Working Memo 835

Date: March 7, 2001

TO: Office of Water Programs Staff

FROM: Robert B. Taylor, P.E., Director
Division of Water Supply Engineering

THROUGH: Robert W. Hicks, Director
Office of Environmental Health Services

SUBJECT: Water - Design - Cross Connection Control

RE: Working Memo 801

This Working Memo is an interim Working Memo which addresses Privately Owned Residential Community Waterworks.

A Model Program for these waterworks is not currently available in Working Memo 801. The current *Waterworks Regulations* are being revised and when completed Working Memo 801 and this memo will require a complete review/revision and consolidation. It seems appropriate to provide the staff with this Model Program in the interim.

/kew

Attachment: Model Program

PRIVATELY OWNED RESIDENTIAL COMMUNITY WATERWORKS

MODEL PROGRAM

CROSS CONNECTION CONTROL

I. Purpose of the Cross Connection Control Program

Purpose of this Cross Connection Control Program (Program) is to eliminate cross connections and protect the public health. This program establishes and enforces cross connection control and backflow prevention measurers for the _____ waterworks. **THIS PROGRAM IS DIRECTED AT SERVICE LINE PROTECTION (CONTAINMENT)** at a waterworks where the waterworks is privately owned (Waterworks Owner) and serves piped water through service connections to residences.

A. The program will prevent backflow of pollution or contamination into the waterworks from a residential water supply system by requiring the installation of an appropriate backflow prevention device or backflow prevention by separation at the service connection. Containment has the highest priority.

B. The program will also prevent backflow of pollution or contamination, at each point-of-use, into the residential water supply system by recommending the installation of appropriate backflow prevention devices or separations at each point-of-use which may be a health or pollutional hazard.

C. An evaluation of the alternative of point-of-use isolation protection in lieu of containment will be conducted at each residence where containment is required.

II. Authority for the Cross Connection Control Program

Commonwealth of Virginia, Department of Health
Waterworks Regulations: Section 12 VAC 5-590-580
Cross Connection Control and Backflow Prevention in Waterworks

III. Administration of the Cross Connection Control Program

A. The Waterworks Owner shall administer and enforce the provisions of this Program. This includes assessments of the waterworks and all residences served.

B. The person in responsible charge of the Program is _____(name and title).

IV. Enforcement of the Program

A. Each resident or residents will be requested to furnish pertinent information regarding water usage and plumbing fixtures in the residence. The lack of such information, when requested in writing shall be deemed evidence of the presence of a high degree of hazard for cross connection.

B. Positive action shall be taken to ensure that the waterworks is adequately protected at all times.

C. Any resident found to be in violation of any provision of this Program shall be served a written notice of violation sent certified mail to the resident's address, stating the nature of the violation, and corrective action required. A reasonable time limit, not to exceed 30 days, from the date of receipt of the notice of violation, will be given to bring the residential water system into compliance with this Program.

D. Upon continuation of any violation beyond the time provided in the notice of violation, water service to the residence shall be denied or discontinued. Water service shall not be restored until the deficiencies have been corrected or eliminated to the satisfaction of the waterworks owner.

V. General Requirements of Waterworks Owner and Resident

A. Waterworks Owner

1. The Waterworks Owner has full responsibility for water quality and for the construction, maintenance, and operation of the waterworks beginning at the water source and ending at the service connection.

2. The Waterworks Owner shall, to the extent of his/her jurisdiction, provide continuing identification and evaluation of all cross connection hazards. This shall include an assessment of each residential water system for cross connections to be followed by the requirement to install backflow prevention devices or separations if necessary. Assessments shall be performed at least annually.

3. The Waterworks Owner shall not install or maintain a water service connection to a residence where cross connections may exist unless such cross connections are adequately abated or controlled.

4. The Waterworks Owner shall not install or allow any connection which would allow water from an auxiliary water system to enter a waterworks, either directly or through a residential water system.

5. The Waterworks Owner shall keep for at least ten years all records of assessments, inspections, operational tests and any repair, overhaul or replacement of devices.

6. In the event of the backflow of pollution or contamination into the waterworks, the Waterworks Owner shall promptly take or cause corrective action to confine and eliminate the pollution or contamination.

7. The Waterworks Owner shall immediately report to the appropriate Commonwealth of Virginia, Department of Health, Office of Water Programs, _____ Field Office at _____ (telephone number) if backflow occurs. A written report will be submitted by the 10th day of the month following the month during which backflow occurred addressing the incident, its causes, effects, and preventative or control measures required or taken.

B. Resident

1. The resident has the responsibility of preventing pollutants or contaminants from entering the water system in the residence or entering the waterworks. The resident's responsibility starts at the point-of-delivery (downstream end of service connection) and includes all piping, plumbing, and related appurtenances downstream of the meter.

2. The resident, at his own expense, is responsible for installing, operating, and maintaining backflow prevention devices and separations required by the program. Testing will be by certified testers.

3. The resident will provide copies of test results, maintenance records and repair or overhaul records to the waterworks owner

4. Within 30 days of completion of testing or work. Such testing or work shall have been performed by device testers which have obtained a certificate of completion of a course recognized by the American Water Works Association, the Virginia Department of Health, the Virginia Cross Connection Control Association, or otherwise be certified by a Commonwealth of Virginia tradesman certification program.

5. In the event of pollution or contamination of the waterworks or a residential water system due to backflow, the resident shall promptly take steps to confine further spread of the pollution or contamination and shall promptly notify the Waterworks Owner of the condition.

IV. Procedures

1. Each residence will be accessed at least annually for cross connection hazards. Assessment may be performed by voluntary inspections, interviews, or by responding to mailed questionnaires. Interviews may be conducted on-site or by telephone.

2. Each assessment will follow the questionnaire in Appendix B.

3. Each resident will be notified in writing as to any testing requirements 60 days prior to their annual due date. The form letter in Appendix E will be used to notify residents of testing due.

4. Each resident will be notified in writing of the degree of hazard determined; type and location of any device or separation required; the applicable University of Southern California Foundation for Cross-Connection Control and Hydraulic Research (USC), American Society of Sanitary Engineering (ASSE), and American Water Works Association (AWWA) approval or standard to use. The deadline for completing the installation will be 30 days. The form letter in Appendix C will be used to notify residents as stated above.

5. Residents requesting a new service connection or reconnection to the waterworks must be assessed by on-site interview for cross connection hazards and the appropriate separation installed, inspected, and operational prior to making the service connection.

VII. Location of Protection

A. Service Line Containment

Where a containment type device is required, the device is generally installed at each service connection to a residential water system.

B. Special Conditions for Service Line Containment

When, as a matter of practicality, the backflow prevention device cannot be installed at the service connection, the device may be located downstream of the service connection prior to any unprotected takeoffs.

C. Point-of-Use Isolation Protection

1. Any residence where all actual or potential cross connections can be easily corrected at each point-of-use and where the residential water supply system is not intricate or complex, point-of-use isolation protection by application of appropriate backflow prevention devices or separations within the residence may be used in lieu of installing a containment device at the service connection.

2. Devices installed under this section shall be selected from the Isolation Device Application table in Appendix A.

VIII. Determination of Degree of Hazard

The type of protection required shall depend on the degree of hazard that exists or may exist.

The degree of hazard, either high, moderate, or low, is based on the nature of the contaminant; the potential health hazard; the probability of the backflow occurrence; the method of backflow either by backpressure or by backsiphonage; and the potential effect on waterworks structures, equipment, and appurtenances used in the storage, collection, purification, treatment, and distribution of pure water.

Table 2.10 of the *Waterworks Regulations* shall be used as a guide to determine the degree of hazard for all situations.

IX. Backflow Prevention Devices and Backflow Prevention by Separation

A. Backflow prevention devices for containment include the reduced pressure principle backflow prevention assembly, the double gate - double check valve assembly, and the pressure vacuum breaker assembly.

B. Backflow prevention by separation gives the highest degree of protection. This method includes the air gap and physical disconnection. The minimum air gap shall be twice the effective opening of a potable water outlet unless the outlet is a distance less than three times the effective opening away from a wall or similar vertical surface, in which case the minimum air gap shall be three times the effective opening of the outlet. In no case shall the minimum air gap be less than one inch.

C. Backflow prevention devices for containment shall be approved for containment by the University of Southern California, Foundation for Cross-Connection Control and Hydraulic Research and shall comply with the most recent American Water Works Association Standards and the American Society of Sanitary Engineering Standards.

D. Backflow prevention devices for containment shall be installed in a manner approved by the Waterworks Owner and in accordance with the University of Southern California, Foundation for Cross-Connection Control and Hydraulic Research recommendations and the manufacturer's installation instructions. Vertical or horizontal positioning shall be as approved by the University of Southern California, Foundation for Cross-Connection Control and Hydraulic Research.

E. Point-of-use isolation devices shall bear an appropriate American Society of Sanitary Engineering Standard Number.

F. Backflow prevention devices with openings, outlets, or vents that are designed to operate or open during backflow prevention shall not be installed in pits or areas subject to flooding.

G. An air gap or physical disconnection shall be used whenever practical to do so in high hazard situations subject to backpressure.

H. Either an air gap, physical disconnection or a reduced pressure principle backflow prevention device will protect against backpressure and backsiphonage when operating properly.

I. Pressure vacuum breakers will not protect against backpressure, but will protect against backsiphonage when operating properly. Pressure vacuum breakers may be used in low, moderate or high hazard situations subject to backsiphonage only.

J. A double gate - double check valve assembly will protect against backpressure and backsiphonage when operating properly, but shall not be used in high hazard situations.

X. Preventative and Control Measures

A. Residence having booster pumps connected to the waterworks shall be equipped with a low pressure regulating or cutoff device to shut off the booster pump when the pressure in the waterworks drops to a minimum pressure, not to be less than 10 psi gauge at the service connection.

B. At the connection of lawn irrigation systems where:

1. Shutoff valves are not located downstream of the backflow prevention device, an atmosphere vacuum breaker, ASSE No. 1001, shall be installed and located at least 12 inches above the highest outlet but no more than 30 inches above the ground.

2. Shutoff valves are located downstream of the backflow device, a pressure type vacuum breaker, ASSE No. 1020, shall be installed and located at least 6 inches above the highest outlet but not more than 30 inches above the ground.

3. Fertilizers or other chemicals are added by a pump or where the irrigation piping is located above the backflow prevention device, a reduced pressure principle backflow prevention device, ASSE No. 1013, shall be installed.

C. Residence with an Auxiliary Water System

The residence may maintain the auxiliary water source (groundwater well or spring, for example) on the property for heating or cooling, irrigation, watering, etc. if a physical separation from the residential water system and the waterworks is provided and maintained at all times.

D. Fire Protection Systems

1. A reduced pressure principle backflow prevention device, ASSE No. 1013, shall be installed at fire protection system connections to the waterworks.

2. Where fire protection systems are installed with piping, joints and connections approved for water distribution system (NSF pw) and the residential water system design provides freely flowing potable water through the fire protection system and the potable water is not allowed to stagnate or deteriorate in water quality, a backflow prevention device is not required.

E. Others specified by the waterworks owner where reasonable cause can be shown for a potential backflow or cross connection hazard.

XI. Annual Questionnaires

A. The questionnaire in Appendix B. will be mailed or hand delivered to each customer for all assessments.
B. Questionnaires will be maintained by the waterworks owner for ten years.

XII. Report to Resident

A. The Report to Resident form in Appendix C. will be completed within 30 days of the assessment and a copy given to the resident.

B. Thermal expansion information contained in Appendix D. will be attached to all Reports to Residents forms where service line containment devices are being required.

C. A copy of the form will be maintained for ten years by the waterworks owner.

XIII. Records

A. An up-to-date listing of Residential water system locations where cross connection control devices (including pressure sensing devices) or separations (including separations from auxiliary or nonpotable water systems and air gaps) are installed shall be maintained by the waterworks owner. The list will contain:

1. location of backflow prevention device, pressure sensing device or separation
2. manufacturer of device
3. device model number
4. device serial number
5. device size
6. ASSE number
7. device testing frequency (annually) (semiannually) (quarterly)
8. last date tested
9. pressure sensing device pressure set point

B. Questionnaires, reports to residents and device tester reports will be maintained by the waterworks owner for ten years.

Appendix A.

Device Application

Degree of hazard	Method of backflow	Pressure or flow conditions	Device	ASSE #
High	BP or BS	Continuous	RPZ	1013 & 1047
	BS only	Noncontinuous	Pipe applied AVB	1001 & 1035
		Noncontinuous	Hose bibb AVB	1011 & 1052
		Noncontinuous	Wall Hydrant w/AVB	1019
		Continuous	PVB	1020 & 1056
Moderate	BP or BS	Continuous	DG-DC	1015 & 1048
Low	BS only		Dual Check:	
		Continuous	w/o vent	1024 & 1032
		Continuous	w/vent	1012

NOTES:

- Degree of Hazard - See *Table 2.10 — Determination of Degree of Hazard* in the *Waterworks Regulations*.
- BS means backflow by backsiphonage.
- BP means backflow by backpressure or superior pressure.
- Continuous means operating under continuous flow or pressure. This condition usually applies to devices installed inline and may have valves downstream of the device.
- Noncontinuous means operating intermittently not to exceed 12 hours under continuous pressure or flow in a 24-hour period. This condition usually applies to devices, which are connected to hose bibs, hydrants, or faucets, which are open to the atmosphere. Valves should not be located downstream of the device.
- RPZ means a reduced pressure principal backflow prevention assembly.
- Pipe applied AVB means an atmospheric vacuum breaker permanently installed in the plumbing or on faucets.
- Hose bib AVB means a hose bib type atmospheric vacuum breaker with a single or with dual checks and a vent.
- Wall hydrant w/AVB means a through the wall, frostproof self-draining type wall hydrant with AVB attached or built in.
- PVB means a pressure vacuum breaker.
- Spill resistant AVB have the same ASSE # as standard, pipe applied AVB.
- Spill resistant PVB have ASSE # 1056.
- DG-DC means a double gate-double check valve assembly.
- Dual Check without a vent means a device composed of two independently acting check valves ("residential dual check" and "beverage dispenser dual check").
- Double check with a vent means a device composed of two independently acting check valves with an intermediate atmospheric vent ("boiler dual check").

INFORMATION:

- Yard hydrants, which are frostproof and drain the water in the barrel through an underground weephole are subject to contamination and are prohibited.
- Some wall hydrants will not drain if the hose is left connected.

Appendix B.

_____ WATERWORKS
SERVING THE COMMUNITY OF
_____
CROSS CONNECTION CONTROL PROGRAM
QUESTIONNAIRE

Introduction

A “cross connection” is an unprotected actual or potential piping or plumbing arrangement between a customer's residential piping system and the public water system through which a substance other than potable water could backflow into the public system.

The most common problems in a home are commode flush tank valves submerged in the tank, the connection of hoses or other devices to hose bibs that are not protected by a hose bib vacuum breaker, and the use of yard hydrants that have a drain hole underground. Most homes can be adequately protected by applying an approved vacuum breaker on all hose bibs and through the installation of an anti-siphon flush valve.

Hoses left submerged in swimming pools, kitchen sinks, bath tubs, animal watering troughs, or having chemical sprayers attached to them while weed-killing are 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 other liquids can be siphoned into the hose and into the home.

Frost proof yard hydrants drain into the ground when turned off. The drain hole underground could allow contaminated groundwater to be siphoned into the home. An approved backflow device installed on the line feeding the hydrants will provide adequate protection but is expensive. An alternative is to just plug the hole or pipe the drain to daylight.

All inside and outside hose bibs except those for dishwashers and washing machines will require vacuum breakers**.**

Vacuum breakers may prevent hose bibs and frost proof yard hydrants from draining. Please read manufactures recommendations for winter draining or purchase the frost-proof type that self-drain.

The waterworks owner has the primary responsibility for preventing substances from an unknown, questionable, or nonpotable source from entering the public water supply.

The consumer, homeowner, or resident also shares in this responsibility and has the primary responsibility for preventing pollutants or contaminants from entering the residential piping system.

We are taking the first step in implementing its Cross Connection Control Program. This is our first mailing of the residential questionnaire. It is our hope that all homes come into compliance by the end of_____. We will be required to send out a questionnaire each year to show that you are still adequately protected.

Your cooperation is needed for us to have an effective program to eliminate cross connections in our water systems. You are asked to complete and return the survey form by the end of _____.

We will contact you to determine the most cost effective means to provide you and the community protection from cross connections and backflow.

Please contact the following at 540-_____if you have any questions:

_____, owner
_____Waterworks
_____address

Appendix B. Continued

_____WATERWORKS
QUESTIONNAIRE
_____Date

Name_____
Address_____
Home Telephone_____
Work Telephone_____

Property Owner if not current resident
Name _____
Address _____
City, State, Zip _____
Telephone_____

Please check any item that may apply to your premises:

___outside spigots without vacuum breaker
___swimming pool
___animal watering trough
___shampoo bowl/sink
___private well, spring or cistern
___darkroom/photo development
___frost-proof spigot with vacuum breaker
___Jacuzzi/hot tub
___frost-proof spigot without vacuum breaker
___ lawn irrigation sprinkler system
___ fire protection sprinkler system
___mop sink/laundry sink/utility sink with hose bib threads
___baptismal pool
___dye vat
___steam or hot water heating system
___carbonated drink machine
___yard hydrant/yard spigot/standpipe
___fish pond
___pressure booster pump
___solar heating system
___dialysis equipment
___water storage tank
___hose end sprayer for fertilizer or other chemicals
___pressure washers

Appendix B. Continued

Please offer a brief description of any other items or treatment units connected to the water system on your property:

_____
_____
_____
_____

Please list any existing cross connection control devices you have installed and if they appear to be working properly:

_____
_____
_____

Any additional comments:

_____
_____
_____
_____

Please return this form to:

_____owner
_____address

Appendix C.

CROSS-CONNECTION CONTROL PROGRAM

_____WATERWORKS

_____Date

_____

_____

_____

Dear _____:

The Cross-Connection Control questionnaire identified certain health hazards associated with your plumbing system, which must be corrected in order to protect the_____ waterworks serving our community. Backflow prevention devices or separations must be installed to comply with our waterworks operation permit. Below is a listing of devices, their locations and appropriate standard to use when purchasing the device? Separations are also detailed below:

_____
_____
_____
_____

The backflow prevention device installed at _____ must be tested on installation and annually thereafter by a certified tester.

The date of completion for this work should be within _____ days.

If you have any questions or require additional information or additional time to complete the required work, please contact me at the above address or by telephone at _____.

Yours truly,

Waterworks Owner

Thermal Expansion

Normally, as water is heated and expands it would back up in the service line and into the main if no usage were occurring. Installation of backflow prevention devices or certain plumbing appurtenances (pressure reducing valves) at the service connection or within the residential water supply system prevent thermally expanded water from flowing from the premises into the distribution system. When the water heater is operating, water is expanding and pressure is increasing, thermal expansion in a closed plumbing system under no flow conditions may cause the emergency temperature and pressure relief valve to open and close frequently and may reduce the life of plumbing fixtures and piping.

The temperature and pressure (T & P) relief valve is an emergency relief valve, not an operating control valve. If the T & P relief valve is used frequently, its useful life will be shortened and it could cease to function. If the T&P valve locks in the closed position, and there is a backflow prevention device on the service line, the water heater could rupture.

Thermal expansion can cause damaging stress and strain to water heaters, solenoid valves, O-rings, float valves, pump seals, and plumbing fixtures or fittings.

Generally, 80 psi for a short period is the maximum pressure under no flow conditions most fixtures, appliances, or appurtenances should be subjected to.

Where thermal expansion is a problem, the following devices could be installed:

1. a bladder or diaphragm type expansion tank;
2. an auxiliary pressure relief valve;
3. an anti-siphon ball cock with auxiliary relief valve into the toilet tank set at no more than 80 psi.

Installation should be in strict accordance with the manufacturer's instructions, the Uniform Statewide Building Code and the National Sanitation Foundation.

Solutions to thermal expansion will be at the discretion of the residential water supply system owner and at the expense of the residential water supply system owner.

Appendix E.

CROSS CONNECTION CONTROL PROGRAM
_____ WATERWORKS
_____ DATE

_____

_____

_____

Dear _____:

In order to comply with our cross connection control program the backflow prevention assembly instated at your residence needs to be tested by a certified tester. This device needs to be tested within 60 days from the date of this letter. The tester should have the necessary report forms, which must be completed and returned to the waterworks.

Should you need assistance in location a certified tester or should you need additional information or time to complete the required work, please call at _____.

Yours truly

Waterworks Owner