

Cross Connection and Backflow Prevention Plan



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Provided by:
The Town of Luray
Water Treatment Plant



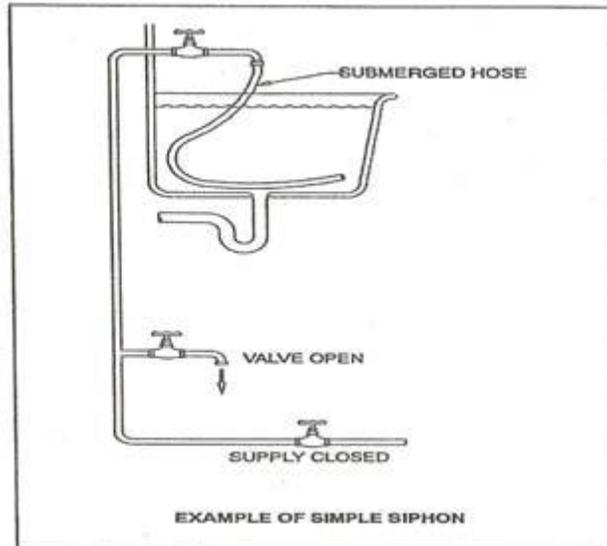
What is a Cross-Connection?

A cross-connection is a link between a potable water system (water that is safe to drink) and a non-potable system (water or other liquids that are not considered safe to drink or are of questionable quality), such as:

- 1) Another water supply of inferior quality (for example, a private well that is not monitored regularly)
- 2) Chemical solutions and toxic (poisonous) substances (such as corrosion inhibitors, cleaning and metal plating solutions, antifreeze)
- 3) Non-potable water (untreated water used in industrial processes, auxiliary supplies used for firefighting)
- 4) Nontoxic (not poisonous) liquids that should not be in the potable water system (beverages such as beer, wine, milk)

A cross-connection can allow undesirable liquids to enter the potable water system through piping systems such as boiler feed lines, chemical mixing vats or temporary connections like hoses or submerged lines. In the presence of a cross-connection, a strong backflow can draw liquid from non-potable sources and pull it back into the public waterworks creating contamination.

Public health becomes a great concern as the contamination typically occurs after the water has been treated. Serious health related problems can arise such as waterborne diseases like hepatitis and typhoid and poisoning from ingesting toxic substances like pesticides or boiler treatment chemicals. Contamination may be confined to a single building or may involve an entire community.



As the supplier, the Town has the responsibility to provide safe drinking water to the public. By treating, disinfecting and testing the water to be sure it meets Virginia Department of Health (VDH) standards for drinking water, the Town takes all necessary steps to ensure that the water entering the distribution system is safe.

It is also the Town's responsibility to protect the water quality once the water enters the distribution system. This system includes pumps, valves, meters and all of the piping that connects the water plant to your water service. Some types of contaminants such as petroleum-based products, for instance, are very difficult, if not impossible, to thoroughly remove from the system once they are introduced. Removal of these contaminants may require replacement of distribution system components and an interruption of water service to the public.

Cross-connection devices ensure that the water and the distribution system is protected. Investing in adequate protective devices such as backflow preventers and maintaining them with annual inspections not only protects the public water system, but protects the public as well.

The Town has implemented a Cross-Connection and Backflow Prevention program to partner with all Town users to ensure water quality is maintained throughout the distribution system.

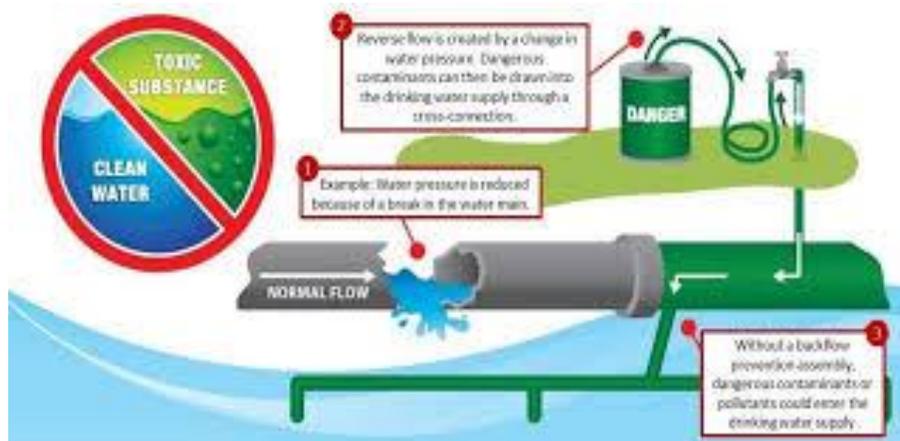
Conditions that Lead to Backflow

In order for potable water to be contaminated by a non-potable substance through a cross-connection, two conditions must exist simultaneously:

- 1) A force that causes liquids in a system to move
- 2) A link that connects the two systems

Backflow is liquid flowing through a pipe in the opposite direction from the direction it was intended to flow. Since a liquid always moves toward the point of the lowest pressure, a common appliance such as a hot water heater which can increase pressure and can cause a backflow into the public water supply.

A water break or heavy pull for fire suppression can also be the source of a backflow situation. Without backflow prevention, toxic chemicals would have the opportunity to enter the system, making it critical to be sure, appropriate devices are in place and functioning properly.



In 1995, the Virginia Department of Health adopted the Clean Water Act requiring all waterworks owners in the State of Virginia to monitor, test and report to the VDH the results of water quality testing. As part of this Act, a cross connection and backflow prevention program must be in place.

Hazard Level	Hazard Risk	Types of Hazards or Activities	Suggested Devices
High	Contamination could cause serious illness or death, if consumed	Medical, dental, laboratories, mortuaries, below grade lawn sprinkler systems, facilities that use chemicals for processing; fire sprinkler systems	Reduced pressure zone assembly (testable devices); Air gap
Moderate	Contamination could cause mild illness or discomfort. Not life-threatening.	Car washes, dishwashers, clothes washing, toilet tanks, solar heating systems	Air gap; Atmospheric vacuum breaker; Pressure vacuum breaker
Low	Contamination would be aesthetically objectionable, but does not affect health.	Private wells, food coolers, beverage dispensers, hose bibb	Air gap; Atmospheric vacuum breaker

The table above is shown as general reference and is not intended to be all-inclusive.

Maintenance

Backflow prevention devices are required to be inspected and tested annually. Most devices require an overhaul every five years to replace the internal rubber components and could require other repairs if testing fails. Those devices that are deemed to be untestable are required to be replaced at a minimum of every five years, and more frequently if an inspection indicates leakage, corrosion or other potential cause for failure. Any receipts for repair or replacement of a backflow prevention device should be maintained as evidence that the required maintenance was performed. The Backflow Prevention Inspection/ Testing form should record any maintenance or repair activities since the last inspection and testing.

Residential Cross-Connection and Backflow Prevention

Businesses are not the only ones required to have backflow prevention devices installed. Many residential applications require monitoring and maintenance as well. Hoses left submerged in swimming pools, hoses in elevated locations above an outside spigot while watering shrubs, or having chemical sprayers attached while weed killing are all conditions that can be extremely hazardous.

Other potential hazards can apply if hoses are left lying on the ground where contaminants such as fertilizer, garden chemicals, or cesspools exist.

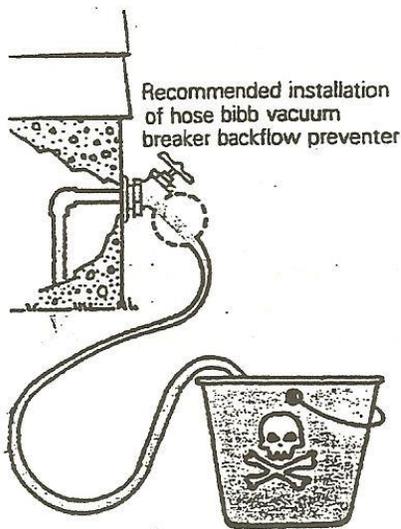
Yard hydrants (that drain into the ground when turned off) need an approved backflow prevention device installed on the line feeding the hydrant. All hose bibbs, both inside and outside, except those for dishwashers and washing machines require vacuum breakers. Caution should be taken during cold weather as a vacuum breaker may prevent a spigot from draining properly and could allow the wall hydrant to freeze.

Read the manufacturers recommendations for winter draining or purchase the type that self-drain.

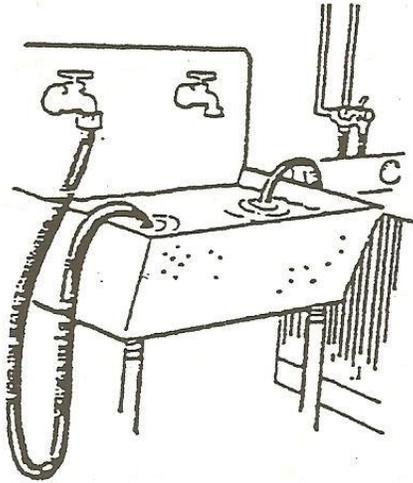
The water closet on a commode can also be a source of backflow allowing cleaning solutions to be siphoned back into the water system. Anti-siphon devices are readily available at your local hardware store.

Examples of how backflow can occur and ways to protect against it can be found on the following pages.

Basic Types of Cross-Connections and the Recommended Backflow Device



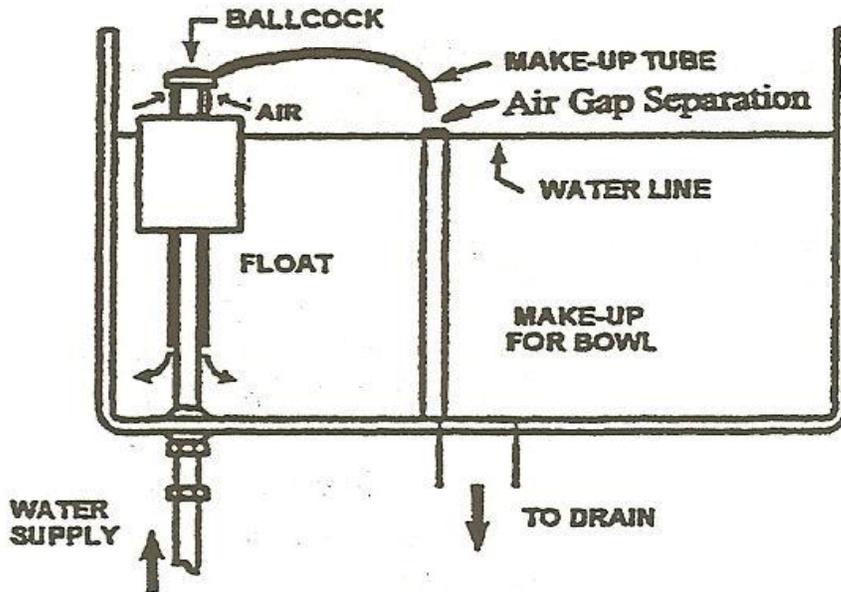
Hose Bibb Vacuum Breaker



Laundry Tub with Threaded Spigot

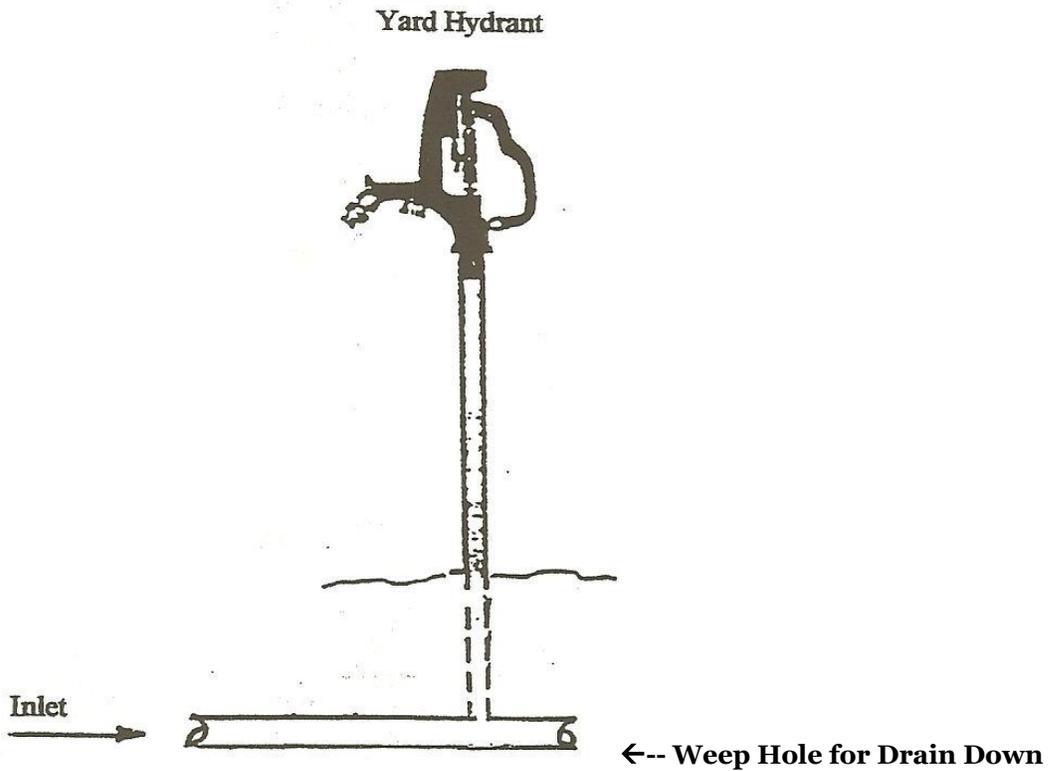
Hose Bibb Vacuum
Breaker required

**Basic Types of Cross-Connections and the Recommended
Backflow Device**



Anti-Siphon Flush Tank

Anti-Siphon Vacuum Breaker



By installing an anti-siphon device in the water closet, backflow is prevented.

The yard hydrant inlet caused water to seep out through weep holes. Other materials can enter the weep holes and contaminate water. A back-flow prevention device such as a dual check valve (DCV) is required on the service line to the yard hydrant.



All consumers of public water need to be aware of the possibilities of contamination and the methods available to combat backflow and cross-connections. Maintaining safe drinking water requires everyone's participation.



What is a cross connection?

A cross connection is any actual or potential link or connection between your drinking water system and any source of contamination.

Cross connections can occur due to backpressure or back siphonage, which together are kinds of backflow.

Backflow is the reversed flow of contaminated water or other liquids into your drinking water system.

Backflow by back siphonage occurs when a partial vacuum causes the water flow to reverse, and contaminants are siphoned or sucked into your drinking water.

Backflow by backpressure occurs when contaminants under pressures greater than pressure in your drinking water system are pushed into your drinking water.

Every time you turn on the faucet
You expect a flow of high quality, clean drinking water. Unfortunately, clean drinking water isn't something you should take for granted. We all need to do our part to ensure that our homes have the clean water we expect each and every day.

Did you know common hazards in and around your house can contaminate your drinking water as well as your neighbors?

PUBLIC WATER SUPPLY

Should I be concerned about cross connections?

Two examples from drinking water systems in Virginia highlight the seriousness of cross connections.

1. An exterminating company was using a water hose connected to a house to mix a chemical pesticide in a tank truck. At the same time, city workers were draining a distribution line serving the subdivision. The pesticide was drawn into the distribution system by back siphonage. When water service was restored, water contaminated with the pesticide flowed directly into homes. For the lack of an inexpensive hose bibb vacuum breaker, this backflow event caused approximately \$80 million in damages to the drinking water system and homes, where plumbing and appliances had to be removed and replaced.



2. A resident called the waterworks claiming, “Your water is burning my mouth!” The woman lived in an apartment located over a convenience store. The investigation showed that a pressurized canister of carbon dioxide used to mix sodas in the store had malfunctioned. As a result, carbon dioxide was forced into the drinking water piping by backpressure. The levels of carbon dioxide were high enough to burn the woman’s mouth. If metallic pipe had been in use, the acidic mix of carbon dioxide and water could of led to a serious illness or death.



What can I do to prevent cross connections?

Having an active program in place to control cross connections and prevent backflow is critical to ensuring the safety of your drinking water.

Did you know...?

Having an approved Cross Connection Control Program is not an option for public water systems? The Virginia *Waterworks Regulations* state:

“...as a condition for the issuance and continued use of the operation permit ...each owner of a waterworks [shall] establish and enforce a program of cross connection control and backflow prevention for each waterworks. The cross-connection control and backflow prevention program shall be approved by the division prior to issuance of the operation permit.” §12VAC 5-590-580

What are the essential elements that make up an effective ongoing Cross Connection Control Program?

There are six key elements of an effective Cross Connection Control program (CCCP):

1. Consumer education and awareness

Your best resource to ensure an effective CCCP is consumers who know what a cross connection is, and how to safeguard against backflow at home, at school, or in the workplace.

Educational materials for consumers should describe...

- Conditions that lead to backflow
- Plumbing hazards with cross connection potential
- Health effects of cross connections
- Ways to eliminate hazards
- Sources of additional information and contact info for assistance

Ways to reach consumers include...

- Using the annual water quality report (also known as a Consumer Confidence Report) to explain your CCCP. Describe steps water customers can take, such as installing hose bibb vacuum breakers to prevent back siphonage when using the garden hose.
- Sending educational materials as a billing insert
- Making Public Service announcements on local television or radio
- Providing education materials when new customers begin service
- Posting consumer education materials on employee bulletin boards

2. Risk assessment

What conditions are you likely to encounter in your water supply's service area? Before you determine what kind of cross connection protection is best, you have to evaluate situations that can produce backflow. This evaluation or risk assessment must be done for every service connection in your system. You must think about how water is used by consumers. Risk assessment involves two steps:

Step 1: Identify the conditions or facilities with potential for backflow.

Step 2: Assign a degree of hazard. This is based on the nature of the contaminant and its potential health effects.

3. Selection of appropriate safeguards

Appropriate safeguards are tailored to the situation, based on degree of hazard, method of backflow (back siphonage or backpressure), and pressure and flow conditions (continuous or non-continuous.)

An air gap or physical disconnection gives the highest degree of protection from backflow. It should be used whenever it is practical to do so in high hazard situations. The length of the gap should be at least two times the diameter of the water outlet.

When use of an air gap is not suitable, a variety of backflow prevention devices can be installed. The table below describes the appropriate application of mechanical safeguards for various situations:

Degree of Hazard	Method of Backflow	Pressure or Flow Conditions	Device or Safeguard
High	Back pressure OR back siphonage	Continuous	Reduced pressure principle backflow prevention assembly (RPZ)
High	Back siphonage ONLY	Non-continuous	Pipe applied atmospheric vacuum breaker, hose bibb vacuum breaker, or wall hydrant with hose bibb vacuum breaker
		Continuous	Pressure vacuum breaker
Moderate	Back pressure OR back siphonage	Continuous	Double gate-double check valve assembly
Low	Back siphonage ONLY	Continuous	Dual check valve

Continuous means operating under continuous flow or pressure. This condition usually applies to devices that are installed inline, where valves may be installed downstream of the device.

Noncontinuous means operating intermittently, and applies to devices which are connected to hose bibbs, hydrants, or faucets that are open to the atmosphere. In these cases, valves are not located downstream of the device.

4. Ongoing reassessment

The number of connections to your water system and the ways consumers use water from your system are constantly changing. How will you know when these changes occur, and whether they introduce new risks to your water system?

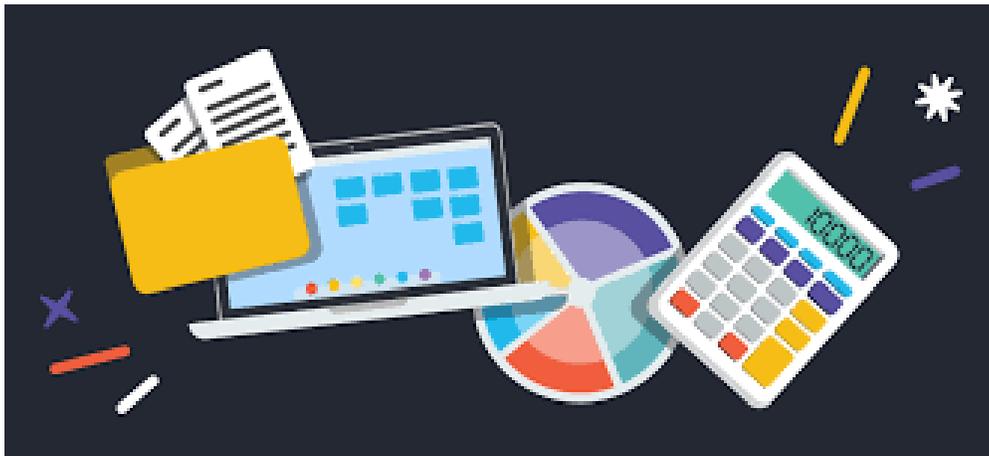
In order to have an effective CCCP, you must make an effort to continually reassess your drinking water system for cross connections. The Virginia *Waterworks Regulations* require that water system owners have inspections and appropriate testing of cross connection control devices conducted annually.

Inspections should include examination of cross connection controls currently in use, as well as investigation to identify new potential cross connection situations. The *Regulations* require that records of the reassessment inspections be kept for at least ten years.

5. Recordkeeping

Recordkeeping is an essential part of effective CCCPs. Good recordkeeping serves numerous purposes:

- It enables you to pinpoint the location and type of potential cross connections that could affect your water system.
- It serves as an inventory of the safeguards that are used throughout the water system and why they are there.
- It allows you to assess how well the CCCP is being implemented.
- It serves as a resource to make sure that testable devices are being inspected and maintained properly.
- It provides accountability, by documenting who is performing specific CCCP tasks.
- It protects the water system from liability and charges of negligence.



All CCCPs include a recordkeeping element, though the specific documentation may vary from waterworks to waterworks. However, all CCCP records must to be saved for a minimum of ten years, and the records must be made available to the Virginia Department of Health upon request. The records maintained by your waterworks may include the following:

- Results of questionnaires sent to customers
- Annual inspection forms
- Lists of potential cross connections (description and location)
- Inventories of the safeguards used for each potential cross connection, along with the reason for its selection
- Specific descriptions for each safeguard including manufacturer, model number, size, etc.
- Documentation of annual device testing, including testers' certifications, inspection dates, test results, etc.

6. Reporting

It is very important to notify the Virginia Department of Health IMMEDIATELY in the event of a cross connection or backflow incident at your public water system. Call your Office of Drinking Water field office if there is any indication or suspicion that contaminated water has entered the water system by backflow. Office of Drinking Water staff will provide specific guidance on correcting the situation, and on steps you should take to notify consumers. Prompt reporting is a necessary step to protect the health of your customers.

Did you know...?

The Office of Drinking Water has established toll-free emergency contact call numbers for waterworks use after normal business hours on nights, weekends, and holidays. Your emergency call will be delivered to a pager, and the call will be returned immediately.

(800) 608-3212

or

(804) 204-3527

User Requirements and Responsibilities

- **Permit and Final Inspection when installing equipment**
 - **Be aware that you have backflow equipment**
 - **Do not engage in Cross Connections**
- **Equipment must be inspected Annually by a certified plumber**
 - **Keep Inspection reports for 10 years**
 - **Maintain and update inspection contact information**
- **Ensure identified deficiencies are corrected in a timely manner**
- **Ensure repair/ replacement of failed assembly is completed without delay**
- **Ensure assemblies that are removed for winterization are re-installed prior to the month testing is due**

Cross-Connection Control Plan

Town of Luray



Section 1 -- Purpose

The purpose of this plan is to protect the potable water supply from the possibility of contamination or pollution by isolating such contaminants or pollutants that could backflow into the potable water system; and to promote the elimination or control of existing cross connections, actual or potential, between the potable water system and non-potable water systems and plumbing fixtures; and to provide for the maintenance of a continuing program of cross-connection control that will systematically and effectively prevent the contamination or pollution of all potable water systems. As water is transported from the treatment facility to the customer, opportunities exist for unwanted substances to contaminate it. One common means for such contamination is by backflow of non-potable fluids through cross-connections into the potable water system. All users of the system, and workmen associated with the system, must be aware of this problem and constantly alert to any connection to the system which may allow such a cross-connection and what preventative measures can be taken to ensure a safe, potable water supply.

Section 2 --Definitions

Air-Gap

The unobstructed vertical distance through free atmosphere between the lowest point of a water supply outlet and the flood level rim of the fixture or assembly into which the outlet discharges. These vertical, physical separations must be at least twice the diameter of the water supply outlet, but never less than 1 inch (25 mm).

Approved

Accepted by the authority responsible as meeting an applicable specification stated, or as suitable for the proposed use.

Auxiliary Water Supply

Any water supply on or available to the premises other than the approved potable water supply. These auxiliary waters may include water from another potable water supply or any natural source such as a well, spring, river, stream, harbor, etc., or "used waters" or "industrial fluids". These waters may be polluted, or they may be objectionable and constitute an unacceptable water source over which the water purveyor does not have sanitary control.

Backflow

The undesirable reversal of flow in a potable water distribution system as a result of a cross-connection.

Backflow Preventer

An assembly or means designed to prevent backflow.

A. Air Gap

The unobstructed vertical distance through the free atmosphere between the lowest opening from any pipe or faucet conveying water or waste to a tank, plumbing fixture, receptor, or other assembly and the flood level rim of the receptacle. These vertical, physical separations must be at least twice the diameter of the water supply outlet, never less than 1-inch.

B. Reduced-Pressure Backflow-Prevention Assembly

The approved reduced-pressure principle backflow-prevention assembly consists of two (2) independently acting approved check valves together with a hydraulically operating, mechanically independent pressure differential relief valve located between the check valves and below the first check valve. These units are located between two (2) tightly closing resilient-seated shutoff valves as an assembly and equipped with properly located resilient-seated test cocks.

C. Double Check Valve Assembly

The approved double check valve assembly consists of two (2) internally loaded check valves, either spring loaded or internally weighted, installed as a unit between two (2) tightly closing resilient-seated shutoff valves and fittings with properly located resilient-seated test cocks. This assembly shall only be used to protect against a non-health hazard (that is, a pollutant).

Contamination

An impairment of a potable water supply by the introduction or admission of any foreign substance that degrades the quality and creates a health hazard.

Cross-Connection

A connection or potential connection between any part of a potable water system and any other environment containing other substances in a manner that, under any circumstances would allow such substances to enter the potable water system. Other substances may be gases, liquids, or solids, such as chemicals, waste products, steam, water from other sources (potable or nonpotable), or any matter that may change the color or add odor to the water.

Cross-Connections -- Controlled

A connection between a potable water system and a non-potable water system with an approved backflow-prevention assembly properly installed and maintained so that it will continuously afford the protection commensurate with the degree of hazard.

Hazard, Degree of

The term is derived from an evaluation of the potential risk to the public health and the adverse effect of the hazard upon the potable water system.

A. Hazard - Health

A cross-connection or potential cross-connection involving any substance that could, if introduced into the potable water supply, cause death, illness, spread disease, or have a high probability of causing such effects.

B. Hazard -Plumbing

A plumbing-type cross connection in a consumer's potable water system that has not been properly protected by an approved air gap or an approved backflow-prevention assembly.

C. Hazard –Non-health

A cross-connection or potential cross-connection involving any substance that generally would not be a health hazard but would constitute a nuisance or be aesthetically objectionable, if introduced into the potable water supply.

D. Hazard -System

An actual or potential threat of severe damage to the physical properties of the potable water system or the consumer's potable water system or of a pollution or contamination that would have a protracted effect on the quality of the potable water in the system.

Industrial Fluid System

Any system containing a fluid or solution that may be chemically, biologically, or otherwise contaminated or polluted in a form or concentration, such as would constitute a health, system, pollution, or plumbing hazard, if introduced into an approved water supply. This may include, but not be limited to: polluted or contaminated waters; all types of process waters and used waters originating from the potable water system that may have deteriorated in sanitary quality; chemicals in fluid form; contaminated natural waters, such as wells, springs, streams, rivers, bays, harbors, seas, irrigation canals or systems, and so forth; oils, gases, caustic and acid solutions, and other liquid and gaseous fluids used in industrial or other purposes.

Pollution

The presence of any foreign substance in water that tends to degrade its quality so as to constitute a non-health hazard or impair the usefulness of the water.

Service Connection

The terminal end of a service connection from the potable water supply, that is, where the water purveyor loses jurisdiction and sanitary control over the water at its point of delivery to the customer's water system. There should be no unprotected takeoffs from the service line ahead of any backflow-prevention assembly located at the point of delivery to the customer's water system.

Water – Non-potable

Water that is not safe for human consumption or that is of questionable quality.

Water - Potable

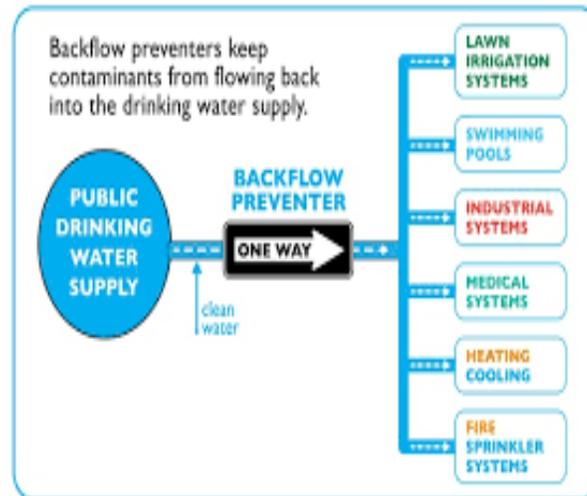
Water that is safe for human consumption as described by the public health authority having jurisdiction.

Water Purveyor

Owner of the source facilities, treatment facilities, and the distribution system providing potable water to customers.

Water-Used

Any water supplied by a water purveyor from a potable water system to a consumer's water system after it has passed through the point of delivery and is no longer under the sanitary control of the water purveyor.



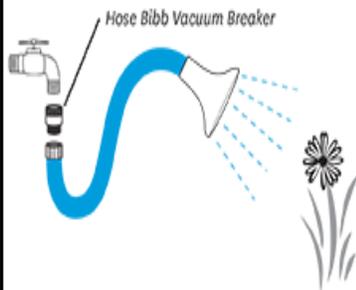
Typical Residential Cross-Connections

- Hose Bibs
- Lawn Irrigation
- Jacuzzis
- Swimming Pools
- Toilet Ball-cocks



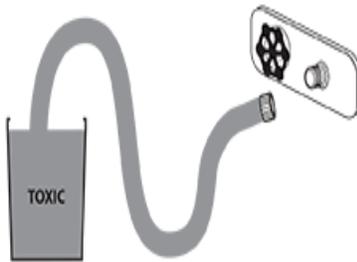
Hose bibbs

Hose bibbs are part of our everyday life. They allow us to hook up a garden hose to water the plants, wash the car, clean out the gutters, fill the swimming pool, etc. However, every time you connect a garden hose to a hose bibb, you are extending the end of the water line. To make



sure that no harmful materials are drawn back into the garden hose, a vacuum breaker should be installed on each hose bibb. When the hose bibb is exposed to freezing conditions, make sure to use a self draining, frost-proof vacuum breaker.

Self Draining, Frost Proof Vacuum Breaker



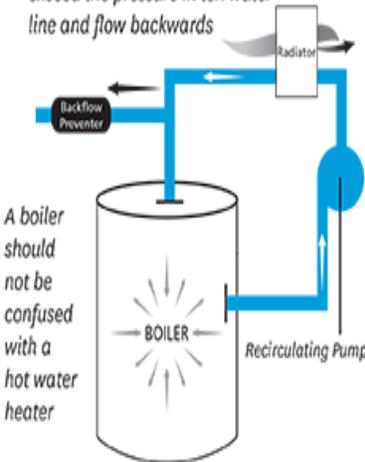
NOTE: Make sure to use only listed or approved products acceptable to your water or health agency. Should you have any questions check with your local water agency, health agency, or building and safety department.

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Boilers

Due to the pressure that may build up inside of a boiler, the pressure of the boiler water may exceed that of the water feeding the boiler. The boiler water (which may be chemically treated with poisonous anti-corrosion compounds, etc.) may be pushed, or backpressured, into the make-up water line. This chemically contami-

If a backflow preventer is not present, pressure in the boiler may exceed the pressure in the water line and flow backwards



A boiler should not be confused with a hot water heater

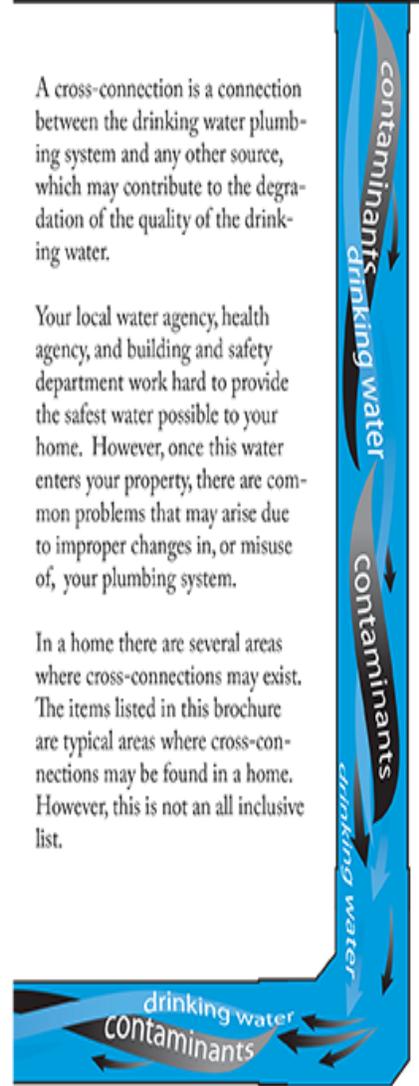
nated water may be forced back into your home's drinking water system, unless there is an appropriate backflow preventer that is designed for backpressure.

Cross-Connections in Household Plumbing

A cross-connection is a connection between the drinking water plumbing system and any other source, which may contribute to the degradation of the quality of the drinking water.

Your local water agency, health agency, and building and safety department work hard to provide the safest water possible to your home. However, once this water enters your property, there are common problems that may arise due to improper changes in, or misuse of, your plumbing system.

In a home there are several areas where cross-connections may exist. The items listed in this brochure are typical areas where cross-connections may be found in a home. However, this is not an all inclusive list.



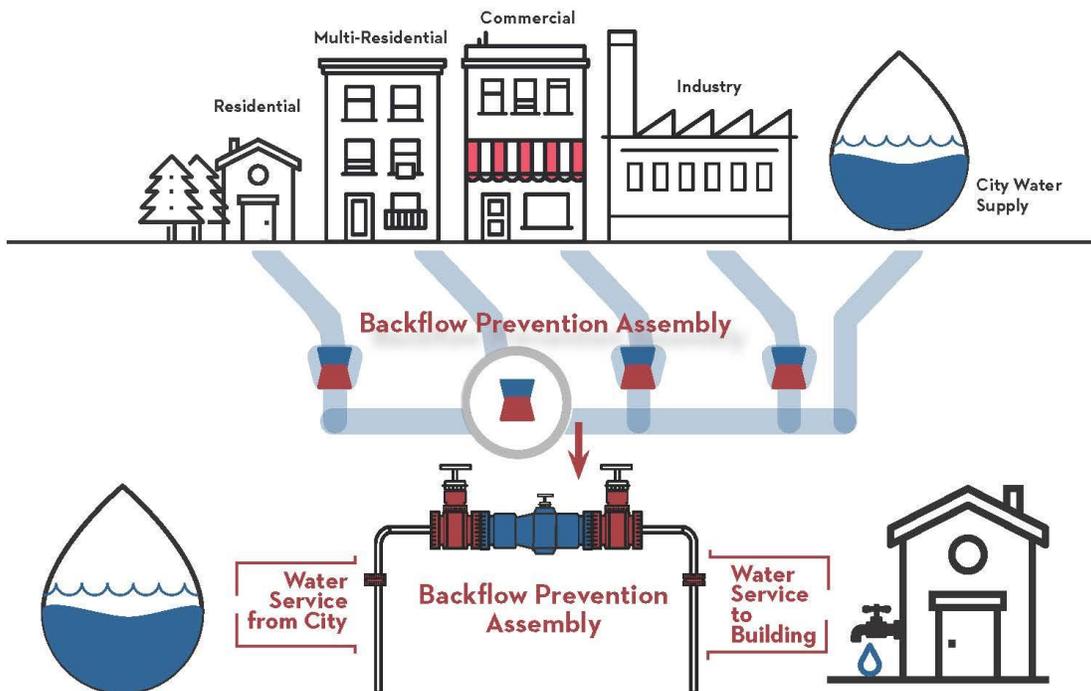
BACKFLOW PREVENTION



- ✔ Required by state and federal law
- ✔ Required by state and federal law to be tested annually
- ✔ Keeps drinking water clean and safe for you and your neighbors

Cross-Connection

An actual or potential connection between a potable water supply and any non-potable substance or source.



Backflow

The undesirable reversal of flow of water or mixtures of water and other liquids, gases, or other substances into the City's water system.

Backflow Prevention Assembly

Any approved assembly used to prevent backflow into a potable water system.

COMMON CROSS-CONNECTION EXAMPLES

These common household and commercial connections to the public water system pose a threat to our clean water if not protected by the appropriate Backflow Prevention Assembly.

-  Irrigation Systems
-  Fire Sprinkler Systems
-  Hose Bibs



Additional resources:
www.cityofaspen.com/crossconnection