Backflow Protection
&
Cross-Connection Control

Presented by:

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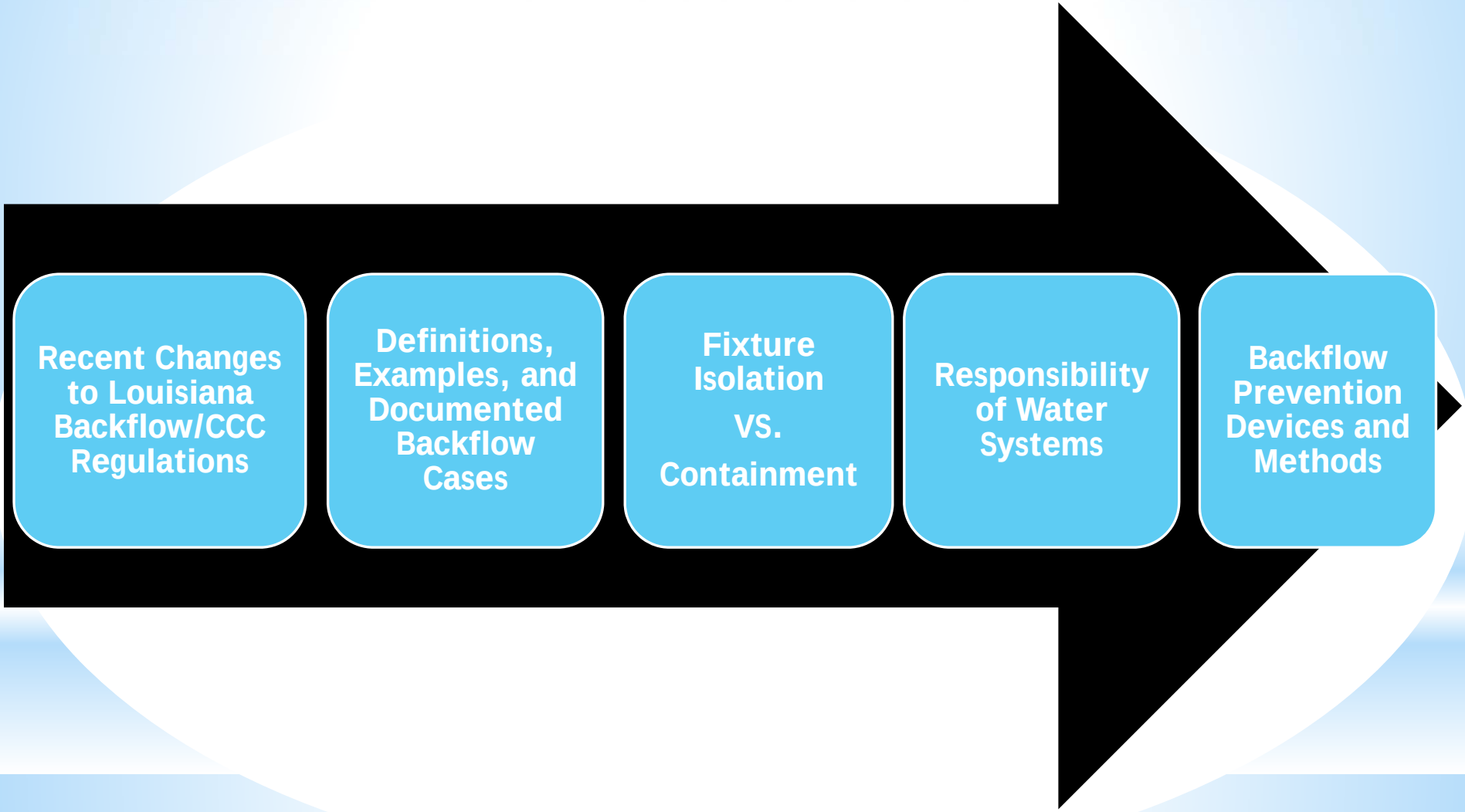
Presentation Overview



Recent Regulation Changes

- Act 836 – New Plumbing Regulations
- Rulemaking – Amended Part XII (Water Supplies) of Title 51 (Public Health Sanitary Code) to address Act 836

Act 836 Overview

- On June 23rd, 2014 Louisiana House Bill 1048 was signed by the Governor and enacted as Act Number 836 of 2014.
- In accordance with the Act, the Louisiana State Plumbing Code (Part XIV of Title 51) is null, void, and unenforceable as of January 1st, 2016.

Act 836 Overview

- As required by the Act, the Louisiana State Uniform Construction Code Council (LSUCCC) has promulgated new plumbing regulations through the evaluation, adoption, and amendment of the following codes as part of the State Uniform Construction Code (LAC 17:I):
  - The 2012 International Plumbing Code; and,
  - The 2012 International Residential Code (Part VII-Plumbing)
- Applicable plumbing provisions of these codes, <u>along with state amendments thereto</u> adopted by the LSUCCC, became effective on January 1, 2016.

Act 836 Overview

- The International Codes can be assessed electronically at: http://publicecodes.cyberregs.com/icod/index.htm
- Louisiana amendments were published by the LSUCCC in LAC 17:I. These amendments can be accessed at: http://www.doa.la.gov/osr/EMR/1512EMR082.pdf
- A complete compilation of the new backflow requirements contained in these new plumbing regulations can be accessed from our Engineering Website at: http://new.dhh.louisiana.gov/assets/oph/Center-EH/engineering/IPC-IRC_Backflow_Protection_Requirements.pdf

DHH Emergency Rule Overview

- Effective February 23rd, 2016
- Update Part XII (Water Supplies) of LAC Title 51 - (Public Health Sanitary Code) to address Act 836.
- Section 344 (Protection of Water Supply/Containment Practices) *(Revised to reference the newly adopted Backflow/CCC regulations of the State Uniform Construction Code)*
- Section 346 (Installer, Repairer, Tester Qualifications for Backflow Prevention Devices and Methods) *(New Section added in order to retain the backflow testing qualification requirements that were previously contained in Part XIV)*

Backflow

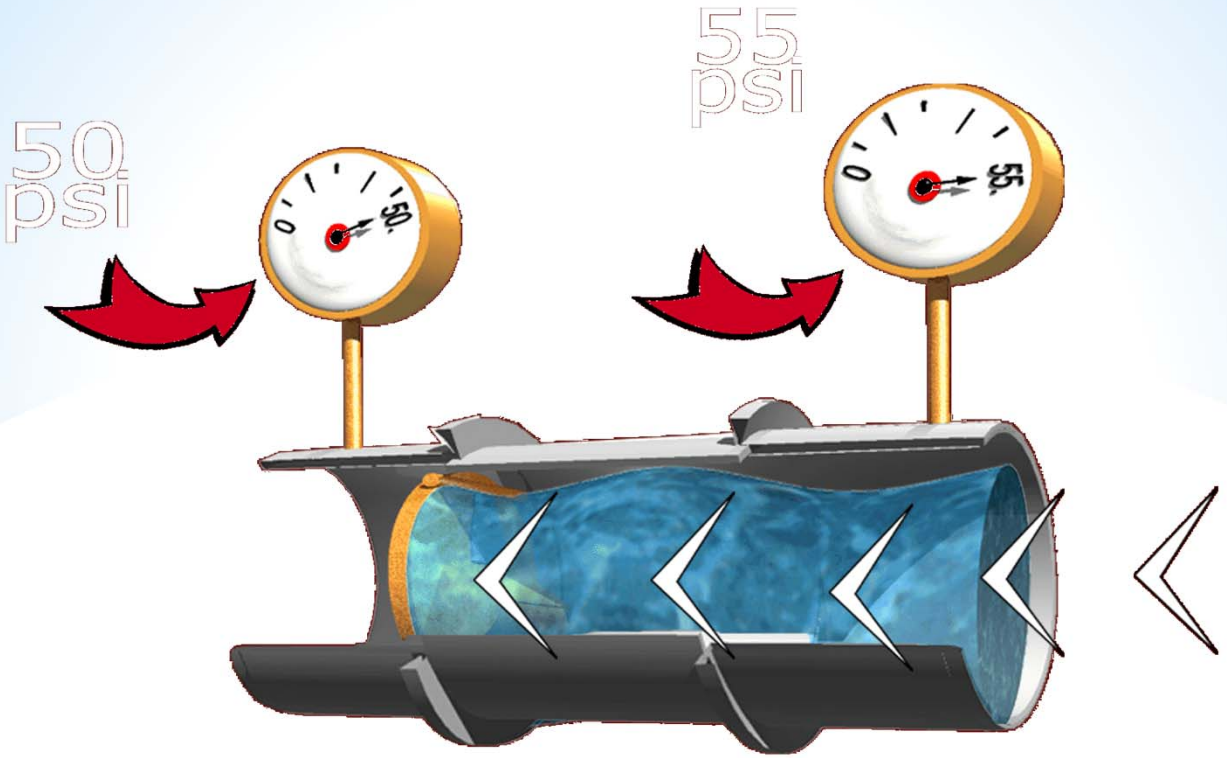
Backflow: An unwanted flow of water in the reverse direction of what is intended which can cause the introduction of pollution or contamination into the distribution pipes of a potable water supply.

Two Causes of Backflow:

* *Back-Pressure*
* *Back-Siphonage*

Backpressure

Pressure in downstream piping becomes greater than the supply pressure causing a reversal of the normal direction of flow.

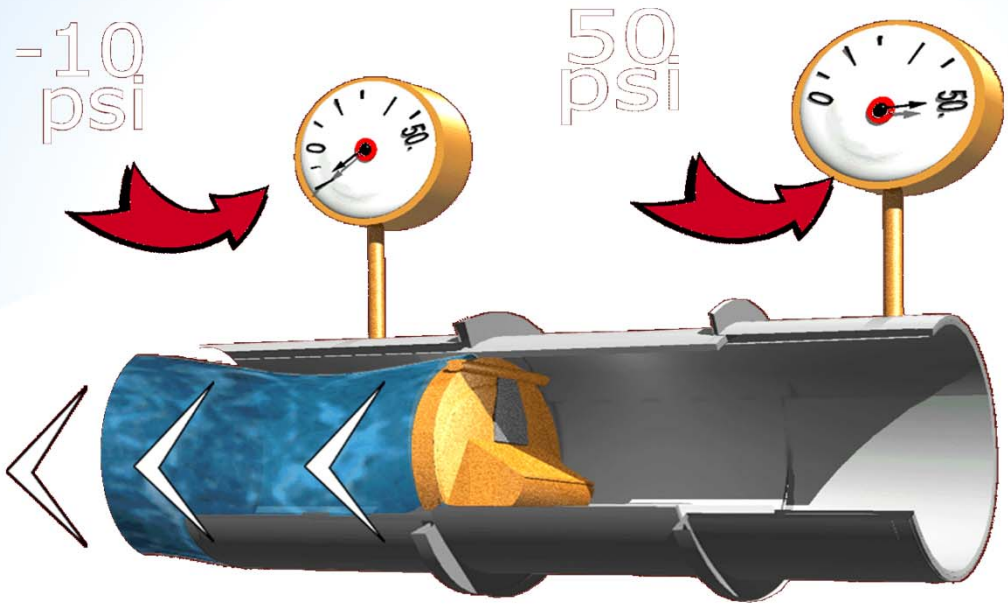


Backpressure

Potential causes of backpressure include heating/cooling systems, pumping equipment, and elevated storage tanks.

Backsiphonage

A reversal of the normal direction of flow in the pipeline due to a negative pressure (vacuum) being created in the supply line.



Backsiphonage

Potential causes of backsiphonage include water main breaks, flushing, pump failure, and emergency firefighting.

http://blog.bioethics.net/2008/10/

Cross-Connections

Cross Connection: Any physical connection or arrangement between two systems, one of which contains potable water and the other of water of unknown or questionable quality, whereby there exists the possibility for flow from one system to the other, with the direction of flow depending on the pressure differential between the two systems.

* **Direct Connection-** a connection that is subject to both back pressure & back siphonage.
* **Indirect Connection-** a connection that is subject to back siphonage only, NOT back pressure.

Cross-Connections

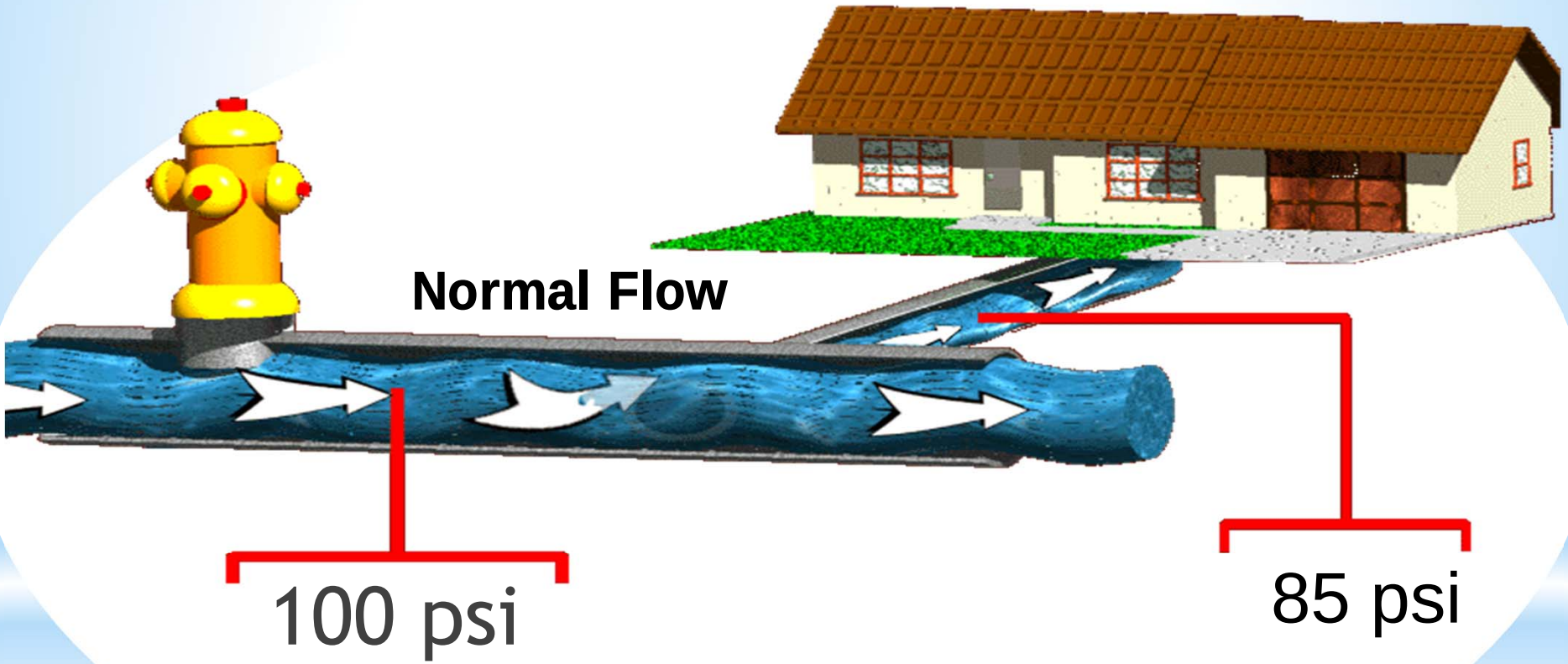
Common Examples:

- Hose Bibs
- Irrigation Systems
- Auxiliary Water Systems
- Chemical Tanks
- Swimming Pools
- Fire Suppression Systems
- Toilets
- Laboratory and Aspirator Equipment
- Boilers

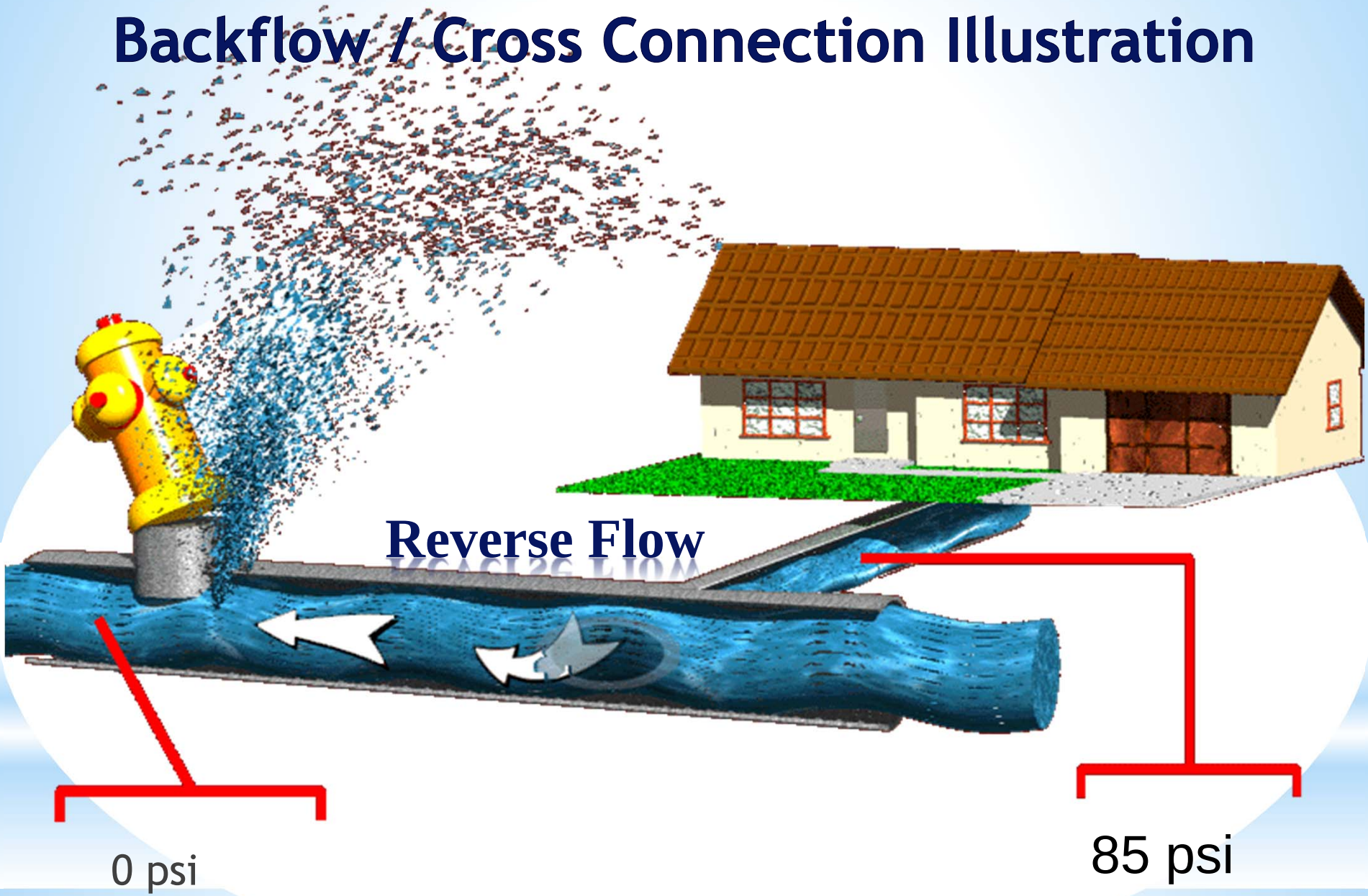
Cross-Connections

Cross-Connections

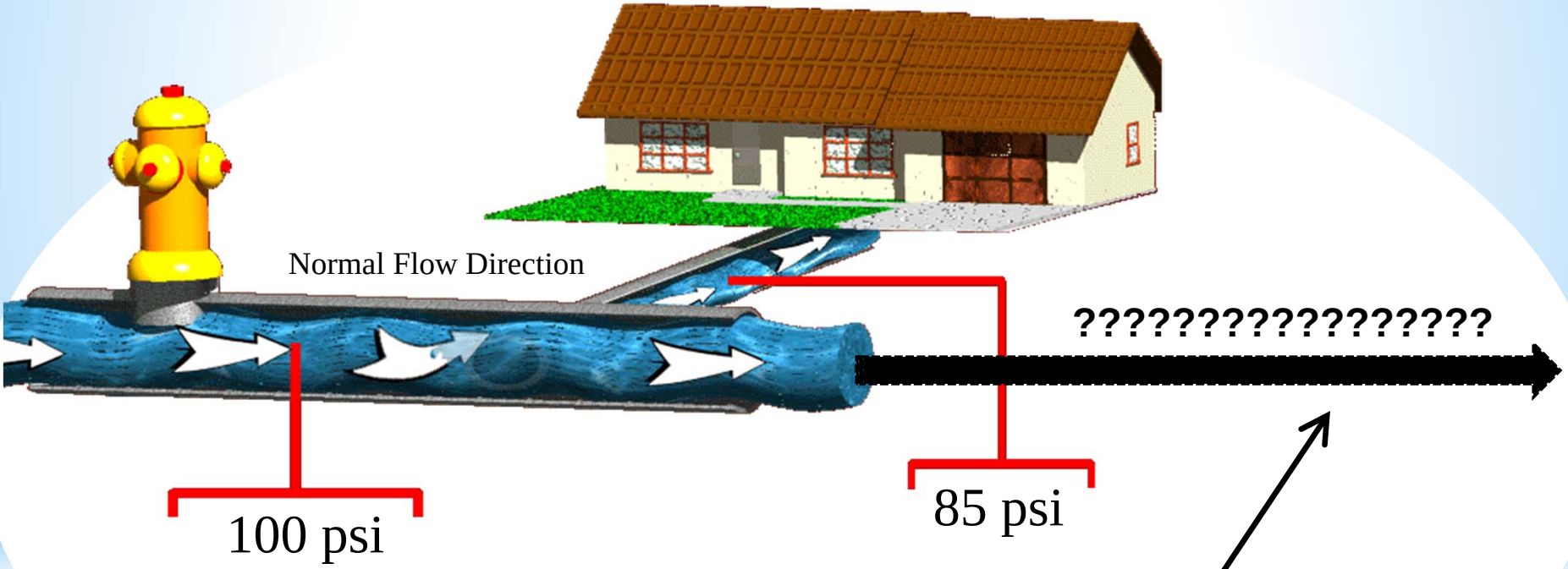
Backflow / Cross Connection Illustration



Backflow / Cross Connection Illustration

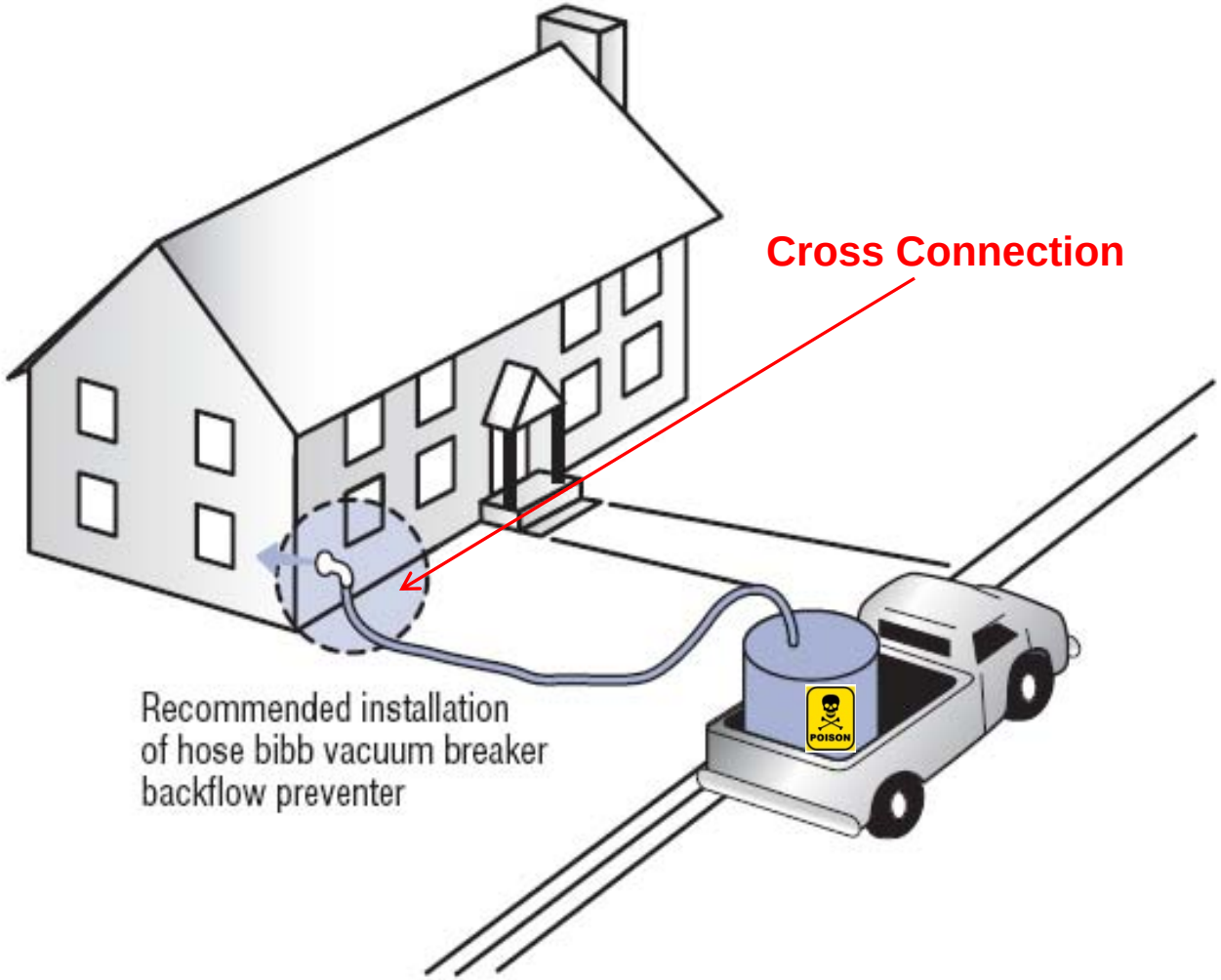


Backflow / Cross Connection Illustration



What was going on downstream at the time of the backflow incident???

Backflow / Cross Connection Illustration



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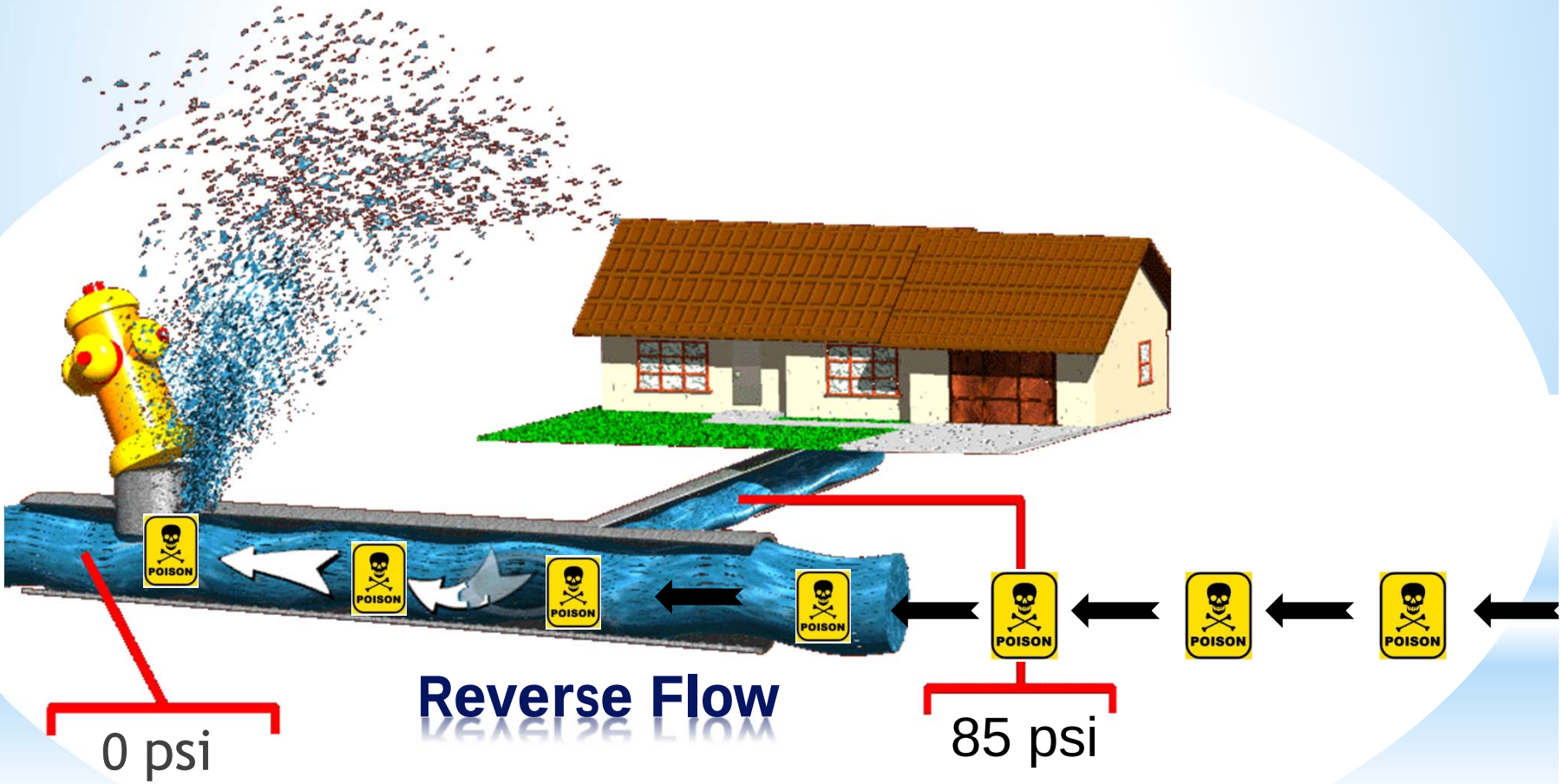
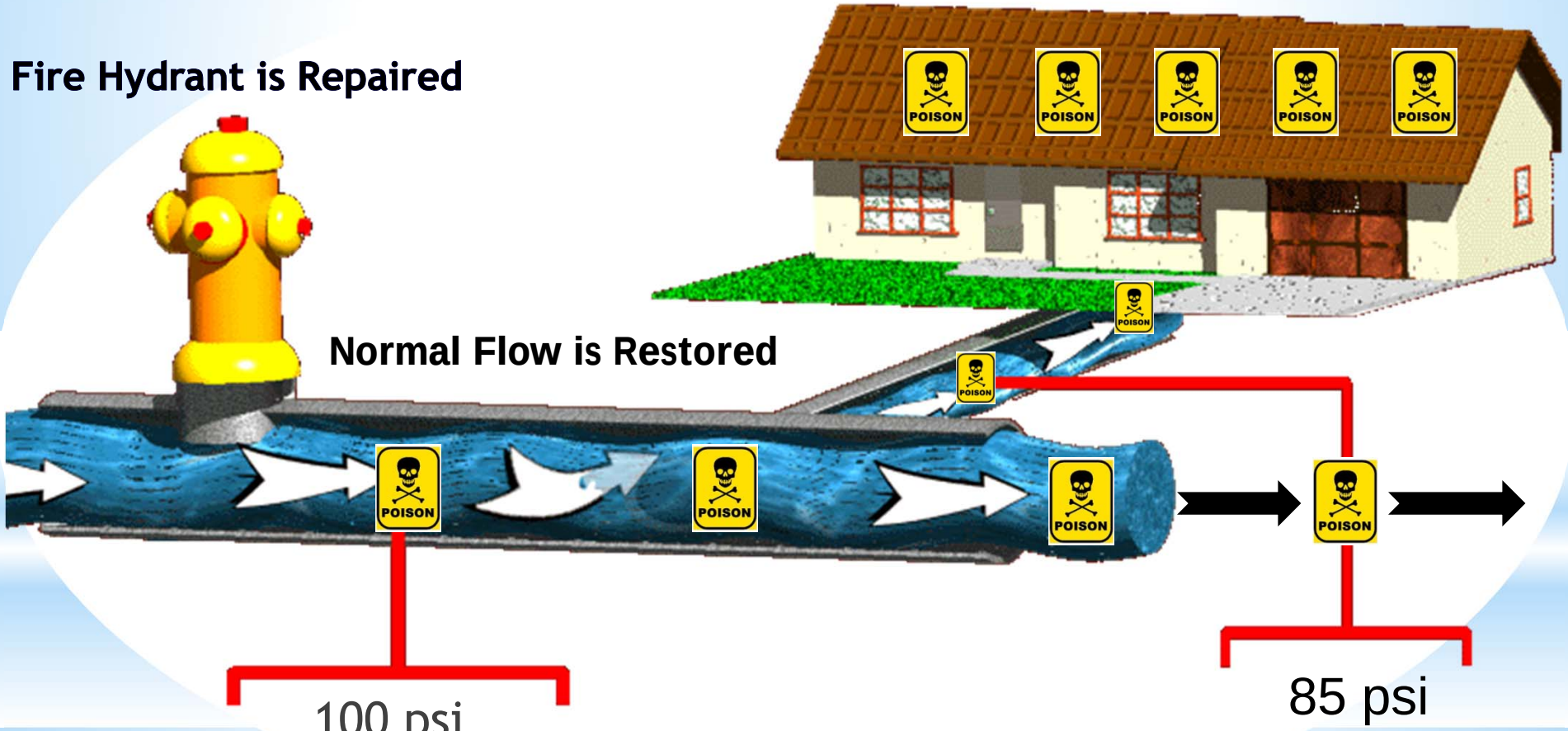


Backflow / Cross Connection Illustration



Documented Backflow Events

- The U.S. Environmental Protection Agency (EPA), Office of Ground Water and Drinking Water - Standards and Risk Management Division has compiled backflow incident data which is summarized in the technical paper titled, *Potential Contamination Due to Cross Connections and Backflow and the Associated Health Risks – Sept. 27th, 2001.*

- The compilation of backflow incident data found that **459** incidents resulted in an estimated **12,093** illnesses from 1970 to 2001.

Source of Contamination	Documented Incidents	Examples of Incidents
Homes With Individual Connections	**55**	
Apartment Buildings or Condominiums	**27**	
Mobile Home Parks	**1**	
Neighborhood	**3**	
Medical Sites	**27**	• In 1982 in Illinois, ethylene glycol back siphoned from an air conditioning system's water holding tank into a group of dialysis machines, contributing to the death of "several" (number not given) patients (AWWA PNW S, 1995).
Schools, Universities, etc.	**31**	
Public Water Systems	**15**	
Institutional Sites (e.g., public buildings, churches)	**24**	• In 1994, the water system at a Tennessee prison was cross-contaminated by the facility's wastewater pump station, resulting in 304 cases of giardia (Craun and Calderon, 2001).

Source of Contamination	Documented Incidents	Examples of Incidents
Restaurants	**28**	
Office Buildings	**18**	• In 1991, trichloroethane entered the distribution system of a city in Missouri from a newspaper office. Uncoordinated flushing by the water system caused the contaminant to spread throughout the system, with concentrations as high as 420 micrograms/L (AWWA PNWS, 1995).
Other Commercial	**66**	
Agricultural Sites	**6**	• In 1995, pesticides (paraquat and atrazine) were back siphoned into a distribution system when an accidental water main cut occurred while a Louisiana farmer was diluting herbicides in a tank. Some people reported nausea, stomach burns and pains, profuse sweating, diarrhea, and shortness of breath. The incident was the subject of a class-action lawsuit (AWWA PNWS, 1995).
Recreational Sites	**10**	
Industrial Sites	**40**	
Other Sites/Site Type Unknown	**108**	

Backflow Prevention

What can be done to prevent incidents???

- Implement and enforce cross-connection control programs.
- Identify and eliminate cross-connections when possible.
- Promote public education to prevent cross-connections.
- Proper selection, installation, testing and repair of backflow preventers.
- Fixture Isolation and Containment Practices.

Fixture Isolation

Fixture Isolation—a method of backflow prevention in which a backflow preventer is located to correct a cross-connection at a fixture located within the premise itself.

Hose Bib

Toilet

Lavatory

Fixture Isolation

From the 2012 IPC (*as amended*):

608.16. Connections to the Potable water system. Connections to the potable water system shall conform to Sections 608.16.1 through 608.16.27. These Sections (608.16.1-608.16.27) are not inclusive of all potential contamination sources which may need fixture isolation protection. For potential contamination sources not listed in Sections 608.16.1 through 608.16.27, backflow prevention methods or devices shall be utilized in accordance with Table B1 of CAN/CSA B64.10-1994.

Fixture Isolation

608.16.1 Beverage dispensers.
The water supply connection to beverage dispensers shall be protected against backflow by a backflow preventer conforming to ASSE 1022 or by an *air gap*. The portion of the backflow preventer device downstream from the second check valve and the piping downstream therefrom shall not be affected by carbon dioxide gas.

608.16.2 Connections to boilers.
The potable supply to the boiler shall be equipped with a backflow preventer with an intermediate atmospheric vent complying with ASSE 1012 or CSA B64.3. Where conditioning chemicals are introduced into the system, the potable water connection shall be protected by an *air gap* or a reduced pressure principle backflow preventer, complying with ASSE 1013, CSA B64.4 or AWWA C511.

608.16.3 Heat exchangers.
Heat exchangers utilizing an essentially toxic transfer fluid shall be separated from the potable water by double-wall construction. An *air gap* open to the atmosphere shall be provided between the two walls. Heat exchangers utilizing an essentially nontoxic transfer fluid shall be permitted to be of single-wall construction.

608.16.4 Connections to automatic fire sprinkler systems and standpipe systems.
The potable water supply to automatic fire sprinkler and standpipe systems shall be protected against backflow by a double check backflow prevention assembly, a double check fire protection backflow prevention assembly or a reduced pressure principle fire protection backflow prevention assembly.

- *[608.16.1 – 608.16.27: provides the required backflow*
- *protection for various fixtures, equipment, and water outlets]*
-

Containment

Containment—a method of backflow prevention which requires a backflow prevention device or method on the water service pipe to isolate the customer from the water main.

Containment

Amended by the DHH Emergency Rule to address Act 836.

Part XII (Water Supplies)

§344. Protection of Water Supply/Containment Practices

A. As used in this Section, "mandatory containment practices" means the containment practices prescribed in and required by the State Uniform Construction Code (LAC 17:I), including maintenance and testing requirements, and any additional or related requirements of this Part.

B. In order to protect its water supply from potential contamination, each water supplier shall develop and implement a written backflow prevention plan outlining the policies and procedures it will use to verify that its customers comply with mandatory containment practices, and shall make a reasonable effort to ensure that only customers who comply with mandatory containment practices connect or remain connected to its water supply.

Containment

§344. continued……

C. Unless otherwise directed by the state health officer, a water supplier shall disconnect or refuse to connect customers who:

1. fail to comply with mandatory containment practices; or
2. fail to provide or allow adequate confirmation of such compliance.

Containment

LAC 17:I (State Uniform Construction Code)

608.18 Containment practices.

Backflow prevention methods or devices shall be utilized as directed by the water supplier or code official to isolate specific water supply system customers from the water supply system's mains when such action is deemed necessary to protect the water supply system against potential contamination caused by backflow of water from that part of the water system owned and maintained by the customer (for example, the piping downstream of the water meter, if provided). Minimum requirements shall be in accordance with Section 608.18.1 through 608.18.2.

2012 IPC - Table 608.18.1(Containment Practices)
Air Gap
1. Fire Protection/Sprinkler System utilizing non-potable water as an alternative or primary source of water
Reduced Pressure Principle Backflow Prevention Assembly
1. Hospitals, Out-Patient Surgical Facilities, Renal Dialysis Facilities, Veterinary Clinics
2. Funeral Homes, Mortuaries
3. Car Wash Systems
4. Sewage Facilities
5. Chemical or Petroleum Processing Plants
6. Animal/Poultry Feedlots or Brooding Facilities
7. Meat Processing Plants
8. Meat Plating Plants
9. Food Processing Plants, Beverage Processing Plants
10. Fire Protection/Sprinkler Systems using antifreeze in such system (a detector type assembly is recommended on unmetered fire lines)
11. Irrigation/Lawn Sprinkler Systems with Fertilizer Injection
12. Marinas/Docks
13. Radiator Shops
14. Commercial Pesticide/Herbicide Application
15. Photo/X-ray/Film Processing Laboratories
16. Multiple Commercial Units served by a master meter
17. Any type of occupancy type or any other facility having one or more Single-walled Heat Exchangers which uses any chemical, additive, or corrosion inhibitor, etc., in the heating or cooling medium
18. Any type of occupancy type or any other facility having one or more Double-walled Heat Exchangers which use any chemical, additive, or corrosion inhibitor, etc., in the heating or cooling medium and which does not have a path to atmosphere with a readily visible discharge
19. Premises where access/entry is prohibited
Pressure Vacuum Breaker Assembly/ Spill Resistant Vacuum Breaker Assembly
1. Irrigation/Lawn Sprinkler Systems
Double Check Valve Assembly
1. Fire Protection/Sprinkler Systems (a detector type double check valve assembly is recommended on unmetered fire lines)
2. Multiple Residential Dwelling Units served by a master meter
3. Multistoried Office/Commercial Buildings (over 3 floors)
4. Jails, Prisons, and Other Places of Detention or Incarceration

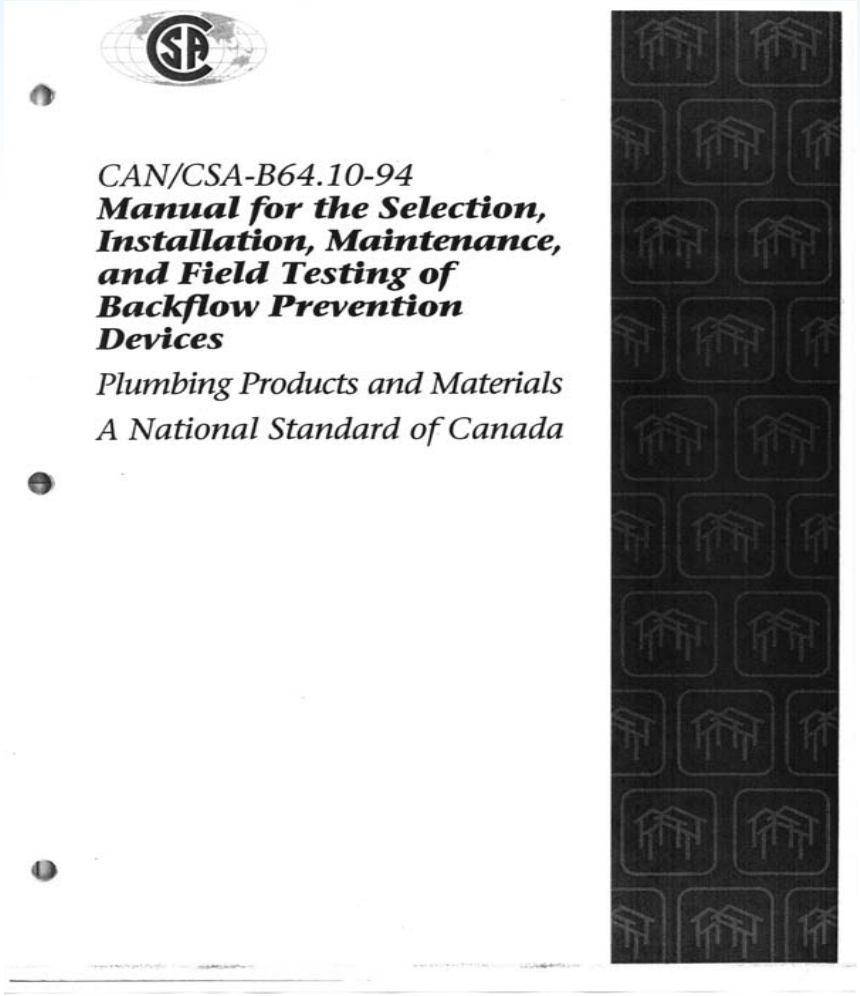
Containment

608.18.2. Other containment requirements.

Table 608.18.1 of this code above is not inclusive of all potential contamination sources which may need containment protection. For potential contamination sources not listed in this table, backflow prevention methods or devices shall be utilized in accordance with **Table B1 of CAN/CSA B64.10-1994**. When a potential contamination source and its associated backflow prevention method or device is not identified in Table 608.18.1 of this code above or **Table B1 of CAN/CSA B64.10-1994**, backflow prevention methods or devices shall be utilized:

i. as directed by the plumbing official; or

ii. as directed by the water supplier.



- For potential contamination sources not listed in this Table 608.18.1 (containment) refer to Appendix B of CAN/CSA B64.10-94 which contains a 3 ½ page list of various cross connections and customer types and the appropriate device(s) to address each hazard.

Selection Of Proper Backflow Prevention Device

Physical Characteristics of the Cross-Connection:

- Direct or Indirect Connection (is it subject to back pressure and/or back siphonage?)
- Continuous Vs. Non Continuous Pressure (are there shut-off valves downstream or will it be subjected to pressure for periods of 12 hours or more?)

Degree of Hazard:

- Non-Health Hazards (Pollutants)
- Health Hazards (Contaminants)

Backflow Prevention Assemblies and Methods

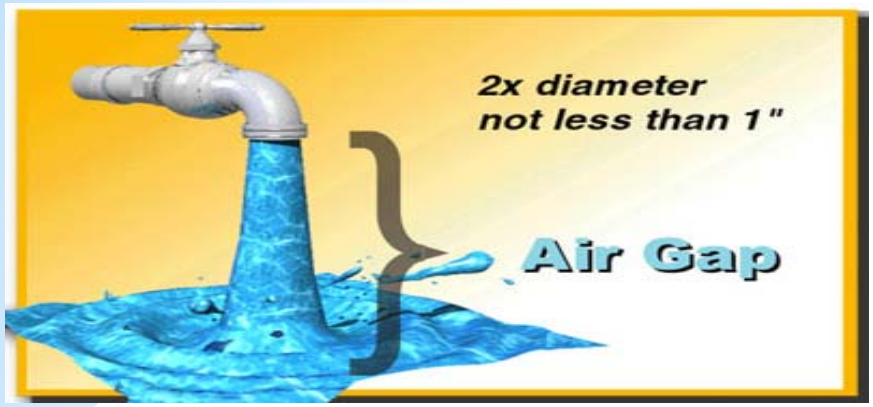
Backflow Prevention Methods:

- Air Gap Separation
- Barometric Loop

Backflow Prevention Assemblies:

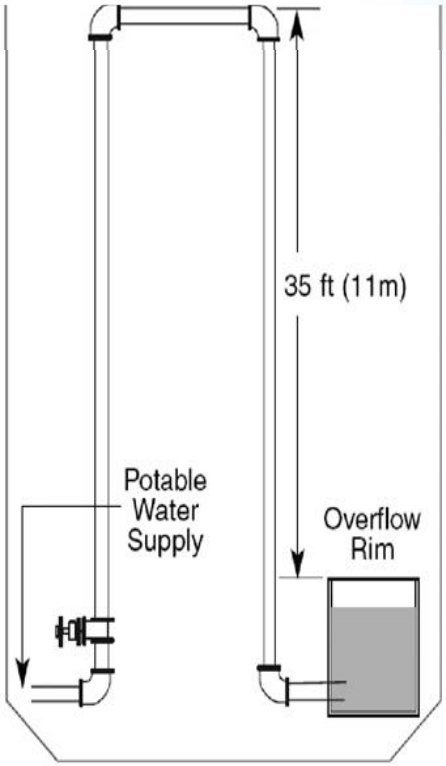
- Reduced Pressure Principle Assembly (RP)
- Double Check Valve Assembly (DC)
- Pressure Vacuum Breaker (PVB)
- Atmospheric Vacuum Breaker (AVB)

Air Gap



- Most effective method of backflow prevention.
- Used in health and non-health installations.
- Protects against back pressure and backsiphonage.

Barometric Loop

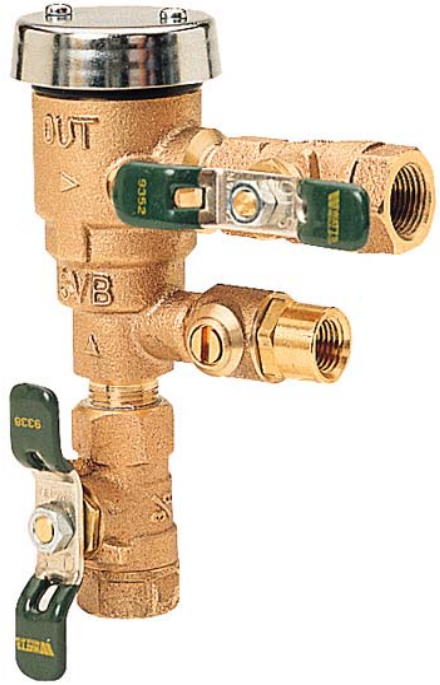


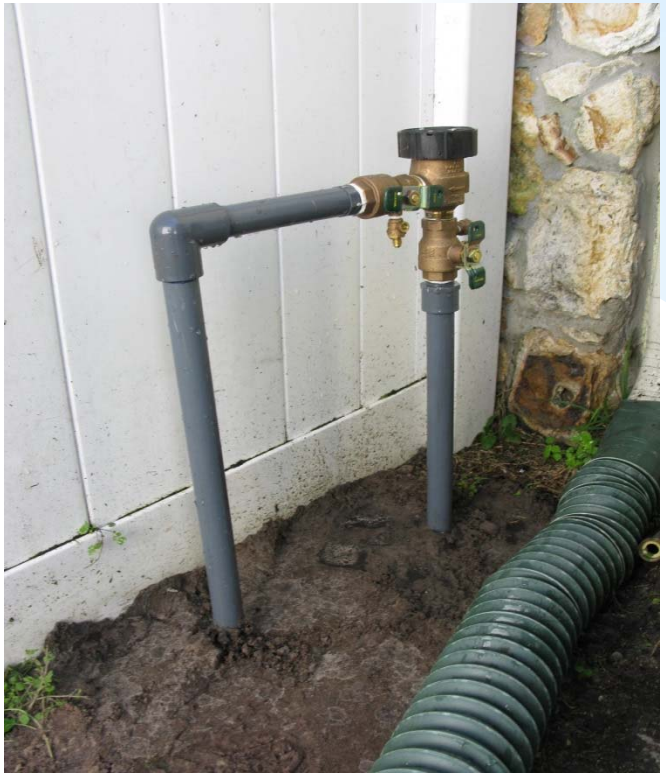
- Based on the principle that a column of water won't raise above 33.9 feet at sea-level atmospheric pressure.
- Used in health and non-health installations.
- Protects against backsiphonage only.

Atmospheric Vacuum Breakers (AVB)

- Used in health and non-health hazard installations.
- Protects against backsiphonage ONLY.
- <u>CAN'T</u> be used under constant pressure (*i.e.* no shut-off valves installed downstream of device).
- Commonly used on plumbing fixtures and hose bibs.

Pressure Vacuum Breaker (PVB)





- Used in health and non-health hazard installations.
- Protects against backsiphonage ONLY.
- Can be used under constant pressure.
- Commonly used in agricultural and irrigation installations.

Double Check Valve Assembly (DC)

- Used in non-health hazard installations.
- Protects against backsiphonage and backpressure.
- Can be used under constant pressure.
- Common installations include fire sprinkler systems, multiple residential dwelling units served by the same meter, multistoried office or commercial buildings.

Reduced Pressure (RP or RPZ)

- Used in health and non-health hazard installations.
- Provides maximum protection against backsiphonage and back pressure.
- Can be used under constant pressure.
- Common installations include carwashes, dry cleaners, funeral parlors, hospital autopsy rooms, industrial processing plants, sewage facilities, etc.

Approved Devices & Assemblies

Table 608.1 of the IPC and Table P2902.3 of the IRC			
DEVICE	**DEGREE OF HAZARD[a]**	**APPLICATION[b]**	**APPLICABLE STANDARDS**
Air gap	High or low hazard	Backsiphonage or backpressure	ASME A112.1.2
Air gap fittings for use with plumbing fixtures, appliances and appurtenances	High or low hazard	Backsiphonage or backpressure	ASME A112.1.3
Antisiphon-type fill valves for gravity water closet flush tanks	High hazard	Backsiphonage only	ASSE 1002, CSA B125.3
Backflow preventer for carbonated beverage machines	Low hazard	Backpressure or backsiphonage Sizes $^1/_4$″ – $^3/_8$″	ASSE 1022
Backflow preventer with intermediate atmospheric vents	Low hazard	Backpressure or backsiphonage Sizes $^1/_4$″-$^3/_4$″	ASSE 1012, CSA B64.3
Barometric loop	High or low hazard	Backsiphonage only	(See Section 608.13.4)
Double check backflow prevention assembly and double check fire protection backflow prevention assembly	Low hazard	Backpressure or backsiphonage Sizes $^3/_8$″-16″	ASSE 1015, AWWA C510, CSA B64.5, CSA B64.5.1
Double check detector fire protection backflow prevention assemblies	Low hazard	Backpressure or backsiphonage (Fire sprinkler systems) Sizes 2″–16″	ASSE 1048
Dual-check-valve-type backflow preventer	Low hazard	Backpressure or backsiphonage Sizes $^1/_4$″-1″	ASSE 1024, CSA B64.6
Hose connection backflow preventer	High or low hazard	Low head backpressure, rated working pressure, backpressure or backsiphonage Sizes $^1/_2$″-1″	ASSE 1052, CSA B64.2.1.1
Hose connection vacuum breaker	High or low hazard	Low head backpressure orbacksiphonage Sizes $^1/_2$″,$^3/_4$″, 1″	ASSE 1011, CSA B64.2, CSA B64.2.1
Laboratory faucet backflow preventer	High or low hazard	Low head backpressure and backsiphonage	ASSE 1035, CSA B64.7
Pipe-applied atmospheric-type vacuum breaker	High or low hazard	Backsiphonage only Sizes $^1/_4$″-4″	ASSE 1001, CSA B64.1.1
Pressure vacuum breaker assembly	High or low hazard	Backsiphonage only Sizes $^1/_2$″-2″	ASSE 1020, CSA B64.1.2
Reduced pressure principle backflow prevention assembly and reduced pressure principle fire protection backflow prevention assembly	High or low hazard	Backpressure or backsiphonage Sizes $^3/_8$″-16″	ASSE 1013, AWWA C511, CSA B64.4, CSA B64.4.1
Reduced pressure detector fire protection backflow prevention assemblies	High or low hazard	Backsiphonage or backpressure (Fire sprinkler systems)	ASSE 1047
Spill-resistant vacuum breaker assembly	High or low hazard	Backsiphonage only Sizes $^1/_4$″-2″	ASSE 1056
Vacuum breaker wall hydrants, frost-resistant, automatic draining type	High or low hazard	Low head backpressure or backsiphonage Sizes $^3/_4$″, 1″	ASSE 1019, CSA B64.2.2

Field Testing Requirements

Section 312.10 of the 2012 IPC and Section P2902.8 of the 2012 IRC:

- Annual inspections shall be made of all backflow prevention assemblies and air gaps to determine whether they are operable, properly installed and maintained, and meet testing/code requirements. Inspections of backflow prevention devices including air gaps used to protect high degree of hazard cross connections shall be documented in writing and the report provided to the owner of the backflow prevention device.

- Reduced pressure principle, double check, pressure vacuum breaker, reduced pressure detector fire protection, double check detector fire protection, and spill-resistant vacuum breaker backflow preventer assemblies shall be tested at the time of installation, immediately after repairs or relocation and at least annually……

Installation, Testing and Repairer Qualifications

New Section added to LAC 51:XII by the DHH Emergency Rule to address Act 836.

§346. Installer, Repairer, Tester and Maintainer Qualifications

A. Installer/Repairer/Maintainer Qualifications. Backflow preventers shall be installed, repaired and/or maintained by a State Plumbing Board of Louisiana (SPBLA)-licensed plumber who holds a SPBLA water supply protection specialist endorsement on his/her plumbing license pursuant to LSA - R.S. 37:1361 et seq. and its implementing regulations (LAC 46:LV.101 et seq.). Backflow preventers associated with a landscape irrigation system may be installed, repaired and/or maintained by a Horticulture Commission of Louisiana-licensed landscape irrigation contractor who holds a SPBLA-issued special water supply protection specialist endorsement in accordance with R.S. 3:3808.P. Backflow preventers located on public property or otherwise under the complete control of the water supplier (for example, water meter and the piping upstream of the water meter, if provided), may be installed, repaired and/or maintained by a Backflow Prevention Assembly Repairer who meets the ASSE 5130-2009 (Backflow Prevention Assembly Repairer Professional Qualification Standard) or other individuals holding a backflow prevention assembly repairer certificate from a nationally recognized backflow certification organization approved by the state health officer.

B. Field Tester Qualifications. Backflow preventers shall be tested by a State Plumbing Board of Louisiana (SPBLA)-licensed plumber who holds a SPBLA water supply protection specialist endorsement on his/her plumbing license pursuant to LSA - R.S. 37:1361 et seq. and its implementing regulations (LAC 46:LV.101 et seq.)*;* or, by a Backflow Prevention Assembly Tester who meets ASSE 5110-2009 (Backflow Prevention Assembly Tester Professional Qualification Standard), or other individuals holding a testing certificate from a nationally recognized backflow certification organization approved by the state health officer. Backflow preventers associated with a landscape irrigation system may be tested by a Horticulture Commission of Louisiana-licensed landscape irrigation contractor who holds a SPBLA-issued special water supply protection specialist endorsement in accordance with R.S. 3:3808.P.

Installation, Testing and Repairer Qualifications

Qualifications Summary:

1. **DHH Approved General Tester –** Can only test.

2. **SPBLA Licensed plumber who holds a Water Supply Protection Specialist (WSPS) endorsement –** Can install, test, and repair.

3. **Horticulture Commission of Louisiana-licensed landscape irrigation contractor who holds a SPBLA-issued WSPS endorsement –** Can install, test, and repair backflow preventers associated with a landscape irrigation system.

Sanitary Surveys

- A sanitary survey is a federally mandated review of a PWS's water source, facilities, equipment, operation, and maintenance.
- Designed to point out sanitary deficiencies and assess a system's capability to supply safe drinking water.
- Sanitary surveys lower the risk of waterborne disease and identify systems that require technical or capacity development.

Sanitary Surveys

Eight areas are evaluated for compliance:

1. water sources;
2. treatment;
3. **distribution systems;**
4. finished water storage;
5. pumps, pump facilities and controls;
6. monitoring, reporting and data verification;
7. water system management and operations; and
8. operator compliance with state requirements.

EPA Sanitary Survey Guidance Manual

Common Questions:

General

- Does the system have an active cross-connection control program?
- How is the program administered? (In house, by contract with the water supplier (wholesaler), coordination with a local agency, or by another authority?)

EPA Sanitary Survey Guidance Manual

Ordinance or Rules of Service

- Has the system adopted an enforceable cross-connection control ordinance or rules of service?
- Are users who are in noncompliance with the cross-connection ordinance or rules of service given written notice to make corrections? What procedures are used when corrections are not made by users?

Program Management

- Does the system (or the responsible authority) have personnel with expertise and authority to carry out the cross-connection control program?

EPA Sanitary Survey Guidance Manual

Cross-Connection Surveys

- Has the system conducted a CCC survey on their system to identify potential issues with existing customers?
- Are new services reviewed to establish the need for backflow protection? If yes, what is the procedure and who is responsible for review?
- How are bulk water users (hydrant meters, water tankers) addressed? Are hydrant meters equipped with backflow devices and water tankers surveyed?

EPA Sanitary Survey Guidance Manual

Device Testing and Maintenance

- Are all backflow devices tested on an annual basis?
- Who tests the backflow devices?
- Does the system (or someone else) maintain installation, inspection, and testing records for devices?

Useful Links

- **DHH-OPH-Engineering Services, Safe Drinking Water Program:** http://new.dhh.louisiana.gov/index.cfm/page/549/n/281
- **LAC Title 51 – Public Health Sanitary Code:** http://doa.louisiana.gov/osr/lac/books.htm
- **Part XII Emergency Rule:** http://new.dhh.louisiana.gov/assets/oph/Center-EH/engineering/Part_XII_ER_on_Cross_Connection_Control_02232016.pdf
- **Compilation of IPC and IRC BF/CCC Requirements (as amended):** http://new.dhh.louisiana.gov/assets/oph/Center-EH/engineering/IPC-IRC_Backflow_Protection_Requirements.pdf
- **List of Louisiana Approved General Testers:** http://new.dhh.louisiana.gov/assets/oph/Center-EH/engineering/LA_Approved_General_Testers.pdf
- **Licensed Plumbers and Irrigation Contractors with WSPS Endorsement:** http://www.spbla.com/rosters.asp
- **Reduction of Lead Fact Sheet:** http://new.dhh.louisiana.gov/assets/oph/Center-EH/engineering/LaLeadRductnFactSheet.pdf

Additional Resources

- University of Southern California (USC) Foundation on Cross Connection Control and Hydraulic Research - Manual of Cross Connection Control
- American Water Works Association (AWWA) - Recommended Practice for Backflow Prevention and Cross Connection Control
- American Society of Sanitary Engineering (ASSE) - Guide to Cross Connection Protection Devices and Assemblies – Application and Selection of Devices
- International Association of Plumbing and Mechanical Officials (IAPMO) – Backflow Prevention Reference Manual
- University of Florida TREEO Center – Backflow Prevention Theory and Practice

Any questions ?

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