



Cross Connection Control and Backflow Prevention Program Guidelines

June 2015

EPB 422

Forward

Cross connections in potable water systems are required to be protected in Saskatchewan under the jurisdiction of the Canadian Plumbing Code 1990 and the *Saskatchewan Plumbing and Drainage Regulations 1996*. These code requirements are also supplemented by good engineering practices outlined in CSA – B64.10-01 / CSA – B64.10.1-01 and the AWWA Canadian Cross Connection Control Manual.

This industry contributed guideline may apply to all waterworks controlled by *The Waterworks and Sewage Works Regulations* and should be used as a companion to the applicable Acts, regulations and other provincial publications currently in use or as may be published from time to time. These include:

- *The Environmental Management and Protection Act, 2010*;
- *The Waterworks and Sewage Works Regulations*;
- The Guidelines for Canadian Drinking Water Quality—Summary Table, Health Canada (August 2012);
- Saskatchewan Drinking Water Quality Standards and Objectives EPB 507;
- Municipal Drinking Water Quality Monitoring Guidelines EPB 202; and
- Guidelines for Chlorine Gas Use in Water and Wastewater Treatment EPB 265.

For private and municipal designers and waterworks owners, the guidelines:

- identify items and factors that should be considered for waterworks; and
- provide accepted practices suitable for Saskatchewan conditions.

This industry contributed guideline is not intended to be a detailed engineering or procedural manual. However, the guide addresses the aspects pertinent to the design of water treatment units and cross connection control considerations so as to safeguard consumer, the public and thereby also protect the environment.

1. Introduction

A cross-connection is defined as “any actual or potential connection between a potable water system and any source of pollution or contamination”. Cross connections are present in every 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 or contaminants can enter the municipal water system and be delivered to other consumers or locations. The task of eliminating all cross connections is enormous. However, all purveyors can implement CCC programs that reasonably reduce the risk of contamination to their systems. For a drinking water (potable water) supply to become contaminated via a cross connection, three things need to happen simultaneously:

1. The potable water supply piping must be unprotected (or improperly protected) from a cross connection;
2. A physical cross connection must be made between the potable water supply piping and a contaminant source; and
3. Backflow conditions must occur.

Backflow is the flow of water (or other solid, liquid, or gas from any source) back into the potable water supply. Backflow may be due to either:

- backsiphonage; or
- backpressure.

Backsiphonage is backflow caused by a negative pressure (vacuum or partial vacuum) in the supply piping. Backsiphonage occurs when system pressure is reduced below atmospheric pressure. The effect is similar to sipping water through a straw.

Backpressure is backflow caused by pressure in the customer's plumbing being greater than the pressure in the water supply piping. The higher pressure in the customer's plumbing may be from a booster pump, heating boiler, etc.

Water distribution systems are exposed to several sources of potential health risks, which include cross-connections and backflow. Implementing a cross connection control and backflow prevention program is one of the ways to minimize water quality degradation in the distribution system. There are several ways to mitigate the potential for backflow:

- provide physical separation between potable water and non-potable water systems.
- install backflow prevention devices and assemblies. The choice depends on the health hazard of the actual or potential cross connection and the plumbing hydraulics.
- implement cross-connection control and backflow prevention programs.
- maintain positive pressures in the distribution system.

Overall water distribution system operations include maintaining chlorine residuals, maintaining positive pressures, and performing appropriate levels of distribution system maintenance, should be covered under a municipality's or water provider's total water quality management program. A cross-connection control program complements the other barriers of the multi-barrier approach to providing safe drinking water. Creating and implementing a cross connection control program is the focus of this document.

Based on the number of actual and potential cross connections in a municipal water system, and the resulting health hazards, it is important for the municipality or water provider to have an effective cross connection control program in place. Setting a comprehensive cross connection control program involves meeting the following objectives:

- establish authority and administrative responsibility;
- establish policy;
- establish budget and a source of funding;
- review and conform to standards for backflow preventers;
- establish a data management system;
- develop a public relations and education program;
- co-ordinate activities with local authorities;
- develop a training program;
- develop standard correspondence;
- develop requirements for a cross connection survey and hazard assessment;
- establish inspection and testing protocols;
- develop a backflow incident response plan;
- establish enforcement strategies; and
- perform quality control and assurance.

2. Cross Connection Control Program

2.1 Authority

A necessary step in the development of a Cross Connection Control Program is to ensure adequate legislation exists or is created to provide the necessary authority to carry out the various functions of an effective program. Where a province or community has adopted the National or Provincial Plumbing Code it is generally found that additional legislation is required particularly in the following areas:

- annual testing of devices;
- licensing personnel engaged in testing of devices to ensure competency;
- authority to enter premise and install device(s) in case of non-compliance and add the cost to the water service charges; and
- authority to terminate the water service in case of non-compliance.

It is therefore recommended that in the case of application to a municipal water system, additional ordinances be established where necessary through the provision of a suitable By-law.

2.2 Policy

In the event a municipality develops a bylaw application to Cross Connection Control the associated policy ought to be designed to contain detailed information about the program so as not to overburden the bylaw. It would be available to all involved in the program (water utility staff, customers, installers and testers, engineers, mayor and council and other interested parties). It would be a separate document and can be used in certain areas of a Cross Connection Control awareness campaign.

The policy would include at the very least the following:

- **Bylaw/Regulations and Standards** – a reference to your bylaw/regulations, standards and codes including national and provincial plumbing and building codes.

The water utility's Cross Connection Control program is implemented under the jurisdiction of a water bylaw and shall adhere to the conditions set out in the bylaw.

The program requirements shall be installed in accordance with and meet the conditions and requirements set out in the Provincial Plumbing and Drainage Regulations and the Canadian Plumbing Code as well as the standards set out in CAN/CSA B64.10-01/B64.10.1-01 and/or the latest update of all documents.

The cross connection control requirements shall meet all local, provincial and national building permit and code requirements.

There are a number of reference manuals also available to assist with program development. A couple would be the AWWA M-14 and the AWWA Canadian Cross Connection Control Manual produced by the Western Canada Section of the AWWA.

- **Responsibilities** - Definition of responsibilities of the water utility and the customer/ building owner.

There are two major areas of responsibility involved with a Cross Connection Control program, those of the water utility and those of the facility owner/customer.

Water utility responsibilities include:

- lead in program for protection of potable water and delivery to facilities;
- creation of bylaw;
- provide staff for program administration;
- provide staff for inspection of facilities and provision of results to the customer which will include required protection, installation and ongoing testing requirements; and
- provide customer awareness - Awareness of the program is probably one of the most important parts of the program as all involved need to know why and what is trying to be accomplished and they need to buy in to the process.

Facility Owner/Customer responsibilities include:

- develop and implement internal program to meet insurance and legal requirements;
- access for inspection for determination of the cross connection control measures;
- protection of cross connections found on property or within facility. The inspection report provided by the water utility will identify the cross connections to be protected on the various fixtures within the building. The owner will be responsible for the purchase, installation and testing of the backflow prevention devices and assemblies;
- provide the water utility with copy of test results; and
- ongoing testing (usually annually) and maintenance of the unit. If a unit fails the testing process it shall be repaired or replaced within a certain time period set out by the water utility.

- **Implementation and Maintenance** - Description of implementation of the program and continued maintenance of the program.

The program should start with the service connections that would involve the most severe hazard to the utility and move to those of the least. The program should focus on commercial, industrial and institutional customers initially and then move to multi-family and residential. The majority of water services in the utility will be in the residential sector and thus is a more onerous task to survey. These customers may be best served through an awareness campaign and the building permit process.

The maintenance of the program should be retained and administered by the utility. This includes the location of the units along with the ongoing testing records. It would be up to the customer to inform and receive approval for the removal of units no longer required.

- **Hazard Classification and Backflow Prevention Requirements** – Identify the level hazard and appropriate protection.

The water provision industry defines hazards to the potable water system in three categories; Severe, Moderate and Minor.

- Minor is nuisance to the water supply but with no possibility of being a health hazard.
- Moderate is minor hazard with a low probability of being a severe hazard.

- Severe is when the hazard can cause a danger to health or cause death.

There are a variety of backflow prevention assemblies and devices designed to protect the levels of hazard. The Canadian Cross Connection Control Manual provides a guide for the assessment of hazards and the selection of backflow preventers for both internal and premise protection.

- **Responsibility for Survey & Hazard Assessment and Regular Inspection & Testing** - Identification of parties involved, i.e. Who's doing what; who to contact for concerns or questions regarding the program.

The water utility is normally responsible for the survey and hazard assessment in order to maintain consistency and ensure the proper protection of its water system. Proper training of staff in the area of cross connection control and experience/knowledge of plumbing principals and systems would be an asset.

The regular testing and inspection of the backflow prevention assemblies should be carried out by journeyman plumbers or pipefitter licensed by the water utility 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 Saskatchewan that training is available through commercial training organization or SIAST.

There needs be a central contact for any inquires regarding the CCC program.

- **Program Backflow Protection Parameters** - Type of backflow prevention (premise, fixture) (CSA B64).

The program will require decisions on what type of protection needed for the potable water system and the monitoring of that protection. A full program would include protection at the fixture where the cross connection exists as well as to area and premise isolation when required. This would include program monitoring and tracking of the backflow devices and assemblies.

A minimal program would require premise isolation and monitoring on the service connections, leaving the internal requirements the responsibility of the owner. This approach would require a survey of the facility to assess the premise protection requirements. A full internal survey in most cases would probably not take that much longer to conduct.

- **Procedures for Access** - Notice requirements on facility access.

The water utility shall provide reasonable notice either by direct contact or written notice in order to gain access to the facility to conduct a survey of the premise. The consumer will be responsible for providing necessary information, scheduling and access for inspection staff to determine backflow potential and identify the appropriate backflow prevention measures.

If for security reasons or others, access is not allowed then it should be assumed a severe hazard location and appropriate premise protection installed or discontinuance of water service.

- **Ownership of Backflow Preventers**

In most programs, the consumer is the owner of the backflow prevention devices and assemblies. The rational is that the cross connection was created by the consumer and therefore they should be responsible to provide the protection. They are also responsible for the maintenance and testing requirements of the backflow preventer.

In some cases the water utility will supply a water meter and backflow preventer for premise isolation and thus retain ownership. As such they would also assume the ongoing maintenance and testing responsibilities.

- **Procedures for Notices and Fines for Non-Compliance** - Issuing of notices, fines and non-compliance consequences.

The customer will receive a copy of the survey requirements from the water utility with any installation and testing requirements along with a date to be compliant. There would be a process developed should the customer not meet the compliant date (first notice, second, final, termination of water service).

A process would be developed by the water provider to address ongoing testing requirements and consequences if requirements are not met (first notice, 2nd and final, termination).

In some cases a system of fines may be developed by the water provider in conjunction to the above. This may also be included in the bylaw to allow enforcement.

The notice to terminate their water service usually gets the quickest reaction.

- **Procedures for Handling Temporary Connections to Hydrants**

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 supplied by the municipality as part of the permit process.

- **Requirements of registering/licensing of testers**

A tester should meet the requirements outlined by CSA B64 stating that a tester should be a journeyman plumber, pipefitter or equal professional and certified cross connection control specialist from an accredited school. The testers test equipment must be verified and calibrated on a regular basis (yearly) to maintain and confirm its accuracy.

Clarification would be required on maintaining registration/licenses. It should include being active and testing a specified number of assemblies a year as well as the verification of test equipment as well as the recertification of the tester every five years or as specified by the utility.

The water utility should maintain a list of testers that can be provided to their customers.

2.3 Awareness

Awareness is a key component of implementing a strong Cross Connection Control Program. The water utility would need to be aware of the program and why it is needed. Customers that would be affected need to be made aware in order that they can buy in and prevent them from becoming defensive because of a lack of knowledge. Plumbers, design engineers, suppliers and other related agencies need to be brought in at the front end of your program. They will become strong allies and provide support and credibility for the program.

Awareness can happen through personal contact and presentations as well as written letters, brochures and bill stuffers to customers. Presentations made to related organizations, conferences and seminars. Advertising in print, radio and TV media can be used as a way to get your 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 get your message out.

2.4 Budget

A budget would be put together as part of the approval process to implement the program. Costs would be put together to address development, implementation and maintenance costs. The major costs would be to conduct the cross connection survey and hazard assessment. Other costs would include data management, public relations, education and training.

The water utility should budget for implementation of the cross connection control requirements for its own facilities at the initial phase of the program. This would ensure that through the consumer's eyes, the water utility is committed to the success of this program.

2.5 Inspection and Testing

New building permits need to be reviewed and backflow prevention requirements need to be identified as part of the process. The person reviewing the plans will need to be trained and aware of the requirements of the program. In some cases the administrator of the program may also be part of the plan review process.

The existing facilities will need to be inspected based on the hazard posed to the potable water utility. A systematic approach needs to be taken and a survey/inspection process starting with the commercial, industrial, institutional connections that may pose the most severe hazard. Connection size may also be a factor as well as how the connection can be isolated.

Residential connections would be addressed and a policy developed on how to handle them. In most cases residential connections would fall in the moderate or minor categories.

The existing inspection process would include the inspection of water utility owned facilities. It is a good idea to carry out these inspections, the installation and testing of the required backflow devices prior to going out to the community. If there is to be "buy in" by your customers this needs to happen first and it is good way to work out your inspection/reporting process.

Some municipalities have taken the position that they will protect all services at the service connection/meter thus isolating the facility from the utility. This approach treats everyone the same but may be overkill in some cases when there is little or no hazard in the facility. There would still be some inspection time required to address the type of premise isolation needed. This leaves the internal protection up to the facility owner/customer and if not installed could result in internal contamination or pollution and could affect internal customers. Legally the utility could still retain some liability with this approach.

The inspection process would identify the cross connections found and the appropriate protection required. The inspection results need to be documented and the requirements provided to the owner/customer along with the timing requirements of the installations as well as the needed testing of the backflow assemblies. The testable backflow assemblies need to be tested on installation and then on an annual basis as a minimum. You may want to test high hazard units more frequently. A unit that has had maintenance done to it should be tested prior to be putting it back in service.

If for any reason access to a facility can not be attained then it would be assumed that it is a severe hazard facility and appropriate backflow prevention would be installed to isolate the premise. If the owner refuses to install the required protection then the municipality would discontinue water service to the facility.

The installation of the backflow preventers is a plumbing system function and as such would be done by journeyman plumbers or pipefitters. The testing of backflow preventers would to be carried out by qualified personal. The WCS AWWA Cross Connection Control Committee administers and sanctions a Cross Connection Control Specialist course and facilitates its delivery through accredited teaching institutions. In Saskatchewan, the course is provided through SIAST. It will be up to the water utility to ensure that testers working in their jurisdiction are qualified and that their test equipment is verified and/or calibrated on a regular basis. The water utility would maintain a list of qualified testers and will need to make it available its customers required to install and test backflow prevention assemblies.

2.6 Records / Data Management / Correspondence

A system will need to be developed to track the facilities inspected, the inspection records and requirements, the devices and assemblies installed and the testing requirements of those assemblies.

Manual and computerized systems could be developed or data management packages are available. The water utility needs to assess their end requirements as it may be easy to handle things manually at the start but as the program grows it will become harder to track the information required and to go back later and input data will be time consuming. As part of this system the utility needs to track the licensed testers and equipment and develop a database of standard letters and notification.

2.7 Enforcement

The water utility should consider the strategies that will be used to enforce the cross connection control program. Enforcement may be required for inspection and testing, submission of reports, installation of devices, and access to premises, etc. While the by-law based legal authority allows the enforcement to occur, a strategy is required to minimize the need for enforcement. For example, if the fine for not complying with testing requirements is much more costly than the actual test, consumers are more likely to arrange for testing.

Enforcement strategies may include notification, fines, and suspension of water services. These should be clearly indicated in the bylaw and policy, and communicated in the education program. Where consumers are notified of ensuing enforcement, the municipality may wish to issue a first notice, followed by a second notice, etc., dependent on the infraction. As noted previously, fines should be set high enough to make sure that paying the fine is considered unattractive compared with complying with the program. For cases where the water service may be suspended, the municipality should make sure to co-ordinate with the health, fire, and legal departments to ensure the consequences of suspending the water have been considered.

2.8 Incident Response Plan

In most cases, water utilities will already have a plan in place to respond to water quality incidents. A backflow incident would be included and handled in the same manner with all the same contacts and notifications made dependant on the situation.

2.9 Quality Control

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

A process would be put into place that allows the water utility to review the performance of testers and the validity of test results submitted. The water utility should maintain an historical record of test results. If need be the water utility would have a means to revoke a testers license. Another quality component would be to maintain records that may verify the impact of local water quality on the performance of backflow preventers.

3. Reporting to the Water Security Agency

Although the Water Security Agency does not specifically regulate or require Cross Connection Control programs the adoption of such programs in accordance with this industry contributed guidelines is recommended as a means to improve water safety and security of drinking water distribution systems and pipelines.

In instances where detected cross connections may result in severe hazards such as depletion of disinfection potential, danger to consumer health or even death, priority measures are required of the water purveyor to notify water consumers and resolve the situation. Detection of cross connection related severe hazards that could adversely affect the quality of drinking water must be reported as an "upset" in accordance with section 34 of *The Waterworks and Sewage Works Regulations* and EPB267, Upset Reporting at Waterworks/Sewage Works (see: http://www.saskh2o.ca/DWBinder/EPB267UpsetReporting_at_WaterworksSewageWorks.pdf).