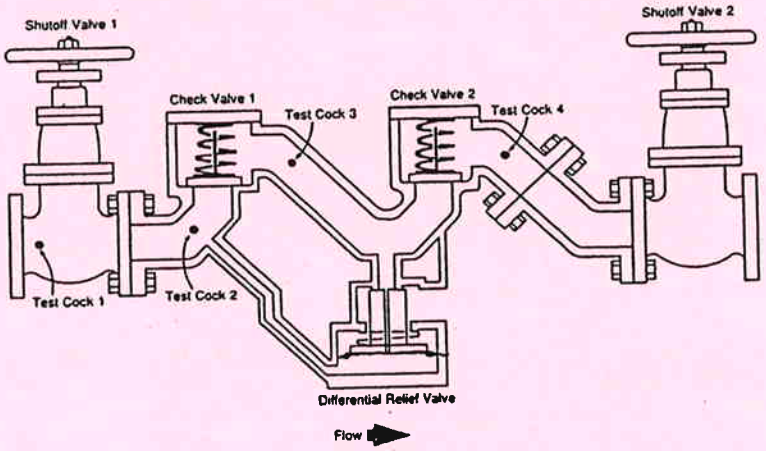
New Systems Information on

Cross Connection Control



October 2002

MISSISSIPPI STATE DEPARTMENT OF HEALTH
DIVISION OF WATER SUPPLY

2001 CROSS CONNECTION CONTROL PROGRAM

Introduction

House Bill 692 was signed into law April 16, 2001, changing the existing cross connection regulations. A summary of these changes are provided below:

1. House bill 692 creates a new category of cross connection- " low hazard posing a very low risk". Low hazard-low risk cross connection are considered exempt from all cross connection regulations- backflow preventers cannot be required at these locations. House Bill 692 defines low hazard cross connections posing a very low risk as:

   a) "Any lawn sprinkler system or lawn irrigation system that is connected to a public water system and was professionally installed regardless of whether the system is underground or above ground or whether the system has pop-up sprinkler heads." **Backflow protection cannot be required for any lawn irrigation system, commercial or residential, unless the sprinkler system is used to apply chemicals or is connected to a wastewater system.**

   b) "Any swimming pool that is connected to a public water system and was professionally installed or any swimming pool that is connected to a public water system and has a fill line with an anti-siphon air gap."

   c)"Any water fountain or cooler that provides drinking water for human consumption, that is connected to a public water system and was professionally installed."

   d) "Any fire sprinkler system that contains only water or a dry pipe and no chemicals that is connected to a public water system and was professionally installed." **Backflow protection cannot be required for fire sprinkler systems unless the sprinkler system contains chemical additives.**

   e) "Any commercial establishment that is connected to a public water system that contains no cross connections directly with a dangerous or hazardous substance or material." **Backflow preventers cannot be required for all commercial meters- a cross connection must exist before requiring backflow protection.**

"Professionally installed" is defined as installed in a workmanlike manner with no apparent errors in installation.

2. Lawn sprinkler systems with chemical injection or lawn irrigation systems connected to wastewater systems are still classified as high hazard cross connections. Backflow

preventers are required on these lawn sprinkler systems.

3. Additional backflow preventers cannot be required on carbonated beverage dispensers if an ASSE 1022 backflow preventer or air gap is present and piping downstrean from the device is not affected by carbon dioxide gas.

4. Existing backflow preventers (installed before April 16, 2001) are no longer initially tested to ensure they are functioning properly. Backflow preventers installed before April 16, 2001 protecting high hazard cross connections still require annual testing.

5. Property owners are no longer required to install "approved" backflow preventers. The Department will continue to publish a list of "recommended" backflow preventers.

6. Double check valves protecting low hazard cross connections no longer require initial or annual testing.

7. The maximum fee of $50 for testing double check valves is removed since they are no longer tested.

8. House Bill 692 also prohibits any public water system from adopting policies or ordinances that contain any provisions more stringent than this legislation. Water systems cannot enforce any ordinance or policy in conflict with the new requirements for cross connection control.

The Mississippi State Board of Health, at its 11 July 2001 meeting, adopted amendments to its cross connection control regulation to reflect the changes required by House Bill 692.

These changes have shifted the focus of Mississippi's Cross Connection Control Program, but cross connection control is still an important tool for water systems to use in ensuring that safe, clean water is provided to every customer. Because the requirement for routine testing of Double Check Valves has been removed, it is doubtful that many low hazard devices will be installed. However, emphasis is still placed on each water system finding, eliminating, and preventing high hazard cross connections. This manual supercedes previous versions to conform to current regulations.

MISSISSIPPI STATE DEPARTMENT OF HEALTH
DIVISION OF WATER SUPPLY

CROSS CONNECTION CONTROL PROGRAM REFERENCE MANUAL

Drinking water provided by public water systems in Mississippi arrives at the customers tap clean and safe. This water will be used in many ways, both potable and non potable. Some water may be used in a way that makes it unfit to drink- for example- mixing chemicals at an industry or watering livestock. A cross connection control program makes sure the water being used by a customer does not re-enter the water supply's distribution system where it will be delivered to the next customer. Every public water system in Mississippi is required by law to implement a Cross Connection Control Program.

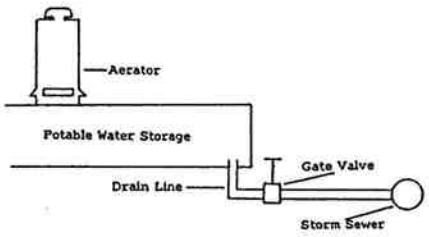


FIGURE 1: Pipe-to-Pipe Cross Connection. *A cross connection is created when the drain line is connected to the storm sewer.*

CROSS CONNECTIONS AND BACKFLOW

A cross connection is any arrangement of piping where a potable water line is connected to potentially contaminated water. A cross connection is either a pipe-to-pipe connection, where potable and contaminated water are directly connected, or a pipe-to-water connection, where the potable water outlet is submerged in contaminated water.

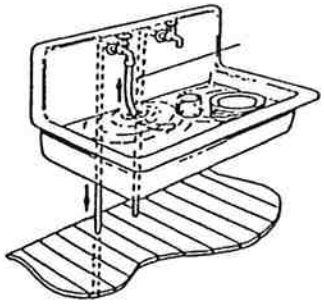
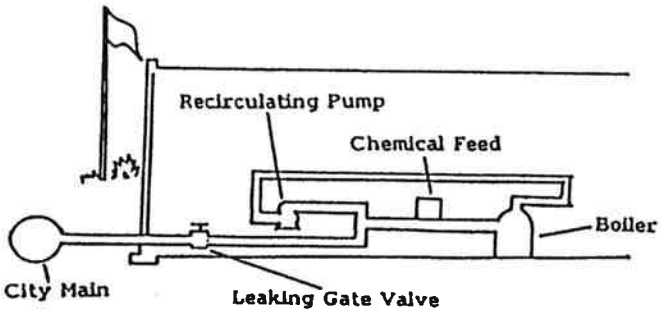


FIGURE 2:PipetoWater Cross Connection. *A cross connection is created when the hose is submerged in water in the sink.*

Backflow occurs when the direction of flow is reversed and contaminated water moves through the cross connection and into the potable water supply.

Backflow is caused by back pressure or backsiphonage. Back pressure backflow occurs when pressure in the contaminated system is higher than the pressure in the potable system. This can happen when non-potable water is being pumped or



stored at a higher elevation. If the pressure in the potable system drops below the pressure in the non-potable system, the non-potable water pushes into the potable system.

FIGURE 3: Back Pressure Backflow. *The recirculating pump for this boiler system will push water treated with corrosion inhibitors through the leaking gate valve into the city water supply.*

Backsiphonage backflow results from a vacuum being created in a water line. The vacuum draws contaminated water into the potable supply. Breaks or repairs on a main water line or changes in flow due to fire fighting can create a vacuum in a water distribution system.

High and Low Hazard Cross Connections

Cross connections are classified according to the risk they A **high hazard** cross connection has the potential to allow a contaminant into the potable distribution system that may cause illness or death.

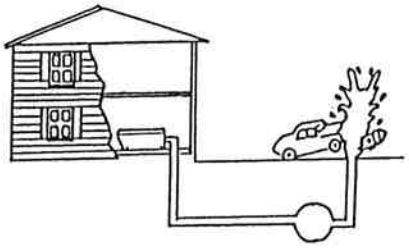


FIGURE 4: Backsiphonage Backflow. *The increased flow from the broken fire hydrant causes a vacuum in the service line and draws water from the bathtub through the submerged inlet into the distribution system.*

Some examples of high hazard contaminants are:

* oil and gasoline
* propane gas
* anti-freeze
* corrosion inhibitors
* E. Coli

A **low hazard** cross connection has the potential to allow a substance into the potable distribution system that is not harmful to health, but would still be objectionable.

Some examples of low hazard pollutants are:

* iron
* manganese
* sand
* stagnant water

Low hazard posing very low risk cross connections includes specific cross connections exempted by state law from any regulation. These are defined as:

a) "Any lawn sprinkler system or lawn irrigation system that is connected to a public water system and was professionally installed regardless of whether the system is underground or above ground or whether the system has pop-up sprinkler heads." **This means backflow protection cannot be required for any lawn irrigation system, commercial or residential, unless the sprinkler system is used to apply chemicals or is connected to a wastewater system.**

b) "Any swimming pool that is connected to a public water system and was professionally installed or any swimming pool that is connected to a public water system and has a fill line with an anti-siphon air gap."

c)"Any water fountain or cooler that provides drinking water for human consumption, that is connected to a public water system and was professionally installed."

d) "Any fire sprinkler system that contains only water or a dry pipe and no chemicals that is connected to a public water system and was professionally installed." **Backflow protection cannot be required for fire sprinkler systems unless the sprinkler system contains chemical additives.**

e) "Any commercial establishment that is connected to a public water system that contains no cross connections directly with a dangerous or hazardous substance or material." **Backflow preventers cannot be required for all commercial meters - a cross connection must exist before requiring backflow protection.**

BACKFLOW PREVENTION

There are five basic appliances that can be installed to protect a water system from backflow through a cross connection:

* air gap (AG)
* atmospheric vacuum breaker (AVB)
* pressure vacuum breaker (PVB)
*double check valve assembly (DCVA)
* reduced pressure principle backflow preventer (RP)

Each device has a specific use.

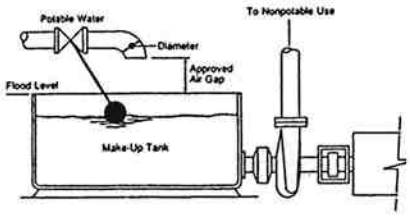


FIGURE 5. Air Gap

AIR GAP

An air gap (AG) physically separates potable water from contaminated water with an air space (Figure 5). It is created when the inlet pipe stops above the rim of the container being filled. The distance between the supply pipe and the overflow rim of the receiving vessel should be two times the diameter of the supply pipe, but never less than one inch.

<u>A properly constructed air gap is the safest way to prevent backflow</u>. An air gap protects against both back-siphonage and

back pressure. It is appropriate for low and high hazard applications. An air gap is the only protection allowed when water lines must come in contact with sewer or storm sewer lines. It can be used with any installation that doesn't require a solid physical connection, such as:

* open spigots
* surge tanks
* watering stations

Air gaps should be inspected periodically to make sure a hose hasn't been added, extending the end of the water line into the receiving vessel. Air gaps do not require annual testing.

Atmospheric Vacuum Breaker

An atmospheric vacuum breaker (AVB) is a device that uses an air inlet to prevent back-siphonage (Figure 6). When potable water is flowing in the normal direction, the force of the water is used to seal off the air inlet, allowing water to flow through the device. When the flow stops, the loss of water pressure permits the air inlet valve to drop. This seals off the supply line and opens the air inlet vent, allowing air into the system. This keeps a vacuum from developing. AVBs may be used on most inlet-type water connections that are not subject to back pressure. Some examples are:

* chemical fill stations
* single zone lawn sprinkler systems
* commercial dishwashers
* fluoride saturators

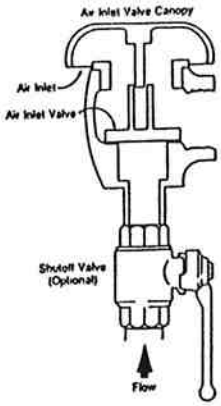


FIGURE 6. AtmosphericVacuum Breaker

AVBs must be installed at least 12 inches above all downstream points of use. They must be installed upstream of any shut off valves. AVBs are not designed for continuous use (more than 12 hours at a time) because this can cause them to stick in the open position. They protect against back-siphonage but not back pressure and are used for low and high hazard cross connections. Atmospheric vacuum breakers must be ASSE approved and should be used for isolation only, not containment. AVBs do not require annual testing by a certified tester. (*See page 9 or more information on isolation and containment.*)

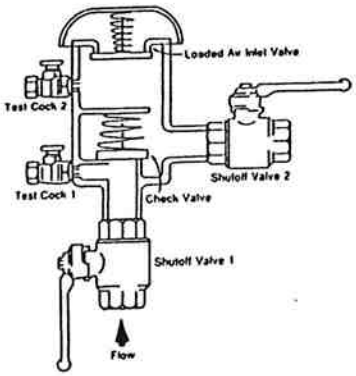


FIGURE 7: Pressure Vacuum Breaker

Pressure Vacuum Breaker

A pressure vacuum breaker (PVB) is similar to an AVB, but it includes a spring to help open the air inlet valve when flow stops and a spring loaded check valve (Figure 7). Like AVBs, PVBs may be used in low and high hazard applications and protect against back siphonage only. Since neither device protects against back pressure, each must be installed 12 inches above the highest usage point. PVBs will work under continuous pressure and can have downstream valves. PVBs can be tested to insure they are working properly. Pressure vacuum breakers are typically used for multi-zone lawn sprinkler systems. PVBs require annual testing by a certified tester.

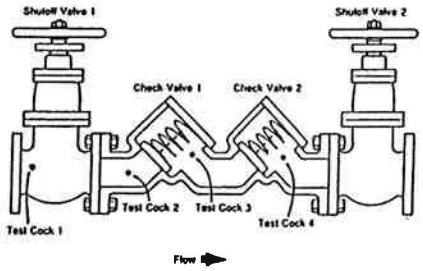


FIGURE 8: Double Check Valve Assembly

Double Check Valve Assembly

A double-check valve assembly (DCVA) is two spring loaded check valves housed in one unit with test cocks and shut-off valves (Figure 8). The check valves operate independently of each other, so if one fails, the other still provides protection against backflow. The check valves are loaded to hold tight against at least 1 psi in the direction of flow. Double check valves can be used to protect against back pressure and back siphonage, but can only be used in low hazard applications. Double check valves cannot be installed below ground level. The head-loss through a double check valve is less than 10 psi. Home-made double check valves are not acceptable because they cannot be tested. State law now exempts DCVAs from annual testing by a certified tester.

Reduced Pressure Principle Backflow Prevention Assembly

A reduced pressure zone backflow prevention assembly (RP) consists of two spring loaded, pressure-reducing check valves with a pressure regulated relief valve between them. During normal operation, flow from the supply side passes through the first check valve, lowering the pressure in the zone between the two check valves, and then through the second check valve to the user. The relief valve is held closed by supply side pressure acting on a diaphragm in the relief valve. Supply side pressure is transmitted to the relief valve through a sensing tube. When water is not flowing, both check valves are held shut by their springs and supply side pressure holds the relief valve closed.

If the supply pressure drops, the relief valve will open to allow water out until the pressure in the zone is at least 2 psi lower than supply pressure. If the supply pressure falls below 2 psi, the relief valve will open and discharge water from the reduced pressure zone, preventing back siphonage. If the assembly is subjected to

back pressure, both check valves should remain closed and prevent backflow. Even if the second check valve is leaking and the assembly is subjected to back pressure, the relief valve will open when the downstream pressure is within 2 psi of supply pressure, discharging any water that leaked through the second check valve, preventing backflow. A continuous stream of water from the relief valve indicates malfunction of one or both check valves or the relief valve. A little water comes through the relief valve during normal operation.

For an RP to work properly, it must be able to discharge water from the relief valve to the atmosphere. This is why RPs cannot be installed in a pit, where the relief valve can become submerged.

Normal pressure loss through this device is between 10 and 20 psi, depending on the size of the device and flow. RPs protect against back pressure and backsiphonage, and can be used in high hazard applications. Rps require annual testing by a certified tester.

If a bypass line is installed around an RP to allow the unit to be taken out of service without shutting off water to the connection, the bypass line must also contain an RP.

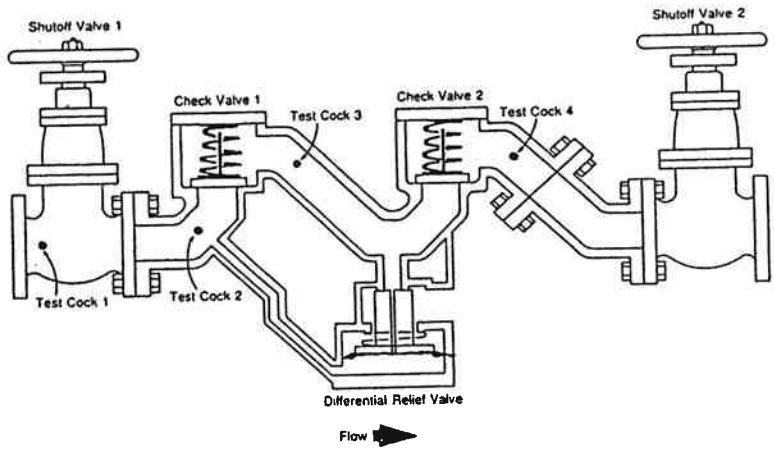


FIGURE 9. Reduced Pressure Principle Backflow Preventer

MISSISSIPPI STATE DEPARTMENT OF HEALTH
DIVISION OF WATER SUPPLY

CROSS CONNECTION CONTROL PROGRAM CERTIFICATION FORM

PUBLIC WATER SYSTEM INFORMATION

Name of Public Water System: _____

PWS ID Number: _____ County: _____

Number of Service Connections: _____ Number of Connections Surveyed: _____

CROSS CONNECTION SURVEY INFORMATION

Number of cross connections identified during survey: ..... _____

Number of cross connections eliminated by changing piping: ..... _____

Number of backflow preventers required on system:..... _____

CERTIFICATION STATEMENT

I hereby certify that a cross connection survey has been completed on this public water system by authorized representative(s) in accordance with the guidelines published by the Mississippi State Department of Health. I further certify that a cross connection control policy or ordinance has been formally adopted and is being enforced by this public water system and that this policy or ordinance establishes a cross connection control program that fully complies with the requirements of the Mississippi Safe Drinking Water Act and the Mississippi Primary Drinking Water Regulations. **NOTE**: A copy of this formally adopted policy or ordinance must be included with this form.

_____

Name/Title of Responsible Official (Mayor, President, Owner)(Please Print or Type)

_____

Signature of Responsible Official

____/____/____

Date

Keep a Copy for Your Records and Mail Completed Form and a Copy of Policy or Ordinance to:
Division of Water Supply, P. O. Box 1700, Jackson, MS 39215-1700

MISSISSIPPI STATE DEPARTMENT OF HEALTH
DIVISION OF WATER SUPPLY

CROSS CONNECTION SURVEY FORM

Name of Public Water System: _____
PWS ID #: _____ **County:** _____

CUSTOMER INFORMATION

Customer Surveyed: _____ Survey Date: __/__/__
Address: _____ Phone Number: (____) - _____
_____ (____) - _____
_____

CROSS CONNECTION SURVEY QUESTIONS

Does a cross connection exist at this location? **YES** ____ **NO** ____
If **YES**, describe the cross connection: _____
_____
_____
_____

1) Is the cross connection: **High Hazard:** _____ **Low Hazard:** _____
2) What type backflow preventer is **REQUIRED** at this location to comply with the Mississippi State Department of Health's Cross Connection Control Regulation?
AG ___ **AVB** ___ **PVB** ___ **DC** ___ **RP** ___
3) Is the correct backflow preventer in place? **YES** ____ **NO** ____
4) If **YES**, what is Type/Size/Model#?
5) If **YES**, is the backflow preventer installed correctly? **YES** ___**NO** ____
6) If **NO**, what corrections to the installation are **REQUIRED**? _____
7) If the correct backflow preventer is not installed, where do you recommend the **NEW** backflow preventer be installed? _____
_____
_____

INSTALLATION & CORRECTIONS SECTION

Was the required backflow preventer installed at this location? (Y/N)
Name of Installer: _____ Date Installed: __/__/__
Type/Size/Model # Device Installed: _____
Tested by (Name): _____ Date Tested: __/__/__

NOTE: This form should be filled out for each location where a cross connection survey is conducted on the public water system and it should be kept on file as a permanent, official record of the water system.

_____

[NAME OF PUBLIC WATER SYSTEM]

_____

[COUNTY] [PWS ID NUMBER(S)]

CROSS CONNECTION CONTROL

_____

[POLICY or ORDINANCE]

[**NOTE**: All entries on this document must be typed or printed.]

SECTION 1. PURPOSE

As required by the Mississippi Safe Drinking Water Act and the regulations of the Mississippi State Department of Health, this cross connection _____ *(policy/ordinance)* has been officially adopted by the officials/owners of the _____ *(name of public water system)* to protect the drinking water from possible contamination.

SECTION 2. DEFINITIONS

(1) **Water System**: Whenever this term is used in this document it shall mean the:

_____ *(name of public water system)*.

(2) **Potable Water:** Water that is acceptable for human consumption.

(3) **Non-Potable Water:** Water not acceptable for human consumption or of unknown quality.

(4) **Cross Connection:** Any arrangement of piping where a potable water line is connected to non-potable water; it may be a pipe-to-pipe connection where potable and non-potable water lines are directly connected, or a pipe-to-water connection where the potable water outlet is submerged in non-potable water. If the potable and non-potable source are separated by gate valves, check valves or devices other than the appropriate backflow preventer as outlined by this policy/ordinance, a cross connection exists. By-pass arrangements, jumper connections, swivel or change over assemblies, or other temporary or permanent assemblies through which, or because of which, backflow may occur are considered to be cross connections.

(4) **Backflow:** The reversal of normal flow direction where water flows from the intended point of delivery towards the supply.

(5) **Back Pressure Backflow:** Backflow caused by a lower pressure in the potable supply than at the point of delivery.

(6) **Back Siphonage Backflow:** Backflow caused by a negative pressure in the potable supply line.

(7) **Health Hazard, (High Hazard):** Contamination with the potential to endanger the health and well being of the consumer.

(8) **Non-Health Hazard, (Low Hazard):** Contamination that will not endanger the health of the consumer, but does not meet established water quality standards for public water systems.

(9) **Low Hazard Cross Connection Posing Very Low Risk:** Specific cross connections exempted by state law from any regulation.

(10) **Professionally Installed**: Installed in a workmanlike manner with no apparent errors in installation.

SECTION 3. BACKFLOW PREVENTION ASSEMBLY REQUIREMENT.

3.01 **Low Hazard Cross Connections Posing Very Low Risk**. The following cross connections have been designated low hazard posing very low risk and therefore below regulatory concern. Backflow preventers **are not** required at these locations:

(i) Any lawn sprinkler system or lawn irrigation system that is connected to a public water system and was professionally installed, regardless of whether the system is aboveground or below ground or whether the system has pop-up sprinkler heads;

(ii) Any swimming pool that is connected to a public water system and was professionally installed, or any swimming pool that is connected to a public water system and has a fill line with an anti-siphon air gap;

(iii) Any water fountain or cooler that provides drinking water for human consumption, that is connected to a public water system and was professionally installed;

(iv) Any fire sprinkler system that contains only water or a dry pipe and no chemical additives, that is connected to a public water system and was professionally installed;

(v) Any commercial establishment that is connected to a public water system, that contains no cross connections directly with a dangerous or hazardous substance or material.

Elimination and Protection of Cross Connections. Cross connections occurring within the Water System (except low hazard posing very low risk as defined above) shall be eliminated or protected with the appropriate backflow preventer. Cross connections are eliminated by establishing an air gap between the potable and non-potable sources. Cross connections are protected by installing the appropriate backflow preventer. It shall be the responsibility of the owner of the cross connection to eliminate the cross connection or protect the cross connection with a backflow preventer of the type recommended by the Water System.

3.02 **Connections to Sewer**. Direct connections, permanent or temporary, between the Water System and a sanitary or storm sewer are prohibited.

3.03 **Home Wells**. Connection to any source of water other than that provided by the Water System including home wells, is prohibited unless a backflow preventer of the type recommended by the Water System is installed.

3.04 **Installation Requirements**. Reduced pressure principle assemblies, double check valve assemblies, and pressure vacuum breakers shall be installed in a manner and location that provides adequate access for testing and repair of the assembly. Reduced pressure principle assemblies and double check valve assemblies shall not be subject to possible flooding. Reduced pressure principle assemblies and double check valve assemblies shall not be installed in a pit or enclosure below ground level.

SECTION 4. RESPONSIBILITY OF WATER SYSTEM

4.01 **Surveys.** An authorized agent of the Water System, utilizing written guidelines published by the Mississippi State Department of Health, shall conduct surveys and on-site visits as necessary to locate existing cross connections. Single family dwellings and multi-family dwellings shall not be included in this survey unless the officials of the Water System have reason to believe a cross connection exists. The survey of the Water System shall be completed by an individual approved by the Water System. Upon completion of this survey, the responsible official of the Water System shall certify to the Mississippi State Department of Health, on forms provided by the Department, that the required survey has been properly performed and completed in accordance with the written guidelines published by the Department.

4.02 **Right of Entry**. The Water System, acting through its authorized agent, shall have the right to enter any non-residential building, during reasonable hours, to inspect the plumbing system installed in any such building or premises provided prior notification of the inspection is given. The authorized agent shall first obtain consent of the owner to enter any single family dwelling.

4.03 **Classification of Hazard**. Each cross connection found will be classified by the authorized agent of the Water System as High Hazard, Low Hazard, or Low Hazard Posing Very Low Risk as defined in Section 2. If a connection is found to be a high hazard cross connection, the owner of the connection shall be notified in writing within ten (10) days, that the cross connection must be eliminated or protected by the installation of the appropriate backflow preventer within 90 days of notification. If the connection is found to be a low hazard cross connection, the owner of the connection shall be notified in writing within 10 days, that the connection shall be eliminated or protected by the appropriate backflow preventer before June 30, 2004 or within one year of notification, whichever is later.

4.04 **Selecting the Appropriate Backflow Preventer**. It shall be the responsibility of the Water System, acting through its agent, to determine the type of backflow preventer required at each cross connection and the location where the backflow preventer will be installed. The type of backflow preventer and the required installation location will be selected by the Water System utilizing guidelines published by the Mississippi State Department of Health.

4.05 **Existing Backflow Preventers.** Any backflow prevention assembly installed prior to April 12, 2001 for the purpose of protecting the Water System against the possibility of backflow shall not require initial testing to insure the backflow preventer is functioning properly.

4.06 **Review of Meter Applications**. The Water System, acting through its authorized

CERTIFICATION OF ADOPTION

This is to certify that the above Cross Connection Control Policy/Ordinance was adopted by:

_____ on ___/___/___
(name of public water system) *(date)*

and is being routinely enforced on this public water system.

_____
(name of responsible official) (please print or type)

_____ ___/___/___
(signature of responsible official) *(date)*