Fiscal Note

Rule Citation No. 15A NCAC 18C .0406

Commission: NC Commission for Public Health

Rule Topic: Rules governing public water systems

DEQ Division: Division of Water Resources

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Impact Summary:

State government:	Yes
Local government:	Yes
Private entities:	Yes
Federal government:	No
Substantial Impact:	No

Necessity: The existing rule .0406 is confusing and is being revised to reference consensus standards for cross-connection control programs. According to M14, *Backflow Prevention and Cross-Connection Control Recommended Practices* [AWWA M14],

> *A cross-connection is an actual or potential connection between any part of a potable water system and an environment that would allow substances to enter the potable water system. Those substances could include gases, liquids, or solids, such as chemicals, water products, steam, water from other sources (potable or nonpotable), and any matter that may change the color or taste of water or add odor to water.*

Cross-connection control programs protect water systems from such contamination. [Lee et al, Craun and Calderon] When required by 15A NCAC 18C .0206, a water system must have an Operator in Responsible Charge (ORC) for a cross-connection control program. The existing rule .0406 specified some conditions in which backflow prevention assemblies would be required. These requirements were addressed during review of construction projects. The rule is being revised to adopt an approach closer to that mandated in M14 [AWWA M14]. The revised rule addresses requirements of a cross connection control program.

Three options were considered for rule adoptions. Option 1: keep existing rule, option 2: the rule proposed today, and option 3: propose an additional rule mandating testing of backflow prevention assemblies and development of a plan to review the water system for needed new installations. Option 1 leaves the cross-connection program unclear, with vague rule language. Option 3 would create substantial and expensive new requirements. Option 2 was chosen as the

best compromise option. The rule being proposed today describes the job responsibilities of a cross-connection control ORC and adopts M14 by reference.

The existing rule specifies that cross connections will be reviewed by the PWS Section based on the degree of hazard involved. The most comprehensive list of PWS Section expectations was written in a supplemental guidance document that has not been updated in recent years. M14 was developed by the American Water Works Association. As is the case with other American Water Works Association standards, M14 is developed by practitioners and represents the state of technology in the cross-connection industry. Adopting the standard by reference ensures a technically robust process and standards that are updated as technology changes. Referencing M14 is also consistent with the approach taken for other rules in 15A NCAC 18C [AWWA M14].

The existing rule lacks a specific requirement for cross-connection control recordkeeping and for reporting cross-connection incidents. Without a consistent requirement, practices among water systems vary and it is difficult for the PWS Section to evaluate programs consistently. All proposed rule changes are risk management tools expected to reduce overall cross-connection incidents and improve reaction when incidents do occur.

1. Background

Non-transient non-community water systems are public water systems that serve at least 25 of the same persons over 6 months of the year [CFR]. EPA describes examples as “schools, factories, office buildings, and hospitals which have their own water systems” [EPA]. The owner of a non-transient non-community water systems controls both the source and the distribution system, and would install and maintain backflow prevention assemblies.

Community water systems are public water systems that serve at least 15 service connections used by year-round residents or regularly serve at least 25 year-round residents [CFR]. EPA further describes community water systems as public water systems that supply “water to the same population year round”[EPA]. Community water systems control the source and water mains in the distribution. The point of service where a customer connects to the public water system is typically metered. Contaminants introduced to the customer’s premises have the potential to contaminate the supplying water system. The North Carolina Plumbing Code governs installation of the customer’s plumbing system. Higher risk customers may require additional oversight to protect the supplying water system’s distribution [AWWA M14]. Most community water systems in North Carolina requiring backflow prevention assemblies specify that those assemblies be installed and maintained by the customer.

2. Proposed Rule Changes

a. Updates text mandating water distribution materials to the current and appropriate standards.
b. Provides the introductory requirement from which the rest of Paragraph (b) follows. The second sentence is verbatim from stricken .0406(b)(2).
    1. The North Carolina Plumbing Code has requirements designed to protect the building from cross connections between hazards and the consumers of water. The placement of the backflow prevention assembly for compliance with the NC Plumbing Code will protect both the consumers of water as well as the distribution system of the supplier of water. Review for plumbing code compliance is handled outside of DEQ and does not need duplicative DEQ review. This is consistent with current practice.
    2. Clarifies the types of connections that require Departmental review, as the existing rule language is confusing. The focus of state review is on connections where there is another source of supply or large service area. A non-public community water system is defined in Rule .0102. this is consistent with current practice, except there was never an additional national guide referenced and therefore, case-specific state review was required.
    3. This section covers both the standards applicable to situations where the plumbing code does not apply, as well as additional potential cross connection situations needing backflow prevention but where state review is not needed.
        A. Specifies the standards that backflow prevention assemblies must meet.
        B. Specifies the standards which must be followed for installation. Several AWWA and ASSE standards are given, which apply to different types of backflow prevention assemblies. The supplier of water must follow the appropriate standard that corresponds to the backflow prevention assembly they are installing.
        C. Covers hazards related to the water treatment process. The supplier of water must ensure that the appropriate backflow prevention is provided in accordance with AWWA M-14.
        D. This paragraph is similar in wording and unchanged in intent from the existing rule in .0406(b)(7)
        E. This paragraph is similar in wording and unchanged in intent from the existing rule in .0406(b)(3) except that installation requirements have been relocated to (3)(F).
        F. Covers installation, taking some language that was included in the Rule and in Appendix B, and centralizing.
    4. Specifies that no connections shall be made to a distribution system without the approval and authorization of the supplier of water. The supplier of water

cannot protect against cross connections if connections are made without their knowledge and consent.

5. A new section on record-keeping ensures that the work that is done to protect the distribution system from cross connections on an ongoing basis is documented. Record-keeping requirements apply to any supplier of water that has 5 or more testable assemblies required by the rule, regardless of the ownership or control of each assembly. Record-keeping requirements include documenting implementation aspects of a cross connection control program.
6. A new requirement for the supplier of water to alert the state if there is a known backflow incident into the public water system, and to prepare a report for the state about the incident if requested. This notification has typically occurred, but as backflow has the potential to cause serious harm to the consuming public, it is important for the state to be aware, in case additional public notifications are warranted.

The preface to M14 states that [AWWA M14, p. ix]:

> *It provides both technical and general information to aid in the development, implementation, and management of a cross-connection control and backflow prevention program, and an understanding of backflow prevention concepts.*

M14 was developed by the industry and captures the state of practice. It does not mandate a particular set of actions but provides a framework for water systems to evaluate their own decisions and make risk mitigation decisions. M14 was first published in 1973, and each of the four editions of this document have updated industry standards.

The PWS Section does not believe that item 3 above impacts the costs or benefits of public water systems. By citing M14 in regulation, the PWS Section is clarifying the process by which public water systems evaluate their exposure to cross-connections and backflow. The new rule is consistent with industry practice and M14 is considered part of the baseline for this analysis. The added benefit of codifying M14 in rule is to promote consistency and transparency, and to support cross-connection control operators justifying risk mitigation practices to governing boards.

3. Estimating the Fiscal Impacts

Recent changes to 15A NCAC 18D .0206 are expected to increase the number of water systems required to have an Operator in Responsible Charge (ORC) for cross-connection control. Proposed rule changes .0406(b)4-6 impose new costs on the water supplier. For the purposes of

the following discussion, water systems serving 10,000 or fewer people are described as small systems [EPA-2], and water systems serving over 10,000 people are described as large systems.

.0406(b)(4) establishes that the supplier of water must authorize connections. Existing cross-connection programs already have a process for overseeing connections, but water systems required to add a program through recent rule changes and most small water systems would spend additional staff time on this requirement.

.0406(b)(5) imposes new recordkeeping requirements on systems. A survey of existing cross-connection control programs in large systems indicated that most of those programs use a software program to track backflow prevention assemblies. Several ORCs commented that limited data were available on backflow assembly repairs required by the proposed .0406(b)(5)(C). It is anticipated that large cross-connection control programs currently lacking software packages will purchase those to manage connections. The workload of tracking for small cross-connection control programs is expected to increase relative to the number of new backflow prevention assemblies anticipated per year, although no software costs are anticipated for small systems due to the availability of free software packages such as the XC2 "EZ" software package [XC2].

.0406(b)(6) imposes a reporting requirement in case of backflow into the public water system. Reporting can be by email and the time required for this activity is included in recordkeeping estimates.

Key data sources were the fiscal note for adoption of 15A NCAC 18D .0206 [18D .0206] and a survey emailed to members of the NCAWWA/WEA cross-connection and backflow subcommittee [Backflow committee]. Survey questions are shown in Appendix A and results are summarized in Table 1.

Population estimates in Table 1 were taken from SDWIS, the database of record. Some survey respondents didn't have data for all questions, where data are missing a blank cell is shown.

Table 1. Cross connection survey results

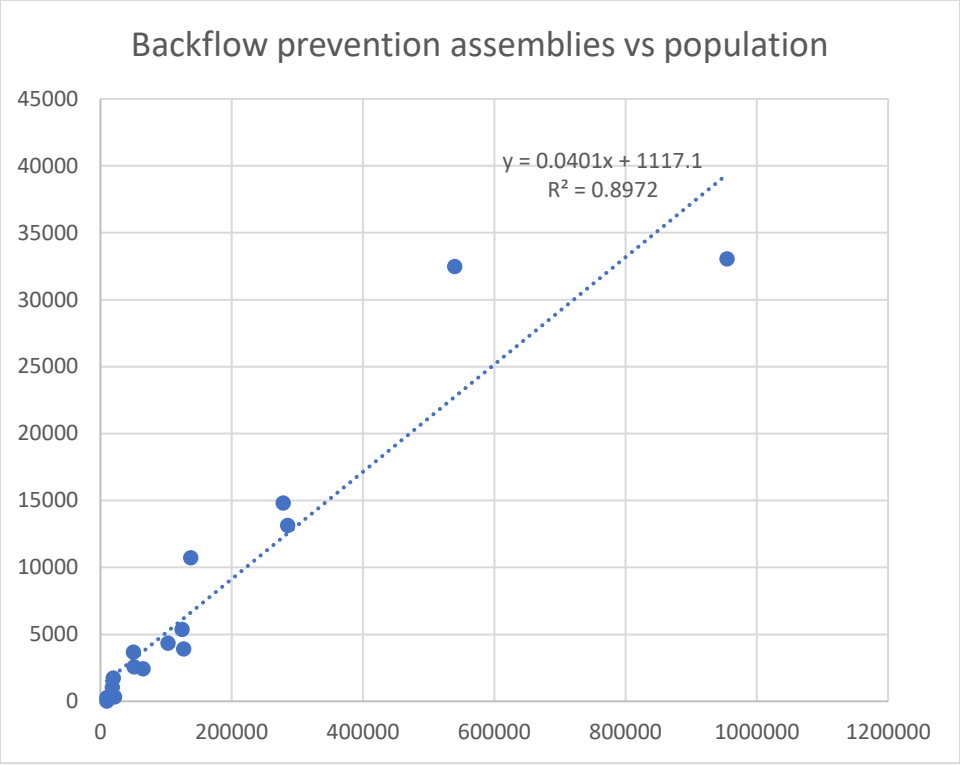
Population	Number of backflow prevention assemblies	% of backflow prevention assemblies repaired or replaced last year	% increase 2011-2015
137414	10728	1.10%	10.38%
540000	32467	0.92%	
126761	3923	7.85%	34.84%
103140	4333	3.97%	
285344	13133		

278440	14803	10.40%	
954644	33040	1.80%	32.43%
9900	287	0.70%	33.33%
21344	332	3.31%	19.07%
19822	1734	2.31%	21.41%
51088	2585		
50394	3666		35.00%
124300	5362	5.63%	37.45%
10025	23		
65000	2429	25.85%	110.94%
18089	1043	1.25%	76.72%
		Increase (median)	34%
		Repair or replace (mean)	5.4%
		Repair or replace (median)	2.8%

Responses from seven of the systems were compared to system responses on the 2015 Needs Survey [Needs Survey]. Needs Survey responses included backflow prevention assemblies owned by the system. For community water systems, we can estimate that 1-2% of backflow prevention assemblies are owned by the system and the balance of backflow prevention assemblies are owned by customers. Several programs had software to track backflow prevention assemblies. The most commonly used software package was XC2. The company offers a free version of the software for up to 10,000 backflow prevention assemblies and a professional version with additional features [XC2]. Some cross-connection programs use an element of an asset management software such as Cityworks [Cityworks]. BSI online $495 annually [BSI]

A chart of current backflow prevention assemblies vs population developed from the survey is included as Figure 1. The regression line is represented as equation 1.

Figure 1. Relationship of backflow prevention assemblies to population, survey respondents.



Equation 1: number of cross connection control devices = .0401*population + 1117.1

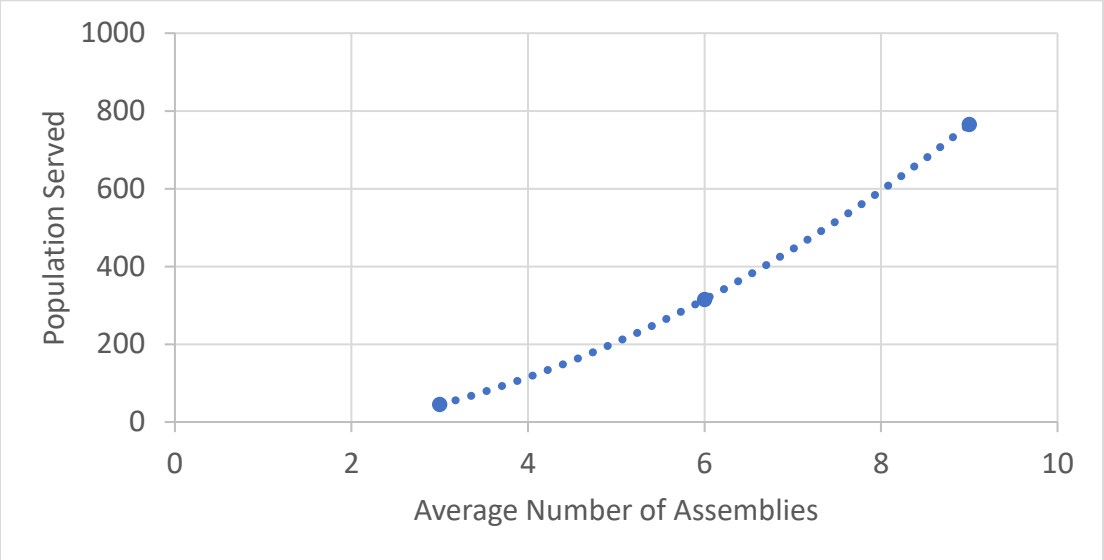
Most of the systems with cross-connection control ORCs participating in the survey were large systems, although one system served a population 9,900. For smaller systems, estimates included data from the fiscal note for 15A NCAC 18D .0206 [18D .0206, Pontius and Evans]. Expected numbers of backflow prevention assemblies by population ranges is included as Table 2. Figure 2 plots the number of backflow prevention assemblies. Analysis using Figure 2 predicted that water systems with a population 216 or greater would have 5 or more backflow prevention assemblies and would therefore be required to have a cross-connection control ORC.

Table 2. Population ranges and expected number of backflow prevention assemblies for small water systems.

System Population	Population Midpoint	# Assemblies (Community)	# Assemblies (Nontransient noncommunity)
<100	50	3	3
100-500	300	6	6
501-1000	750	9	9

System Population	Population Midpoint	# Assemblies (Community)	# Assemblies (Nontransient noncommunity)
1001-3300	2150	15	12
3301-10000	6650	31	15

Figure 2. Number of back flow prevention assemblies as a function of population served. Chart reflects populations 0-1,000 and applies to community and nontransient noncommunity water systems in that range.



Small systems and large systems are distinct populations and are generally handled using separate data. The exception is anticipated increase in number of backflow prevention assemblies. Published data did not include summary recommendations for small water systems. In general, we expect water systems with cross connection control programs to add backflow prevention assemblies over time, as operators interact with new customers and inspect existing facilities. PWS Section staff inspect all water systems on a frequent basis and review connections that may require backflow prevention. Staff indicate that small systems vary substantially from one another based on the presence (or lack) of industry customers, but that changes within individual small systems are less frequent than seen in large systems [Staff communication]. With no other data sources available for small systems, we are using the 35% increase over four years found from the survey of cross-connection control programs. Although we do not anticipate this number to be reached, it is used as an extreme upper estimate of the number of backflow prevention assemblies added in small water systems.

Additional data needed to estimate costs for backflow prevention assemblies are the time required to track new devices and the associated hourly salary costs. Professional expertise

suggests that contacting a homeowner, inspecting a backflow prevention assembly, and entering that assembly into a database can be completed in something more than 2 hours and less than 8 hours [Professional judgement]. Labor cost was $22 per hour [18D .0206, NCAWWA-WEA].

a. Costs
    1. Non-transient non-community water systems

All non-transient non-community water systems in North Carolina have populations less than 10,000. The water system owner controls the entire distribution system and has control over the installation and maintenance of backflow prevention assemblies. The .0406(b)(4) rule change is not anticipated to increase costs for non-transient non-community water systems, as a non-transient non-community water system would already be authorizing installation of backflow prevention assemblies. Changes to .0406(b)(5) and .0406(b)(6) are expected to increase reporting and recordkeeping costs for non-transient non-community water systems.

Cross-connection ORC's of non-transient non-community water systems have an existing requirement to maintain records. Over time, new backflow control assemblies will be added to the system. The cross-connection ORC will be required to add that assembly to inventory and to notify the Public Water Supply section of backflow incidents. Although not explicitly required by rule, the ORC has implicit responsibility to test and maintain backflow prevention assemblies owned by his employer.

Summary hours estimates are shown in Table 3. Based on 15A NCAC 18D .0206 analysis, all non-transient non-community water systems serving 216 or more people were assumed to have a cross connection control program. The initial estimate of backflow prevention assemblies was computed using summary data from Table 2. The number of assemblies after 4 years are estimated based on a 35% increase as described in the previous section, rounded to a whole number. The high hours estimate was based on 8 hours per new backflow prevention assembly added, with the low-cost estimate used 2 hours per new backflow prevention assembly.

Table 4 displays estimated total labor cost by water system type. Labor cost was $22 per hour as described in the previous section and was applied to the populations shown in Table 3 and summarized by water system type.

Table 3. Estimated number of cross connection control devices and high and low labor estimates in non-transient noncommunity water systems.

System Population	Estimated # Assemblies		Average annual increase	Estimated hours	
	Initial	After 4 years		Low	High
100-500	6	8	0.5	1	4

501-1000	9	12	0.75	1.5	6
1001-3300	12	16	1	2	8
3301-10000	15	20	1.25	2.5	10

Table 4. Costs to non-transient non-community water systems expected to have a cross-connection control program.

Owner Type	Number of systems	Added labor cost (low estimate)	Added labor cost (high estimate)
Local gov.	95	$2,090	$8,360
Private	41	$902	$3,608
Federal	2	$44	$176
State gov.	3	$66	$264

2. Small community water systems

Community water systems do not have control over the entire distribution system. .0406(b)(4), .0406(b)(5) and .0406(b)(6) are expected to increase community water system costs.

Cross-connection ORC's have an existing requirement to maintain records. Over time, new backflow control assemblies will be added to the system. The cross-connection ORC will be required to add that assembly to inventory and to notify the Public Water Supply section of backflow incidents. The PWS Section anticipates that the cross-connection ORC will inspect new backflow prevention assemblies before authorizing new connections.

Summary hours estimates are shown in Table 5. The initial estimate of backflow prevention assemblies was computed using summary data from Table 2. The number of assemblies after 4 years are estimated based on a 35% increase as described in the previous section, rounded to a whole number. The high hours estimate was based on 8 hours per new backflow prevention assembly added, with the low-cost estimate used 2 hours per new backflow prevention assembly.

Table 5. Estimated number of cross connection control devices and high and low labor estimates in community water systems.

System Population	Estimated # Assemblies		Average annual increase	Estimated hours	
	Initial	After 4 years		Low	High
100-500	6	8	0.5	1	4
501-1000	9	12	0.75	1.5	6
1001-3300	15	20	1.25	2.5	10
3301-10000	31	42	2.75	5.5	22

Table 6. Costs to community water systems expected to have a cross-connection control program

Owner Type	Number of systems	Added labor cost (low estimate)	Added labor cost (high estimate)
Local gov.	429	$9,438	$109,296
Private	435	$9,570	$58,608
Federal	3	$66	$704
State gov.	2	$44	$616
Mixed	1	$22	$132

3. Large community water systems newly required to have a cross-connection control ORC

Prior to revisions to 15A NCAC 18D .0206 there were 10 community water systems serving 10,000 or more people without a cross connection control program. The fiscal note for adoption of 15A NCAC 18D .0206 [18D .0206] assumed that these systems would be required to begin a cross-connection control program. Such systems have several operators already and are expected to hire a new operator or retrain a current operator to be cross-connection ORC.

New cross-connection control programs would not have the same history of operations as existing programs. As with small systems, much of the labor cost was modeled using the increase in connections. Equation 1 was used to estimate the current number of backflow prevention assemblies based on system population. Addition of new assemblies to the system was estimated using the median assembly increase from survey [Appendix A].

Large community water systems would be more likely than small systems to purchase software to track backflow prevention assemblies. Depending on features, quotes for two commonly used software packages ranged from $ 1,300 - $20,000. Additional features would be expected to reduce labor costs. The high cost estimate assumes 8 hours of labor per new device at $22 per hour and $5,000 for software licenses. The low-cost estimate assumes 2 hours of labor per new device at $22 per hour and $20,000 for software licenses.

Table 7. Estimated annual costs, 10 large systems with new programs.

Estimated assemblies		Low cost estimate	High cost estimate
Current number	Increase per year		
20,476	6,979	$ 264,887	$ 309,549

4. Large community water systems with an established cross-connection control program

There are 139 large water systems with established cross-connection control programs. Cross-connection control ORCs indicate that they already have a process for reviewing connections required to install backflow prevention assemblies, but that new reporting and recordkeeping are more detailed than current standards will add cost [Appendix A]. Reporting and recordkeeping were modeled at 5 days per year and operator salaries at $22 per hour [NCAWWA-WEA]. The estimated cost was $122,320 per year

5. State Government – Cross-connection control program oversight

The Public Water Supply Section addresses cross connection control during sanitary surveys. With the rule change, state government employees will need to 1) add fields to the sanitary survey to more closely track cross connection control programs and 2) conduct some training on cross connection control. Assuming that 40 hours of developer time are required, 16 hours of technical staff training time are required, and that 24 hours of management time are required to oversee these activities, the total state government costs of the rule change are $3,288.

6. Complete cost estimates

When all contributions are summed, the low-cost estimate is $412,737 per year and high cost estimate is $616,921 per year.

b. Benefits

Cross connections can introduce biological or chemical contaminants into a system, leading to illness or death [AWWA M14]. The agency does not have sufficient data to estimate the frequency of cross connection incidents in the state and their severity, although professional experience suggests the frequency of major incidents is consistent with national trends. Nationally, 7 of the 12 largest outbreaks in water distribution systems 1971 – 1998 were attributed to cross connections. Increasing oversight of cross-connections has substantial public health benefits. Those 7 cross-connection incidents resulted in a total of 6302 disease outbreaks or on average 190 cases per outbreak, with a range of 304-2,000 illnesses [Craun and Calderon]. For some perspective on potential costs of an outbreak we examined a paper detailing illnesses and response costs for an outbreak of Salmonella typherium in Alamosa, Co in 2008. This outbreak resulted from contamination of a water storage tank and would more closely match "distribution" contamination noted by Craun and Calderon than cross-connection. The paper estimated 1,423 illnesses and a cost of $1.5 million [Ailes]. For smaller outbreaks or contamination that was attenuated by control measures the expected cost would be lower.

Backflow and cross connection incidents also present direct costs to water systems, including substantial monitoring and labor costs and extra water use to clean out lines. A 1997 cross connection near the Charlotte, NC airport persisted for over 24 hours. 3M employees traveled from Minnesota to test proprietary chemicals while utility employees traveled door to door to notify customers and other utility employees flushed the distribution system [Krouse].

The proposed changes to 15A NCAC 18C .0406 will not eliminate cross connection incidents. The added reporting and recordkeeping should spur local programs to evaluate potential cross connections. When properly installed and maintained, backflow prevention assemblies will reduce the number of cross connection incidents in the water distribution system. Active monitoring and oversight of backflow prevention assemblies and planning by cross-connection control programs are expected to improve response times to incidents that occur and reduce the overall impact. Even with active cross-connection control programs, incidents are still expected to occur and to have cost impacts to public water systems. A 2003 study identified an average cost of $16,143 per cross connection incident and estimated an average of 3.3 cross connection incidents per 5 year period (or 0.6 per year) in water systems with a cross connection control program. The most expensive individual cross connection incident reported in this study was estimated at $1.6 million, while some incidents reported were estimated as $0 [Lee et al]. It should be noted that the total number of incidents identified is higher in water systems with cross-connection control programs than was seen in previous work on disease outbreaks [Craun and Calderon]. This may reflect cross-connection control program staff proactively identifying and managing smaller incidents, with the increased effort reducing overall risk [Lee et al].

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Appendix A

Proposed Regulation

15A NCAC 18C .0406 is proposed for Readoption as follows:

15A NCAC 18C .0406 DISTRIBUTION SYSTEMS

(a) Water Pipe Materials. ~~Distribution mains~~ Water pipes shall be cast iron, ductile iron, ~~asbestos-cement,~~ reinforced concrete, plastic, or other material designed for potable water system service and shall be ~~the appropriate AWWA standards, section C, or NSF Standards No. 14 and No. 15 that~~ ~~is~~ certified as meeting the specifications of NSF/ANSI Standard 61 Drinking Water System Components – Health Effects, which is hereby incorporated by reference including any subsequent amendments and editions. Copies are available for public inspection as set forth in Rule ~~.0102~~ .0102(a) of this Subchapter. The pressure rating class of the pipe shall be in excess of the maximum design pressure within that section of the water distribution system. The quality of pipe to be used shall be stated in the project specifications.

~~(b) Cross-Connections~~

~~(1) No potable water supply shall be connected by any means to another source of water supply or to a storage facility unless such connection has been previously approved by the Department. No connection shall be made to any plumbing system that does not comply with the North Carolina State Building Code, volume II, or any applicable local plumbing code.~~

~~(2) No person shall introduce any water into the distribution system of a public water supply through any means other than from a source of supply duly approved by the Department or its representatives, or make a physical connection between an approved supply and unapproved supply unless authorized in an emergency by the Department or its representative.~~

~~(3) In cases where storage capacity is used only for non-potable purposes and there is installed either an elevated or ground tank or a ground reservoir, the following precautions shall be taken:~~

~~(A) When the reservoir or tank is filled from a supply other than a public water supply and the public water supply is used as a supplemental supply, the pipeline from the public water supply shall be installed in such a manner that the water will be discharged over the top or rim of the reservoir or tank. There shall be a complete physical break between the outlet end of the fill pipe and the top or overflow rim of the tank of at least twice the inside diameter of the inlet pipe.~~

~~(B) When the reservoir or tank is filled entirely by water from a public water supply:~~

~~(i) If a covered ground reservoir or covered elevated tank is used, an approved reduced pressure back-flow preventor or an approved double check valve assembly may be used. The back-flow prevention device shall be installed in such a manner as to afford adequate protection, be easily accessible, and include all necessary pressure gauges and drains for testing. Gate valves shall be installed in the line at both ends of the back-flow prevention device.~~

~~(ii) If an uncovered ground reservoir or uncovered elevated tank is used, a complete physical break shall be provided between the reservoir or elevated tank and the public supply. The physical break between the inlet pipe and the top or overflow rim of the reservoir shall be at least twice the diameter of the inlet pipe.~~

~~(4) All cross-connections between potable water supplies and non-potable or unprotected supplies that are not specifically covered in the categories in this Paragraph will be considered special problems and the protective devices required shall be determined by the Department on the basis of the degree of health hazard involved.~~

~~(5) Persons desiring to install non-potable water supplies in conjunction with a public water supply shall submit detailed plans and specifications in triplicate showing the non-potable water supply and its relation to the potable water supply to the Department in accordance with Rule .0302(a) of this Subchapter.~~

~~(6) Any such interconnection to a potable water system is subject to the approval of the water supplier and shall not be made until authorized by the water supplier in addition to the Department.~~

~~(7) No person shall fill special use tanks or tankers containing pesticides, fertilizers, other toxic chemicals, or their residues from a public water system except at a location equipped with an over-the-rim free discharge of water or a reduced pressure backflow preventer properly installed on the public water supply that has been approved by the Department. No supplier of water shall permit the filling of such special use tanks or tankers except at locations so equipped.~~

(b) Cross-Connections: No person shall construct, maintain or operate a physical arrangement whereby a public water system has a cross-connection without the use of proper backflow protection. No person shall introduce any water into the distribution system of a public water supply through any means other than from a source of supply duly approved by the Department or its representatives, or make any physical connection between an approved supply and unapproved supply unless authorized in an emergency by the Department or its representative.

(1) Service Connection Relation to Plumbing Code. No supplier of water shall provide a service connection to any plumbing system that does not comply with the North Carolina State Building Code, Volume II, and any applicable local plumbing code, as determined by local plumbing code officials. The supplier of water shall install or require to be installed the appropriate testable backflow prevention assembly prior to making the service connection. Design of backflow prevention assemblies for service connections do not require Department review.

(2) Connections Requiring Departmental Review. Connections between a public water system and the following connection types require review and approval by the Department prior to making the connection. Installation of a testable backflow prevention assembly or air gap is required when the connection is non-potable or unapproved. Engineering plans and specifications shall be submitted in accordance with Section .0300.

(A) Any regulated public water system;

(B) Any community non-regulated public water system. Before providing connection, a supplier of water shall ensure that the construction of the non-regulated public water system either was approved in accordance with Rule .0301(a) or that proper backflow prevention is provided to protect the quality of the water in the public water system;

(C) Non-potable water treatment processes within a potable water treatment plant; and

(D) All cross-connections between potable water supplies and non-potable or unprotected supplies that are not specifically addressed in this Rule or AWWA M-14 *Backflow Prevention and Cross Connection Control,* which are considered special problems for which the degree of health hazard involved shall be determined by the Department.

(3) Backflow Prevention Not Addressed by the Plumbing Code.

(A) Testable backflow prevention assemblies shall meet American Society of Sanitary Engineering (ASSE) standards and carry an ASSE seal, be on the University of Southern California approval list for testable backflow prevention assemblies, or be on the North Carolina State Plumbing Code approval list for approved testable backflow prevention assemblies.

(B) Each assembly must be installed in accordance with the standard AWWA C510, AWWA C511, ASSE 1013, ASSE 1015, ASSE 1020, ASSE 1047, ASSE 1048, or ASSE 1056 applicable to the selected backflow prevention assembly, or Rule .0102(c)(2) for an air gap.

(C) For each identified water treatment process related hazard, the supplier of water shall provide the appropriate backflow prevention assembly or method to protect the water supply and water treatment employees in accordance with AWWA M-14 *Backflow Prevention and Cross Connection Control*.

(D) Filling stations for special use tanks or tankers containing pesticides, fertilizers, other toxic chemicals, or their residues. No person shall fill special use tanks or tankers containing pesticides, fertilizers, other toxic chemicals, or their residues from a public water system except at a location equipped with an over-the-rim free discharge of water or a reduced pressure backflow preventer properly installed on the public water supply. No supplier of water shall permit the filling of such special use tanks or tankers except at locations so equipped.

(E) A supplier of water shall not authorize for construction or other temporary, non-emergency use; connections to hydrants not equipped with an approved air gap; or a properly installed reduced pressure principle backflow prevention assembly.

(F) Non-potable Storage. In cases where storage capacity is used only for non-potable purposes and there is installed either an elevated or ground tank or a ground reservoir, the following precautions shall be taken:

(i) When the reservoir or tank is filled from a supply other than a public water supply and the public water supply is used as a supplemental supply, the pipeline from the public water supply shall be installed with an air gap.

(ii) When the reservoir or tank is filled entirely by water from a public water supply:

(I) If a covered ground reservoir or covered elevated tank is used, an approved reduced pressure back-flow preventer or an approved double check valve assembly may be used.

(II) If an uncovered ground reservoir or uncovered elevated tank is used, an air gap is required.

(G) Installation.

(i) Backflow prevention assemblies shall be installed in accordance with manufacturers' recommendations and specifications and be free from any field modifications.

(ii) Back-flow prevention assemblies shall be located and installed in such a manner as to afford adequate protection; be easily accessible for regular testing, maintenance, and inspection; and include all necessary test cocks and drains for testing. Valves shall be installed in the line at both ends of the back-flow prevention device to provide for replacement and maintenance.

(iii) Bypass lines parallel to a backflow prevention assembly shall have an approved backflow prevention assembly installed that is equal to that on the main line.

(iv) Reduced Pressure Principle Assemblies shall be installed above ground or below ground in a vault with positive gravity drainage to atmosphere employing a drain of sufficient size to handle the full flow of discharge from a discharging assembly, 12-inch minimum clearance from vault walls and floor, and in accordance with manufacturers recommendations. A reduced pressure principle assembly may be installed as protection for either a high-health or low-health hazard.

(v) Double Check Valve Assemblies shall be installed either vertically or horizontal and above ground, or below ground in a vault with positive gravity drainage to atmosphere. A double check valve assembly shall be installed as protection for a low-health hazard only.

(vi) Pressure Vacuum Breaker Assemblies shall be installed only where there is no means or potential means of a pressure higher than the supply pressure caused by a pump, elevated tank, boiler, air/steam pressure, or any other means which

may cause backflow, and in accordance with manufacturers recommendations. A pressure vacuum breaker shall be installed as protection for a high-health or low-health hazard that is subject to backsiphonage only, and with no backpressure.

(4) Supplier of Water Must Authorize Connections. Interconnection to a public water system is subject to the approval of the supplier of water and shall not be made until authorized by the supplier of water.

(5) Recordkeeping. A community or non-transient non-community public water system with five or more testable backflow prevention assemblies protecting the distribution system as required under this Rule shall maintain the following records beginning on January 1, 2020:

(A) Records of the location, type, installation date, and size of backflow prevention devices whose failure would create a high-health hazard or a low-health hazard and the associated hazards;

(B) A description of specific ongoing plans, actions, or schedules to inventory existing backflow prevention devices under (A) and to identify and address any uncontrolled cross-connection hazards;

(C) Final results of all backflow prevention assembly field testing and air gap inspections; and

(D) Review of new service connections and existing service connections during change of account owner to ensure any required backflow prevention devices are properly installed and tested.

(E) A supplier of water which contracts with a third-party to implement any part of their cross-connection program may allow records required by this paragraph to be maintained on the premises of the third-party, as long as the records are available on demand by the supplier of water.

(F) Program records under Paragraph (C) shall be maintained for a minimum of four years. Remaining records in this Paragraph shall be maintained while still current and/or in use.

(6) Reporting. Each supplier of water shall notify the Department of any known incident of backflow into the public water system that creates a risk of contamination as soon as possible upon discovery of the incident but no later than the end of the next business day. If requested by the Department, the supplier of water shall submit a written report of the incident describing the nature and severity of the backflow, the actions taken by the supplier of water in response to the incident, and the action plan intended to prevent such incidents in the future.

History Note: *Authority G.S. 130A-315; 130A-317; P.L. 93-523;*
Eff. January 1, 1977;
Readopted Eff. <date>; December 5, 1977;
Amended Eff. April 1, 2014; September 1, 1990; December 1, 1988; June 30, 1980.

Appendix B

Data request

Questions sent to the NCAWWA/WEA Schools Committee, Backflow Subcommittee [Backflow subcommittee]

1. Which water system do you represent?
2. How many total backflow prevention assemblies are in the system's distribution? If possible to determine, how many assemblies were in the distribution system in the years 2015 and 2011?
3. How many backflow prevention assemblies were repaired or replaced last year?
4. Does your program use a database or software package? Which one?