to conduct the assessment.

> ***NOTE:*** *The majority of water services a drinking water system owner will have will be in the single family residential sector. The Building Code exempts residential buildings within the scope of Part 9 from having premise isolation unless an auxiliary water supply is present. A municipality may choose to educate these property owners through an awareness campaign.*

The assessment should identify the cross-connections found and whether the required protection is in place. The assessment results should be documented and provided to the property owner. The assessment results could include information such as when installations are needed and the device testing frequency.

> ***NOTE:*** *The type of survey conducted and accepted by the drinking water system owner (i.e., owner self-report; registered/licensed external qualified person conducting assessment on behalf of owner; assessment by qualified staff of drinking water system owner) should recognize the potential hazards present and the manner in which backflow prevention devices may have been previously installed. It should also identify any changes made since original construction that may require that action be taken to protect*

the drinking water supply within the facility, or the connection between the drinking water supply and the facility.

For the hazard assessment, Clause 5.1.4 of CSA B64.10-11 requires identification of:

- the probability that back siphonage will cause backflow;
- the probability that back pressure will cause backflow;
- the severity of any hazard; and
- the type of building.

NOTE: *Assessment of the probability of backflow and severity of the hazard is a very subjective task, since there is no simple formula to apply.*

New building permits need to be reviewed and backflow prevention requirements need to be identified as part of the process in accordance with the Building Code. Educating building officials and building inspectors with respect to Building Code requirements and the objectives of the backflow prevention program may improve the success of the program.

The CAN/CSA B64.10–11 Standard, AWWA Canadian Cross Connection Control Manual, and AWWA Manual M14 all provide guidance on the type of backflow prevention device and level of hazard protected against (i.e., minor, moderate, or severe), and the type of cross-connection and level of hazard (e.g., Annex B of CSA B64.10–11 where photo lab sinks are considered a severe hazard).

NOTE: *Many of the standards and manuals use different terminology for some aspects. For example, AWWA Manual M14 uses the classification of health hazard, or non-health hazard, while the Canadian publications use a three-tiered classification of minor, moderate, or severe. The AWWA Manual M14 provides guidance on the "recommended protection for water purveyor's hazards," which covers the distribution system, treatment plants, offices, and work areas.*

The assessment process should also include the inspection of facilities owned by the drinking water system owner. It is a good idea to carry out these inspections, and any resulting installation and testing of the required backflow prevention devices prior to implementing the program with respect to other potentially affected property owners. Doing so demonstrates that the drinking water system owner has proactively conducted a review of its facilities and addressed the potential hazards. Through such an approach the drinking water system owner can ensure that its assessment/inspection reporting processes are working and foster increased "buy in" from other property owners.

NOTE: *In accordance with the CSA B64.10-11 standard as referenced in the Building Code for the selection and installation of devices, it would be appropriate to isolate the premise as a preventative measure where access*

to a facility is restricted. If the facility owner refuses to install the required protection, then the drinking water system owner may use the tools available, based upon the advice of legal counsel, to protect the drinking water supply.

Survey and hazard assessments should be conducted every five (5) years or as warranted by a change in ownership or facility operations.

3.1.7 - Regular Inspection and Testing (Device)

Regular inspection and testing of backflow prevention devices should be carried out according to recognized industry standards, including CSA B64.10.1-11 Maintenance and Field Testing of Backflow Preventers. There are many other sources for inspection and testing standards, including the AWWA Canadian Cross Connection Control Manual. Generally, backflow prevention assemblies should be tested on installation, when repaired or relocated and at least once a year following installation.

NOTE: *A unit that has been taken out of service for maintenance should be tested prior to putting it back in service.*

Temporary water connections to hydrants should not be allowed unless protected as well as being metered. The protection required would be a Reduced Pressure backflow (RP) preventer supplied by the applicant with test results indicating it is in good working order, or an RP backflow preventer supplied by the drinking water system owner as part of a hydrant use permit process.

3.1.8 - Incident Response Planning and Reporting

Municipal drinking water system owners must have a plan in place to respond to adverse water quality incidents and other problems (other drinking water system owners should also consider having a plan in place). This would include appropriate and expeditious communication to the customers in the affected area, and between the different personnel involved in sampling, flushing, lab analysis, and on-site inspections. This plan should be expanded to incorporate information specific to backflow incidents. This would include procedures municipal staff should follow to isolate and sample the affected area. An on-site cross-connection survey and hazard assessment of the facilities to determine the source of contamination should also be performed. By isolating and flushing the contaminant, it can typically be removed from the system in a timelier manner.

NOTE: *There is an obligation under s.18 of the Safe Drinking Water Act, 2002 to report adverse drinking water test results prescribed in the Drinking Water Systems Regulation, Ontario Regulation 170/03, to the Ministry of the Environment and Climate Change and the medical officer of*

health, and to take such other steps as are directed by the medical officer of health under that regulation.

In instances where detected backflow incidents may result in severe hazards such as depletion of disinfection potential or danger to consumer health, priority measures are required of the drinking water system owner/operator to notify water consumers and resolve the situation. Detection of backflow related to severe hazards that could adversely affect the quality of drinking water must be reported as an "other observation" in accordance with section 16-4 of the Drinking Water Systems Regulation.

The plan should provide for collection of as much information as possible, including licensed laboratory results to determine the type of contamination and the required measures based on health impacts (e.g., boil water advisory, drinking water advisory, etc.). A data management system can be used to identify the addresses where existing backflow prevention devices are installed. This will help reduce or narrow the facilities that may require an on-site inspection for determination of the origin of the contaminant.

While the contaminants can come from facilities with unknown cross-connections that are not protected by backflow prevention devices, they can also come from malfunctioning backflow preventers. In these cases, it is important for the drinking water system owner to have the proper authority available to require immediate testing during a water quality incident to check if a backflow preventer is malfunctioning.

As a follow-up to a backflow incident, the drinking water system owner should promptly review its records and where it is identified that unprotected facilities may have caused the incident, work to have proper backflow preventers installed and tested, and that malfunctioning backflow preventers are repaired or replaced, and re-tested, all in a manner consistent with the policy.

Although the Ontario Ministry of Environment and Climate Change does not specifically regulate or require backflow prevention programs, where such programs exist, operating them in accordance with this guideline will help promote continuous improvement of drinking water safety and security of drinking water distribution systems and provide a consistent approach across the province when dealing with backflow prevention.

3.1.9 - Program Compliance

When a drinking water system owner decides to put in place a backflow prevention program, it will also need to consider ways to promote compliance with affected stakeholders. Backflow prevention programs include selection, installation, inspection (maintenance), testing and reporting requirements that will need to be monitored. In situations where stakeholders refuse to participate the

drinking water system owner will need to consider whether mechanisms are available to it that will promote compliance such as notifications, work orders, fines, etc. If so, these should be clearly detailed within the policy, and communicated in the education program.

3.1.10 - Quality Assurance

The program should be flexible enough to provide for changes due to technology and new innovations in the industry. Program administrators should review their processes and refine them to best suit the requirements of the drinking water system owner on a regular basis.

A process could be put into place that allows the drinking water system owner to review the performance of testers and the validity of test results submitted. The drinking water system owner should maintain a historical record of test results. If need be the drinking water system owner should have a means of revoking a tester's registration/licence. Another quality assurance component would be to maintain records that may verify performance and the impact that the backflow prevention devices may have on local water quality.

3.1.11 - Program Maintenance

The drinking water system owner should be responsible for program maintenance and administration. This includes maintaining ongoing testing records and information as to the location of the devices.

3.2 - Property Owners - Roles and Responsibilities

Property Owner/Customer responsibilities may typically include:

- developing and implementing an internal program to meet insurance and legal requirements (e.g., availability of Material Safety Data Sheet (MSDS));
- deciding on a voluntary basis whether to provide the drinking water system owner or its agent with access to the facility in order for the system owner to determine appropriate cross connection control measures;
- protecting cross-connections found on property or within facility in accordance with the assessment/inspection report provided by the drinking water system owner or its agent;
- receiving approval from the drinking water system owner prior to the removal of any devices;
- advising the drinking water system owner of any changes to its backflow prevention devices so that the hazard survey can be updated;
- the purchase, installation and testing of the backflow prevention devices and assemblies;

- providing the drinking water system owner with a copy of test results; and
- conducting ongoing testing (usually annually) and maintenance of the unit (e.g., as per manufacturer directions or CSA B64.10.1-11 Maintenance and Field Testing of Backflow Preventers).
    - ***NOTE:*** *If a unit fails the testing process it should be repaired or replaced within a certain time period set out by the drinking water system owner.*

3.2.1 - Device Ownership

In most programs, the property owner is the owner of the backflow prevention devices and assemblies. The rationale is that the potential cross-connection was created by the property owner, or its tenant, and therefore the property owner should be responsible for providing the protection.

In this case, as owner of the device, the property owner is responsible for maintaining and testing the backflow prevention device in accordance with best practices and/or the backflow prevention programs requirements.

> ***NOTE:*** *In some cases the drinking water system owner may supply a water meter and backflow preventer for premise isolation and thus retain ownership. In such instances the drinking water system owner would also assume the ongoing maintenance and testing responsibilities associated with the device and any implemented backflow prevention program requirements.*

3.2.2 - Education and Outreach

Raising awareness of the issues associated with cross-connections and the damage to the drinking water supply and public health is critical if a backflow prevention program is to succeed. A strong commitment to education and outreach on the part of those that have decided to implement such a program is integral to ensuring that affected property owners are aware of the risks associated with cross-connections and the role that they play in ensuring that they are protected. For these reasons, if a drinking water system owner establishes a backflow prevention committee, affected property owners should be encouraged to actively participate in and become involved with the committee.

3.2.3 - Survey and Hazard Assessment

The property owner should ensure that a survey and hazard assessment is conducted in accordance with the drinking water system owner's backflow prevention program and that any piping and process changes are conducted under a building/plumbing permit issued by the municipality.

3.2.4 - Selection and Installation of Devices

The property owner should ensure that backflow prevention devices are selected and installed in accordance with the requirements of the Building Code and outlined within CSA B64.10–11 Selection and Installation of Backflow Preventers.

> ***NOTE:*** *The requirements for the selection and installation of backflow preventers for new construction or changes in use are set out in the Building Code and this work should be conducted by persons qualified for those purposes.*

3.2.5 - Regular Inspection and Testing (Device)

Generally, annual testing of each backflow prevention device is recommended as a minimum; however this should be evaluated on a case-by-case basis depending on the risks to the drinking water system. The drinking water system owner may have special testing requirements and the property owner should discuss these with the drinking water system owner.

> ***NOTE:*** *Inspection and testing should be carried out according to the requirements as detailed within the backflow prevention program and should recognize industry standards, such as CSA B64.10.1-11 Maintenance and Field Testing of Backflow Preventers.*

3.2.6 - Records Management

The property owner should maintain copies of the survey and hazard assessment, inspection, testing, maintenance and repair records on the premises where the devices are located. The property owner should also make records available in accordance with any requirements contained in the backflow prevention program.

Reference Materials

- Ontario Water Works Association (OWWA) - Cross Connection Control Committee
- AWWA Canadian Cross Connection Control Manual
- Ontario Backflow Prevention Association (OBPA) Model By-Law
- American Water Works Association (AWWA) M14 Manual Recommended Practice for Backflow Prevention and Cross Connection Control
- InfraGuide – Methodology for Setting a Cross Connection Control Program
- *Municipal Act, 2001*
- *Building Code Act, 1992*
    - Building Code, Ontario Regulation 332/12
- *Safe Drinking Water Act, 2002*
    - Drinking Water Systems Regulation, Ontario Regulation 170/03
- Ontario's Drinking Water Quality Management Standard – Pocket Guide Ontario Ministry of the Environment (July 2007 – PIBS 6278e)
- *Fire Protection and Prevention Act, 1997*
    - Fire Code, Ontario Regulation 213/07
- NFPA Standards
- Canadian Standards Association (B64 Series Standards)
- Canadian Standards Association (CSA) B64.10-11 Selection and Installation of Backflow Preventers
- Canadian Standards Association (CSA) B64.10.1-11 Maintenance and Field Testing of Backflow Preventers
- CAN/CSA–B125–12 Plumbing Fittings
- Saskatchewan Ministry of Environment - Cross Connection Control and Backflow Prevention Guidelines (February 2010 – EPB #422)
- Ontario Ministry of the Environment - Guidance Document Preparing for Corrosion Control Plans for Drinking Water Systems (December 2009 – PIBs #7463)