Implementation of US EPA's Operator Certification Program for Small Drinking Water Systems in Virginia

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Abstract

Virginia Tech researchers conducted a study to assist the Virginia Department of Health (VDH) in determining the policies and procedures necessary for the implementation of the United States Environmental Protection Agency final guidelines for the certification and recertification of small water system operators of community (CWS) and nontransient noncommunity public (NTNC) water systems serving under 3,300 people. A 42-question survey was developed and mailed to 2011 public water systems that serve 3,300 people or less.

Survey results revealed that small systems in Virginia encompassed a diverse group of waterworks and owners/operators. Significant differences were found when survey results were analyzed by the number of people served and system category. Systems serving less than 100 people tended to not have a licensed operator, not have a full time employee, not meter their customers, and not have an operations and maintenance budget. As the system size increased, the likelihood of each increased.

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Chapter 1: Introduction

The small water system research project was conducted to assist the Virginia Department of Health in determining the policies and procedures necessary for the implementation of the United States Environmental Protection Agency (USEPA) final guidelines for the certification and recertification of the operators of community (CWS) and nontransient noncommunity (NTNC) public water systems (PWS) serving under 3,300 persons. These final guidelines were published in the Federal Register in February 1999 by the USEPA and require that each state must adopt or implement a public small water system operator certification program by February 5, 2001. If a state has not adopted and implemented an approved program, the USEPA will withhold 20% of the capitalization grants a state is otherwise entitled from the Drinking Water State Revolving Fund (DWSRF).

One of the most challenging aspects of this legislation is certifying operators for the very small water systems. Since federal law allows each state flexibility in determining what constitutes a very small water system, many states have determined that systems serving fewer than 100 persons fall into this category (DeNileon, 2000). Examples of these systems include mobile home parks, state parks, campgrounds, rest areas, schools and daycare centers. Approximately 19 states currently require very small systems to have a certified operator and the remainder will have to establish programs by the February 2001 deadline (DeNileon, 2000).

Presently the Virginia Department of Health (VDH) has responsibility for drinking water quality and waterworks. In addition, the VDH is responsible for the DWSRF, which provides funding for construction projects and various technical assistance activities related to drinking water. Virginia is projected to receive $15,000,000 during fiscal year 2000 in support of the Commonwealth's DWSRF from the USEPA. If 20% of the DWSRF were withheld, a loss of $3,000,000 would be incurred.

The Virginia Board for Waterworks and Wastewater Operators (VBWWO) is responsible for regulating plant operators through classification, licensing, and prosecution in the Commonwealth. PWS operators are licensed through VBWWO in

conjunction with Virginia's Department of Professional and Occupational Regulation (DPOR). DPOR has the responsibility to oversee all non-medical professional licensing in the Commonwealth of Virginia. DPOR acts as an administrative agency that processes licenses and provides record keeping, but does not set policy. VBWWO, DPOR, and VDH work together to oversee the licensing process in Virginia.

Currently, Virginia has five classes of licensed operators for waterworks, but VBWWO is seeking to incorporate a sixth class for small water systems. VDH requires all water systems that serve more than 400 people and provide any sort of treatment to have at least one licensed waterworks operator in responsible charge at all times (Code of Virginia, 1995). Therefore, the upcoming regulations will most impact those smaller systems serving less than 400 persons that were not previously regulated.

Virginia Tech researchers were given the opportunity to research with the goal of "identifying and evaluating factors that encourage or impair licensed operator availability to small systems and recommend appropriate actions to meet small systems needs for licensed operators" through a grant from the Virginia Department of Health. The specific objectives of this research project were as follows: (1) develop a survey and a computerized, statistical way of analyzing the answers; (2) develop a GIS map of Virginia in Arcview with the locations of the small public water systems (PWS) in Virginia; (3) review and analyze the impact of relevant state and federal regulations on small PWS; (4) conduct interviews with personnel from the EPA, VDH, and DPOR in order to gain additional insights about the interpretation of regulations and problem areas; (5) review the issue of licensure versus certification through discussions with regulatory personnel, people affiliated with the American Water Works Association (AWWA), the Virginia Rural Water Association (VRWA) and the Association of Boards of Certification (ABC); and (6) provide insight on a practicable plan for the VDH.

Chapter 2: Information Gathered and Literature Reviewed

2.1 Definitions

Small system- water system serving less than 3,300 people

Community water system (CWS)- a public water system providing water to at least 15 service connections used by year-round residents or regularly serves at least 25 year-round residents

Transient non-community system (TNC)- serve transient populations in a specific geographic place (e.g. campgrounds, gas stations, parks)

Non-transient non-community system (NTNC)- a public water system that is not a community water system and that regularly supplies water to at least 25 of the same people, at least six months each year but not year-round (e.g. schools, factories, hospitals)

Licensure- a method of regulation whereby the Commonwealth of Virginia, through the issuance of a license, authorizes a person possessing the character and minimum skills to engage in the practice of a profession or occupation which is unlawful to practice without a license

Public water system (PWS)- a system that provides water to the public for human consumption through pipes or other constructed conveyances, if such a system has at least fifteen service connections or regularly serves at lest twenty-five individuals. Such term includes (i) any collection, treatment, storage, and distribution facilities under control of the operator of such systems and used primarily in connection with such system, and (ii) any collection or pretreatment storage facilities not under such control which are used primarily in connection with such system.

2.2 Overview of Regulations

2.2.1 Virginia Waterworks Regulations for Personnel (12 VAC 5-590-460)

A. Waterworks operators designated by the waterworks owner to be in responsible charge must possess a valid waterworks operator license issued by the Virginia Board for Waterworks and Wastewater Operators (VBWWO), Department of Professional and Occupational Regulation (DPOR), in accordance with that board's regulations (18 VAC 160-20-10 et seq.) and Chapters 1,2,3 and 23 of Title 54.1 of the Code of Virginia. The license must be of a classification equal to or higher than that of the waterworks. Additional operating personnel at the waterworks must also be licensed as specified below.

B. The number and class of operators in attendance and additional operating personnel are a minimum to meet the requirements of protection of the public health of the consumer and safety of the operating personnel. The classification of operators and additional operating personnel in attendance must conform with Table 2.1.

B1. The owner shall designate one or more properly licensed operators to be in responsible charge of the waterworks at all times. When no designated operator is on duty or in communication with the operating personnel in attendance at the waterworks, a substitute operator shall be designated by the owner. The substitute operator shall possess a valid operator license of a classification equal to or greater than that of the waterworks.

B2. All waterworks having design capacity of 2.0 mgd or higher and employing filtration must have a minimum of two operating personnel on duty whenever the plant is in operation. All other waterworks employing filtration must have a minimum of one operating person on duty whenever the plant is in operation.

B3. Waterworks designed for softening only and utilizing chemical precipitation:

B3a. Waterworks having a design capacity of 2.0 mgd or higher must have a minimum of two operating personnel in attendance at all times the plant is in operation; and

B3b. All other waterworks must have a minimum of one operating person in attendance at all times the treatment plane is in operation.

B4. Waterworks utilizing iron and manganese removal by precipitation and having a design capacity of 0.5 mgd or higher must have a minimum of one operating person on duty at all times the treatment plant is in operation.

B5. Waterworks providing treatment or no treatment and serving 400 or more persons and not previously covered will require daily attendance at each treatment facility by an operating person for sufficient time to insure proper operation of the facility and protection of the public health, as determined by the commissioner.

Table 2.1 Minimum classification for waterworks operations.

Plant Classification	Plant Capacity (MGD)	Equivalent Population Served	Treatment	Operator in Responsible Charge (Class)	Shift Supervisor (Class)	Others
Class I	15.0 or more	150,000	Conventional filtration or filter rate more than 2 gpm/ft^2	I	I	II, III, IV Trainee*
Class I	5.0 but less than 15.0	50,000 but less than 150,000	Conventional filtration filter rate more than 2 gpm/ft^2	I	II	II, III, IV Trainee*
Class II	Less than 5.0	Less than 50,000	Filtering rate greater than 2 gpm/ft^2	II	II	III, IV Trainee*
Class II	0.5 but less than 5.0	5,000 but less than 50,000	Conventional filtration	II	III	III, IV Trainee*
Class III	Less than 0.5	Less than 5,000	Conventional filtration	III	III	IV or Trainee
Class III	_____	5,000 or more	Approved treatment other than conventional filtration and fluoridation	III	IV	IV or Trainee
Class III	_____	Sufficient persons or connections to be classified as a public water supply	Not under higher classifications but using fluoridation	III	IV	Trainee*
Class IV	_____	Less than 5,000	Approved treatment other than conventional filtration and fluoridation or no treatment serving 400 or more persons	IV	IV	Trainee*

- Trainees should meet basic prerequisites for operators with the exception of experience and have potential for licensing wherever listed in these guidelines. Owner must provide a qualified substitute operator when only one operator is normally employed. The substitute must have the same class license as the operator.

2.2.2 Department of Professional and Occupational Regulation (DPOR) Regulations

The VBWWO and DPOR Rules and Regulations found in Statutes Title 54.1, Chapter 23 should be accessed for the detailed rules and regulations. What ensues is only a summary of these regulations and is meant as a brief overview.

Part I. Licensing and Classification Requirements

- To serve as an operator of a waterworks, it is necessary to hold a valid license issued by the Board of a classification equal to or greater than the classification of the waterworks and in the appropriate category
- Licenses for waterworks operators expire on the last day of February of each odd-numbered year. The Department of Commerce shall mail a renewal notice to the licensee outlining the procedures for renewal. Each licensee applying for renewal shall return the renewal notice and established fee.
- The following fees apply and are nonrefundable and shall not be prorated:
  -Application for licensure by examination or by reciprocity $95
  -Application for reexamination $75
  -Renewal of license $55
  -Penalty for failure to renew license within 30 days of expiration $55
- Table 2.2 provides a description of the waterworks classification system:

Table 2.2 Classification of waterworks facilities and waterworks operators in Virginia.

Class[a]	Treatment at Water System	Pop. Serving (persons)	Capacity (MGD)
V	May or may not have chlorine disinfection only.	X ≥ 400	-----
IV	Disinfection, corrosion control, iron/manganese removal, softening, slow sand filtration, rechlorination, and other approved methods of treatment; any combination. *No fluoridation*.	X ≤ 5,000	-----
III	Chemical coagulation, sedimentation, filtration other than slow sand filtration, disinfection, fluoridation, aeration, corrosion control; any combination.	X ≤ 5,000	X ≤ 0.5
II	Identical to Class III.	5,000<X≤50,000	0.5< X ≤50
I	Identical to Class III.	X > 50,000	X > 5.0

a. The same classifications apply to facilities and operators. An operator must have a license of the same or a more stringent classification in order to operate the waterworks.

Part II. Entry Requirements

- The Board may issue a Class V, IV, III, II, or I license only after an individual has met all the experience and examination requirements as set forth in the regulations. Each license shall be in the appropriate category and classification and shall indicate the highest classification of works the holder is qualified to operate.
- The Board may issue a license to any person holding a currently valid license or certificate in a state, territory, or possession of the United States, or in any foreign

country, or a certificate issued by the Association of Boards of Certification, provided the requirements and standards under which the license or certificate was issued are equivalent to those established by the regulations.

- Licensure is based on demonstrating minimum required knowledge, skills and abilities by examination and having practicable experience. Table 2.3 summarizes the education, specialized training and experience requirements for operator's license by class.

Table 2.3 Summary of requirements for operator's license by class.

License Class	Education[1]	Current License	Total Experience Required (Years)	Experience must be at this class facility or higher (Years)				Maximum Substitution Permitted (Years)
				Cl. V	Cl. IV	Cl. III	Cl. II	
V	BS degree	None	0.5	0.5				0.0
	High School	None	0.5	0.5				0.0
	None	None	1.0	1.0				0.0
IV	BS degree	None	0.5		0.5			0.0
	High School	None	0.5		0.5			0.0
	None	None	1.0		1.0			0.0
III	BS degree	None	1.0		1.0			0.0
		IV	1.0		1.0			0.0
	High School	None	2.0		2.0			1.0
		IV	2.0		2.0			1.0
	None	IV	4.0		4.0			2.0
II	BS degree	None	1.5			0.5		0.0
		IV	1.5			0.5		0.0
		III	1.5			0.5		0.0
	High School	III	4.0			2.0		2.0
	None	III	7.0			3.0		3.5
I	BS degree	II	2.5				1.0	0.0
	High School	II	6.0				2.0	3.0
	None	II	10.0		4.0	3.0	3.0	5.0

1 BS degree = bachelor's degree in engineering or engineering technology; or in physical, biological, or chemical science or engineering. All other bachelor's degrees will be considered the equivalent of high school education for meeting the education requirement, although individual courses in science, engineering, or public health may be substitutes for experience in accordance with §2.3 C.

High School = high school diploma, or GED, or college degree other than BS degree defined above.

All experience must be at a waterworks or wastewater works of the appropriate category and of a class equal to or higher than the class indicated in the table. Experience gained at a waterworks or wastewater works of higher class than currently held license must be under direct supervision and direction of a properly licensed operator.

- Please see the DPOR Regulations for the specific requirements for the Class I-V licenses.

Part III. Standards of Practice

- The Board may fine any licensee, suspend or revoke a license, either or both, if it finds that
  1. The license was obtained or renewed by fraud or misrepresentation; or
  2. The license operator has been found guilty by the board, or by a court of any material misrepresentation in the course of performing his/her operating duties; or
  3. The licensed operator has not demonstrated reasonable care, judgment, or application of his/her knowledge and ability in the performance of his/her operating duties; or
  4. The licensed operator violates or induces another person to violate any provisions of Chapters 1,2,3 and 23 of Title 54.1 of the Code of Virginia, or any provisions of these regulations.

2.2.3 Environmental Protection Agency (EPA) Federal Register: Final Guidelines for the Certification and Recertification of the Operators of Community and Nontransient Noncommunity Public Water Systems

The USEPA Federal Register published on Friday February 5, 1999 provides detailed rules and regulations. What follows is only a summary of these regulations and is meant to be a brief overview.

Public Health Objectives

The public health objectives of the guidelines are to ensure that:

- Customers of any public water system can be provided with an adequate supply of safe, potable drinking water;
- Consumers are confident that their water is safe to drink;
- Public water system operators are trained and certified and that they have knowledge and understanding of the public health reasons for drinking water standards;
- Ongoing training is necessary to the public health objectives of this program.

Antibacksliding

These guidelines represent only minimum standards. Therefore, it is expected that States whose current operator certification program requirements exceed these minimum standards not lower their operator certification program requirements. The Environmental Protection Agency will not approve the operator certification program of any State that reduces its standards below the level that existed 12 months prior to the effective date of these guidelines unless the reduction can be justified by the State and is approved by EPA.

Baseline Standards

Each state operator certification program must include as a minimum the essential elements of the nine baseline standards described below. Essential elements to avoid DWSRF withholding are introduced by the term "the States must." The State must describe how its operator certification program complies with each essential element. Additionally, several of the baseline standards include highly recommended elements that are intended to complement, improve, and expand the parameters of essential elements of an operator certification program. These highly recommended elements are introduced by words such as "the States should."

Authorization

As evidenced by an Attorney General's certification, or certification from delegated counsel, the State must have the legal authority to implement the program requiring the certification of operators of all community and nontransient noncommunity (NTNC) water systems and to require that the systems comply with the appropriate requirements of the program.

Classification of Systems, Facilities, and Operators

To avoid having DWSRF capitalization grants withheld, a state's program must meet the following requirements:

- It must classify all community and NTNC water systems based on indicators of potential health risks, which may include: (1) complexity, size, source water for treatment facilities, and (2) complexity, size for distribution systems. In addition, it must develop specific operator certification and renewal requirements for each level of classification.
- It must require owners of all community (CWS) and NTNC water systems to place the direct supervision of their water system, including each treatment facility and/or distribution system, under the responsible charge of operator(s) holding a valid certification equal to or greater than the classification of the treatment facility and/or distribution system.
- It must require, at a minimum, that the operator(s) in responsible charge or equivalent must hold a valid certification equal to or greater than the classification of their water system, including each treatment facility and distribution system, as determined by the State.
- It must require that all operating personnel making process control/system integrity decisions about water quality or quantity that affect public health be certified.
- It must require that a designated certified operator be available for each operating shift.

Operator Qualifications

To avoid DWSRF withholding, States must require the following for an operator to become certified:

- Operator applicants must take and pass an exam that demonstrates that the operator has the necessary knowledge, skills, ability and judgment appropriate for the classification. All exam questions must be validated.
- Operator applicants must have a high school diploma or a general equivalency diploma (GED). States may allow experience and/or relevant training to be substituted for a high school diploma/GED. Any education, training, or experience that is used to meet this requirement for any class of certification may not be used to meet the experience requirement.
- Operator applicants must possess the defined minimum amount of on-the-job experience for each appropriate level of certification. The amount of experience required should increase with each classification level. Post high school education may be substituted for experience and credit may be given for experience in a related field such as wastewater. Experience that is used to meet the experience requirement for any class of certification may not be used to meet the education requirement.

Grandparenting

The USEPA recognizes that there are many competent small system operators that may not meet the initial requirements to become certified. EPA has allowed a transition period to allow these operators to continue to operate the system through "grandparenting." Grandparenting determinations should be based on factors such as system compliance history, operator experience and knowledge, system complexity, and lack of treatment.

If States choose to include a grandparenting provision in their programs, they must include the following requirements:

- Grandparenting is permitted only to existing operator(s) in responsible charge of existing systems that, because of State law changes to meet these guidelines must for the first time have a certified operator.
- The system owner has two years after the effective date of the State's regulation to apply for grandparenting of the existing operator in responsible charge.
- The grandparented operator's certification must be site specific and non-transferable to other operators.
- Once an operator is grandparented, he or she within a State specified time period, must meet all requirements to obtain certification renewal including the payment of necessary fees, acquiring necessary training to meet the renewal requirements, and demonstrating the skills, knowledge, ability and judgement for that classification.
- If the classification of the plant or distribution system changes to a higher level, then the grandparented certification will no longer be valid.
- If the grandparented operator chooses to work for a different water system, he or she must meet the initial certification requirements for that system.

Enforcement

The State agency with primary enforcement responsibility for the Public Water System Supervision (PWSS) Program must have regulations that meet the requirements of these guidelines and require CWS and NTNC water systems to comply with State operator certification requirements. The Governor in nonprimacy States must determine which State Agency will have this responsibility. States must have appropriate enforcement capabilities, for example: administrative orders, bilateral compliance agreements, criminal or civil administrative penalties, and/or stipulated penalties.

States must have the ability to revoke or suspend operator certifications or take other appropriate enforcement action for operator misconduct. Examples of operator misconduct may include: fraud, falsification of application, falsification of operating records, gross negligence in operation, incompetence, and/or failure to use reasonable care or judgement in the performance of duties.

Certification Renewal

In order to avoid having DWSRF capitalization grants withheld, States must meet the following requirements:

- The State must establish training requirements for renewal based on the certification level held by the operator
- States must require all operators including grandparented operators to acquire necessary amounts and types of State approved training. States may determine other requirements as deemed necessary.
- States must have a fixed renewal cycle not to exceed three years
- The State must require an individual to recertify if the individual fails to renew or qualify for renewal within two years of the date that the certificate expired.
- States must pay special attention to ensure that grandparented operators possess the knowledge, skills, ability and judgment to properly operate the system.

Resources Needed to Implement the Program

States must provide sufficient resources to adequately fund and sustain the operator certification program. Components include, but are not limited to staff, data management, testing, enforcement, administration, and training approval. USEPA recommends that States establish a dedicated fund that is self-sufficient.

Recertification

The States must have a process for recertification of individuals whose certification has expired for a period exceeding two years. This process must include review of the individual's experience and training, and reexamination. An individual is not certified with an expired certificate. The State may develop requirements that are

more stringent for recertification for individuals whose certification has been expired, revoked, or suspended.

Stakeholder Involvement

Stakeholder involvement is vital to the public health objectives of the program to ensure the relevancy and validity of the program and the confidence of all interested parties.

States must include ongoing stakeholder involvement in the revision and operations of State operator certification programs. Public comment on rule revisions is not adequate stakeholder involvement. A stakeholder board or advisory committee is strongly recommended.

Program Review

States must perform reviews of their operator certification programs. USEPA recommends that States perform periodic internal reviews and occasional external/peer reviews. Review items include regulations, exam items for relevancy and validity, compliance, enforcement, budget and staffing, training relevancy, training needs through examination performance, and data management system.

2.3 Interviews

One of the project objectives was to conduct interviews with personnel from the EPA, VDH, and DPOR in order to gain additional insights about the interpretation of regulations and problem areas. The research team conducted numerous interviews throughout the project, which are listed below in Table 2.4.

Table 2.4 Interviews conducted

Organization	Contact	Place	Date
VT Printing Services	Jenny Akers	Blacksburg, VA	5/25/99
VT Graduate Student	Rob Dietz	Blacksburg, VA	6/8/99
Virginia RWA	Andy Crocker	Blacksburg, VA	6/11/99
VT Graduate Student	David Keuhl	Blacksburg, VA	6/14/99
Virginia Water Research Center	Alan Raflo	Blacksburg, VA	6/10/99*
Virginia Water Research Center	Jane Walker	Blacksburg, VA	6/10/99
Southeast Rural Community Assistance Project, Inc.	Wayne Weikel	Roanoke, VA	6/17/99
Southeast Rural Community Assistance Project, Inc.	Linda Sims	Roanoke, VA	6/17/99
United States Environmental Protection Agency	Peter Shanaghan	Chicago, IL	6/21/99
United Water Inc.	Gordon Grimes	Chicago, IL	6/21/99*
Association of Board Certification	Sandra Canning	Chicago, IL	6/21/99
Association of Board Certification	Jen McDowell	Chicago, IL	6/22/99
Nebraska HHSS	Richard Koenig	Chicago, IL	6/23/99
CSUS Professor	Ken Kerri	Chicago, IL	6/23/99
Water Advisory Committee	WAC	Lexington, VA	7/15/99
Virginia Department of Health	Mark Anderson	Richmond, VA	7/19/99*
Virginia Department of Health	Bennett Ragnauth	Richmond, VA	7/19/99*
Department of Professional and Occupational Regulation	DPOR Board	Richmond, VA	7/21/99
Blacksburg Water Treatment Plant Operator	Jerry Higgins	Blacksburg, VA	7/27/99
VT Cntr. Survey Research	Alan Bayer	Blacksburg, VA	1/25/00*
Floyd Public Service Authority	Ann Young	Floyd, VA	4/6/00
AWWA Regional Meeting	Richard Puckett	Roanoke, VA	4/13/00

* Denotes multiple meetings; Most recent contact listed

2.3.1 Development of a Small Systems Survey

Dr. Ken Kerri, a professor from California State University at Sacramento (CSUS) and a highly respected professional in small water systems, suggested that the survey be mailed out in the fall because summer is the peak demand for the operators and the winter would not be ideal. He felt it was important to emphasize on the cover letter that the Commonwealth of Virginia was developing a small water system program and the survey provided the operators/owners the opportunity to express their feelings about operator certification for small water systems. Mr. Andy Crocker from the Virginia Rural Water Association (VRWA) thought that the survey response rate could be increased by publicizing the survey in order to make small systems operators aware of its importance.

Representatives from the Southeast Rural Community Assistance Project Inc. (SERCAP) believed that the operators/owners who responded to the survey would most likely be the ones with the available resources. Therefore, they thought the smaller systems should be targeted in order to receive a larger response. SERCAP thought the small systems research team may have to telephone and/or visit systems. They also suggested the use of an "enticement" with the survey such as a ruler or a copy of the survey results. SERCAP strongly recommended that the research team make the surveys confidential and make it obvious to the respondents that their opinions can influence certification/licensure decisions.

Mr. David Keuhl, a graduate research assistant in environmental design at Virginia Polytechnic Institute and State University published *The Virginia Small Water Systems Survey: An Assessment of Public Health Performance Appraisals*. He sent out an eight page, 85-question survey to small water systems in the Commonwealth and had a return rate of 13.3%. Keuhl provided the research team with numerous suggestions for the survey and proofread the final version of the survey. Some of his suggestions include:

- A classification system (community, transient noncommunity, and non-transient noncommunity water systems) be built into the survey since he found that distinct differences occurred in the survey group

- The use of a scanned survey (opscan) to minimize data entry
- The use of additional mailings and reminder postcards to increase the amount of participants
- The use of "don't know" as a choice for the survey questions
- To use specific examples to help the respondents choose the most appropriate choice (e.g. describing a NTNC system and providing several examples)
- Making the survey easy to fill out and using identification numbers
- Asking if the small system metered their customers

Mr. Alan Bayer from the Survey Research Center at Virginia Tech provided numerous insights to maximize the survey response rate including:

- To make the survey appear more professional by using a booklet format on cream or off-white
- To have additional mailings with identification (tachometer) numbers on each survey
- The use of identification numbers to keep track of who has replied and to prevent bothering the small system with future mailings
- To ensure the information would be treated confidentially
- To create a nice title for the project such as "Virginia Water Systems Program"
- The use of stamps on each envelope instead of prepaid envelopes

2.3.2 Current State of Small Systems in Virginia

Mr. Andy Crocker from VRWA described a small water system in Virginia as a system with approximately 100 connections with one operator that may or may not be licensed. If the operator were licensed, it would be a class IV or V license. He stated that it was typical for the operator to be responsible for both the water and the wastewater treatment plants as well as to perform numerous other duties such as maintain the lawn as well as read the meter. Mr. Crocker thought the majority of the small system operators were dedicated hard working people, but needed equipment and/or additional help. Overall, he believed that Virginia was in good shape and that the operators had a solution

oriented standpoint. Andy did recommend that the water system manager be involved in training and learning about water systems because most managers lack the understanding of small systems. He suggested only making the grant money available if the system manager also received training.

Dr. Ken Kerri stated that "most people have delivered relatively safe water for years." He mentioned that several states are currently addressing the operator certification issue for small systems including California, Pennsylvania, and Michigan. Currently, California State University at Sacramento is producing a series of videos for small water systems, which will be incorporated into the California Certification guidelines.

Mr. Richard Koenig, the chair of Northeastern Nebraska's American Water Works Association has had extensive experience with small water systems. He stressed that one-on-one contacts is key to small water system feedback. Richard explained that Nebraska has a training position dedicated to small systems.

Representatives from SERCAP stated that "they had a lot of respect and admiration for 99.99% of small water system operators in Virginia." They mentioned that current small system operators are very hard workers and are usually not paid for overtime hours. Mr. John Hirst and Mr. Wayne Weikel from SERCAP both emphasized that an operator who is in responsible charge of a public water supply should have the ability to read and follow directions. They also pointed out the importance of the owner being held somewhat liable for the small system since the owner is usually reluctant to pay necessary maintenance costs because he or she does not understand the system's needs and requirements.

2.3.3 Operator Training and Qualifications

Mr. Richard Koenig explained that Nebraska requires that all operators are able to read and write as a safety precaution. He stated that the ability to read operational manuals and chemical placards is very important while operating a small water system. Richard also did not favor reciprocity because he believed that water system

characteristics were geographically specific. For example, operating a water system in the desert would not necessarily be the same as operating a water system in a mountainous region. Nebraska holds a training course during one week where four twenty-question exams are administered.

Mr. Andy Crocker from VRWA association believed that training of small system operators was necessary, but that some operators would face a conflict because they could not leave their positions for an extended period of time. He did not think that money for training would be a problem for the operators. Andy recommended that training sessions would be better attended if they were located throughout the entire State and near the operator's location. He thought the State should assume some of the cost for the small system operator's travel and licensing expenses and that training money should be set aside through funds and grants.

Ms. Linda Sims from SERCAP mentioned that it is difficult for operators to prepare for and take licensing tests because they are not accustomed to book studying and written testing. Therefore, she recommended that a correspondence course or video-teleconference be established. Linda mentioned that "Professional Development Workshops" were successfully held through video teleconferencing at nine locations throughout the state. These workshops are organized and offered by Virginia Tech under the auspice of a grant from the VDH.

Mr. Wayne Weikel from SERCAP felt that traveling for training would be a major concern for operators since most training is typically too far away. He suggested providing operators with reliable materials to study and review before the certification/licensure test and to offer the test more than two times a year. John Hirst recommended that the VT VWRRC sponsor a web page for small systems available for training and licensure/certification questions. Representatives from SERCAP also thought that reciprocity should be established in Virginia since in the next few years the number of people dealing with small water systems will increase. They suggested training be provided by VRWA since they already offer training for small water systems.

Mr. Mark Anderson from the VDH explained that training approaches used in Virginia include event training, correspondence courses, computer-based training, distance learning through community colleges, web based courses, video conferencing,

satellite conferencing, VHS tapes, on site, one-on-one mentoring, and structured on the job training. He provided a list of current operator training programs available to water system operators in the Commonwealth of Virginia:

- Virginia Tech Short Courses
- VMI Advanced Short School
- Virginia Rural Water (VRWA) Workshops and Symposiums
- VRWA Circuit Rider Program
- VRWA Water Annual Conference
- Virginia Peer Review Program
- Virginia Apprenticeship Program
- Virginia Section-AWWA Workshops, distribution rodeo, lab sessions
- Virginia Section-AWWA Operations Committee Sponsored Training
- Virginia Section-AWWA Annual Conference (technical sessions)
- Joint VWEA/Virginia Section-AWWA Workshops
- VDH Circuit Rider Program
- VDH/VT Professional Development Series
- VDH Sponsored Courses and Special Training (e.g. CCR)
- Cross Connection Control and Backflow Device Testing Courses
- Courses Offered by Private Sector Training Providers
- The Associates Degree Program for Waterworks Operators at Mountain Empire Community College
- Individual Community College Courses (noncredit and credit)
- College and University Courses (noncredit and credit)
- Equipment Vendor Training (storage tanks, feeders, instrumentation, etc.)
- Training Provided by Consultants
- California State University (Sacramento) Correspondence Courses

2.3.4 Establishment of New Class VI License

All three representatives from SERCAP agreed that a class VI license should be added to the DPOR Regulations to regulate small system operators. They agreed that it would be prestigious for the operators to be licensed versus being certified. Wayne Weikel stated that the license/certification fee should be affordable and felt that the owner should be responsible for the fee. John Hirst thought that tenure and track record should be taken into account for license/certification and that the operator should pay the initial fee, but then the owner should pay the renewal fees.

The Department of Professional and Occupational Regulation Board for Waterworks and Wastewater Works held a discussion concerning the creation of a new class for small system operators. It was noted that the Virginia Department of Health (VDH) would permit the waterworks and the owner while DPOR would handle the licensing of the operator. Mr. David Dick from DPOR said that the small system operators would have to be licensed rather than certified if DPOR were to be responsible for processing licensing. Therefore the Licensure Board agreed to recommend the creation of a Class VI waterworks operator. The Class VI includes those waterworks serving fewer than 400 people using a groundwater source without any treatment. Entry requirements for the Class VI operator were proposed as the same as the Class V operator.

Mr. Richard Puckett, the Field Director for the VDH Abingdon Environmental Engineering Field Office presented a detailed version of what to expect in the DPOR regulation revisions concerning operator licensure and training. He explained that currently in Virginia that waterworks serving less than 400 people and providing no treatment are not required to have a licensed operator. The current Class V includes groundwater source waterworks with hypochlorination serving greater than 400 people and includes consecutive waterworks with or without hypo-rechlorination. The Class VI license will apply to non-complex waterworks which, due to the lack of treatment, were not previously required to have a licensed operator. The Class VI experience will not count toward the on-the-job experience requirements of the higher classifications because there is no treatment experience.

2.3.5 The Grandparenting Clause

Dr. Ken Kerri emphasized that when you certify/license a large number of people, you want a high success rate. If there is a low success rate your exam will be vigorously attacked and criticized. He explained that the grandparenting clause would allow more time for the operators to obtain the training and skills necessary to pass the written exam. Dr. Kerri said the grandparenting clause would only apply to the operators' current system and if the operator would to move or transfer to another waterworks, the grandparenting would not carry over. It would still be necessary for the grandparented operators to pass the exam at the end of the specified period or they would not be certified/licensed.

Mr. John Hirst from SERCAP thought that Virginia should use the optioned grandparenting clause, but also should set up a plan to enforce slack operators. Richard Koenig of NHHSS also thought that the grandparenting clause was beneficial when it was implemented in Nebraska. This grandparenting was specific to the system where the operator was presently employed.

Mr. Mark Anderson from the VDH recommended that grandparenting should be approached on a case by case basis. For example, someone who has always been in compliance would receive a grandparented license, while someone who is usually out of compliance would not. He thought consumers' trust could be destroyed if an out of compliance operator was grandparented in and then still did not come into compliance by the specified deadline.

The DPOR Board thought the grandparenting clause should be implemented or problems may occur. For example, people might go to an unsafe drinking water supply to avoid a costly increase caused by having to hire a licenses operator. The grandparenting clause would allow a period for the operator/owner to get up to the standards. The Board agreed that the grandparenting clause would be for a site-specific license and the individual must be determined as the operator in charge of the facility. A renewal period of two to three years was suggested. The Board agreed that the operators would need to pass a written or hands-on exam in the future. Mr. Mark Anderson from the VDH estimated that 200 facilities would be affected by the grandparenting clause.

Mr. Richard Puckett explained the specifics of the proposed grandparenting clause to be implemented in Virginia under the new DPOR regulations. He stated that many very small waterworks operators might not be able to meet the initial licensure requirements. A two-year transition period will allow existing operators to become licensed through the grandparenting clause. The owner of a waterworks, who for the first time must have a licensed operator, can nominate the existing operator for the grandparenting provision. Only one person can be nominated per waterworks and a person can only be nominated for one waterworks. The application must be made within two years of adoption of the DPOR regulations.

Mr. Puckett mentioned that the license issued under the grandparent clause will be site specific, non-transferable and will expire two years after issuance. The Class VI licensure exam must be passed before the expiration date. This transition process allows up to four years for the nominee under the grandparent clause to pass the exam. However, at the time of adoption of the DPOR regulations, a licensed operator in responsible charge must be designated by the waterworks owner. A contract operator may be necessary until the nominee under the grandparenting clause becomes licensed.

2.3.6 Continuing Education Requirements

According to Mr. Richard Puckett, a new addition to the two-year renewal process in Virginia is the training requirement. The following Continuing Professional Education (CPE) contact hours necessary for the renewal are listed in Table 2.5.

Table 2.5 Proposed continuing professional education contact hours in Virginia

License Class	Number of Contact Hours Per Year
I, II, III	20
IV	16
V	8
VI	4

A contact hour equals 50 minutes of instruction. The proposed number of contact hours for the Class VI license is 4 hours. These contact hours can be in any subject pertaining to the knowledge, skills, and abilities associated with the current classification held or the next higher classification. Examples include training on specific equipment, safety training, computer training, or training provided by organizations such as VDH, AWWA, VRWA, and equipment vendors. The trainer will provide the operator with documentation for the CPE contact hours earned.

2.3.7 Circuit Riders

Dr. Ken Kerri explained that circuit riders are used as a back-up operator when the typical operator goes on vacation. Dr. Kerri highly recommends the use of circuit riders to be responsible for a number of different systems in an area. These circuit riders would be paid a salary from each community or customer.

Mr. Richard Puckett suggested an alternative for the individual needing to obtain a license be for the waterworks owner to hire a licensed operator. This licensed operator may want to contract with one or more waterworks owners on a part-time, circuit-rider basis. Richard believed that communication and availability would be key in making this option work. The operator in responsible charge must be on site as needed to initiate the appropriate action in a timely manner.

2.4 Review of Other States Programs

The small systems research team contacted representatives from 15 states to ascertain how small water system certification/licensure was currently being handled across the United States. Ten out of the 15 states replied that they did have a small systems policy. Seven of the states with a small systems policy used certification instead of licensure to track small system operators. The average renewal period for license/certification of these states was two years with a range of one year up to three years. Data gathered from fifteen states nationwide indicated the mean cost of initial small systems certification was $36 with a range of $0 to $200. The mean renewal cost

for these same fifteen states was $22 with a range of $0 to $75. Of the ten states with current small systems policies, the average initial cost of license/certification was $48 and an average renewal cost of $26.50. On the job experience, passing an exam and having a high school diploma/GED were typical minimum requirements to obtain or renew a certificate/license.

Small water systems were typically monitored with inspections. The grandparenting clause was only used at eight of the ten states with small system policies. Training available in these states included workshops, technical assistance programs, correspondence courses and college courses. Training reimbursement was normally not available to the operators. All of the states had circuit riders available, typically through their state rural water association. Most of the states did not have a small systems web page available to operators. Certification/licensure exams were routinely given on paper, 2-3 times per year at a variety of locations throughout the state. Continuing education units (CEU's) were required in seven of the ten states with small system policies. The number of CEU's varied per state and tended to depend on the renewal period. Table 2.6 provides the specific information for each state on their certification/licensure programs.

Table 2.6 State certification/licensure programs in the United States

State Policies					***Permission***		***Training Available***					
State	*Small Sys. Policies*	*Year Imp.*	*Agency In charge*	*Grand-par Clause*	*Licen. vs. Cert.*	*Renewal Period (yr)*	*Schooling i.e. Cont. Education Credits*	*# Continuing Education Credits*	*Work-shops*	*Tech. Assist. Programs*	*Corresp. Courses*	*College Courses*
FL	Y	70's	DEP	N	L	2	N	NA	Y	Y	Y	Y
MA	Y	78	DEP	N	C	2	Y	5 / 2 yr.	Y	Y	Y	Y
PA	Y	60's	DEP	N	C	1	N	NA	Y	Y	Y	Y
IL	Y	60's	EPA	Y	C	3	Y	15 / 3 yr.	Y	N	Y	Y
MT	Y	67	DEQ	N	C	2	Y	4-10 / 2 yr.	Y	Y	Y	Y
NH	Y	88	DES	Y	C	2	Y	5-10 / 2 yr.	N	Y	Y	N
KY	Y	60's	DEP	N	C	2	Y	12 / 2 yr.	N	Y	N	Y
WY	Y	70's	DEQ	N	L	3	Y	21/ 3 yr.	Y	F=Y	Y	Y
CT	N	F=00	DPH	Y	C	3	N	NA	F=Y	N	Y	F=Y
CA	N	F	F=DHS	F=Y	NA	F=2	N	NA	Y	Y	Y	Y
AR	Y	57	ADH	N	L	2	Y	2.4/ 2 yr.	Y	Y	Y	Y
NJ	N	F	F=DEP	NA	NA	NA	NA	NA	NA	NA	NA	NA
SD	N	F	DENR	F=Y	F=C	F=1	N	NA	F=Y	F=Y	F=Y	F=Y
MD	N	F	MDE	N	C	3	N	NA	Y	Y	Y	Y
TN	Y	80's	DEC	N	C	1	N	NA	Y	Y	Y	Y

Table 2.6 State certification/licensure programs in the United States continued

State	*Monitored*	*Exams Freq.*	*# of locations*	*Computer vs. Paper*	*Minimum Requirements*
FL	Monthly Op. Reps.	2 / yr	7 - 10	P	HS Dip / GED ; 1 yr. Trainee exp. ; 1 training course
MA	Yearly	3 / yr	Varies	P	HS Dip / GED ; Depending on operator grade too.
PA	During Inspections	2 / yr	7	P	Min. education and work experience
IL	During Inspections	12 / yr	6	P	HS Dip/GED; experience
MT	During Inspections	anytime	7	P	HS Dip/GED; waiver for exceptions
NH	During Inspections	3 / yr	1	P	HS Dip / GED
KY	During Inspections	7 / yr	4	P	Education and experience depending upon license
WY	During Inspections	2 / yr	16	CP	HS Dip / GED ; Min. 6 months exp. + CEU's
CT	During Inspections	2 / yr	1	P	HS Dip / GED
CA	F	F=2 / yr	F=20	F=P	F=HS Dip / GED
AR	During Inspections	21 / yr.	10	P	HS Dip / GED; Regs. Changing for exemption
NJ	NA	NA	NA	NA	NA
SD	F	F=18 / yr.	Varies	F=P	F=HS Dip and Experience
MD	During Inspections	12/yr	Varies	P	HS Dip / GED ; experience; passing exam
TN	During Inspections	4/yr	3-7	P	HS Dip / GED ; experience; passing exam

Table 2.6 State certification/licensure programs in the United States continued

	Operator Cost				
State	*Initial cost Cert. - Licen.*	*Renewal Cost Cert. - Licen.*	*Training Reimbursement*	*Circuit Riders*	*Small Sys. Web Page*
FL	$200	$75	In the future	Florida-RWA	Y
MA	$30	$15	N	Northeast-RWA	N
PA	$20	$5	N	Tech. Ass. Out.	Y
IL	$40	$40	N	Illinois-RWA	N
MT	$50	$30	N	Montana-RWA	Y
NH	$50	$50	N	Northeast-RWA	N
KY	$30	$20	N	Kentucky-RWA	Y
WY	Free	Free	N	Wyoming-RWA	N
CT	$30	$30	N	Atlantic-RWA	N
CA	F=Free	F=Free	F=N	California-RWA	N
AR	$35	$10	F=Y	Arkansas-RWA	N
NJ	NA	NA	NA	NA	N
SD	F=$5	F=$3	F=Y	SDRWA, MWAP, DENR	Y
MD	$75	$75 + $150 cap	N	Maryland-RWA	N
NC	$25.00	$20.00	N	TAUD	N

KEY
C = Certification
L = Licensure
F = Future
Y = Yes
N = No
P = Paper
CP = Computer
NA = Not applicable

2.5 Published Literature

A literature review was performed by the research team to gather information relating to the development of the survey, operator training and qualifications, operator certification/licensure, the current state of small systems, and the USEPA final guidelines for the certification and recertification of CWS and NTNC PWSs serving under 3,300 persons.

2.5.1 Development of Small Systems Survey

The small water systems survey was designed and developed using the approach recommended by Dillman (1978). Some of the key ideas used in the construction process include:

- The questionnaire is printed as a booklet.
- No questions are permitted on the front cover.
- The questionnaire pages are printed in a photographically reduced form.
- The questionnaire booklet is reproduced on white or off-white paper by a printing method that provides quality very close to the original typed copy
- The survey begins with "easy" questions
- The questions are grouped to place questions with similar content together.
- Objectionable questions are placed after less objectionable questions.
- Clear directions are provided on how to provide answers to the survey.
- Multiple columns are used to save space on the survey.
- All questions fit the pages of the questionnaire, allowing no overlap.
- The questionnaire cover contains (1) a study title, (2) a graphic illustration, (3) any needed directions, and (4) the name and address of the study sponsor.
- The questionnaire back cover consists of an invitation to make additional comments, a thank you, and plenty of white space.
- The original study objectives are met while making the questionnaire look good and be interesting to the respondent.

Suggestions by Dillman for the implementation process include:

- The importance of the survey is established in the respondent's mind by describing it as useful to some group with which the respondent identifies in the first paragraph of the cover letter.
- The second paragraph of the cover letter seeks to convince the respondent that his or her response is important.
- The third paragraph of the cover letter promises confidentiality.
- The fourth paragraph of the cover letter reemphasizes the social usefulness of the survey.
- The respondents are promised a copy of the results if they choose to provide their name and address on the back cover.
- An identification number is used and explained to the respondent in the cover letter.
- First-class postage is affixed to the envelopes.
- A reminder post card should be used and mailed out one week after the original survey to serve as both a thank you for those who have responded and as a friendly and courteous reminder for those who have not.
- A replacement questionnaire is sent only to nonrespondents three weeks later. It is nearly the same in appearance as the original questionnaire, except it has a shorter cover letter that informs nonrespondents that their questionnaire has not been received and appeals for its return.
- Another reminder postcard should follow the second mailing.
- A third follow-up survey is sent if the desired survey response has not been achieved.
- Early return surveys are scrutinized to identify any potential problems.
- Respondent questions and comments should be acknowledged.

2.5.2 Current State of Small Systems

The National Characteristics of Drinking Water Systems Serving Populations Under 10,000 (USEPA, 1999) is a summary report drawn from three sources: the 1995

Community Water System Survey, the 1995 *Drinking Water Infrastructure Needs Survey*, and FY98 data from the *Safe Drinking Water Information System* (SDWIS). Some of their principle conclusions for waterworks in the United States include:

- There are 54,367 CWS in the USA serving about 252 million people. Approximately 93 percent of CWS are small systems serving fewer than 10,000 people. Although these small systems comprise the majority of CWS, they serve just 20 percent of the population served by CWS.
- There are 20,255 NTNC water systems, serving about 6 million people.
- There are 95,754 TNC water systems serving approximately 17 million people.
- Ownership type and size are related. Most systems serving 500 or fewer people are ancillary owned or privately owned systems, while most larger systems are publicly owned.
- The smallest systems (serving less than 501 people) appear to have experienced little growth in service population between 1990 and 1994. The only evident growth was found in the number of systems serving 101 to 500 people, which experienced only a 2.5 percent increase in median connections for this period.
- A system's water source is an essential factor in determining operating characteristics, and source corresponds closely to system size. Large systems are more likely to use surface water or purchased water as their primary source, whereas most small systems use ground water.
- Production per connection increases steadily as system size increases.
- Publicly owned systems serving less than 500 people generally receive more technical assistance than privately owned or ancillary systems of the same size.
- Through source water protection and wellhead protection programs, water systems can improve the quality of their water, decrease the likelihood of waterborne disease outbreaks, and reduce the need for future capital expenditures for treatment facilities and equipment. The importance of source water protection is highlighted by the finding that 93 percent of groundwater systems serving 1,001-3,300 people and 83 percent of those serving less than 1,001 people have a potential source of contamination within 2 miles of their wells.

- More than 50 percent of systems serving 25 to 100 people do not keep separate income and expense statements.
- Median total water revenue per connection for the smallest CWS (serving 25-100 people) is $0, indicating that at least half of the smallest systems do not charge for water through rates or fees.
- Unmetered systems tend to be very small systems; only 37% of all connections served by systems serving 25-100 people are metered.
- Small systems have more than 3 times the per-household need of large systems. The small systems need is $3,300 per household until the year 2015. Transmission and distribution is the largest category of need cited by small systems.
- Over 60 percent of small systems also report need in source development, often because their sources are threatened by contamination or supply problems.
- Systems serving 25-500 people have many more violations per 1,000 people than do any other size category of systems.
- Over 97 percent of NTNC water systems serve fewer than 3,301 people and most have large service populations per connection.
- TNC systems serving 3,300 or fewer people account for over 99 percent of violations committed by TNCWS. Of there violations, almost 97% were committed by systems serving fewer than 501 persons. Most of these violations were monitoring and reporting.

While some small communities are in wealthy areas, most small communities have difficulty raising the capital needed to upgrade their water systems and the revenue needed for daily water system operation and maintenance (NRC, 1997). Customers of small water systems may also have to pay higher costs because the costs are spread over a smaller population. Small communities that lack adequate revenue for water distribution and treatment can have difficulty complying with the Safe Drinking Water Act (NRC, 1997).

2.5.3 Operator Training and Qualifications

A discussion about operator certification was held on June 22, 1998 and was moderated by Mr. Eric J. Way (Way, 1998). Other participants were Ms. Sandra D. Canning, manager of water treatment, Sierra Pacific Power Co., Mr. Ted Kennedy, deputy executive director, New England Water Works Association, Mr. David Leland, manager, Drinking Water Program, Oregon Health Division, and Mr. Curtis L. Truss Jr., executive director, Operator Training Committee of Ohio. According to Mr. Kennedy, the impact of the new operator certification regulations will be minimal for states with well-established operator certification programs and utilities that currently subscribe to them. NTNC water systems will face the biggest challenge in implementing the new requirements. Kennedy explains "The people who run them (NTNC water systems) see themselves not as public health professionals and drinking water operators but as convenience store owners and campground operators." Ms. Canning stated, "Getting the message out to some of the smaller systems and educating them that they will need a certified operator will be a challenge. Just compiling a list of these systems will be a big undertaking for some state programs."

Dr. Ken Kerri believes that training is important to managers, operators, and regulators (Kerri, 1998). Managers want to train operators to safely operate and maintain water treatment processes, facilities and equipment. Operators want to gain pay raises and want training to advance in their profession. Safety and environmental health regulators want operators trained to ensure compliance with rules that the regulators must enforce. According to Kerri, the training process has many steps including:

- Define the target audience and determine objectives.
- Conduct needs assessment to determine what the operators need to know and then to document the current level of their job knowledge, skills, and abilities.
- Review training objectives to meet needs assessment.

Training methods suggested by Kerri include traditional classroom instruction;

home-study, self-study, or correspondence courses; and work-related training, such as apprenticeships, internships, on-the-job training, and technical assistance. Supplemental training options are also suggested by Kerri including the use of slides, overheads, videos, television, compact disks, interactive computer training, computer simulation games, meetings, and teleconferences. In order for the training to be successful, appropriate training times, training methods and technology must be selected.

Funding available for training tends to vary by state. Some states such as Pennsylvania, fully or partially fund their own training centers for educating water and wastewater operators (DeNileon, 2000). A discussion about operator certification took place June 19, 1990 at the AWWA Annual Conference held in Cincinnati, Ohio (Lay, 1990). Ms. Trudie Lay, AWWA's small systems program manager, was the panel moderator and began the discussion by saying operator certification should increase operator credibility, health safeguards and career opportunities. She explained that the key players involved in the certification process include the Association of Boards of Certification (ABC), health organizations, the USEPA, and several support groups such as AWWA, California State University at Sacramento, the National Rural Water Association and the Rural Community Assistance Program and others.

Operator training was an important issue at the roundtable discussion. Mr. Kenneth M. Hay, an education-training specialist for the USEPA stated, "There is a tremendous problem with small systems. It seems difficult to get these operators the training they need so they can become state-certified operators." Mr. Galen Gault, director of Operations and Maintenance at Jones and Henry Engineering Inc., thought it was a big problem for small system operators to be able to afford to leave their system for one or two days to travel to the city in which the certification/licensure exam is being administered. Mr. Stephen E. Moehlman, executive director of the Association of Boards of Certification, replied, "If an operator has to travel a long distance to take the exam or has to take a significant amount of time away from the job, then certification becomes more of an obstacle than an opportunity. States with limited resources cannot afford to administer the test at a multitude of locations." The Association of Board Certification (ABC) was discussed as an option to help operators becomes certified. Mr. Moehlman explained that not all states were members of ABC due to financial reasons.

A roundtable discussion was held in Toronto, Ontario on June 23, 1996 to discuss operator certification in North America (Rossiter, 1997). Mr. David Rossiter, director of education for AWWA, stated "Money seems to be a consistent problem for certification programs-programs are cut back, their income is reduced, they lose their money to a state general fund, and so on." Ms. Cynthia Finan, executive director for the North Carolina AWWA and Water Environment Association, thought that certification programs need to be self-supporting in order for the programs to be strengthened. Mr. Gerald Samuel, manager of certification for the Alberta Training and Certification Section, remarked, "It's ridiculous to spend millions on facilities and nothing on the people who will operate them." Mr. John P. Scheltens, the president of the Association of Boards of Certification, agreed, "The money we spend on operators and training is worth so much. I can't think of a better investment for the public health protection than having qualified operators. The return on investment is worth every penny."

Operator training has been found to have both quantitative and qualitative benefits. Directly measurable benefits include money saved on plant operation and maintenance, improved operator performance on certification exams, better quality plant effluents, achievement of optimum chemical dose and favorable impressions on regulatory agency personnel (Kerri, 1990). Operator training also gives the public satisfaction that their water is being properly treated and confidence that they have credible operators to protect the environment. Other important benefits, which may be difficult to measure include protection of capital investment, compliance with regulations, safety, staff selection and promotion, and operator self-esteem (Kerri, 1990).

2.5.4 The Grandparenting Clause

The USEPA gave the States the option of allowing uncertified operators to continue to operate their systems if they are unable to meet the initial requirements using the grandparenting clause. Initial requirements could include having a high school education or equivalent and passing an exam. However, these operators will need to meet recertification requirements within the renewal period determined by the state.

"The agency concluded that putting people out of work was unnecessary, and it may not be legal in some states to impose requirements that could cause workers to lose their present job if they do not meet the initial certification requirements" (DeNileon, 2000). Grandparenting provides a transition period for some states to accomplish the certification of operators who were not previously certified. Some states such as New Jersey are not allowing grandparenting. Alan Dillon of the New Jersey Department of Environmental Protection stated, "We found that people were beating the system" (Pontius, 1998). The USEPA recommends that grandparenting be performed on a case-by-case basis and that issues such as operator experience and knowledge, system compliance history, type of treatment and system complexity be considered (DeNileon, 2000).

2.5.5 Continuing Education Requirements

Ms. Sandra Canning, manager of water treatment at Sierra Pacific Power Co., believed that the new guidelines will really have an impact on very small water systems since nontransient-noncommunity are now included. She said, "Quite a few programs have continuing education requirements, but the new guidelines will affect operators by requiring continuing education units" (Way, 1998). Mr. Eric J. Way, program manager of the Operator Training and Certification Unit at the Michigan Department of Environmental Quality, stated that when Michigan introduced continuing education as a requirement in the early 90's the number of training programs increased, the attendance went up, and the number of people staying to the end of the day to get the credit went up.

Chapter 3: Methods

3.1 Survey Background Information

A 42-question survey was developed using the approach suggested by Dillman (1978). The VDH provided a mailing list of 2011 small systems that served less than 3,300 people throughout the Commonwealth of Virginia. Small systems included both public and private water systems categorized as community water systems (CWS), nontransient non-community (NTNC), and transient non-community (TNC) systems. An identification (ID) number was utilized on the surveys to ensure anonymity and to track the survey responses.

Each of the 2011 systems was sent a questionnaire in September 1999. A reminder postcard was sent out a week later to each system to serve as both a thank you for those who had responded and as a friendly reminder for those who had not. A month after the original mailing was sent (October 1999), when the number of returned surveys had declined, a second copy of the survey was sent to each owner/operator who had not completed and returned the first survey. Additionally, a second reminder postcard was mailed one week later.

All surveys that were received by December 1, 1999 were entered into a database. The database was constructed to track the survey responses and contained the names of the owners/operators, small PWS addresses, the status of the survey, and the ID numbers used to identify the survey. A receiving log was also created to document the amount of surveys received on a workday basis. A graph of the survey responses received per day can be found in Figure 3.1.

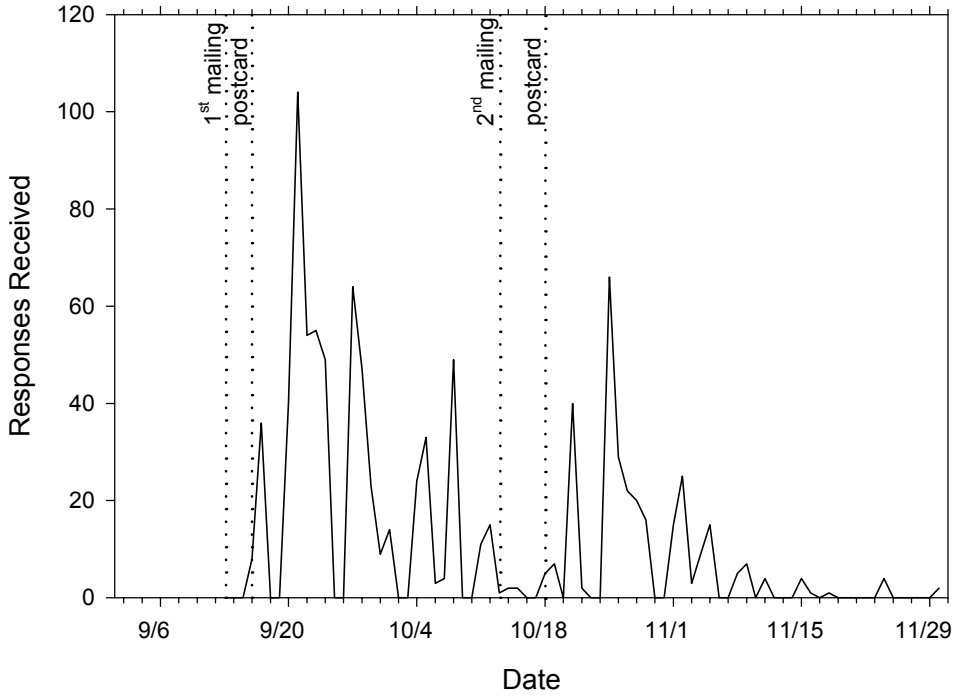

Figure 3.1 Small system survey response graph

3.2 Instrument Design

After consultation with Alan Bayer, an expert in the area of survey research at Virginia Tech, a survey was developed and printed as a six by eight-inch booklet, which opened from right to left. The front page provided the owner/operator with an explanation of the intent of the survey. It provided the VDH's definition of a small drinking water system, the telephone and email addresses of contact persons and an indication that all survey responses would be treated confidentially. The survey was divided into three parts for a total of 41 multiple answer questions with the opportunity for the owner/operator to express his or her opinions in a space at the end of the survey.

Respondents could also request copies of the survey results if they desired by providing their mailing or email address.

The survey began with the *Opinions* section, which contained twelve questions pertaining to the owner/operator's opinions on certification issues. Questions included which organization should manage certification, which type of training was preferred, and how much was reasonable for training and certification. A second section entitled *Facility Characteristics* followed featuring eighteen questions looking at the type and size of the system, water source, existence of annual operations and maintenance budget, unit operations, length of time to identify a replacement operator, prevention of serious problems and number of people employed. The final section *Owner/Operator Information* asked eleven questions about the highest level of formal education, history or training and correspondence courses, familiarity of state and federal regulations and job duties. The final question was open-ended and provided the respondent with the opportunity to express any opinions or make additional comments.

3.3 Data Entry

The Survey Center at Virginia Tech was contracted to enter all data from the surveys that were received. Data entry accuracy was verified by randomly selecting a ten- percent sample of the surveys to double-enter by an employee who had not entered the original data. The center confirmed greater than 99% accuracy for the surveys. The Survey Center designed written documentation of all code alternatives and generated marginal frequency distributions for each question. A copy of responses where the respondent had the opportunity to write an answer in the "other" line was also provided.

Chapter 4: Survey Results

A dot density plot was created using zip codes for the 2011 small drinking water systems to evaluate the spatial distribution of small systems. The small PWSs were distributed across the state. Small PWSs occurred commonly in both urban and rural areas. However, many small PWSs were clustered around highly populated cities, including Roanoke, Arlington, Fairfax, Manassas, Vienna, Richmond, and Newport News (Figure 4.1).

A total of 1050 responses to 2011 questionnaires (52%) were received. Of the 1050 respondents, 63 respondents stated their water system was either out-of-business, had consolidated with another system, did not want to participate, the survey did not apply, or had changed address. Some respondents were responsible for more than one system and were directed to fill out separate surveys for each system they owned or operated. Several respondents responsible for multiple systems indicated how many systems one survey could represent and noted any significant differences. A total of 987 surveys contained useable data and was included in the data analysis. The useful survey return rate was 49% (987/2011).

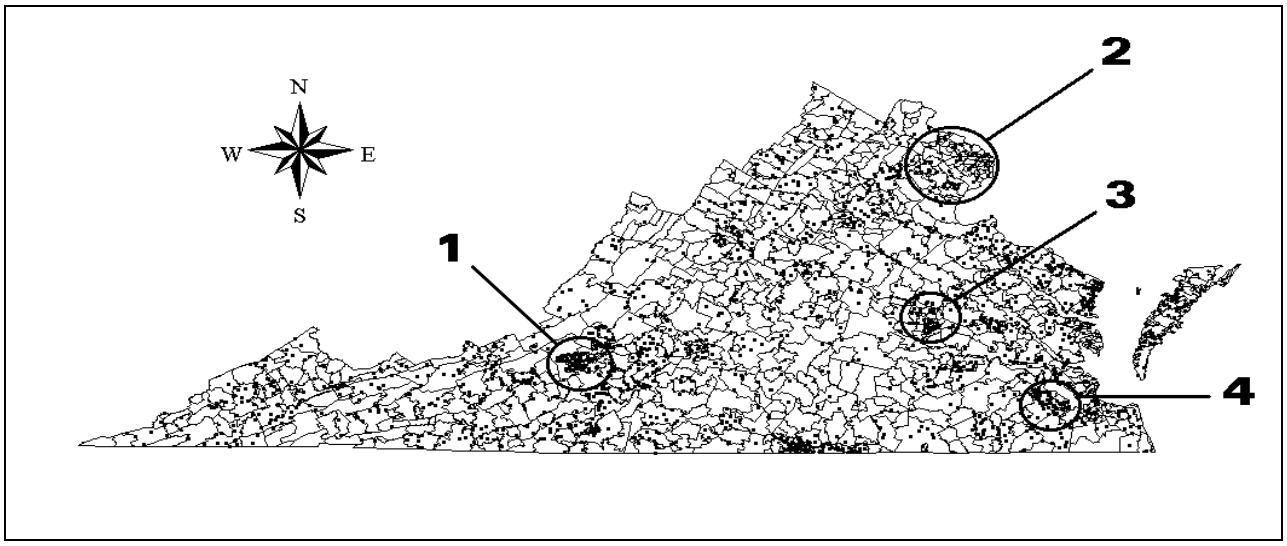

Figure 4.1. Dot density plot of 2011 small PWSs in Virginia where one dot equals one facility. Data provided for 447 of 830 zip codes, August 25, 1999. (1) Roanoke, (2) Northern Virginia: Arlington, Fairfax, Manassas, Vienna, (3) Richmond, and (4) Newport News.

4.1 Profile of the Responding Owner/Operator

Small PWS respondents who answered the survey have many occupations. School employees, engineers, blasters, town government and service employees, homeowner association representatives, mayors, and utility employees were only a few of the job descriptions provided. Eighty-eight percent of the respondents were either an operator and/or owner of the facility. Most respondents (83%) had worked at the small PWS four or more years. Only 12% of respondents worked 1 to 3 years, while 5% worked less than one year at the small PWS. Forty percent (40%) of survey respondents reported working for only one water system serving less than 3,300 people, while 27% reported working for five or more water systems.

Owners/operators of small PWSs had a high level of formal education (Table 4.1). Ninety-five percent of the respondents had at least a high school diploma or GED; over two-thirds had at least some college education. In addition to their formal education, many respondents had taken drinking water-related training. More than half of the respondents (55%) had taken classroom-based water-related training courses and 27% had taken water-related correspondence courses. Sixty-five percent of the CWS

owners/operators had participated in drinking water-related training followed by 52% of TNC systems and 37% of NTNC systems.

Table 4.1 Distribution of highest level of formal education achieved by the survey respondents.

Respondent Highest Level of Formal Education	Response
Less than High School Graduate	5 %
High School Graduate or GED	20 %
Trade or Vocational School after High School	6 %
Some College	24 %
College Graduate	30 %
Graduate or Professional School	15 %

Approximately half (46%) of the respondents possessed a license to operator a waterworks, with a distribution as follows: Class I: 12 %; Class II, 4 %; Class III: 14%; Class IV: 12 %; Class V: 4 %. The VDH requires that any system that serves more than 400 people or applies any type of treatment (e.g., chlorination) must have at least one licensed operator on duty at all times. Survey results revealed that 48% of the respondents apply chlorine at their small system and should therefore have at least one licensed operator. Therefore, approximately 2% of the small systems surveyed may be in violation of the VDH regulations. The majority (77%) of respondents from systems serving less than 100 people did not have a license. This is significant when compared to the systems serving 101-1000 people where over half (57%) of the respondents do possess an operator's license (Figure 4.2).

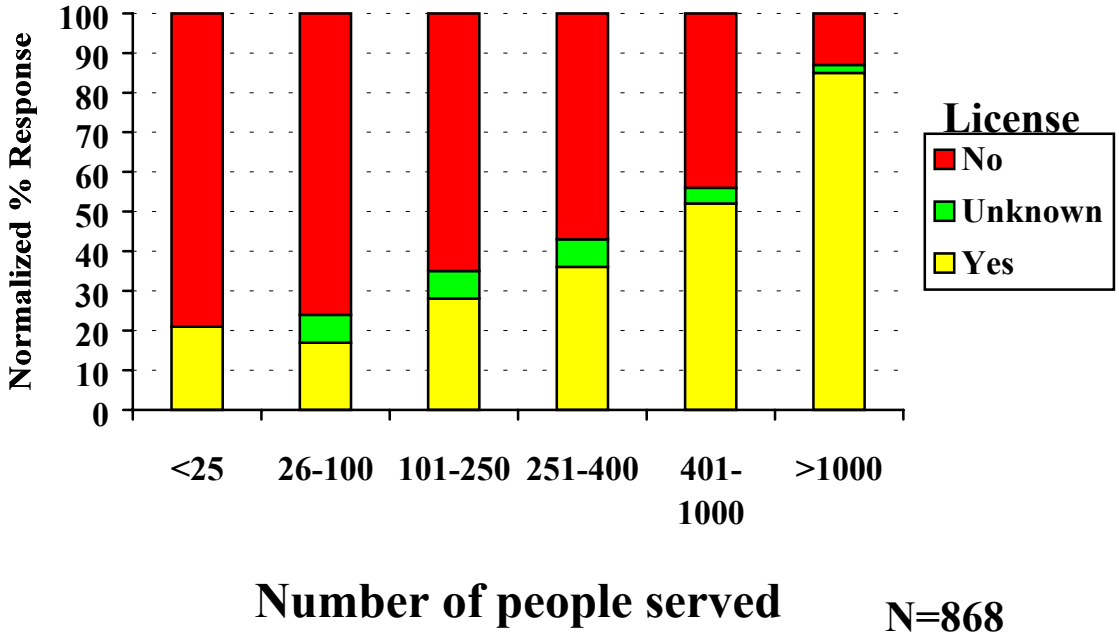

Figure 4.2. Distribution of licensed operators vs. number of people served

CWS had the highest percentage of licensed owners/operators with 56% having a valid license to operator in the Commonwealth of Virginia. NTNC systems only had 29% licensed operators. Twenty-four percent of operators/owners at TNC systems were licensed, 57% were not and 19% were unsure (Figure 4.3)

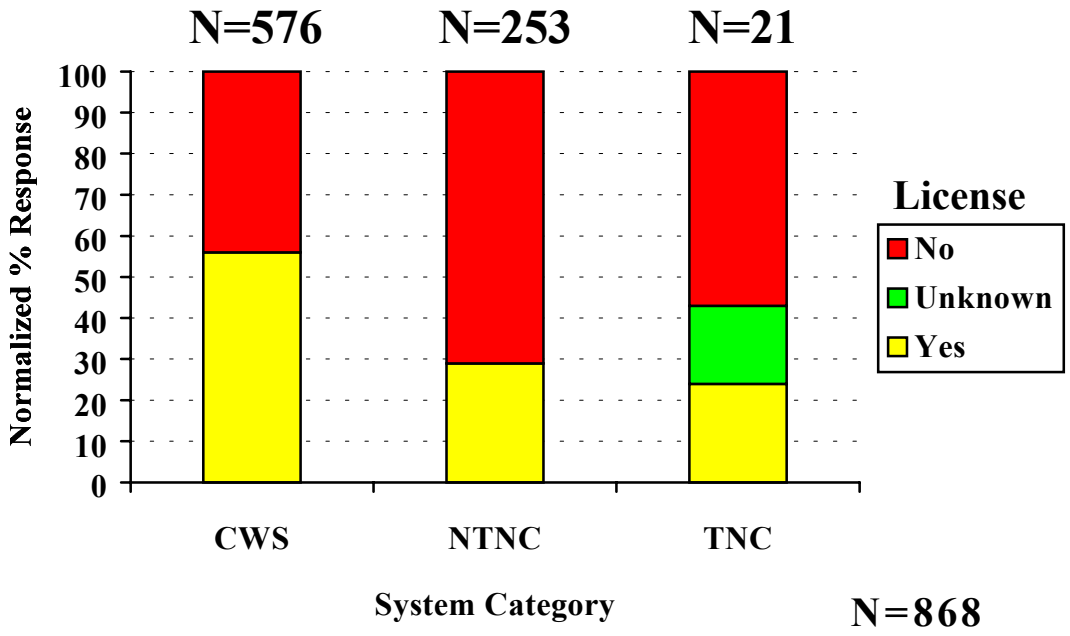

Figure 4.3. Licensed operators per small system category.

The owners/operators of small water systems reported having many drinking water-related responsibilities. Greater than half (52%) of all responding operators/owners performed other job-related duties in addition to operating the water system. Of the remaining operators, one quarter of the operators did not perform other job-related duties (28%), and one-fifth of the small PWSs lacked an operator (20%). The majority of the owners/operators at NTNC systems performed other job-related duties (66%) followed by 52% of the owners/operators at TNC systems and 47% of the CWS. Only 32% of respondents at systems serving less than 100 people stated they had other job related duties compared to 65% of the respondents at systems serving 101-1000 people and 55% of respondents at systems serving greater than 1000 people.

Most of the respondents (72%) dealt with their water systems' administration; 63% performed bacterial testing. About half of the respondents were responsible for pump maintenance, meter reading, customer assistance, flow measurement, grounds maintenance, consumer confidence reports (CCR), pipe maintenance, and maintaining the chlorination equipment (Figure 4.4). Twenty to forty percent of the respondents tested the

water for pH, turbidity, hardness, and/or corrosion control, while 10-20 % sampled for THMs, tested for alkalinity, or had other duties.

Similar trends are found if the job duties of systems serving less than 100 people are examined. However, less of the operators/owners of these very small systems responded to having the responsibilities of administration, corrosion control, customer service, flow measurement, hardness testing, maintaining chlorinators, pH adjustments, and turbidity testing as compared to all the systems serving under 3,300 people surveyed.

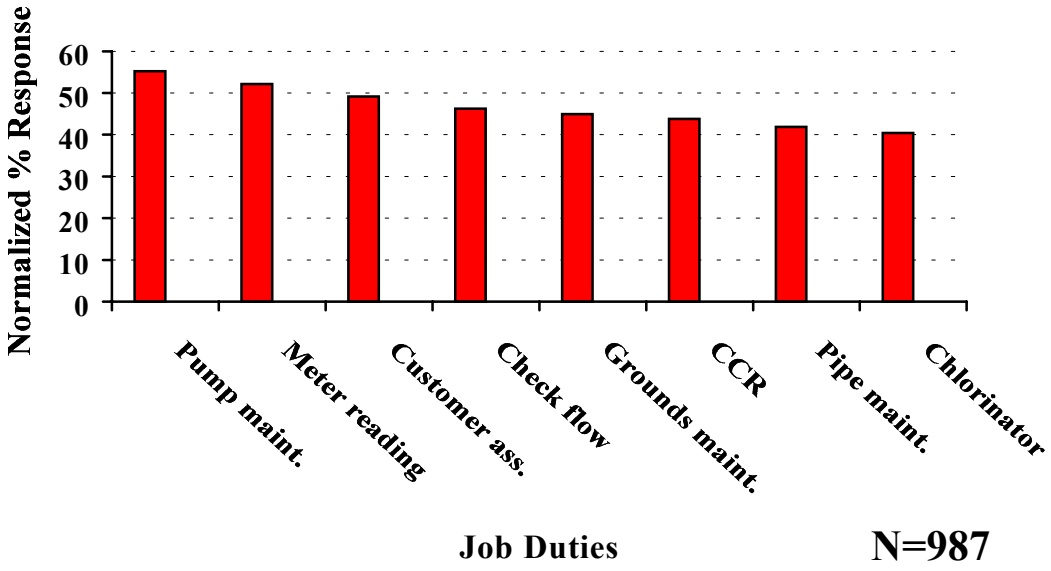

Figure 4.4. Typical job duties that are performed by operators/owners of small water systems.

4.2 Small Public Water System Profile

Almost all of the systems surveyed (95%) operated and/or owned a CWS or NTNC PWS. Only 2% of the respondents identified themselves as representing transient noncommunity (TNC) PWSs, and 3% of the respondents were not sure of their system classification. The majority (66%) of systems serving fewer than 100 people were CWS while 25% was NTNC (Figure 4.5). Over half (56%) of the systems serving 101-1000 people were CWS and 40% were NTNC. Every system category including CWS, NTNC, and TNC most commonly served 26-100 people.

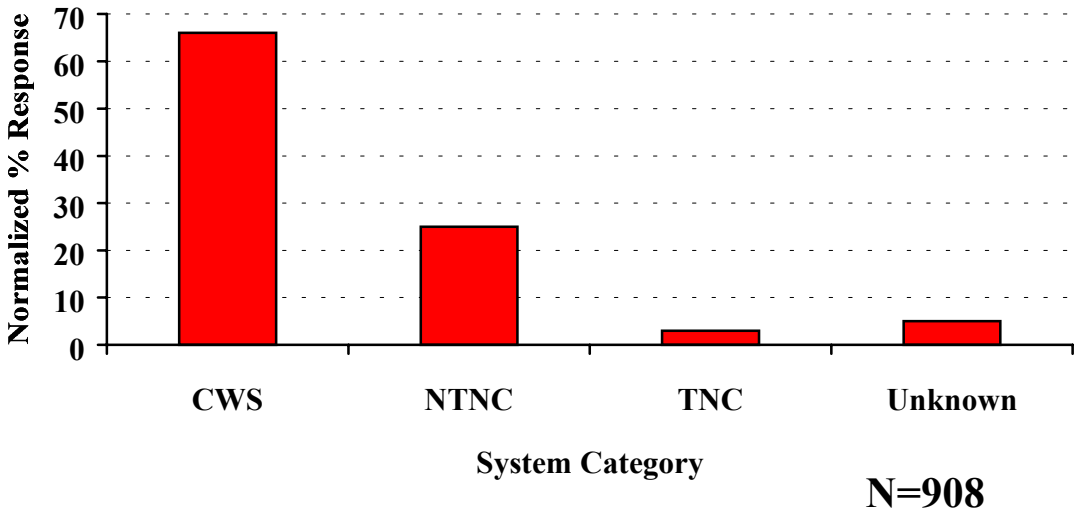

Figure 4.5 Number of systems serving less than 100 people and system category.

For most (85%) of the systems, groundwater was the source water; 70% of the responding small PWSs used a single water source. For those systems that did not use groundwater, either water was purchased from another system or surface water was used (including springs, rivers, creeks, pond, lakes, or reservoirs). The distribution of small PWSs by size of the population served was collected from the survey data (Figure 4.6). Sixty-four percent of CWS respondents serve 400 people or less.

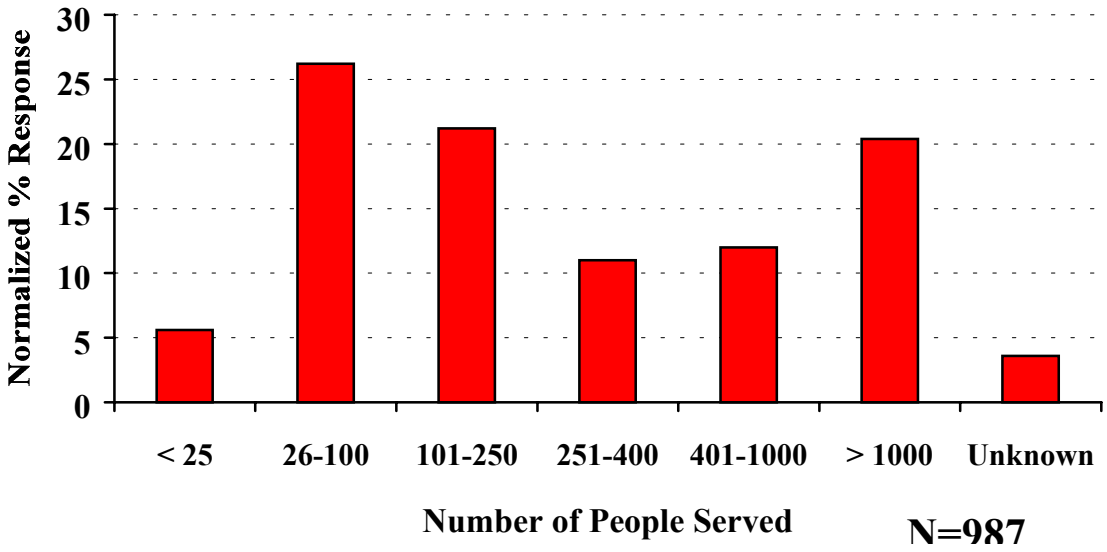

Figure 4.6. Size of population served by PWSs in Virginia that responded to the survey.

About two-thirds of small drinking water systems employed two people or fewer. Few systems employed 3 to 4 employees (11%), while five or more people were employed at 22% of the PWSs. Nearly half of the small PWSs did not have any full-time employees (47%), thirteen percent had one full-time person, while only 6% of PWSs had 2, and the remainder had 3 or more full-time employees. About one-third of the operators (37%) were not paid to operate the small PWS.

Approximately 70% of systems serving under 100 people did not have a full time employee working at their small water system. Further 44% of the systems serving under 100 people did not have any employees.

About half of the small systems (45%) did not have an annual operations and maintenance budget. However, as the number of people served increased, the system was more likely to have a budget. If the respondent had some college or completed college, their small water system was twice as likely to have an annual operations and maintenance budget. CWS were the most likely to have a budget (65%) followed by TNC with 38% and NTNC with 34% (Figure 4.7).

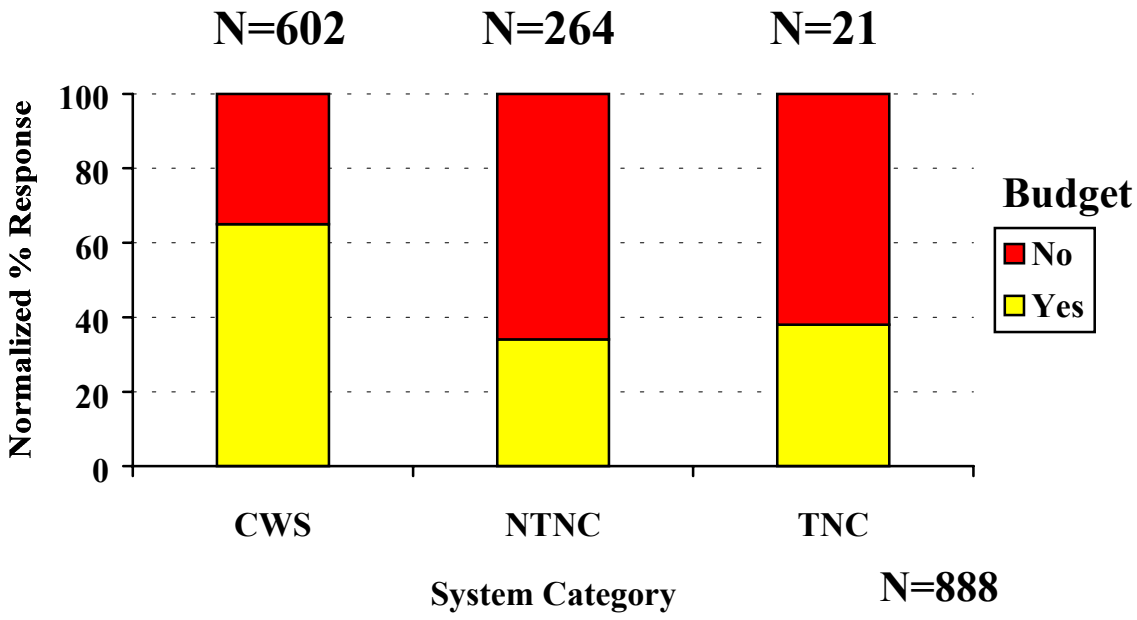

Figure 4.7. Presence of operations and maintenance budget per small system category.

The majority (59%) of respondents stated that the water system customers were metered. Only 40% did not meter their customers and 2% did not know if their customers were metered or not. The majority (65%) of the CWS was metered, half (52%) of the NTNC were metered and only 38% of the TNC were metered. Differences occur when the systems serving less than 100 people are compared to systems serving 101-1000 people. The majority of the smaller systems do not meter their customers (62%) whereas 62% of the larger systems do meter their customers. Figure 4.8 shows the distribution of metering versus the number of people served.

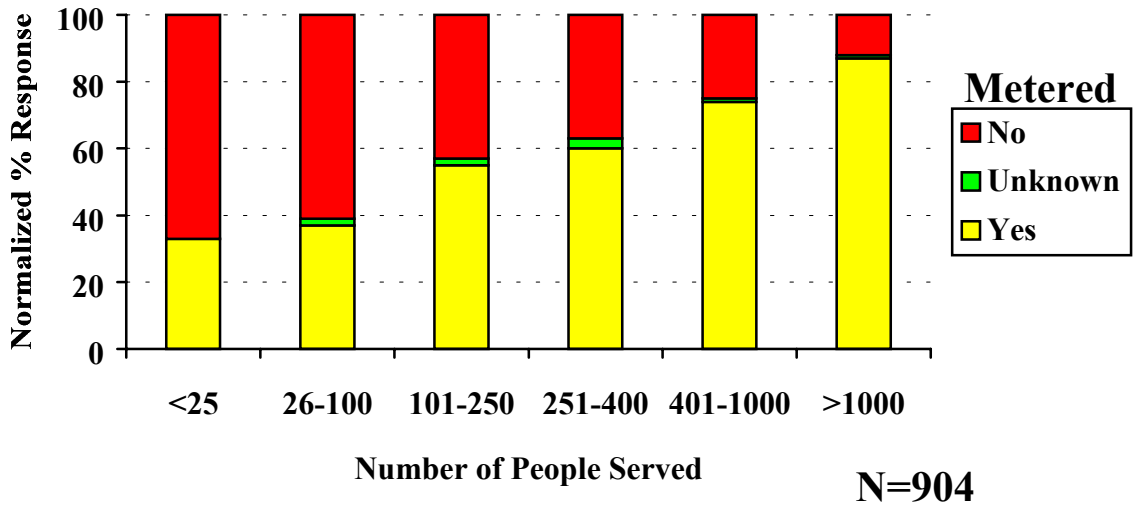

Figure 4.8. Distribution of metering per number of people served.

In the event an operator was absent for an extended period of time, 53% of the small PWSs had a non-operator look after the facility(ies); some facilities were overseen by an operator from a nearby systems or circuit rider who regularly visited and worked at more than one system. At 18% of the PWSs, the facility maintained itself in the operator's absence; 16% did not have an operator, and 13% used other alternatives when the operator was absent. Almost half of the responding PWSs (41%) were in contact with 2 to 5 other small drinking water systems within 30 miles of their system. Sixteen percent of the respondents knew fewer than two systems, while 24% of respondents were in contact with more than six systems within a 30 miles range of their system. One third of PWS operators worked at the small PWS 40 or more hours per week; fifteen percent of PWS operators worked at the water system between 6-39 hours per week; a little more than a third of the water system operators worked less than 5 hours per week.

4.3 Operations and Facilities at Public Water Systems

The majority of small PWSs used pumps, storage tanks, and chlorination (Figure 4). Less than thirty percent of small PWSs use hydrants, filtration, corrosion inhibitors,

backup power, or alkalinity adjustment (Figure 4.9). Less than ten percent of small PWSs use iron/manganese removal, coagulation or flocculation, sedimentation, fluoridation, membrane filtration, softening, rechlorination, activated carbon, ion exchange, aeration, or disinfectants other than chlorine.

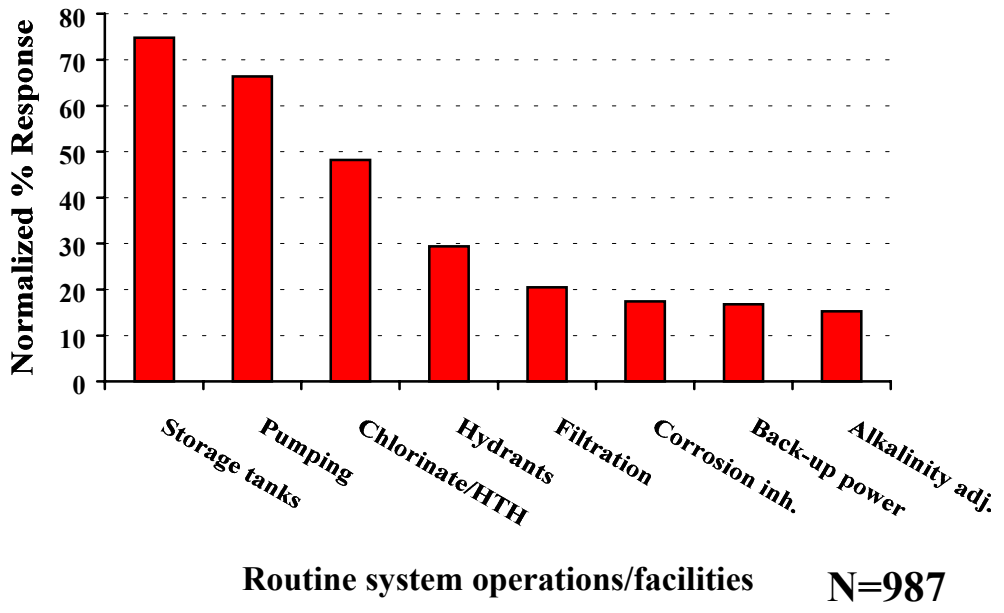

Figure 4.9 Typical treatment practices and equipment used by small PWSs.

4.4 Sources of Technical Assistance

When the need for technical assistance arose, three-quarter of the respondents contacted the Virginia Department of Health (VDH). Twenty-five to thirty percent of the respondents contacted plumbers and maintenance consultants, Virginia Rural Water Association (VRWA), or a well driller (Figure 4.10). Ten to twenty percent of the respondents contact another waterworks, other operators, labs, or American Waterworks Association (AWWA) (Figure 4.10).

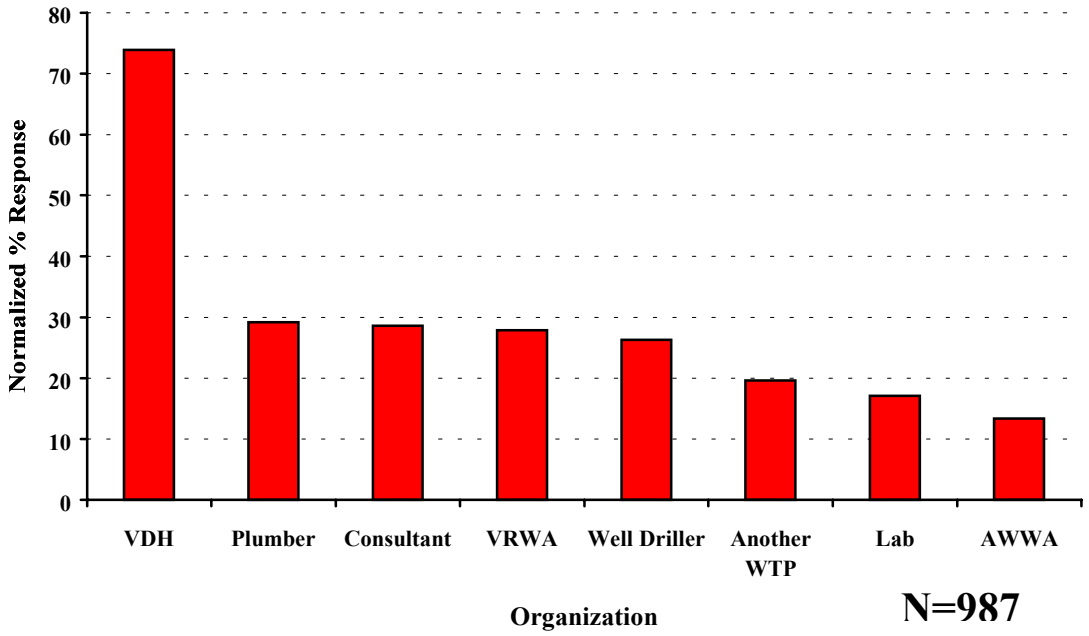

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Figure 4.10. Organization respondents contact for technical assistance.

Less than ten percent of the respondents contacted organizations like USEPA, Southeast Rural Community Assistance Project Inc. (SE/RCAP), or the local government. A little more than eight percent of the respondents had not needed technical assistance. Sixty-eight percent of the respondents (68%) had Internet or email either available at home or at work. Of the 30% who did not have access to the Internet, 70% were interested in this service and 21% were not.

More than half of the respondents did not hold a waterworks operator license issued by VBWWO/DPOR. A little less than half of the respondents felt that they were familiar with all federal and state drinking water standards, while another 50% were familiar with some standards. Respondents completing college had the highest percent (60%) that claimed to be familiar with all of the regulations. Overall, the majority (95%) of the respondents claimed to be familiar with all or some of the regulations. Even systems serving under 100 people had a high response rate (96%) to understanding some or all of the state and federal regulations. Respondents working at CWS systems were

more familiar with all of the regulations (53%) as compared to NTNC at 35% and TNC at 43%. If the small water system had a budget, the owners/operators were twice as likely to be familiar with all of the standards.

4.5 Certification / Licensure Issues

Half of the respondents stated their "biggest concern" about operator certification or licensure was "more government regulations." Even if the respondents were familiar with some or all of the state and federal regulations, their biggest concern was still more government regulations. Ten to fifteen percent of the respondents were concerned with travel time, certification/license renewal training, passing the exam, cost of travel, or the certification/licensure fee. Twenty-two percent of respondents agreed that serious problems would not have occurred in the last five years at their water system if more money had been spent on maintenance. Thirteen percent of respondents believed problems could have been prevented if they had access to technical assistance. Less than ten percent of respondents agreed that a certified operator, full-time person, or more operator training would have prevented serious problems at their small PWS.

Forty-three percent of the respondents believed their water system would not consolidate with another water system in order to reduce operating and administrative costs. One-third of the respondents responded "maybe" and one quarter responded their system would consolidate to reduce operating and maintenance costs. Respondents who were owners and owners/operators were more inclined towards consolidation at 62% and 60% respectively than the operators at 51%. CWS owners/operators were the most likely to respond that consolidation could definitely or possibly be accomplished (63%) followed by 58% of owners/operators at TNC systems and 51 % at NTNC systems.

A little more than half of the respondents (54%) preferred that VDH oversee the certification/licensure program, while twenty percent preferred DPOR (20%). Less than ten percent of the respondents preferred that a non-profit organization, university, or consulting company handle the small drinking water system operator certification/licensure program. This is illustrated in Figure 4.11. About twenty percent

of the respondents (18%) were unsure as to which organization they would recommend manage operator certification/licensure.

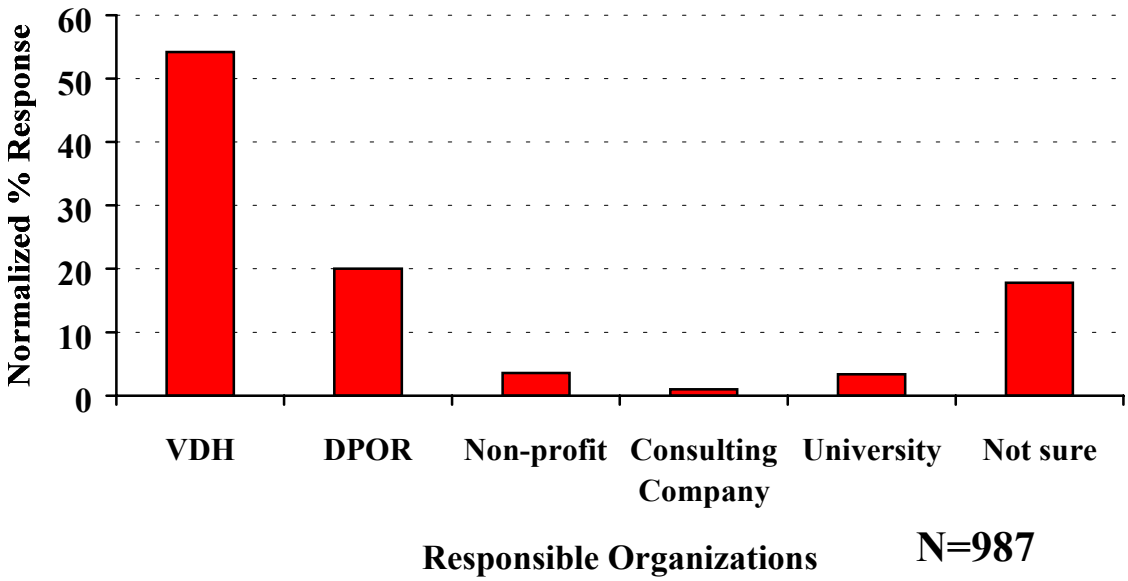

Figure 4.11. Organization respondents preferred to oversee certification/licensure program.

Similar trends appeared among the system categories as to which organization was preferred to manage a certification/licensure program. Over half of the CWS chose VDH (54%) followed by 24% who chose DPOR. Similarly, half of the NTNC (53%) selected VDH and 16% chose DPOR. The majority of the TNC picked VDH (67%) while 14% selected DPOR. VDH was the most popular choice to oversee the certification/licensure program regardless of system category.

Approximately half of the respondents believed their system would license existing personnel if certification or licensure were required. Twenty-five percent of the respondents did not know what their water system would do, and fourteen percent believed their water system would wait until it was contacted by a regulatory agency. Less than six percent of the respondents believed that their system will contract with a vendor, and about two percent of the respondents believed their system would hire a certified operator.

The most common response (37%) for respondents working at very small systems serving under 100 people was that they were unsure as to what their system would do if licensure or certification were required, followed by 34% who believed they would certify existing personnel. In contrast, the majority (54%) of respondents at systems serving 101-1000 people thought they would certify their existing personnel and only 23% did not know what their water system would do.

4.6 Financial Implications of Licensure

Most survey respondents (82%) believed the owner should pay the certification or licensure fee. Almost two-thirds of the respondents believed paying a certification/licensure fee of $50 or less per year would be reasonable. Seventeen percent of the respondents believed the fee should be greater than $50 but less than $100. Overall, operators were willing to pay more per training event than owners were. Forty-eight percent of operators and 38% of owners/operators were willing to spend over $150 per training event while only 5% of owners were.

Sixty-two percent of the respondents believed their system could not afford any increase in the operator's salary if certification or licensing was required. Of the small PWSs surveyed, eight percent of the respondents believed their water system could afford an hourly $0.25-0.50 increase in operator's salary. Eleven percent of the respondents believed a $0.50-$1.00 increase would be possible, while seven percent believed a $1.00-$1.50 increase, two percent believed a $1.50-$2.00 increase, and ten percent believed $2.00 or more increase was possible.

The majority of systems (80%) serving fewer than 100 people could not afford pay increase if certification or licensing is required. A little over half of the systems (59%) serving 101-1000 people did not think a pay increase was possible. In addition, the majority of systems (76%) without a budget could not afford any pay increase with the proposed licensing/certification requirements.

If an individual was paid to operate the small water system, the most common pay range (55%) was above $7.50 per hour. Almost 30% of the respondents stated that they

were not paid or that the question did not apply. Approximately 8% of the owners/operators were volunteers. The majority (48%) of respondents from systems serving less than 100 people were not paid and 15% were found to volunteer.

4.7 Operator Training

Forty-two percent of respondents would prefer any type of training to occur during the winter. A little more than twenty percent of the survey respondents would prefer training to occur during the spring, and less than twenty percent of the respondents would prefer training to occur during summer or fall. Respondents preferred each individual training option be offered in the winter. Almost three-quarter of respondents (72%) would prefer a one-day training session. Every system category including CWS, NTNC, and TNC all preferred a one-day training session. About ten percent of the respondents each preferred the training session last at least a week long, or several evenings throughout the week or a weekend. Therefore, an ideal training session would be offered as a one-day training session in the winter. Survey respondent's opinions on training are reported in Table 4.2.

Table 4.2. Distribution of preferred training activities chosen by the respondent. Multiple responses chosen.

Preferred Training by Respondent	Percent Chosen
Textbook	51 %
Videotape	58 %
Internet	28 %
Workshop less than 200 miles	6 %
Workshop less than 100 miles	29 %
Workshop less than 50 miles	51 %

Only 28% of the small system owners/operators preferred training through use of the Internet. However, the Internet can serve as a valuable resource where the operators can access a schedule with the location and times of licensing exams, take practice exams, and learn relevant information about upcoming training sessions.

Operators/owners from systems serving greater than 1000 people had the highest interest in Internet training (48%). The majority of respondents regardless of system size or system category did have access to the Internet either at work, home, both work and home or at another location (Figure 4.12 and Figure 4.13).

Figure 4.12. Internet availability to owners/operators of small systems (either at work, home, both or another location) by system size.

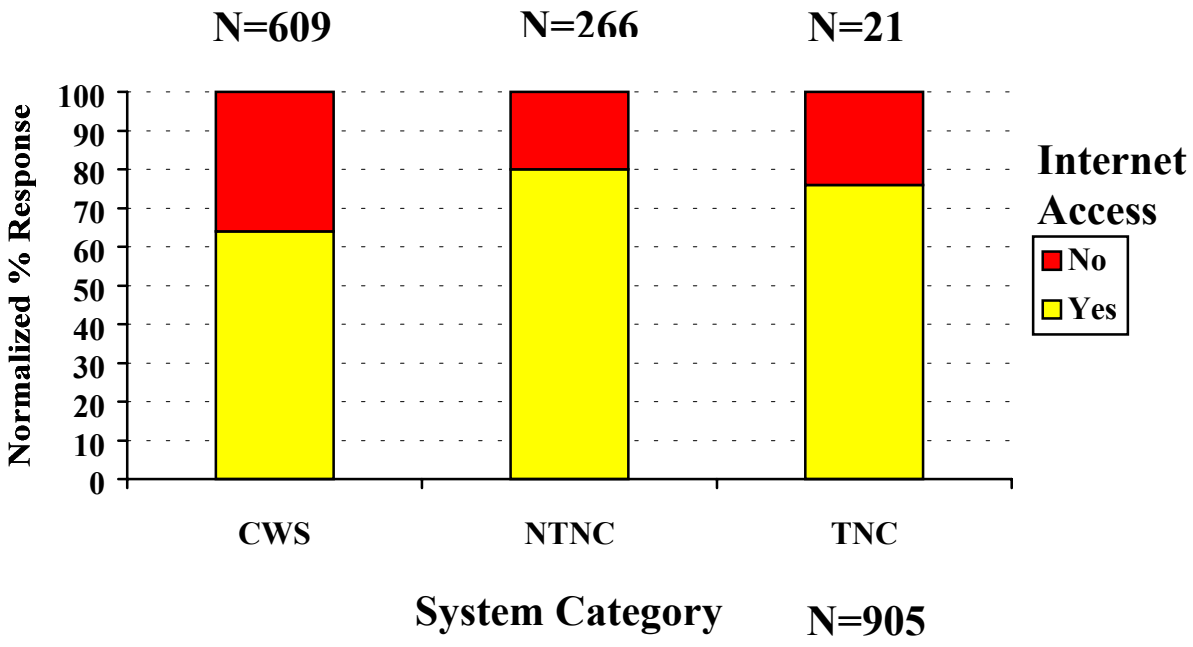

Table 4.13 Internet availability to owners/operators of small systems (either at work, home, both or another location) by system category.

Respondents believed the owner should pay for operator training courses (86%). Twenty-five dollars was the favored cost per training event (39%). Twenty percent of survey respondents estimated a reasonable cost per event between $25-$50, fifteen percent estimated $50-$75, thirteen percent estimated $75-$100, six percent estimated $100-$150, and seven percent estimated greater than $150 would be a reasonable cost per training event.

Chapter 5: Discussion

In 1999, Virginia had over two thousand CWS and NTNC PWSs that served 3,300 people or less. The survey results indicated that more than half of these (58%) serve less than 400 people. These CWS and NTNC small systems were distributed across more than 40,000 square miles of Virginia. Clusters of small PWSs occurred near major population centers such as Alexandria, Charlottesville, Richmond, Roanoke, and Virginia Beach; the rural areas also contain many, dispersed small PWSs.

Under USEPA Final Guidelines for the Certification and Recertification of the Operators of Community and Nontransient Noncommunity Public Water Systems, all Virginia's CWS and NTNC PWSs will be required to have a licensed or certified operator. Currently PWSs serving $\geq$ 400 people and/or providing treatment must have an operator that holds a license at least equal to the classification of the PWS (Table 1). Many small systems that serve less than 400 people will now need to obtain a certified/licensed operator in order to comply with USEPA regulations. Approximately 650 NTNC systems and about 850 CWSs will likely be affected by this regulation (Anderson, 2000).

5.1 State Implementing of Licensure in Virginia

Under current Virginia law, VDH regulates drinking water facilities and VBWWO, in conjunction with DPOR, licenses and regulates the operators of those PWSs. VBWWO has the power to fine the operator and suspend or revoke a license when appropriate. Many survey respondents revealed they are most familiar with VDH. Over half of the survey respondents selected VDH as the organization that they would prefer oversee a certification program, and close to three-quarter of the respondents first contact VDH for technical assistance. Almost half of the survey respondents held a DPOR-issued waterworks license and twenty percent of the respondents' chose DPOR to oversee a new certification/licensing program.

In order to comply with USEPA's final guidelines, Virginia's operator certification program must meet nine base-line standards. These are: (1) classification of systems, (2) owners place direct supervision of water system under responsible charge of

a certified operator(s), (3) operator must hold a minimum valid certification equal to or greater than that of the system, (4) only certified operators can make process control and system integrity decisions, (5) operator must be available at all times, (6) operator applicants must take and pass an exam determined by each state, (7) operator applicants must have high school diploma or GED, (8) operator applicants must have the State defined on-the-job experience, (9) States may allow experience, relevant training, or both to be substituted for high school diploma or GED (USEPA Federal Register, 1999). In Virginia, the essential element for meeting USEPA's final guidelines will be to develop and implement a certification program to meet the needs of base-line standards 2-8.

At present VBWWO/DPOR issues five different types of licenses to water system operators. The type of operator license depends upon the treatment operations at the water system, population served, and system capacity in terms of volume of water treated per day (Table 1). VBWWO has proposed a class VI water systems license. The class VI license would apply to systems serving 400 persons or less that do not treat their drinking water because the source is very high quality groundwater. This could include most of the CWS and NTNC PWSs that responded to the survey as 85% of the respondents reported treating groundwater.

USEPA's final guidelines allow Virginia to decide the type of exam (e.g., written, oral, performance-based, or a combination) as long as the exam demonstrates that the applicant has the necessary skills, knowledge, ability, and judgement appropriate for the classification (USEPA Federal Register, 1999) In a poll of fifteen states nationwide, the majority of the states administer paper exams for PWS operator applicants. Depending on the state, the certification/licensure exams are offered between 2 to 21 times per year at 1 to 20 locations. DPOR, which conducts the waterworks operator exam in Virginia, offers exams three times each year.

Data gathered from fifteen states nationwide indicated that states have either one or two year certification/licensing cycles and the mean cost of initial small systems certification was $36 with a range of $0 to $200. Many states require operators to renew their certification; on the job training experience and passing an exam were frequently required to obtain or renew a certification/license. The mean renewal cost for these same fifteen states was $22 with a range of $0 to $75. In Virginia, operators taking the Class I

–V licensing exams pay a fee of $95 (which includes a $40 test fee), followed by a two-year renewal fee of $55. Virginia will likely require an initial operator certification and certification renewal fee for small PWS operators; this fee would support staff and overhead expenses incurred by implementation and day-to-day operations of the certification/licensure program. According to the survey, over two-thirds of the respondent preferred fees of $50 or less.

A little more than half of the survey respondents believed their system would certify existing personnel to meet the new regulations. This presumption seems feasible because more than eighty percent of the respondents had worked four or more years at their current system. Certification/licensure could give operators the ability to render their services to other CWS and NTNC PWSs and could increase operator self-esteem (Kerri, 1998). In order to become certified/licensed the operator applicant must have a high school diploma or GED. Based on survey responses, about five percent of Virginia's small PWS operators could be in violation of this criterion. USEPA recognizes that many existing competent operators are successfully operating water systems and might not meet the initial requirements (USEPA Federal Register, 1999). In order to reduce the number of systems in violation, Virginia could consider grandparenting operators on a case-by-case basis. Grandparenting can be used to prevent PWSs from being in violation of regulations. According to USEPA, grandparenting should be based on factors such as system compliance history, operator experience and knowledge, system complexity, and lack of treatment (USEPA Federal Register, 1999).

Survey respondents were divided on the issue of restructuring small PWSs by consolidation: 40% No, 25% Yes, 32% Maybe. Consolidation of PWSs may have drawbacks because "EPA supports consolidation of nonviable water systems, though its drinking water grant formula - which is based, in part, on the number of water systems in a state -inadvertently penalizes states that consolidate their water systems" (USGAO, 1994). An alternative to consolidation is the formation of small water system co-operatives that would pool their buying power to share the cost of operator services. A report by the Virginia Water Resources Research Center recommends "the VDH (or a sub-contractor) take the lead and provide start up costs to initiate a demonstration project that will produce sufficient data and offer an incentive for many potential participants"

(Garcia et al, 1999). This report further states "the VDH should make grants and loans available to small water systems conditional on the basis of participation in the co-operative." PWS co-operatives maybe a positive choice for many small systems and should be further researched.

5.2 Small Water System Diversity

"We are a private company with one well serving only our employees. For us to be classified as a waterworks is ridiculous!" –Survey Respondent

Small water systems are typically defined as systems serving less than 3,300 people. However, this category encompasses a variety of water systems from day care centers with one well to small housing developments. Community water systems, nontransient noncommunity PWS and transient noncommunity PWS are all part of the small system classification.

When the survey results were further analyzed by number of people served, significant differences were found between systems serving less than 100 people, 101-1000 people and greater than 1000 people. For example, 77% of the employees at systems serving less than 100 people did not posses a license to operator a waterworks whereas 57% of the employees at systems serving 101-1000 people and 87% of employees at systems serving greater than 1000 people did have a license. Approximately 70% of the systems serving under 100 people did not have a full time employee and 44% did not have any employees. Sixty-six percent of the systems serving less than 100 people were CWS, 25% were NTNC and 3% were TNC.

Differences can also be found between the system size and the presence of an annual operations and maintenance (OM) budget as well as the metering of customers. The majority (62%) of systems serving less than 100 people did not meter their customers in contrast to only 38% unmetered customers in systems serving 101-1000 people and 6% unmetered in systems serving greater than 1000 people. This same trend was also found nationally. A survey of the National Characteristics of Drinking Water Systems Serving Under 10,000 found that very small systems tended to be unmetered with only

37% of all connections served by systems serving 25-100 persons metered (USEPA, 1999). Only 38% of the systems serving less than 100 people had an OM budget whereas 53% of the systems serving 101-1000 people and 80% of the systems serving over 1000 people had an OM budget.

Each system category (CWS, NTNC, and TNC) also had its own unique set of characteristics. CWS had the highest percentage of licensed owners/operators with 56% having a valid license, NTNC systems had 29% licensed operators and TNC systems had 24% licensed operators. Sixty-six percent of NTNC system owners/operators performed other job-related duties, followed by of 52% of TNC systems and 47% of CWS. CWS were more likely to have an OM budget (65%) than TNC systems (38%) and NTNC systems (34%).

One of the biggest challenges facing most state and federal agencies is certifying operators of very small systems (determined as systems serving less than 100 people by many states) since the classification includes both NTNC systems and CWS such as mobile homes (DeNileon, 2000). Presently only 19 states require a certified operator at these very small systems and the rest will need to establish a program by February 2001 (DeNileon, 2000). It is crucial that the Commonwealth of Virginia recognize the variance within the small systems to implement a successful operator certification/licensure program and be able to provide the appropriate training for this unique category.

5.3 Financial Status of Virginia's Small Public Water Systems

"I am married to the owner of the trailer park. I got the job of the well when my mother in law died. I know very little about our system except through state water control board." –Survey Respondent

Nationwide, operator certification will be a challenge for many small systems because they often lack sufficient resources and expertise to comply with drinking water regulations (NRC, 1997). Most small PWSs in Virginia have not set aside funds to support operator certification and training expenses. Many PWS owner/operators that

responded to the survey commented about the absence of manpower, funds, time, or operators in order to meet the upcoming operator certification requirements. One survey respondent wrote, "I am not making any money with the water system after all the bills are paid." Small drinking water systems usually have a small customer base and thus do not generate a large amount of money. A small customer base results in higher unit prices of goods and services, and these increased costs have a greater impact on water rates (Haught et al., 2000).

Two-thirds of all small drinking water systems in Virginia stated that they could not afford any increase in operator salary if a certified/licensed operator is required. One-third of the small PWS do not pay their operators, possibly because: (1) many PWSs do not have an annual operations and maintenance budget (45%), (2) PWSs lack the capital needed to upgrade the facility and revenue needed for day-to-day operation and maintenance (Williams et al., 2000). Without an annual operations and maintenance budget PWSs make themselves unavailable to loans and grants because loans and grants are usually not available to systems without a sufficient operating budgets and/or sufficient water rates (Williams et al., 2000). If a small PWS could adopt an annual operation and maintenance budget, it could be more competitive for grants and loans, may find certifying/licensing/hiring PWS operators easier, and could provide money for maintenance.

5.4 Public Water System Operator Training in Virginia

"VDH has done a good job of assisting through the years with all of the mandates. I would like to any additional training come through them and also consider some type of grandparenting clause for operators who have done this type of work for over five years." –Survey Respondent

Ninety percent of the survey respondents believed the PWS owner should pay for the training sessions and 20% believed that the cost per training session should be $50 or less. Training by videotape, textbook, or a combination of the two was the preferred training method selected by small PWS owner/operators who responded to the survey. The actual cost of training courses depends on the training budget, training objectives, and the trainer (Kerri, 2000). USEPA's final operator certification guidelines (USEPA

Federal Register, 1999) require all PWS operators to take training courses before renewing their certification; many operators will require training in order to be certified or licensed the first time.

Virginia currently has operator-training programs that are used throughout the State for all PWSs; in the future, some of these programs could incorporate more training for small systems operators. Existing training programs include weeklong operator school at Virginia Tech, correspondence courses, apprenticeships, college and university courses, private sector training, distance learning short courses, and video conferencing. Training materials used include videotapes, textbooks, Internet, CD-ROM, television, and slides/overheads. However, the remote location of some of these systems, the part-time or volunteer status of most small system operators, and the cost of traveling to and attending training courses can discourage these operators from taking advantage of these resources. In addition, most current water treatment operator training programs are designed for operators of medium and large systems and therefore fail to provide the small system operator with the combination of broad general knowledge and hands-on practical training they need (NRC, 1997).

Training course registration fees supports some of these training courses, while other courses are free. In 1999 and 2000, distance-learning drinking water training courses (approximately one three hour lecture per month) were organized and offered by Virginia Tech for no fee in multiple locations throughout Virginia. These courses were free to participants because costs were covered through a grant received from the VDH. Participants provided positive feedback and appreciated that the courses were free.

Well known training materials such as *Small Water Systems Video Information Series* and the training manual *Small Water System Operation and Maintenance* could be used for small PWS operator training courses (CSUS, 2000). The Internet could be used to provide training to some, but not all small systems operators, as two-thirds of the respondents reported having Internet access and 28% chose the Internet as a desirable training tool. The length, location, and time of year of the small systems training sessions will need to be tailored to the need of the operators. Respondents preferred short-term (one-day) and local (within 50 miles of their home) training sessions during the winter months. Paying for training is a major concern and challenge for many survey

respondents; the USEPA's operator training reimbursement may be helpful to cover training costs. The Safe Drinking Water Act (SDWA) authorizes USEPA to provide reimbursement for training costs, including an appropriate per diem, for unsalaried operators and certification of individuals who are required to undergo training as a result of the guidelines (USEPA Federal Register, 1999).

5.5 Licensure versus Certification

"Personally I don't think you need a certified operator to collect water samples and mail them off for testing. Too much government interference!" –Survey Respondent

Currently in Virginia, waterworks are classified into five classes based on source water type, design capacity, distribution system complexity, and treatment complexity. Class I is the most complex and Class V is the least complex. Operators are licensed through both the Virginia Board for Waterworks and Wastewater Operators (VBWWO) and Virginia's Department of Professional and Occupational Regulation (DPOR). An operator must have a license of the same or more stringent classification in order to operate the waterworks. VBWWO has proposed a new Class VI waterworks operator in response to USEPA Final Guidelines for the Certification and Recertification of the Operators of Community and Nontransient Noncommunity Public Water Systems. This class includes those waterworks serving less than 400 people using a groundwater source without any treatment (Puckett, 2000). The VBWWO decided to add a Class VI license because they did not want to change the existing licensing system and create a unique certification program. If DPOR and VBWWO were to be responsible for the small system operators, they would have to be part of the licensing requirements. Therefore a Class VI license with a biannual review was deemed appropriate to meet the USEPA Final Guidelines.

5.6 Difficulties Facing Small Systems

"I visit many small water systems and provide technical assistance. I find many small system operators are totally uninformed of the operator certification requirement. Many systems with treatment are improperly operated and the operator can do little more than make a solution." –Survey Respondent

Many small systems will face difficulties when trying to comply with new environmental and drinking water regulations. Typically, small systems lack technical and financial resources needed to meet their environmental responsibilities. Operators will have to comply with the Volatile Organic Chemical (VOC) Rule, the Total Coliform Rule, the Surface Water Treatment Rule, and the Lead and Copper Rule in addition to the new operator certification guidelines and upcoming regulations on arsenic and radon. The USEPA has published literature in an attempt to provide information and assistance to small systems in the areas of drinking water, wastewater, and solid and hazardous waste. One of the essential elements of successfully implementing an operator certification program in the Commonwealth of Virginia is notifying the small system operators/owners of the new regulations and providing necessary technical assistance and training.

Chapter 6: Summary

This project conducted a survey of the owners/operators at 2011 CWS, NTNC and TNC PWSs that serve 3,000 people or less. For the 987 useful responses that were received, the owner/operators were an educated group in which 95% possessed a high school education and more that half had some college education. Forty-six percent of the respondents possessed a license to operate a waterworks, which means that only about half of those surveyed will be affected by the new regulations.

Survey results revealed that the small systems in Virginia encompassed a diverse group of waterworks and owners/operators. Numerous survey respondents were unaware of the upcoming operator certification/licensure regulations and did not even consider themselves as owning/operating a small water system. As one survey respondent noted, "We are a church that has a daycare and a preschool. Wish we did not have to be classified as a waterworks." Significant differences were also found when the survey results were analyzed by the number of people served. Systems serving less than 100 people tended to not have a licensed operator, not have a full time employee, not meter their customers, and not have an operations and maintenance budget. As the system size increased, the likelihood of each increased. Each system category also had its own unique set of characteristics.

To certify all operators of CWS and NCNT, Virginia will likely build upon the current framework of cooperation between VDH and the Virginia Board for Waterworks and Wastewater Operators (VBWWO)/Department of Professional and Occupational Regulation (DPOR). VBWWO has proposed a new Class VI license that would apply to PWSs which serve less than 400 people and use high quality groundwater that does not require treatment. The Virginia Department of Health provides technical assistance and training to any Virginian PWSs, including small systems. Three-quarters of the respondents indicated that they first call VDH for assistance. In order to train those small systems operators who will need to be licensed/certified, VDH will likely need to target its training efforts to the specific needs and backgrounds of the proposed Class VI license. The training materials will need to reflect the duties/requirements of this group. The small systems owner/operators who responded to the survey indicated that they preferred wintertime, one-day training events at locations within 50 miles of their facility.

The most desirable cost range was less than $50 per event, and paper or video training materials was preferred. Electronic materials, e.g. internet training, may be used to reach these small systems. Most have access to the internet, but few are familiar with web based training.

By certifying/licensing CWS and NTNC PWS operators, Virginia will give recognition to these people. If DPOR is chosen to manage operator certification/licensure, licensure rather than certification will be implemented in Virginia. Certification/licensure will acknowledge that these operators have the knowledge and ability to operate CWS and NTNC PWSs in Virginia.

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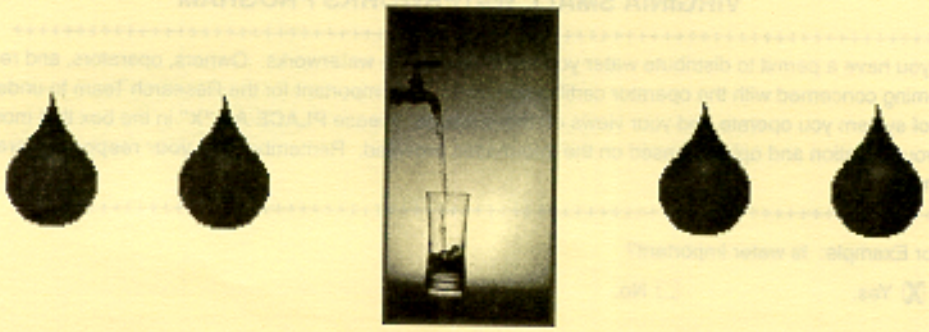

September, 1999

VIRGINIA SMALL WATERWORKS PROGRAM
(ALL REPLIES CONFIDENTIAL)

In response to federal regulations, the Commonwealth of Virginia must develop a certification or licensure program for small water system operators. For the purpose of this study, a small waterworks is a system that serves at least 25 people 6 months of the year and a maximum of 3,300 year round residents. Virginia Tech has received a grant from the Virginia Department of Health (VDH) to help you comply with federal regulations.

The questions are very important to the Virginia Tech Small System Research Team. In order that the results represent the small systems community, it is critical that we hear from you. You may have recently received a previous copy of this survey. **If you have previously filled out this survey, thank you. If not, this additional copy will provide you with the opportunity to express your opinions.** The survey will only take about 15 minutes to complete. If you have a question concerning the survey, please call Dr. Greg Boardman at (540) 231-6020 or email Carrie Adam at cadam@vt.edu. We will be happy to assist you.

All responses will be treated confidentially. The number on the survey is to help group responses by system size and type of source water.

To help you respond quickly, we have enclosed a self-addressed stamped envelope. Your contribution is critical to the success of this study. **Thank you very much for your time and consideration.**

Sincerely,

G. S. Boardman

Greg Boardman
Professor
Virginia Tech

Carrie Adam

Carrie Adam
Research Associate
Virginia Tech

VIRGINIA SMALL WATERWORKS PROGRAM

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If you have a permit to distribute water you are considered a waterworks. Owners, operators, and regulators are becoming concerned with the operator certification issue. It is important for the Research Team to understand the type of system you operate and your views on these issues. Please **PLACE AN "X"** in the box that most closely reflects your situation and opinion based on the information provided. Remember that **your responses are strictly confidential.**

++

For Example: Is water important?

☒ Yes. ☐ No.

PART I Opinions

1. Are you an Operator, Owner, Both, Neither, or Other?
   - ☐ Operator (For example: Take water samples, equipment maintenance, etc.)
   - ☐ Owner (For example: Name appears on permit, pays bills, etc.)
   - ☐ Operator and Owner (For example: Please see above descriptions)
   - ☐ Neither
   - ☐ I don't know
   - ☐ Other: _____

2. Would the owner or operator pay for training courses?
   - ☐ Owner would pay ☐ Operator would pay ☐ Each would share the cost

3. How much would you or your employer be willing to pay per training event? **[Please check only one.]**
   - ☐ $25 per training event
   - ☐ $25-50 per training event
   - ☐ $50-75 per training event
   - ☐ $75-100 per training event
   - ☐ $100-150 per training event
   - ☐ More than $150 per training event

4. If you were required to take additional training to operate your system, in which of the following training activities would you participate? Please check all that apply.
   - ☐ Textbook/manual/correspondence course
   - ☐ Video tape training (you must have access to a TV and VCR)
   - ☐ Internet training (you must have a computer and an internet connection)/Computer based training
   - ☐ Workshop offered within 200 miles of your home
   - ☐ Workshop offered within 100 miles of your home
   - ☐ Workshop offered within 50 miles of your home

5. **If Virginia**, in order to comply with Federal regulations, **was forced** to begin a certification or licensure program, how much money would be "reasonable" to pay each year for the certificate or license? **[Please check only one.]**
   - ☐ Less than $25 ☐ $25-50 ☐ $50-75 ☐ $75-100 ☐ $100-125 ☐ $125-150 ☐ $0, I would not be willing to pay

6. If your water system had the option to consolidate with other water systems to reduce operating and administra-

tive costs, do you think it could happen?

☐ Yes ☐ No ☐ Maybe

7. If a fee were required for certification or licensure, would the water system owner or operator pay the fee?

☐ Owner pays fee ☐ Operator pays fee ☐ Neither

8. Of the choices below, which organization would you recommend manage operator certification / licensure? **[Please check only one.]**

☐ Virginia Department of Health (VDH)
☐ Department of Professional and Occupational Regulation (DPOR)
☐ Non-Profit Organization
☐ Consulting Company
☐ University or College
☐ Not Sure

9. Your biggest concern about operator certification is.... **[Please check only one.]**

☐ Certification/Licensing fee
☐ Cost of travel, exam and training sessions
☐ Time it will take to travel to the exam and training sessions
☐ Passing the certification exam
☐ More government regulations
☐ Training required to renew license/certificate

10. Which time of the year would you prefer for a training course or short school? **[Please check only one.]**

☐ Spring (March, April, May)
☐ Summer (June, July August)
☐ Fall (September, October, November)
☐ Winter (December, January, February)

11. How long could you be available to attend a training session? **[Please check only one.]**

☐ Over a weekend
☐ Over a week
☐ Several evenings throughout the week
☐ Day long program (includes travel time)

12. Where is the Internet or E-mail available to you?

☐ Not available, not interested
☐ Not available, but interested in internet access and training
☐ At work only
☐ At home only
☐ Both at work and at home
☐ Other: _____

PART II Facility Characteristics

13. Please indicate which of the following categories best describe your system? **[Please check only one.]**

- ☐ Community Water Systems
  For example: mobile home parks, towns, housing developments, apartments / condominiums, Air Force bases, state parks, hospitals, prisons
- ☐ Non-Transient Non-Community Water Systems
  For example: schools, daycare centers, office buildings, mines, factories or other industrial installations
- ☐ Transient Non-Community Water Systems
  For example: restaurants, campgrounds, parks, motels / hotels, rest area, camps, resorts, ski areas, beaches
- ☐ Don't know

14. How many of the same people are served by your drinking water system?

- ☐ Less than 25
- ☐ 26 - 100
- ☐ 101 - 250
- ☐ 251 - 400
- ☐ 401 - 1000
- ☐ Greater than 1000
- ☐ I don't know

15. What is the source of your water? Please check all that apply.

- ☐ Well
- ☐ Spring
- ☐ River or Creek
- ☐ Lake, Reservoir or Pond
- ☐ Purchased from another system
- ☐ I don't know
- ☐ Other: _____

16. Do you use more than one water source?

☐ Yes ☐ No. ☐ I don't know.

17. Are all the water system customers metered?

☐ Yes ☐ No ☐ I don't know

18. Does the water system have an annual operations and maitenance budget?

☐ Yes ☐ No ☐ I don't know

19. Please check all the operations and facilities in your water system.

- ☐ Activated carbon or charcoal
- ☐ Aeration
- ☐ Alkalinity adjustments
- ☐ Back-up power
- ☐ Chlorinate/Hypochlorinate (HTH)
- ☐ Coagulation and / or Flocculation
- ☐ Corrosion Inhibitors
- ☐ Filtration
- ☐ Fluoridation
- ☐ Hydrants
- ☐ Ion exchange
- ☐ Iron/manganese removal
- ☐ Membrane filtration (examples: cartridge filtration, ultra filtration, microfiltration, package plants)
- ☐ Other disinfectants
- ☐ Pumping
- ☐ Rechlorination
- ☐ Sedimentation
- ☐ Softening
- ☐ Storage tanks
- ☐ Other

20. If your operator left, how long would it take to hire or identify a replacement? **[Please check only one.]**

- ☐ Maybe a few weeks
- ☐ Maybe a few months
- ☐ A very long time
- ☐ There is not an operator
- ☐ I don't know

21. If a new licensed operator is required, how much more per hour could the owner afford?

- ☐ $0
- ☐ $0.25 to $0.50
- ☐ $0.50 to $1.00
- ☐ $1.00 to $1.50
- ☐ $1.50 to $2.00
- ☐ $2.00 or more

22. If you need **technical assistance** with operating the drinking water system, whom do you contact? Check all that apply.

- ☐ Plumber, maintenance
- ☐ Local/State Health Department (VDH)
- ☐ Other operators
- ☐ Virginia Rural Water Association (VRWA)
- ☐ Your local government
- ☐ A Consultant
- ☐ U.S. Environmental Protection Agency (EPA)
- ☐ American Water Works Association (AWWA)
- ☐ Southeast Rural Community Assistance Project (SERCAP)
- ☐ Well Driller
- ☐ Lab
- ☐ Another waterworks
- ☐ I have never needed technical assistance
- ☐ Other: _____

23. If your facility had one or more serious problems in the last five years (For example: power outages, detection of coliforms, loss of a chlorinator or pumps, and water shortages, as well as other problems of similar importance) do you think that problems could have been avoided or solved more quickly if: **[Please check all that apply.]**

- ☐ If a certified operator was available
- ☐ If more money was spent on maintenance
- ☐ If a person was present full time at the waterworks
- ☐ If operator had more training
- ☐ If you had more access to technical assistance

24. If an individual is paid to operate the waterworks, what is the pay range?

- ☐ Volunteer
- ☐ Not paid/question does not apply
- ☐ $4.00 to $5.50 per hour
- ☐ $5.51 to $6.50 per hour
- ☐ $6.50 to $7.50 per hour
- ☐ Above $7.50 an hour

25. How many people work at your water system?

- ☐ 0
- ☐ 1
- ☐ 2
- ☐ 3
- ☐ 4
- ☐ 5 or more
- ☐ I don't know

26. How many people work **full time** at your water system?

- ☐ 0
- ☐ 1
- ☐ 2
- ☐ 3
- ☐ 4
- ☐ 5 or more
- ☐ I don't know

27. Does your water system operator perform other duties besides operate waterworks **[For example, does he/she also maintain public streets, do snow removal, operate waste water plant, and others?]**

- ☐ Yes.
- ☐ No.
- ☐ There is not an operator.

28. When the operator is absent for an extended period of time, who operates the system in their absence? (For example: 1 week or more) **[Please check only one.]**

- ☐ The system maintains itself
- ☐ Another water system employee
- ☐ Another operator at a nearby water system
- ☐ There is not an operator
- ☐ A contract operator or circuit rider
- ☐ Other:

29. How many other small systems do you know of within 30 miles of your system?

- ☐ 0
- ☐ 1
- ☐ 2 - 5
- ☐ 6 - 10
- ☐ More than 10
- ☐ Don't know

30. Since operator certification / licensure is going to be required, your water system will: **[Please check only one.]**

- ☐ Contract with a vendor who provides services of a contract operator or circuit rider
- ☐ Hire a new certified operator
- ☐ Certify existing personnel
- ☐ Wait until contacted by a regulatory agency
- ☐ I don't know

PART III Owner / Operator Information

31. How many hours per week is an operator present at your waterworks? **[Please check only one.]**

- ☐ Less than 2 hours
- ☐ 3-5 hours
- ☐ 6-10 hours
- ☐ 11-25 hours
- ☐ 26-39 hours
- ☐ 40 or more hours
- ☐ Do not have an operator

32. Please indicate your highest level of formal education.

- ☐ Less than high school
- ☐ Some high school
- ☐ Completed high school or GED
- ☐ Trade/vocational school after high school
- ☐ Some college
- ☐ College graduate
- ☐ Graduate school/ professional school

33. Have you taken any training courses (For example: Virginia Tech Short School for Operators, State sponsored courses and workshops, etc.?

☐ Yes. ☐ No.

34. Have you taken any water related correspondence courses? For example, Sacramento.

☐ Yes. ☐ No.

35. Please indicate the number of years you have worked on your current water system:

- ☐ Less than 6 months
- ☐ 6-12 months
- ☐ 1-3 years
- ☐ 4-6 years
- ☐ 7-12 years
- ☐ More than 12 years

36. Are you familiar with the federal and state standards that your system must meet?

☐ All ☐ Some ☐ None

37. Presently, how many waterworks serving less than 3,300 people are you working for?

- ☐ 1
- ☐ 2
- ☐ 3-4
- ☐ 5 or more
- ☐ None

38. We understand that some waterworks do not have to have licensed operators. What is the level of your Virginia water systems license?

- ☐ I do not hold an operator license.
- ☐ I
- ☐ II
- ☐ III
- ☐ IV
- ☐ V

39. Please check all duties of your job regarding the waterworks.

- ☐ Administration
- ☐ Alkalinity testing
- ☐ Consumer Confidence Report
- ☐ Corrosion Control
- ☐ Customer service
- ☐ Flow measurement
- ☐ Grounds maintenance (For example: lawn, trees, etc.)
- ☐ Hardness testing
- ☐ Maintaining chlorinator
- ☐ Maintaining and cleaning pipes and/or tanks
- ☐ Maintaining pumps
- ☐ Meter reading
- ☐ pH testing
- ☐ Sampling for trihalomethanes (THMs)
- ☐ Sampling for microbial / bacteria testing (For example: coliforms)
- ☐ Turbidity testing
- ☐ Other _____

40. Do your customers complain of any taste or odors in the drinking water?

- ☐ Yes, sometimes.
- ☐ Yes, rarely.
- ☐ No. (Skip to question 42)

41. [Answer only if you replied Yes to question 40] If customers complain of tastes and odors in the drinking water, then please check all of the following taste and odor problems that have occurred in your system.

- ☐ Chlorine
- ☐ Earthy
- ☐ Musty
- ☐ Sulfur
- ☐ Rotten egg
- ☐ Marshy
- ☐ Chemical
- ☐ Gasoline
- ☐ Metallic
- ☐ Other: (Briefly describe) _____

_____

42. If you have any additional comments, please use the space provided below. **Thank you in advance for your time.** (If you'd like a copy of the results please provide your mailing and/or E-mail address below.)

_____

_____

_____

_____

_____

_____

_____

Return To:

Virginia Small Water Systems Program
Attention: Carrie Adam
418 New Engineering Building
Civil & Environmental Engineering
Virginia Tech
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Chapter 9:Vita

Carrie Ann Adam was born in Steubenville, Ohio on November 23, 1976. She was raised in Weirton, West Virginia and graduated as valedictorian from Weir High School in June 1995.

In August 1995, she entered West Virginia University (WVU) in Morgantown, West Virginia. Carrie graduated in the WVU Honors Program with a bachelor in civil and environmental engineering in May of 1999. Upon graduation, she entered graduate school at Virginia Polytechnic Institute and State University. Carrie earned a master degree in environmental engineering in December 2000.

The author is a Charles E. Via scholar and a member of the American Water Works Association.