Basic Cross Connection Control Seminar

Introduction to Cross Connections

EGLE

What is a Cross-Connection?

"A connection or arrangement of piping or appurtenances through which a backflow could occur."

Or

"Any piping arrangement which allows a potable water system to be connected to a non-potable system."

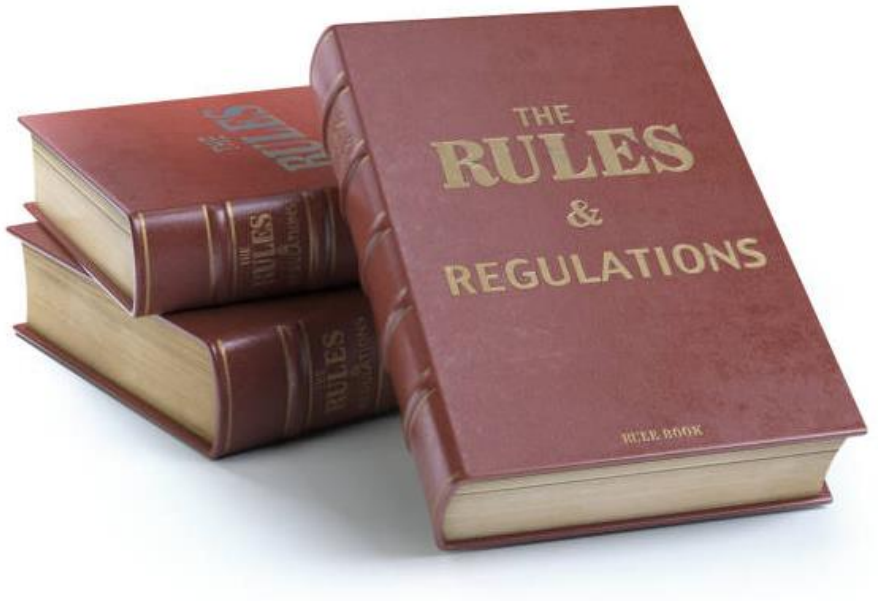
EGLE

Why are Cross Connections a Concern?

- Public Health Hazard
- Cross-connections are the links through which contaminating materials may enter a potable water supply
- Can cause water quality complaints, illness, sickness and even death

Laws and Rules & Guidance

- Part 14 of Act 399 requires PWS's to have an ordinance and program to look for and eliminate cross connections



- Michigan Plumbing Code

- "DEQ Cross Connection Manual"

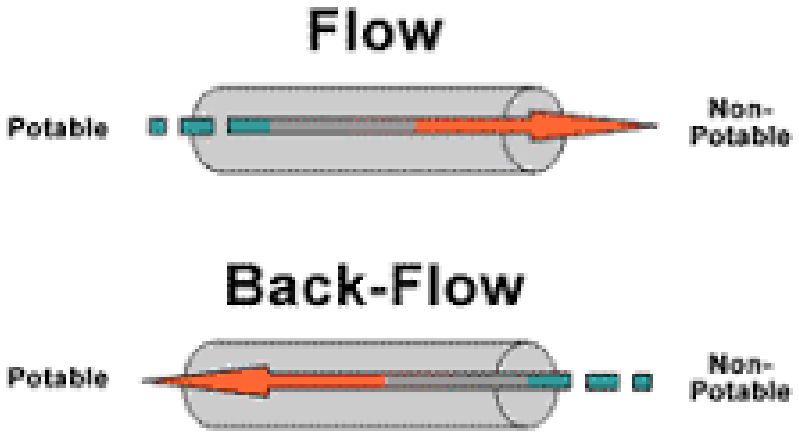
Other Cross Connection Terms

- Backflow
  - Backpressure
  - Backsiphonage
- High Hazard vs. Low Hazard
- Testable vs. Non-Testable
- Inspections vs. Testing

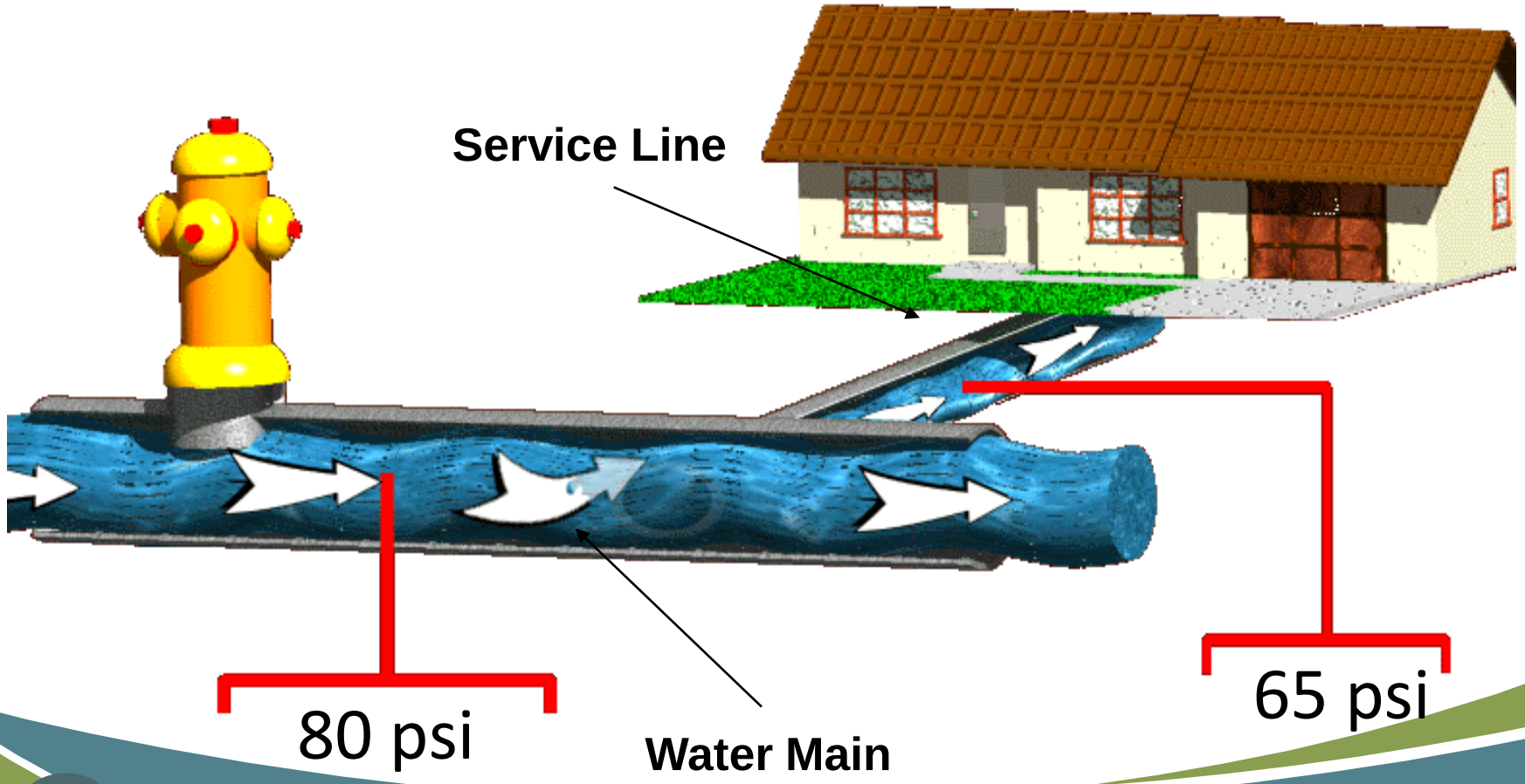
Backflow

The undesirable reversal of flow of water or other substances into the potable water distribution supply.

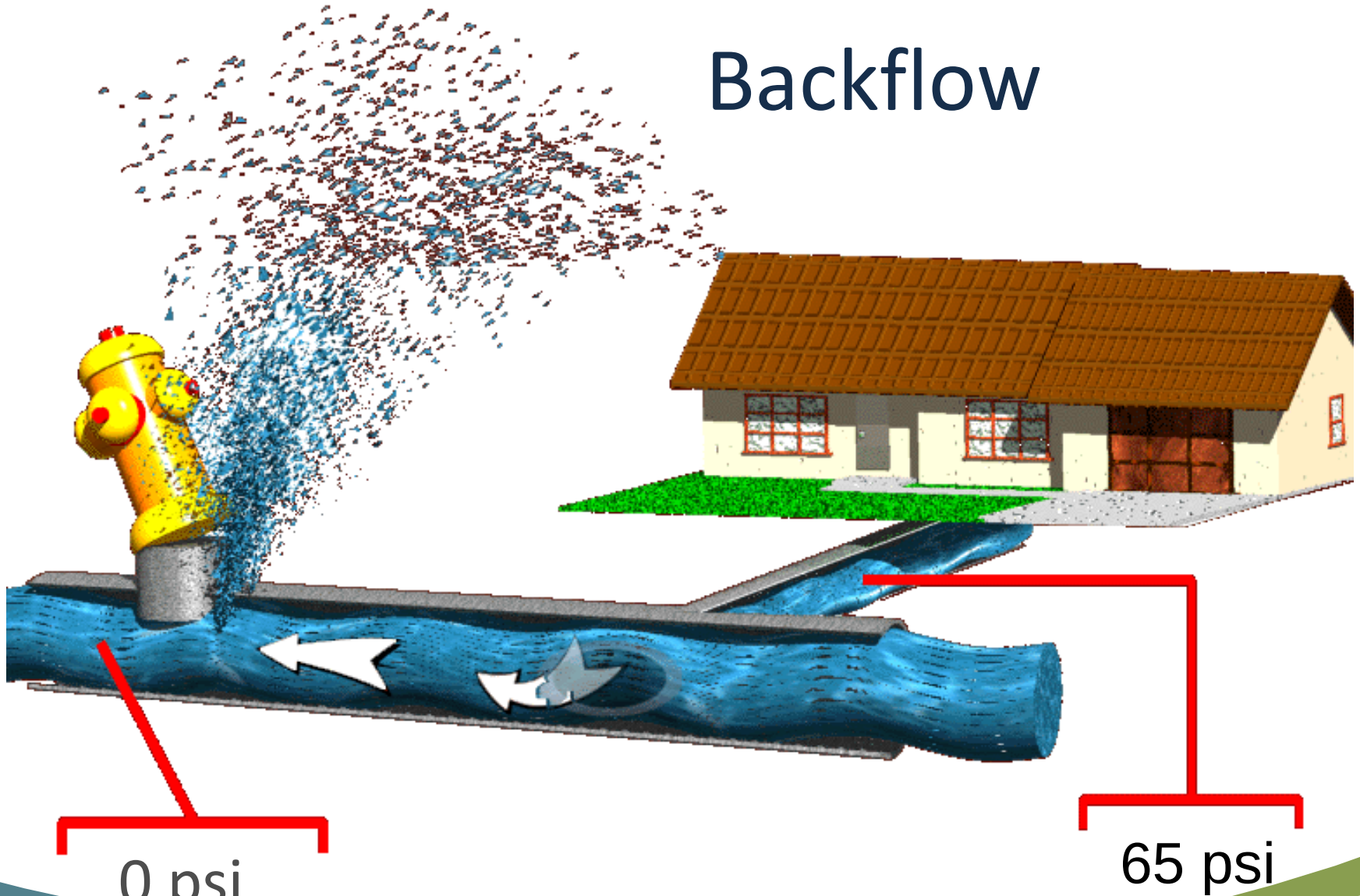
It can be caused by backpressure, backsiphonage or combination of both.



Normal Flow

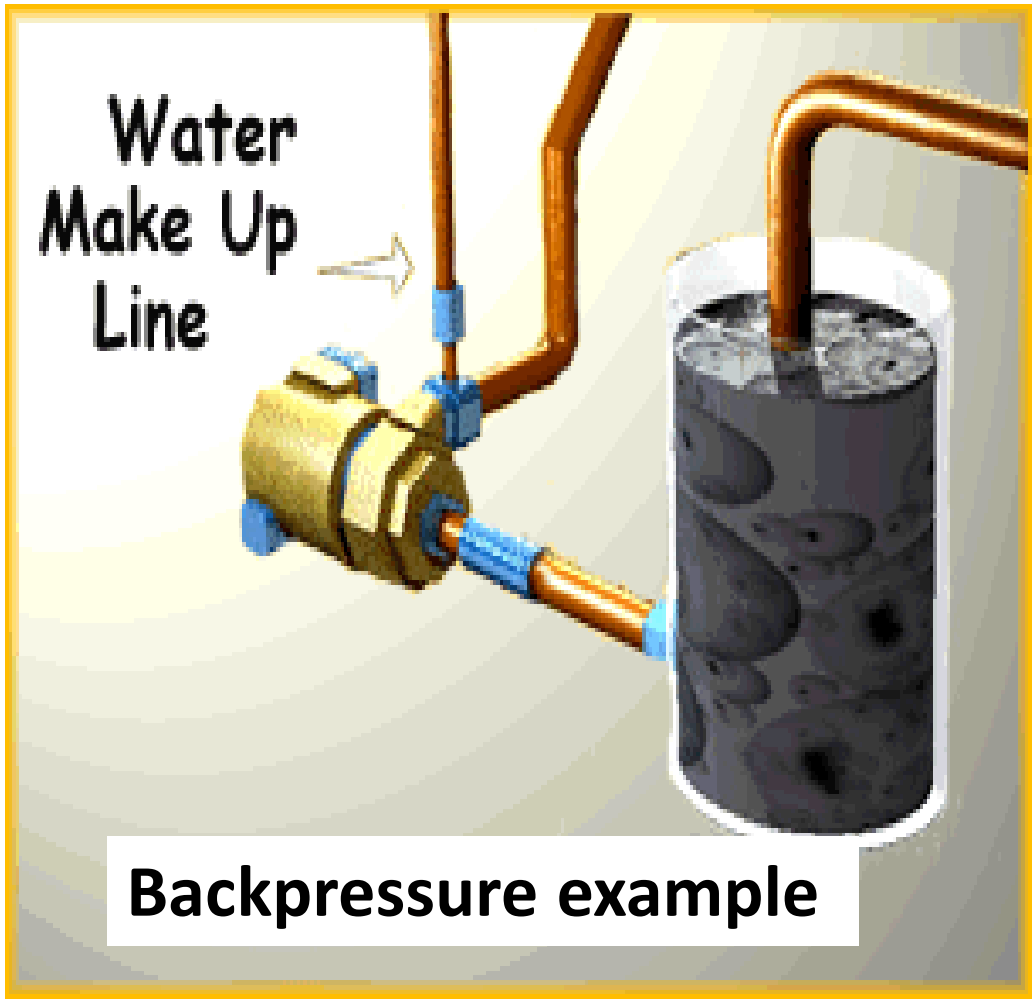


Backflow



Backpressure

- Is the reversal of normal flow caused by the downstream pressure exceeding the upstream pressure in the potable water lines.
- Common Causes:
  - Pumps
  - Boilers
  - Elevation differences

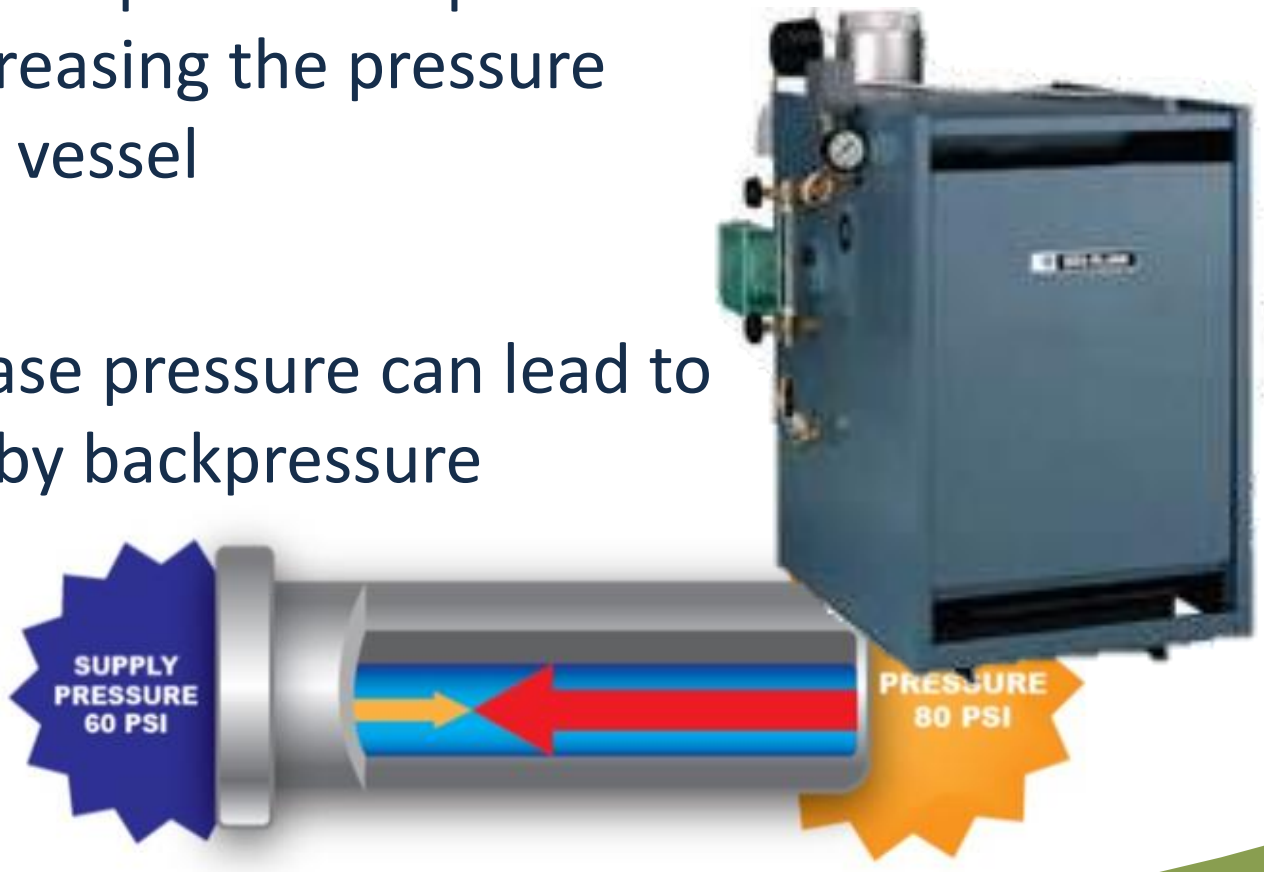


Backpressure example

Backpressure - Boilers

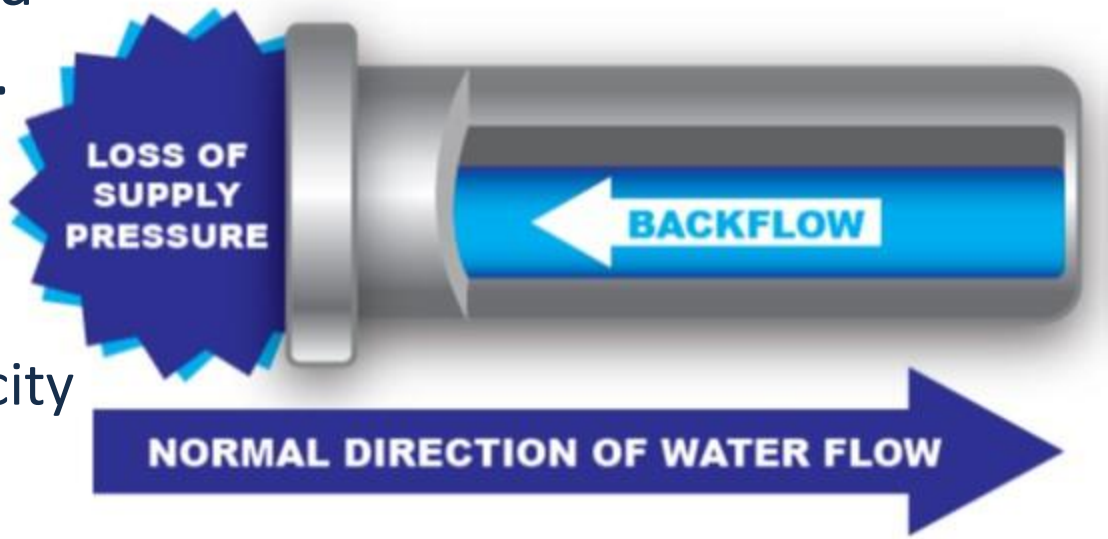
- Boilers heat up water to produce steam increasing the pressure inside the vessel

- The increase pressure can lead to backflow by backpressure



Backsiphonage

- Is the reversal of normal flow caused by a vacuum or partial vacuum in a water supply system.



- Common Causes:
  - Poor Hydraulic Capacity
  - Water Main Breaks
  - Fire Demands

Backsiphonage by Heavy Demands

Fire Fighting

Water Main Breaks

Backpressure or Backsiphonage??

EGLE

High Hazard vs. Low Hazard

Health Hazard = High Hazard
(Contaminant)

Non-Health Hazard = Low Hazard
(Pollutant)

Does your water taste or smell bad?

EGLE

High Hazard vs. Low Hazard

Typical High Hazard

- WWTPs
- Funeral Homes
- Dentist Offices
- Car Washes
- Plating & Chemical Plants
- Laboratories
- Marinas
- Hospitals
- Restaurants & Taverns
- Chemically Treated Boilers
- Chemically Treated Lawn Irrigation System
- Fire Suppression with Additives
- Sumps

Typical Low Hazards

- Offices
- Fire Suppression Systems (with no additives)
- Residential (with no lawn sprinkling)
- Low Pressure Untreated Boilers

Testable vs. Non-Testable

- Testable Assemblies can and must be tested routinely to assure they are working properly. Assemblies will have test cocks and isolation valves for performing the test.
  - RPZ, DCVA, PVB

- Non-Testable Devices are not designed to be tested and are not required to be tested.
  - AVB, HBVB, Vented DCVA

Testable vs. Non-Testable

Testable

Non-Testable

Inspections vs. Testing

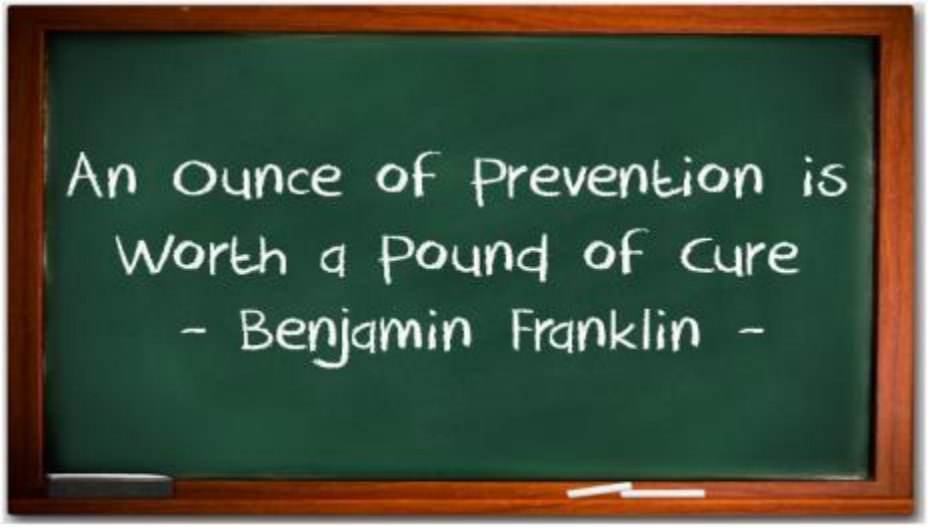
Inspections: Usually done by municipal personnel or their contractor to identify potential cross connections.

Testing: Usually done buy a plumbing company hired by the customer to ensure assemblies are working properly.

EGLE

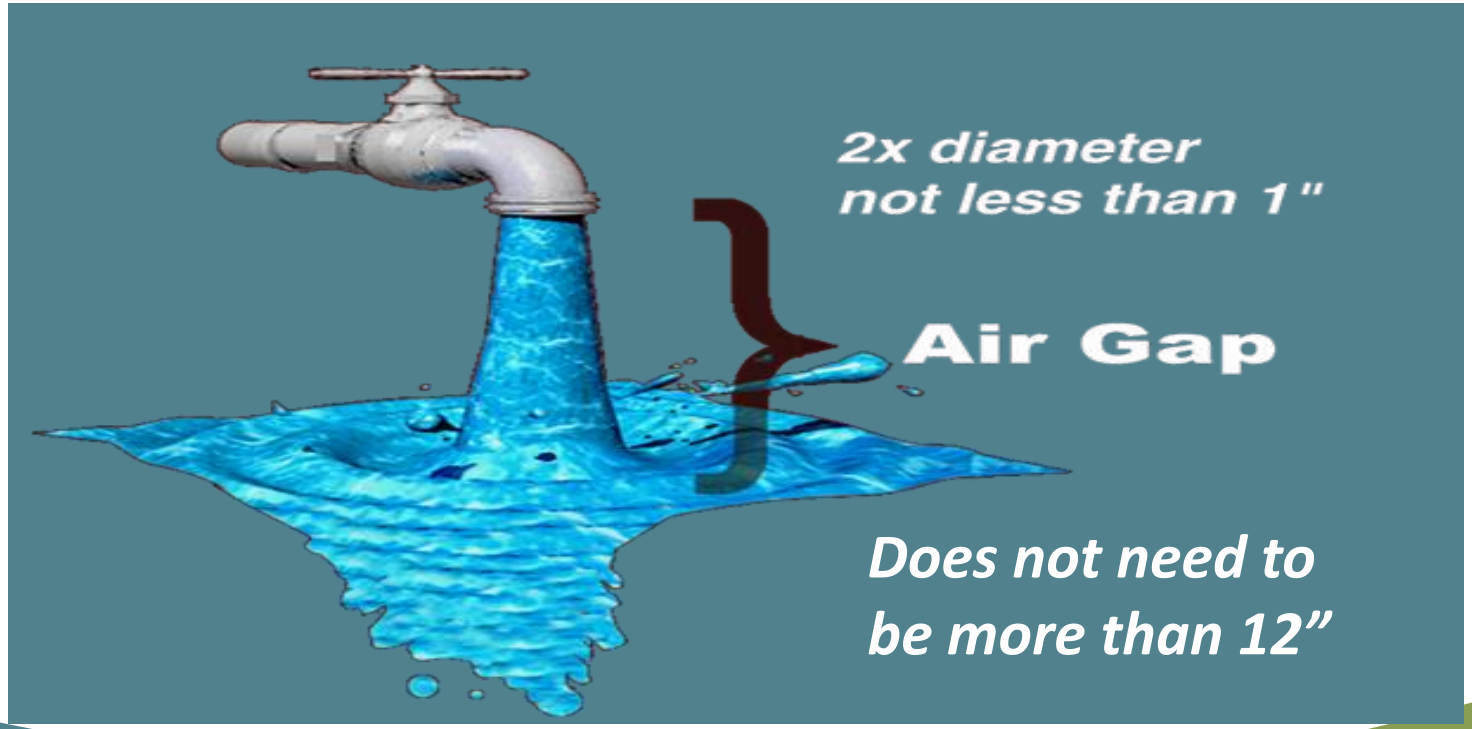
Five Means of Preventing Backflow

- Air Gap Separation
- Reduced Pressure Principle Assembly
- Double Check Valve Assembly
- Pressure Vacuum Breaker
- Atmospheric Vacuum Breaker

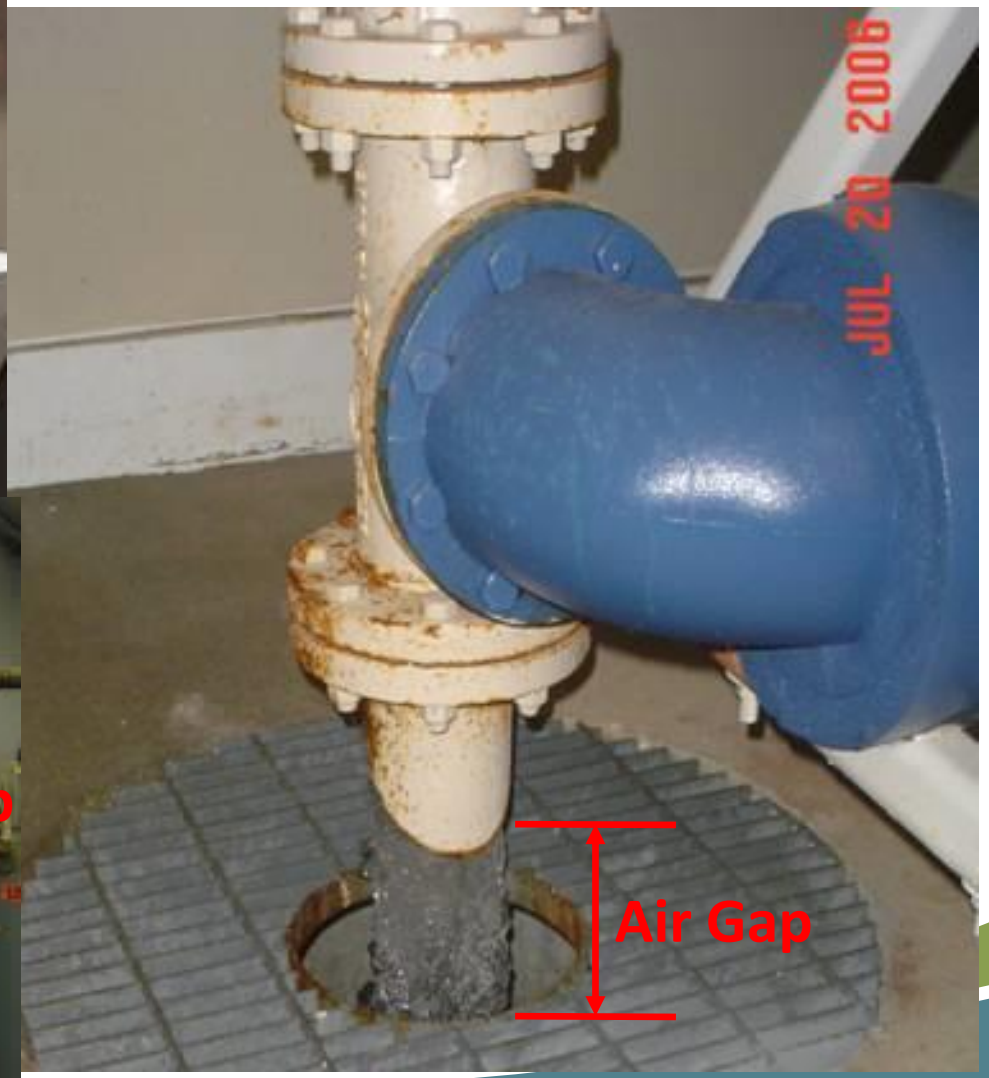


Air Gap

- The physical separation between the discharge end of a potable water pipe and the top (flood rim) of an open receiving vessel



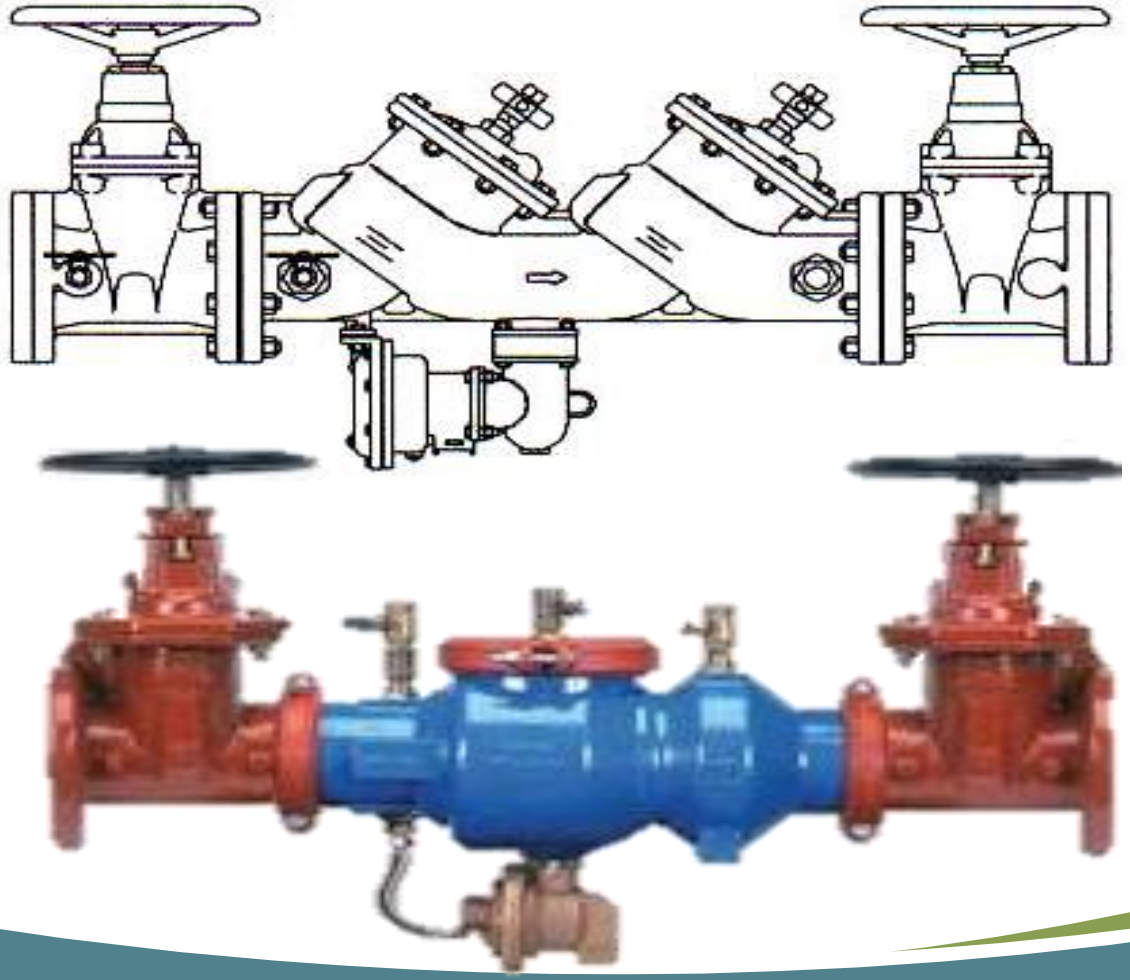
More Air Gaps



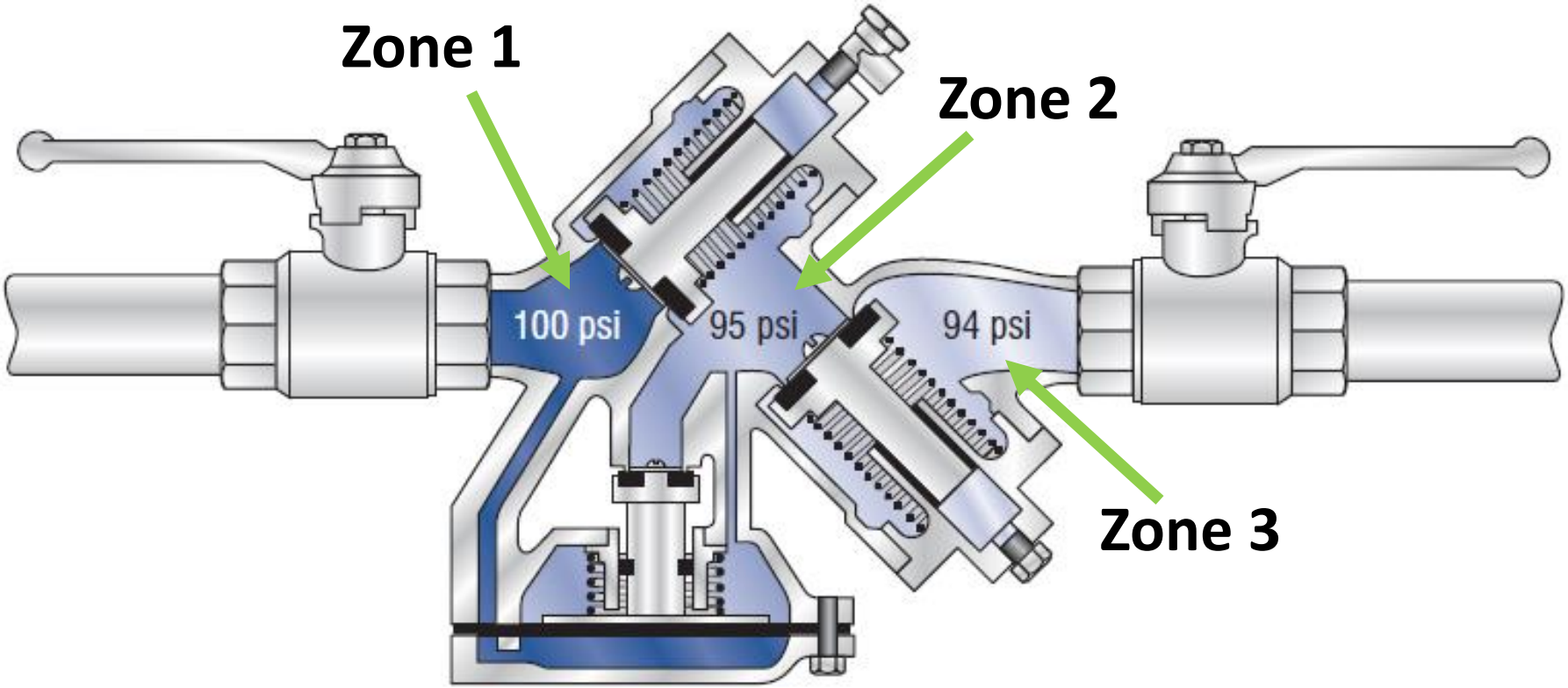
Air Gaps “Devices”

EGLE

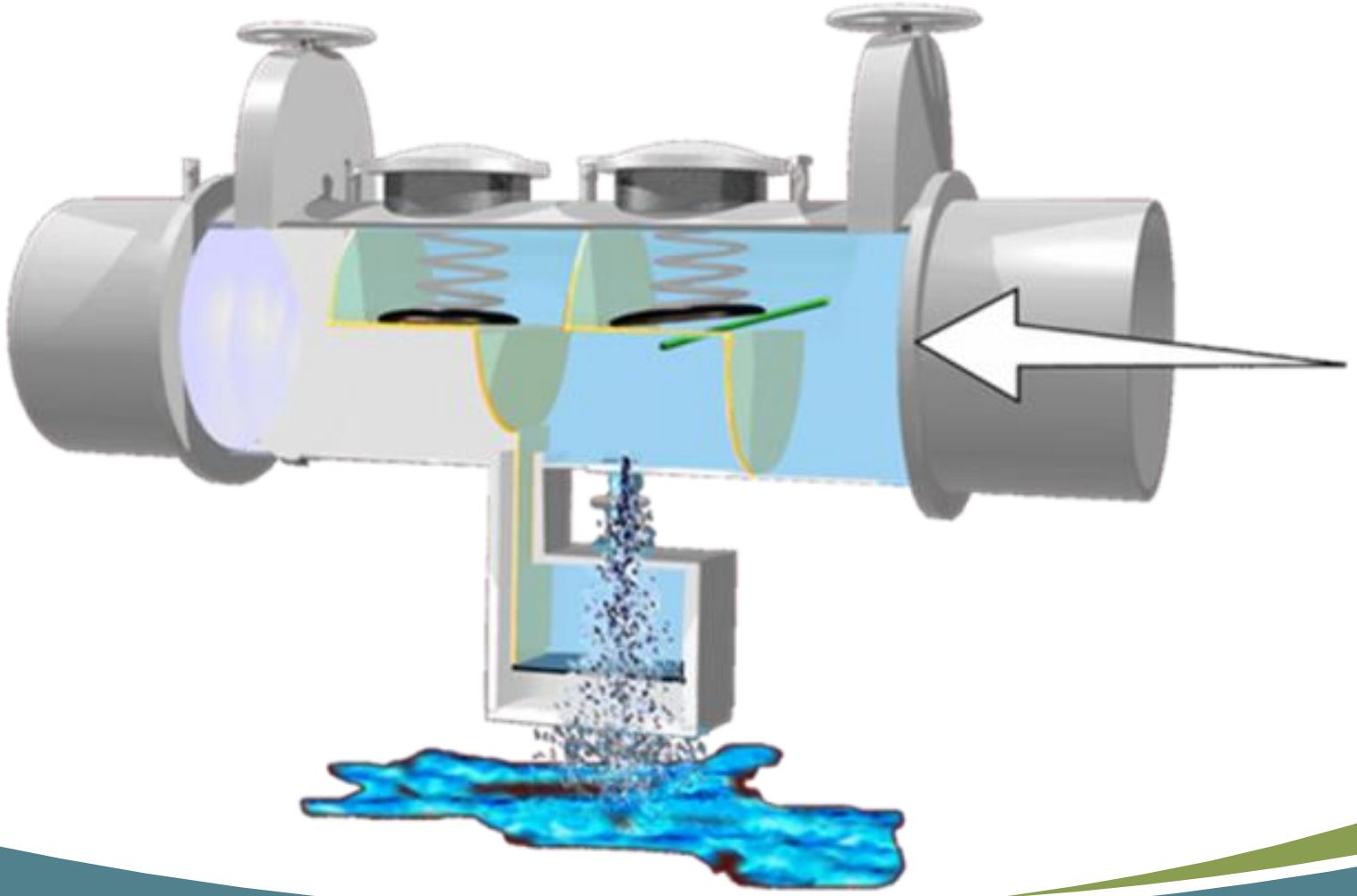
Reduced Pressure Principle Backflow Preventer Assembly (RPZ)



RPZ – Normal Flow



RPZ – 2nd Check Valve Fouled



RPZ – Applications

Applications:

- Backpressure
- Backsiphonage
- Low Hazard (Pollutant)
- High Hazard (Contaminant)

RPZ - Installation Recommendations

- Install Assembly Downstream of Meter - they can waste some water.
- Must be installed above grade - relief port cannot be flooded.
- Provide adequate room for testing, repair and maintenance.
- Can be Horizontal or Vertical Installations.
- Try to install about waist high for easy maintenance.
- Protect from Vandalism, Flooding and Freezing.

RPZ – Good Installations

Warm Climates

Cold Climates

Interior

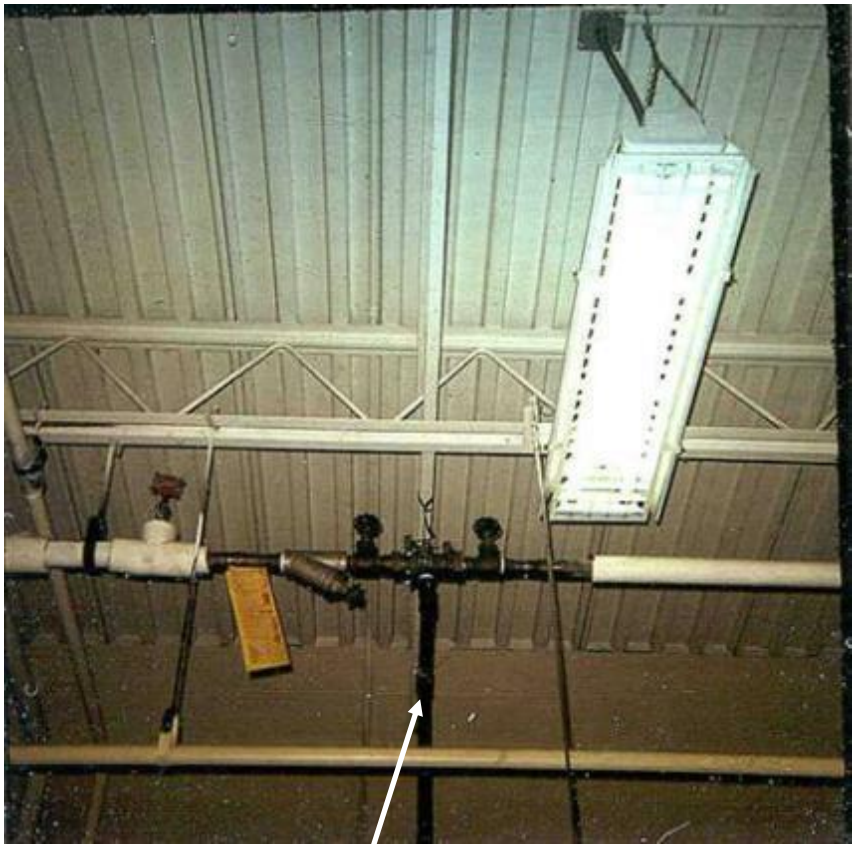
Not so Good Installations

How are these RPZs going to be tested or repaired?

Approved Installation?

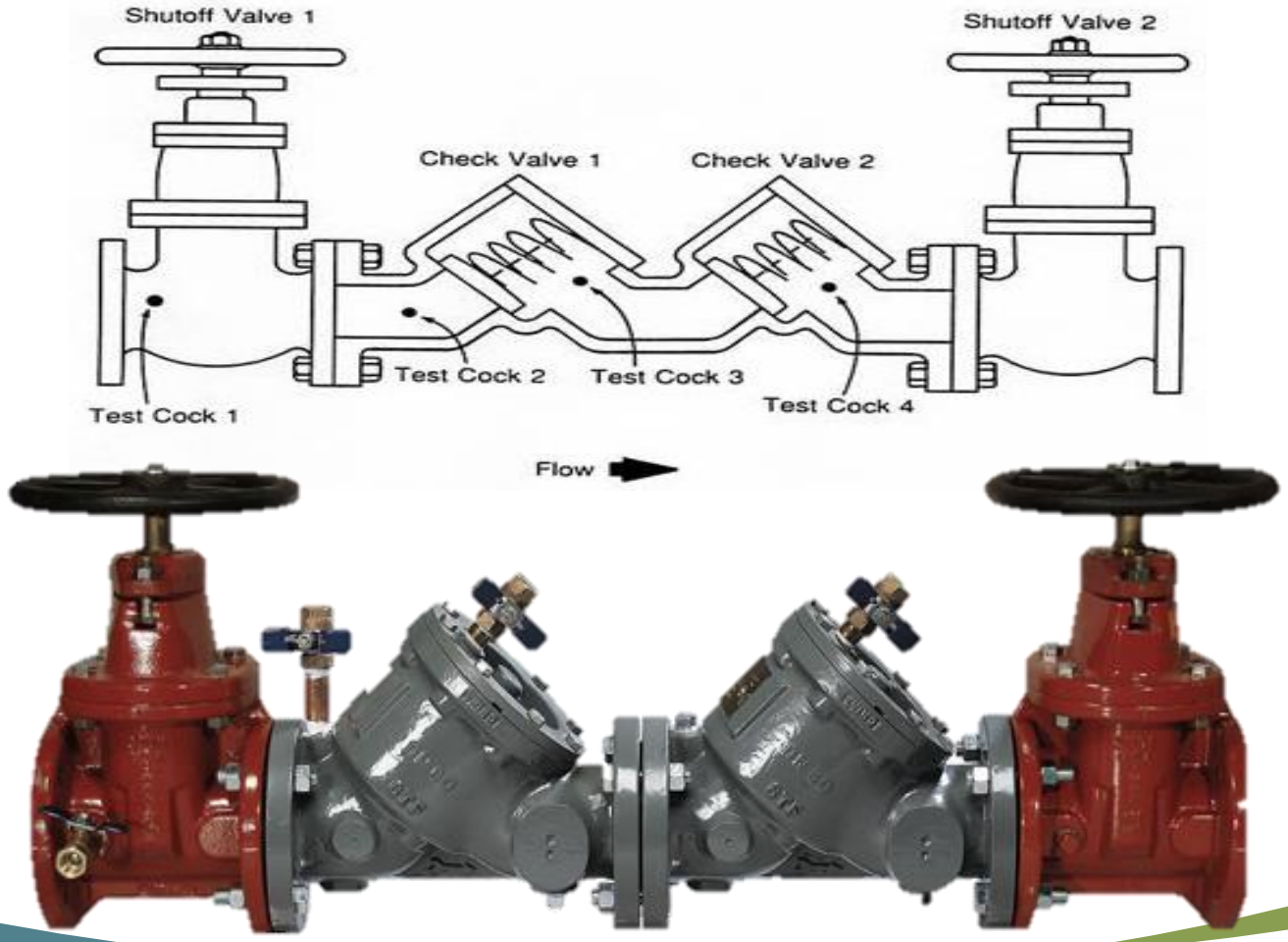
RPZ Discharge Ports

Proper Air Gap

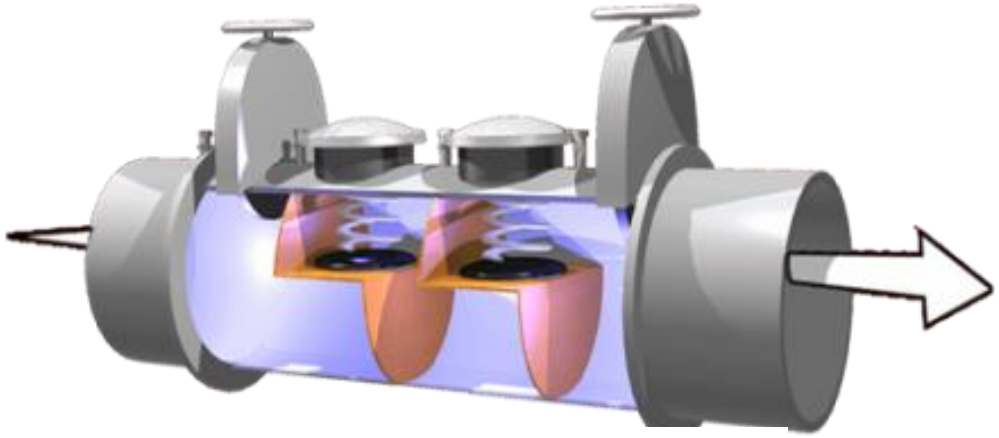


Air Gap?

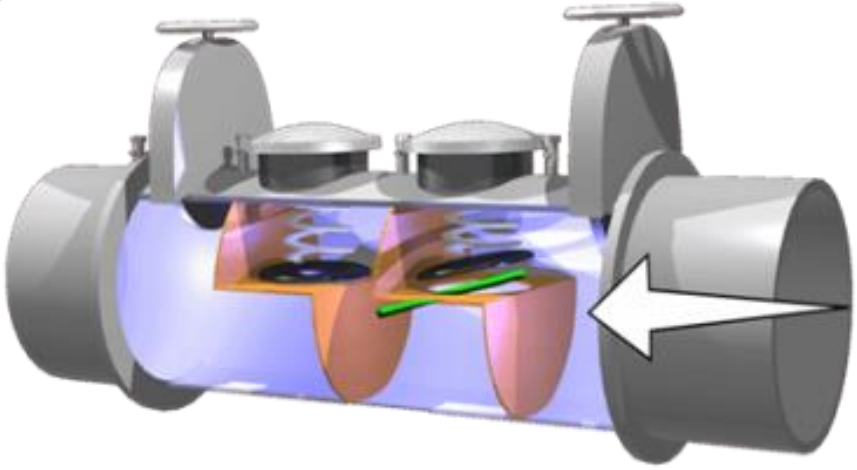
Double Check Valve Assembly (DCVA)



Double Check Valve Assembly (DCVA)



Normal Flow



Backpressure with Second Check Fouled

EGLE

Double Check Valve Assembly (DCVA)

Applications:

- Backsiphonage
- Backpressure
- Low Hazard Only (Pollutants)!

Typical Uses:

- Beverage Dispensing Equipment
- Untreated Boilers
- Untreated Fire Suppression Systems

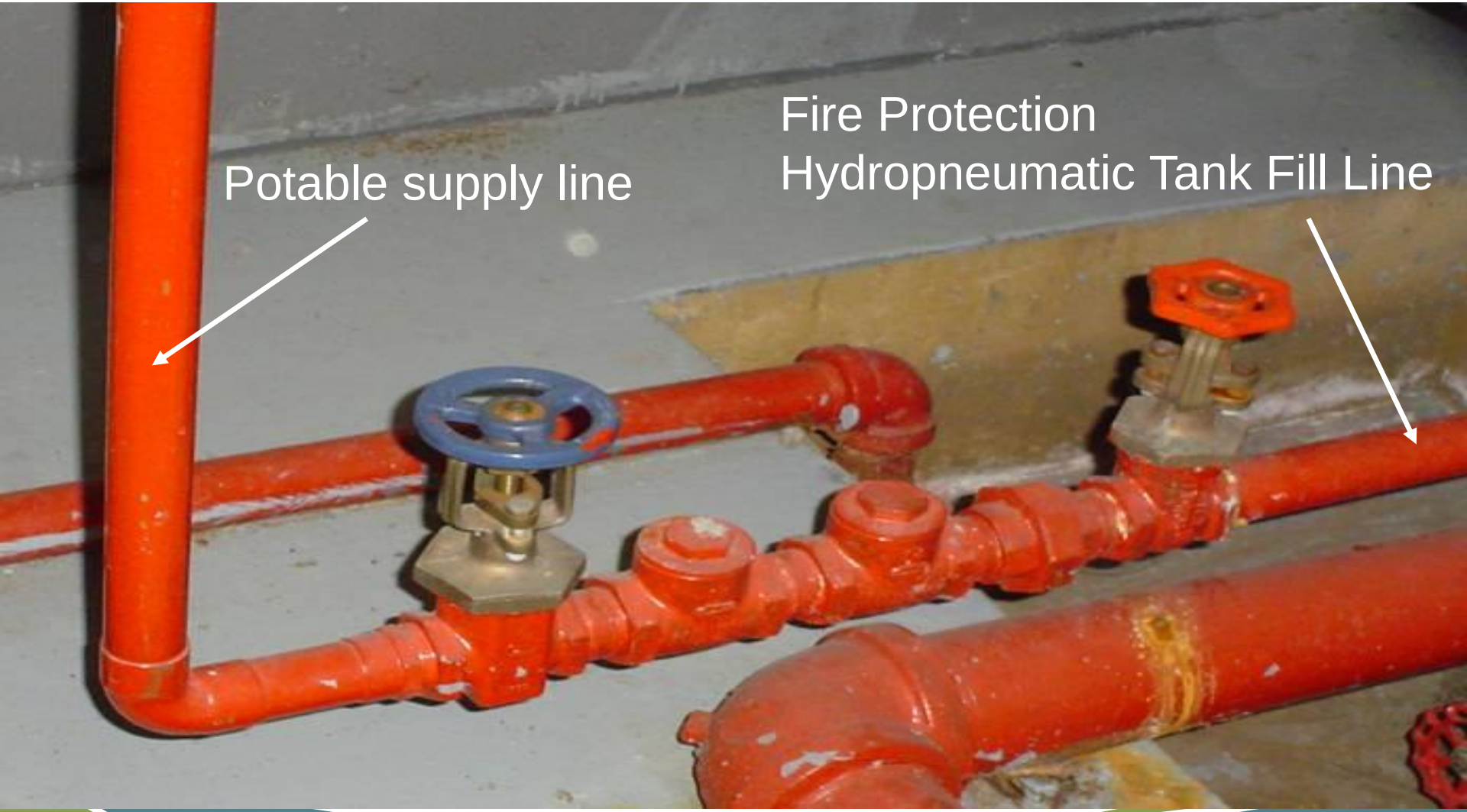
Non-testable Double Check Valve Devices

- NOT the same as an assembly

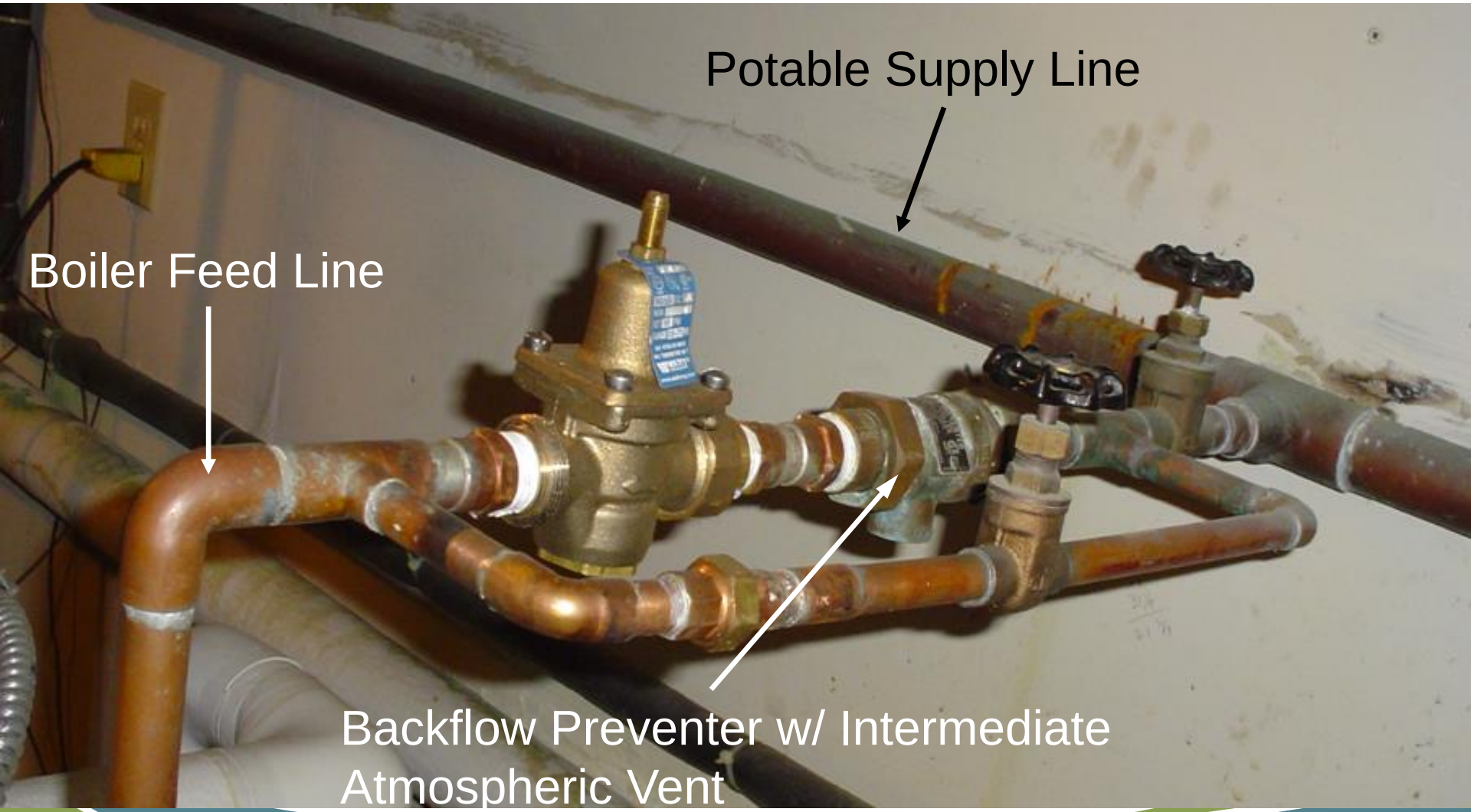
- Dual Check Valve for Carbonated Beverage Dispensers (ASSE #1022)

- Backflow Preventer with Intermediate Atmospheric Vent (ASSE #1012)

Approved Assembly?

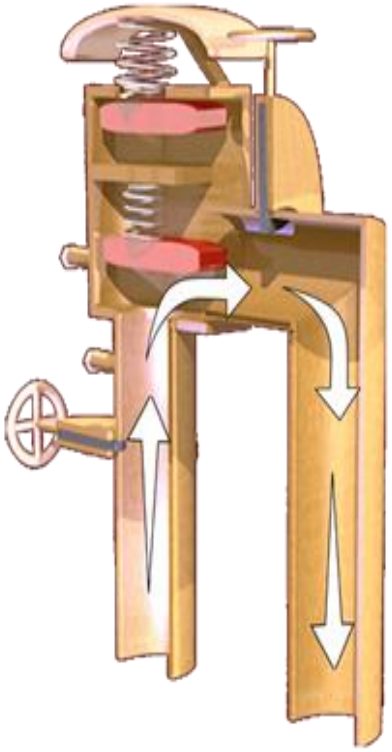


Is this Adequate Protection?

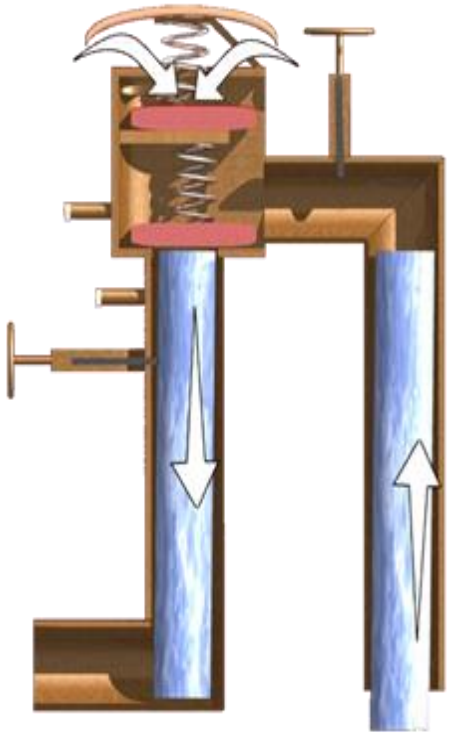


Pressure Vacuum Breakers (PVB)

Pressure Vacuum Breakers (PVB)



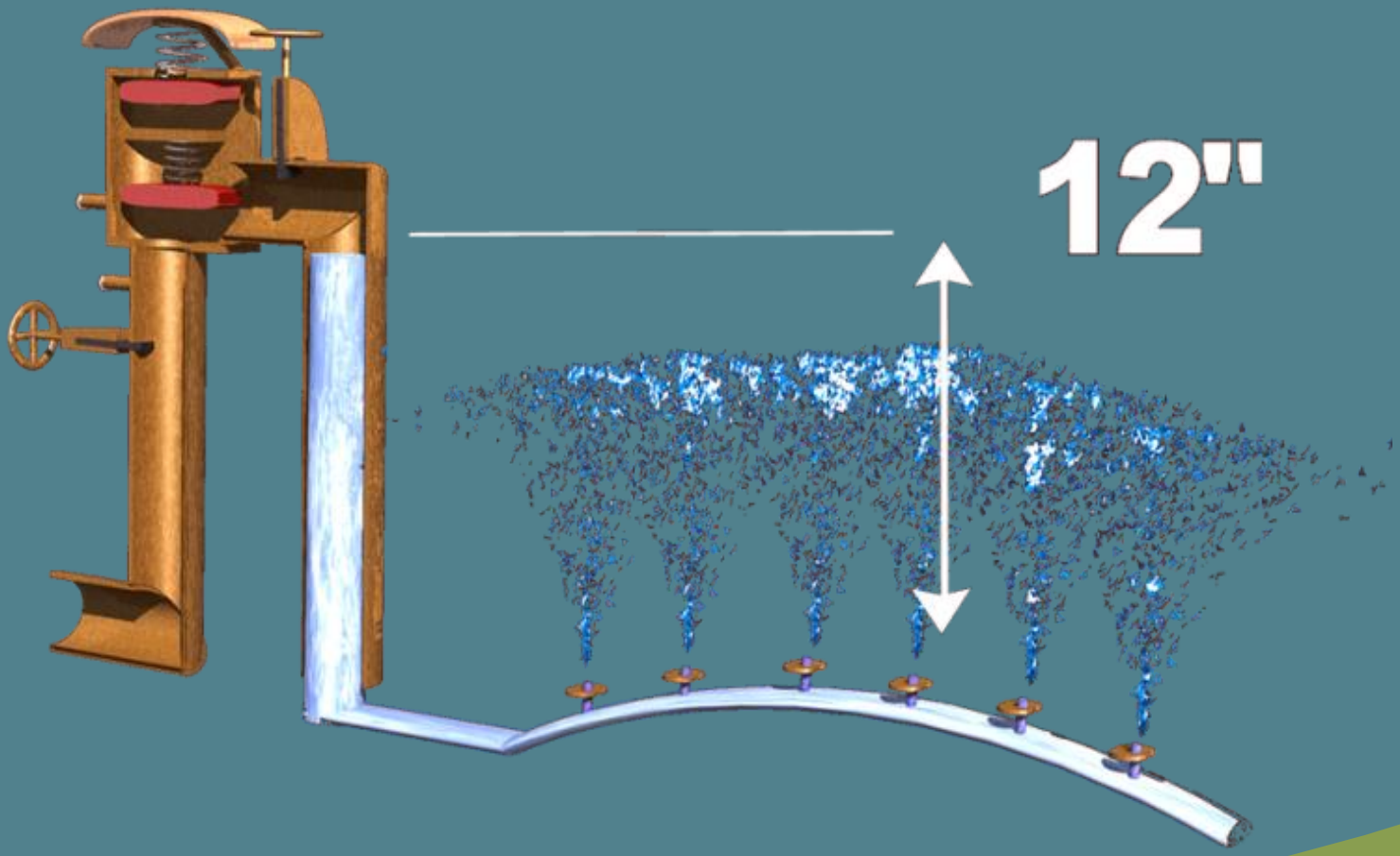
Normal Flow



Backsiphonage Condition

Downstream valves are allowed!

Pressure Vacuum Breaker



Pressure Vacuum Breaker

Applications

- Backsiphonage ONLY
- Low hazard (Pollutant)
- High hazard (Contaminant)
- Must be ≥12” Above Highest Point of Use
- Downstream shut-off valves allowed
- Must be Installed in Vertical Position

Typical Uses

- Marina Dock Water Supply
- Funeral Homes
- Lawn Irrigation Systems

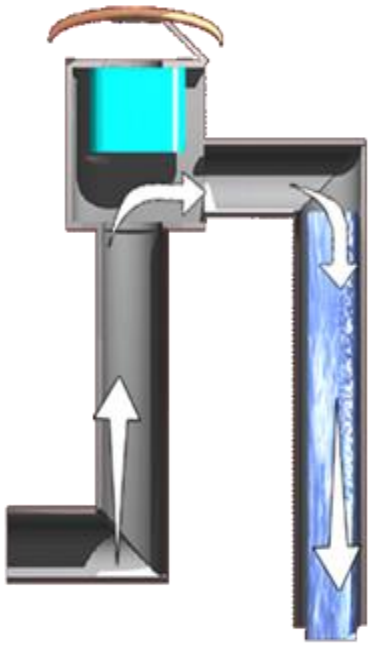
Note: Spill-Resistant PVB’s are available for indoor installations

EGLE

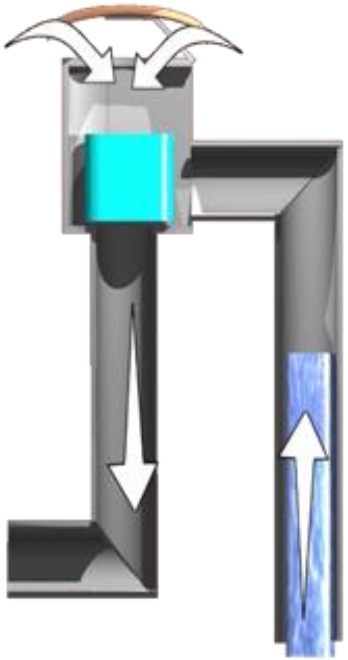
Is This a Proper Installation?

Atmospheric Vacuum Breakers (AVBs)

Atmospheric Vacuum Breakers (AVBs)



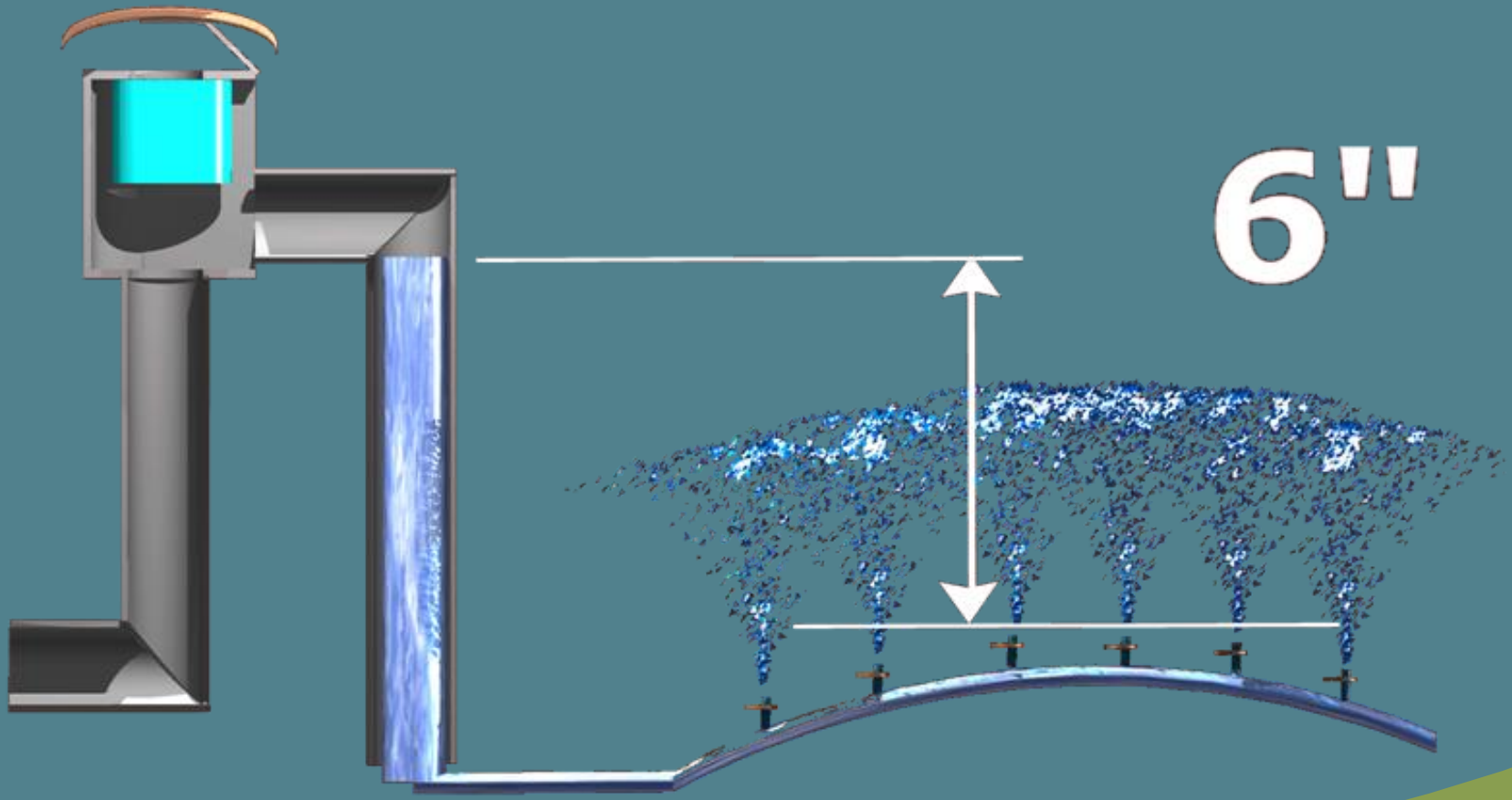
Normal Flow



Backsiphonage Condition

No downstream valves allowed!

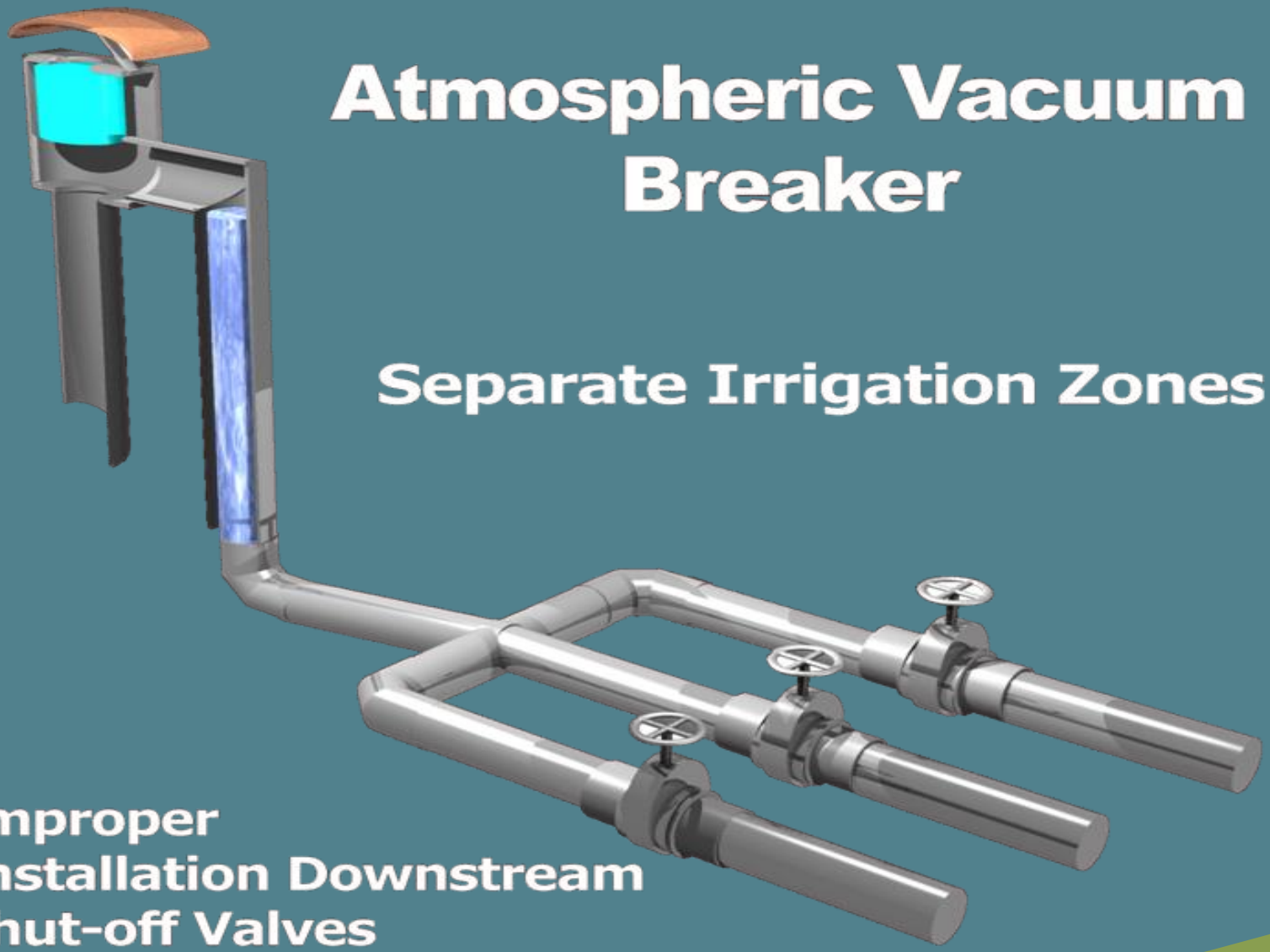
Atmospheric Vacuum Breaker



EGLE

Atmospheric Vacuum Breaker

Separate Irrigation Zones



Improper Installation Downstream Shut-off Valves

EGLE

Atmospheric Vacuum Breakers:

Applications:

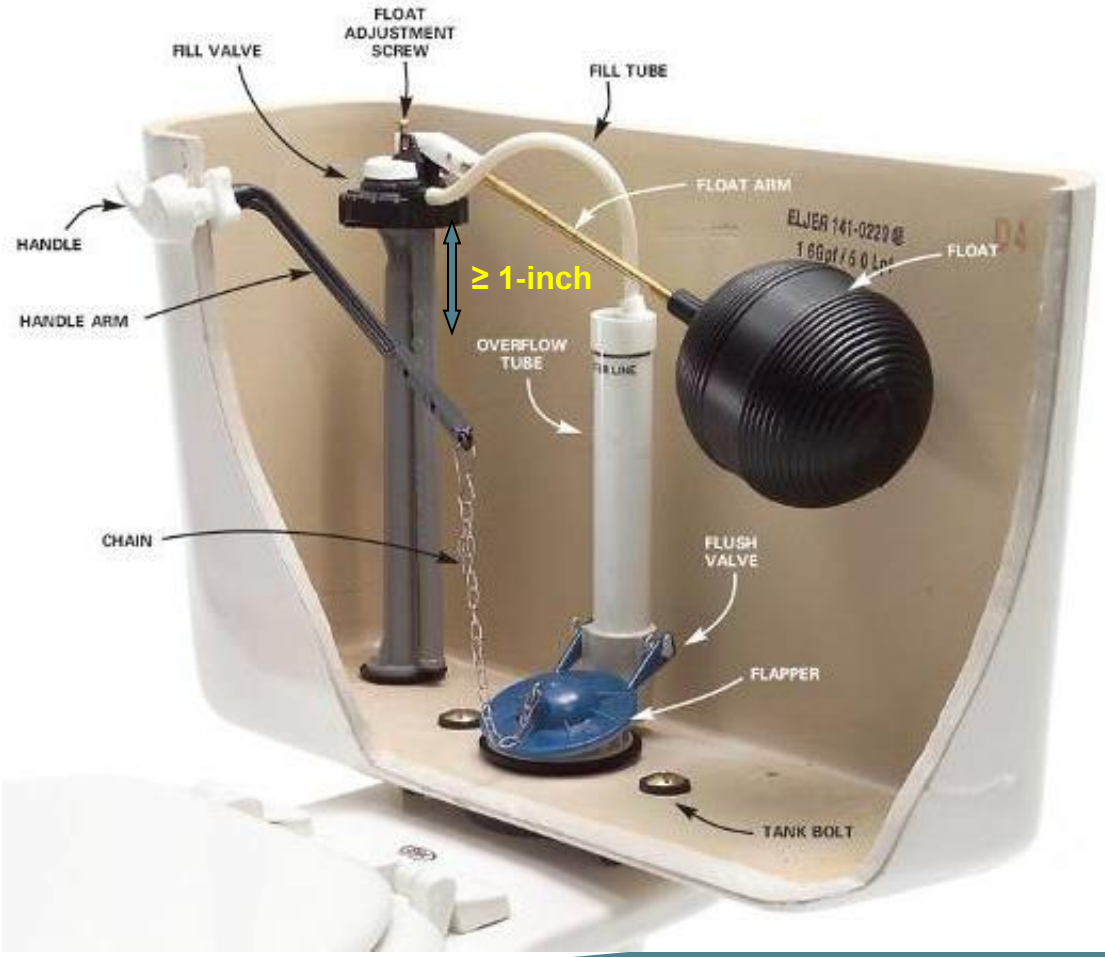
- Backsiphonage ONLY
- CANNOT be subject to continuous pressure
- Downstream valves are NOT allowed
- Must be ≥12” Above Highest Point of Use
- No more than 12 hours of continuous pressure
- High Hazard (Contaminants)
- Low Hazard (Pollutants)

Typical Uses:

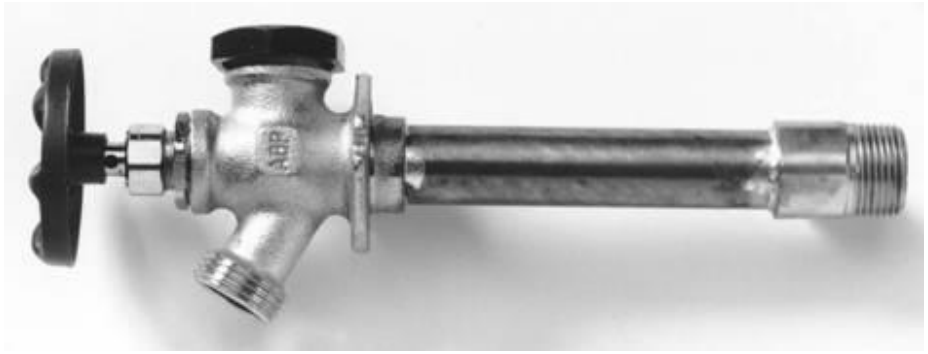
- Janitor Sinks
- Laboratory Sinks
- Hose Bibs
- Toilets
- Urinals

Water Closets

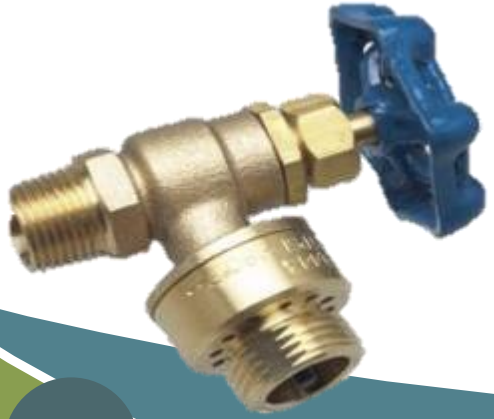
- Fill valve must conform to ASSE 1002
- Must be installed at least 1-inch above the overflow pipe
- New “Eco-friendly” pressure flushing designs must be reviewed carefully

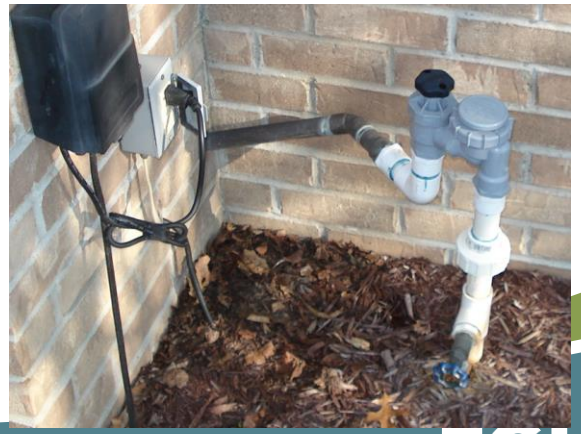


AVB Examples



AVBs have a variety of applications including Hose bibs, sinks, sprinklers, water closets, etc.





Approved Backflow Preventers

- Must meet ASSE or CSA Standards
- Required by Plumbing Code
- Required Standards are listed in Cross Connection Rules Manual and MI Plumbing Code

What Type of Assembly is This?

Backflow Prevention Summary

	Air Gap	*RPPBP*	*DCVA*	*PVB*	*AVB*
High Hazard	**X**	**X**		**X**	**X**
Low Hazard	**X**	**X**	**X**	**X**	**X**
Back pressure	**X**	**X**	**X**		
Backsiphonage	**X**	**X**	**X**	**X**	**X**

Isolation vs. Containment

Containment:

Separates the water user from the public water system by placing a back flow prevention device on the main service line. Cross Connections exist downstream of the backflow preventer.

Isolation:

Backflow Preventers / methods are provided throughout points in the private piping system where cross connections are located. However, no device exists on the main service line.

Or you may do a combination of both.

EGLE

Isolation vs. Containment

ISOLATION

- Preferred because in plant personnel are protected.
- Smaller size devices or no devices are required
- Often cheaper
- Educational for plant personnel, managers, & owners

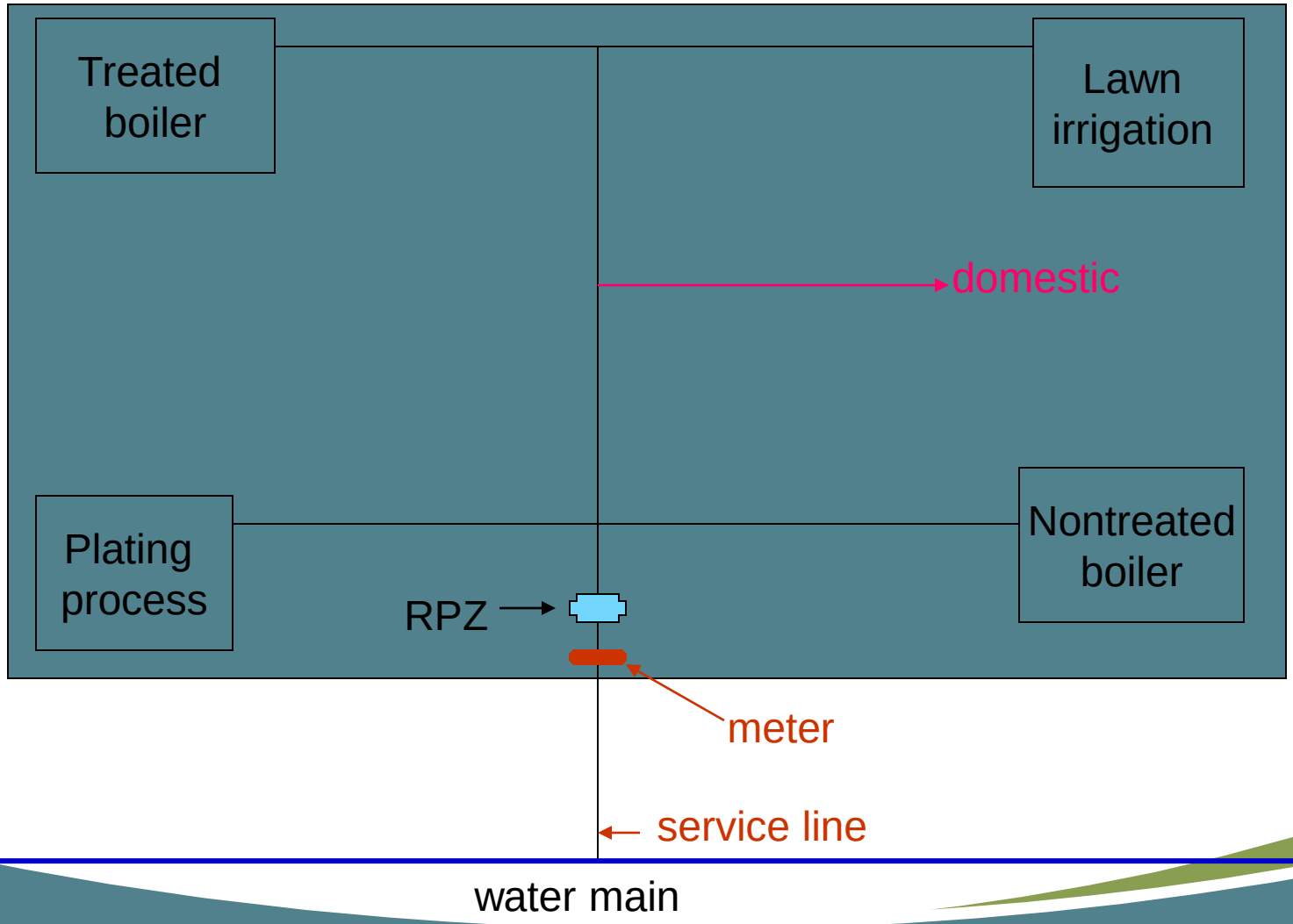
CONTAINMENT

- Facility is contained (separated from public system)
- Frequent plumbing changes
- Untraceable or hidden plumbing
- Confusing plumbing
- Access to facility is refused or prohibited by owner
- Facility employees may not be protected

EGLE

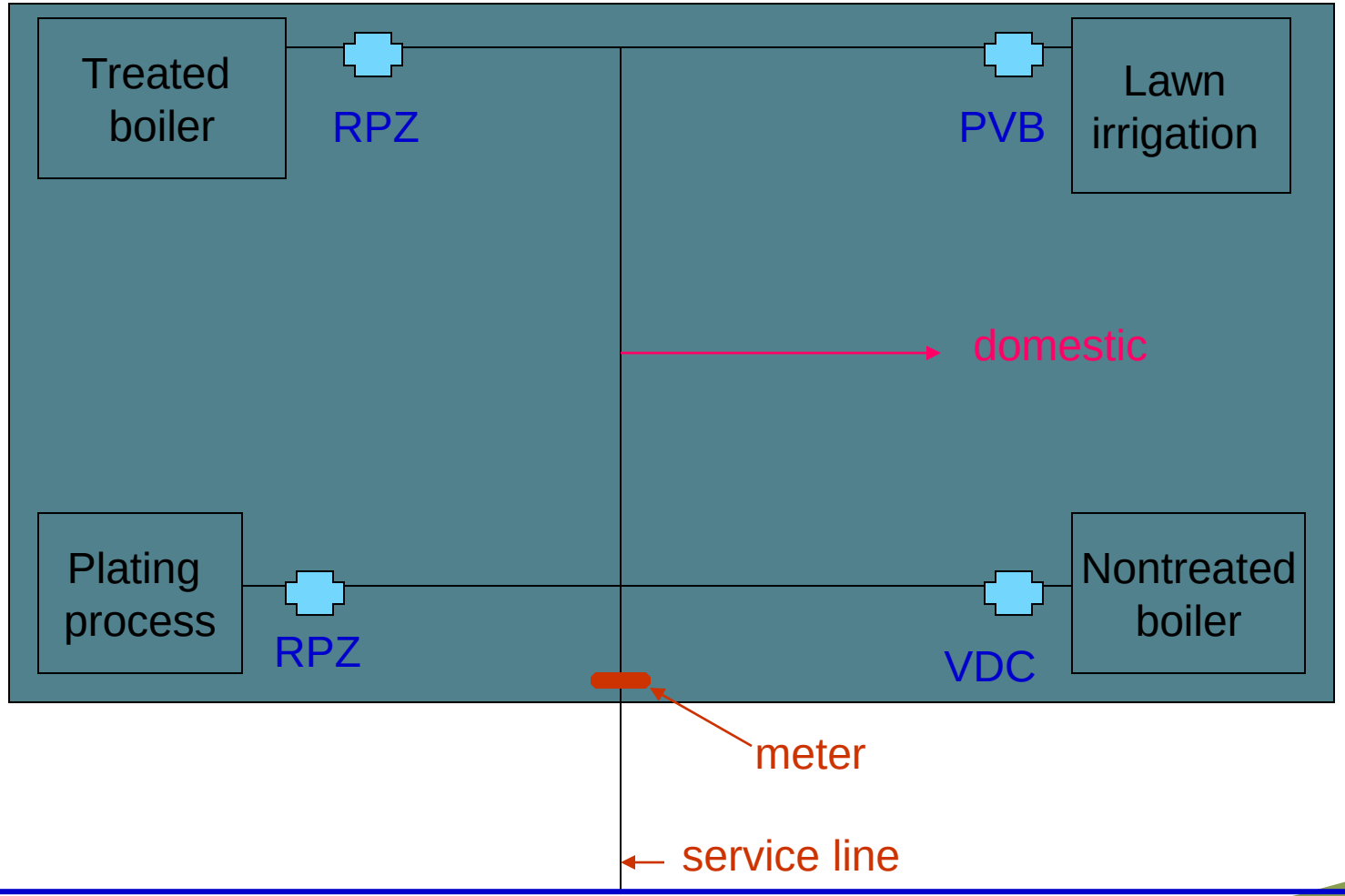
Containment Example

Protects the water supply, but not the building occupants

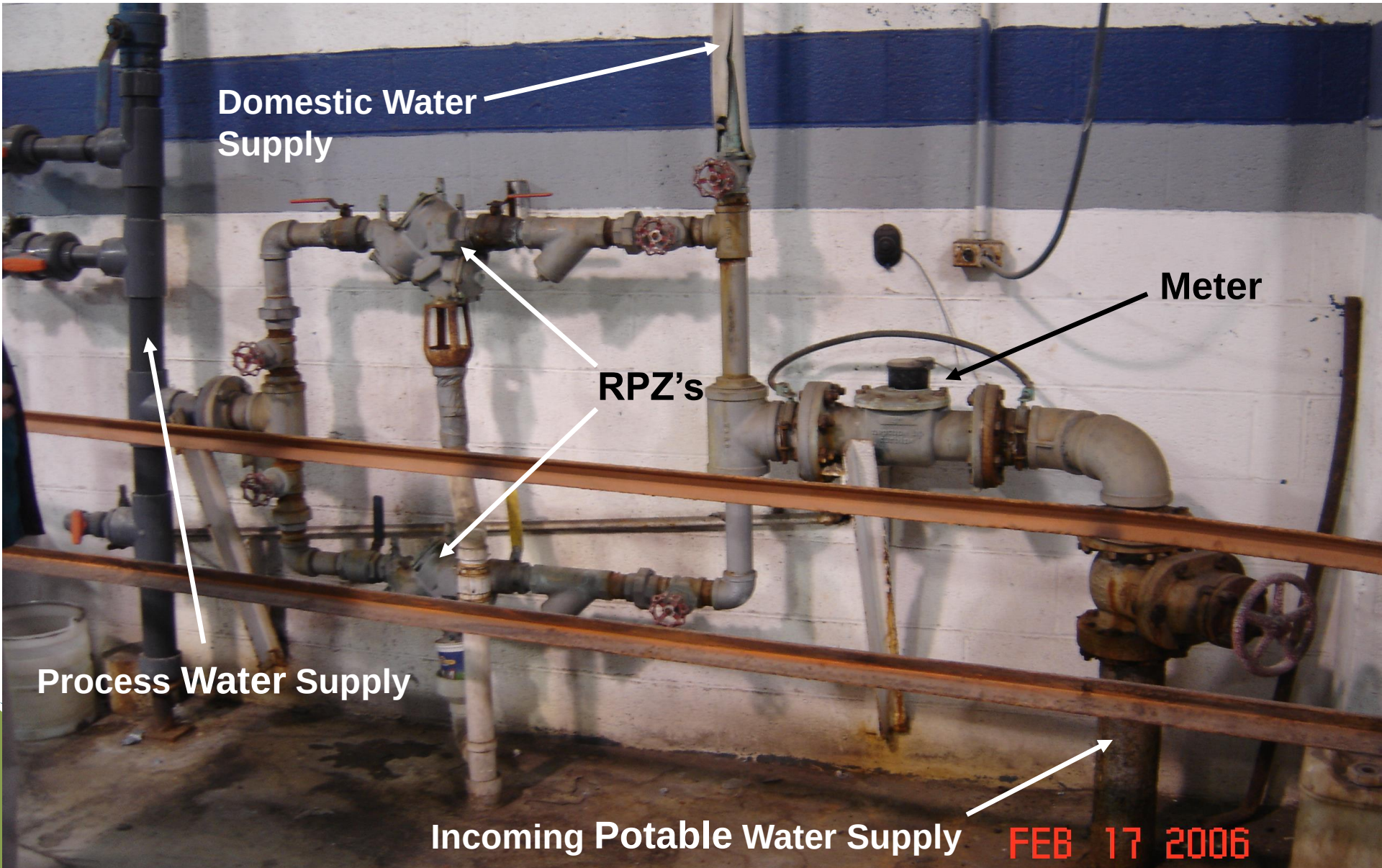


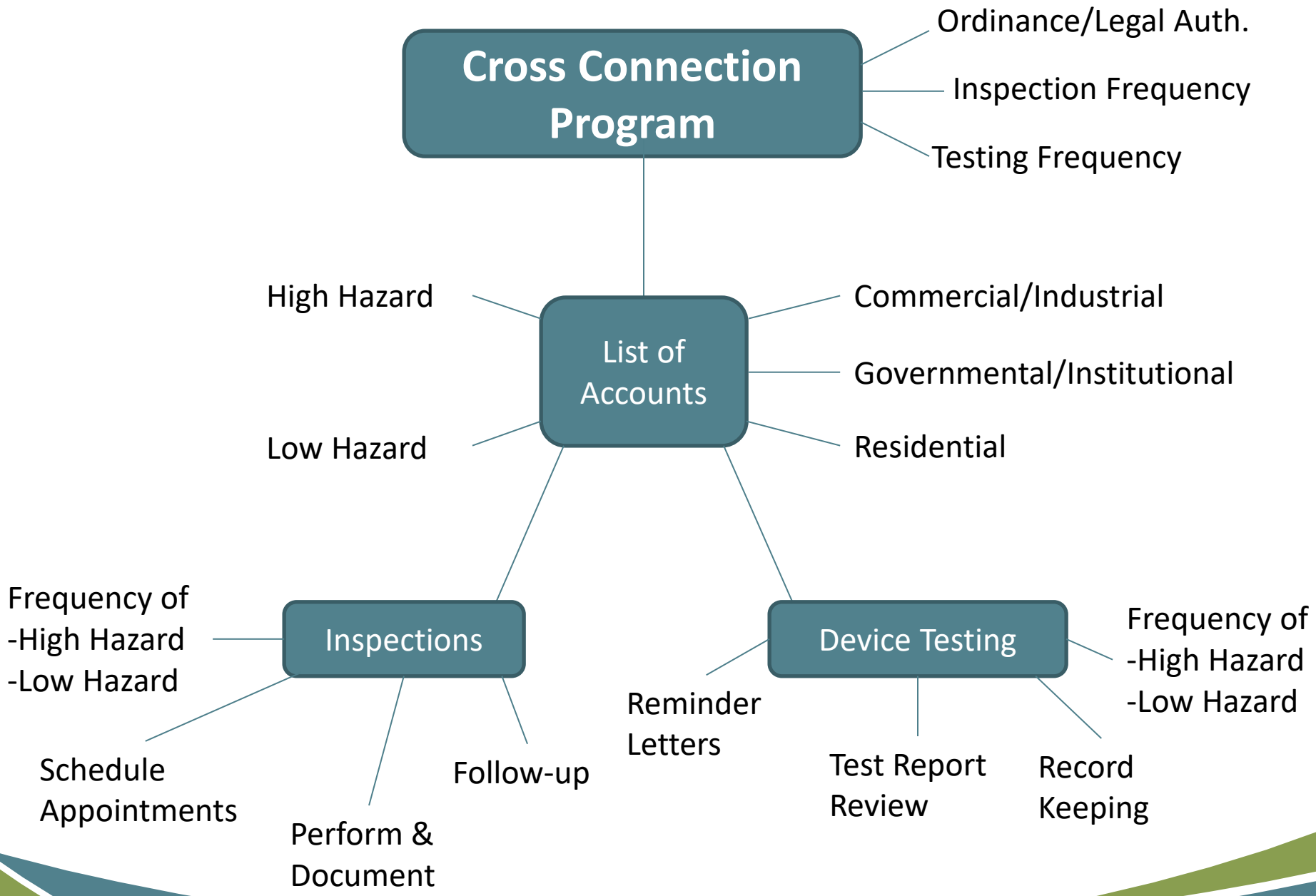
Isolation Example

Protects the building occupants & the water supply



Isolation Example




Cross Connection Program
Ordinance/Legal Auth.
Inspection Frequency
Testing Frequency
List of Accounts
High Hazard
Low Hazard
Commercial/Industrial
Governmental/Institutional
Residential
Inspections
Frequency of
-High Hazard
-Low Hazard
Schedule Appointments
Perform & Document
Follow-up
Device Testing
Reminder Letters
Test Report Review
Record Keeping
Frequency of
-High Hazard
-Low Hazard

Recent Changes

- Recent amendments to Act 399 included:
  - Specific references to residential accounts.
  - Reduction of device testing to 5 years (irrigation w/ no treatment)
  - Since 1/1/2018, device testing requires ASSE 5110 certified testers.

- Ongoing Debates
  - Michigan representatives continually debating the testing frequency
  - Implementing cross connection in residential setting

EGLE

Introduction to Cross Connections

Questions?

EGLE - Community Water Supply (michigan.gov)

Scott Schmidt- EGLE OTCU Senior Environmental Quality Analyst
Bob Weir, E.I.T. - EGLE District 72 Engineer