Training center targets small system operators

This new program will help rural and remote systems enhance their managerial and technical capacity by honing operators’ computer and laboratory skills.

Yuefeng Xie, Charles A. Cole, and David A. Long

Pennsylvania has a total population of more than 12 million people and the largest rural population in the nation. Public water systems (PWSs) serve about 86 percent of the population, and private wells serve the remaining 14 percent. In 1996, about 2,300 community water systems (CWSs), 1,300 nontransient–noncommunity water systems (NTNCWSs), and 6,500 transient–noncommunity water systems (TNCWSs) existed in the state. Of the total 10,688 PWSs in Pennsylvania, 10,361 systems, or 97 percent, are small systems, defined by the US Environmental Protection Agency (USEPA) as those serving ≤ 3,300 people. Table 1 shows the percentages of small systems among the three types of PWSs in Penn-
Almost all NTNCWSs and TNCWSs are small systems. Compared with the national figure, a higher percentage of Pennsylvania’s population is served by small water systems.

Operator training has long history in Pennsylvania

Organization recruits operators as trainers. The Pennsylvania Environmental Training Partnership, administered through a joint agreement between the Department of Environmental Protection (DEP) and the Department of Community and Economic Development, has recruited a group of trainers to teach training courses on drinking water and wastewater. These trainers are also full-time operators at drinking water and wastewater treatment facilities throughout the state. In addition, under the federal Safe Drinking Water Program, DEP has 23 regional technical employees who specialize in providing regulatory and technical training to public water suppliers and other DEP staff.

Certification board created in 1968.

The State Board for Certification of Sewage Treatment and Waterworks Operators was created by Pennsylvania Act 322 in 1968. The board comprises professionals from the drinking water and wastewater treatment industries, a university representative, and the secretary or other representative of DEP. DEP staff support the board in carrying out the mandates of the certification act. Several years ago, the board recognized that the act needed to be updated to improve operator certification in Pennsylvania. In addition, the current act needs to be redrafted to meet new requirements of the 1996 amendments to the federal Safe Drinking Water Act (SDWA) and the recently published “EPA Guidelines for Operator Certification.” An initiative to accomplish these goals is now under way.

Water industry representatives share their knowledge. In 1992, Pennsylvania passed Act 5, creating the Technical Assistance Center (TAC) for Small Water Systems Board. The TAC board advises DEP on issues affecting small systems in Pennsylvania. Its members include representatives from the Pennsylvania Rural Water Association, AWWA’s Pennsylvania Section, the Water Works Operators’ Association of Pennsylvania, Rural Housing Improvement Inc., and other professional and local government organizations. These organizations provide knowledge on the training and needs of small system operators and offer a number of training programs designed for small systems.

More training is a must to meet small systems’ specialized needs

Small systems face difficulties in complying with regulations. Because of technical, managerial, and financial problems, many small systems do not have the capacity to comply with existing or future regulations. Capacity refers to the overall capability

<table>
<thead>
<tr>
<th>Location</th>
<th>Percent of Systems*</th>
<th>Percent of Population†</th>
<th>Percent of Systems*</th>
<th>Percent of Population†</th>
<th>Percent of Systems*</th>
<th>Percent of Population†</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pennsylvania</td>
<td>87</td>
<td>8.3</td>
<td>99.5</td>
<td>3.9</td>
<td>99.9</td>
<td>6.9</td>
</tr>
<tr>
<td>United States</td>
<td>86</td>
<td>9.1</td>
<td>99.5</td>
<td>1.9</td>
<td>99.7</td>
<td>3.7</td>
</tr>
</tbody>
</table>

*Percentage of small systems in the category
†Percentage of total population served by small systems in the category

P

Public water systems serve about 86 percent of the population in Pennsylvania; private wells serve 14 percent.

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<table>
<thead>
<tr>
<th>Location</th>
<th>Monitoring and Reporting percent</th>
<th>Maximum Contaminant Level percent</th>
<th>Treatment Technique percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pennsylvania</td>
<td>94.6</td>
<td>4.2</td>
<td>1.2</td>
</tr>
<tr>
<td>Virginia</td>
<td>73.3</td>
<td>26.2</td>
<td>0.5</td>
</tr>
<tr>
<td>Maryland</td>
<td>33.7</td>
<td>51.6</td>
<td>15.6*</td>
</tr>
<tr>
<td>United States</td>
<td>90.7</td>
<td>7.7</td>
<td>1.6</td>
</tr>
</tbody>
</table>

*For Maryland, total violations = 99.9 percent due to rounding

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of a water system to consistently produce and deliver water meeting all National Primary Drinking Water Regulations (NPDWRs).4 The 1996 SDWA amendments focus on the technical, managerial, and financial capacity of small systems. These capacity development provisions offer a simple, flexible framework to address the challenges facing small water systems. Technical capacity includes source water and infrastructure adequacy and technical knowledge, skills, and abilities. For many small systems, however, source water is not protected or is not of adequate quality or quantity. Many systems cannot provide safe drinking water because of deteriorating infrastructure, including well construction, source water intakes, and treatment, storage, and distribution systems.5–7 Training and operator certification are key to enhancing small systems’ technical, financial, and managerial capacity.4 The Pennsylvania Environmental Training Partnership has provided timely, high-quality training programs to small water systems, and since 1991, more than 7,700 participants have benefited from the program.

Monitoring and reporting troubles top the list of small system violations. In Pennsylvania in 1996, CWSs had 4,869 violations, NTNCWSs experienced 2,920 violations, and TNCWSs had 2,628 violations.2 Eighty-four percent of the CWS violations occurred at small systems (serving ≤ 3,300 people). This figure is comparable to that (90 percent) of the nation and that of the neighboring state of Virginia, in which 85.2 percent of violations occurred in systems serving ≤ 500 people.8 Of the three types of violations—monitoring and reporting, maximum contaminant level (MCL), and treatment technique—most of the violations involved monitoring and reporting (Table 2).9 In the MCL and treatment technique categories, Total Coliform Rule violations were the most common ones in Pennsylvania (Table 3).2 This situation is also true in the surrounding region and across the United States.2–3,8–10 Nitrate and lead and copper violations also occur often (Table 3).

Current programs experience low attendance because of logistics. Each year, workshops are planned to help small system operators. However, many sessions must be canceled because operators are unable to attend because of inconvenient training locations, inflexible schedules, or the technical level of the programs. Low attendance is the major cause of cancellation. Between 1996 and 1998, about 50 percent of scheduled water courses were canceled because of low registration (Table 4).

Operators are challenged by source water quality. Source water quality in Pennsylvania presents a challenge to many small systems. In northeast Pennsylvania, water generally contains high concentrations of iron and manganese, whereas in Lancaster County and neighboring counties, raw water generally contains high concentrations of nitrate, which is reflected in the many nitrate MCL violations.2 In Berks County, many groundwater sources contain a high concentration of radionuclides. In Pennsylvania as a whole, many of the groundwater sources are highly corrosive.11

More certified operators are needed. Although Pennsylvania currently has 5,600 certified water treatment plant operators, another 4,000 certified operators are needed to run NTNCWSs and CWSs that lack staff with sufficient expertise and technical knowledge. Additionally, the 5,600 existing operators need to be recertified. Helping these 10,000 opera-
tors to become certified and recertified is a challenge for Pennsylvania.

Operators require more skills in a dynamic environment. A basic training program is needed to help small systems adapt to a changing world. Drinking water system operators need better access to information and assistance to develop their knowledge and skills. Key components of accomplishing this include more effectively using the existing Environmental Training Partnership trainers and regional trainers; expanding the training network of associated professional associations, universities, and the DEP; and sharpening trainers’ skills. For many existing training programs, the challenges include how to more effectively create and deliver training courses to small system operators, effectively use current technologies (e.g., the Internet and interactive video telephones), and tailor course material to enhance small system operators’ knowledge, skills, and abilities. For many small systems, more training is needed on current and future regulations, such as the Disinfectants/Disinfection By-products Rule, the Enhanced Surface Water Treatment Rule, and the Ground Water Rule. It is also important to disseminate the USEPA small system compliance and variance technologies for current and future regulations. In addition, a wealth of information is now available on the World Wide Web, but many small system operators don’t have access to it or don’t know how to use computers to gain access to it.

Technology assistance center to help tackle problems

A Small Public Water Systems Technology Assistance Center (SPWSTAC) has been established at Pennsylvania State University at Harrisburg (Penn State–Harrisburg) with funds provided by USEPA and DEP. This cooperative effort proposes using two approaches to tackle small system problems in Pennsylvania and the surrounding region.

First, the trainers themselves must be trained. Pennsylvania’s Environmental Training Partnership has 40 trainers. A cost-effective way to train operators is to use these existing trainers; however, many of them lack sufficient knowledge and experience in technology applicable to small systems, and many have expressed interest in improving their teaching skills. Thus, training courses will be provided for them in two areas: (1) educational techniques for adult learners and (2) compliance and variance technologies for small systems. Trainers will learn how to use adult learning concepts and develop expected learning outcomes.

Many systems cannot provide safe drinking water because of deteriorating infrastructure, including well construction, source water intakes, and treatment, storage, and distribution systems. Because many of the teaching materials currently available are not tailored to the educational level and abilities of a small system operator, the trainers will find out how to locate course information and use audiovisual materials and interactive learning techniques.

Conventional treatment technology information is often not applicable to extremely small systems. USEPA has been developing lists of small system compliance and variance technologies for the appropriate NPDWRs and has published the “Small Sys-
tem Compliance Technology List for the Surface Water Treatment Rule,” the “Small System Compliance Technology List for the Surface Water Treatment Rule and Total Coliform Rule,” and the “Small System Compliance Technology List for the Non-Microbial Contaminants Regulated Before 1996.” Affordability is the key criterion in evaluating these technologies, and these lists play an important role in helping small systems make sound treatment technology decisions. Thus, all trainers need to be aware of these technologies. Other topics may include corrosion control, source and wellhead protection, and disinfection.

Next, operators need instruction in computer and laboratory skills. The second component of the SPWSTAC program is training the operators. During the next few years, a large group of small system operators—including nontransient–noncommunity operators who will now need to be certified, individuals seeking continuing education for recertification, and operators who wish to upgrade their skills and knowledge—will require training. Small system operators will need direct training in basic computer skills, as well as in laboratory and operating skills in the areas of disinfection, corrosion control, and source water protection.

A major focus of operator training will be on the use of computers, an area in which many small system operators are believed to have limited knowledge. In order for these operators to help themselves, they must develop basic computer skills, including learning how to use the Internet and its many resources for small systems. These include Web sites of the DEP, the USEPA Office of Ground Water and Drinking Water, the AWWA Small Utility Network, the National Rural Water Association, the National Drinking Water Clearinghouse, and the Montana Water Center at Montana State University at Bozeman. For many small system operators, however, effectively using these resources is a challenge. The SPWSTAC proposes to give operators hands-on information on surfing the Internet, using e-mail, downloading information, and using on-line forums to get technical information. Workshops will guide operators through many of the Web sites listed here. Operators should also be able to use the several computer-based self-training packages available on compact disc.

Because monitoring and reporting violations are prevalent among small systems, the proposed training courses at the SPWSTAC will also cover collecting, preserving, and analyzing water samples for pH, resid-
ual chlorine, turbidity, phosphate, total coliforms, and other basic water quality parameters. Other hands-on laboratory courses will focus on chemical feed pump calibration and maintenance, chlorine handling, and jar testing.

Existing course will be restructured to reach more operators

Through the Environmental Training Partnership, DEP currently offers a 12-week course called “Small Water System Operation and Maintenance.” However, this course has been only modestly attended. Under the proposed program, this course will be reformatted and offered at Penn State campuses and centers to better serve small systems in rural and remote locations. Pennsylvania State University is made up of 30 campuses and centers around the state; thus, 90 percent of the population is within 30 mi (48 km) of a Penn State campus (Figure 1). Because these sites are also linked by an interactive video telephone system, operator training courses can be delivered through these systems at multiple locations. This will make it easier for more operators to attend training programs.

Summary

The authors propose two approaches—train the trainers and train the operators—to assist small system operators in Pennsylvania and the surrounding region. The objective of the train-the-trainers program is to better use existing trainers by upgrading their skills in adult learning techniques and compliance and variance technologies. The train-the-operators program seeks to provide operator training courses in computer, laboratory, and operation and maintenance skills. The training courses will be offered through Penn State’s network of 30 campuses and centers around Pennsylvania. Many training courses will be delivered through an interactive video telephone system at multiple locations. However, training is only one of many tools that can be used to develop small systems’ capacity. As the core faculty of the SPWSTAC at Penn State–Harrisburg, the authors understand that the center must work closely with other professional organizations, training partners, and federal and local governments interested in providing technical, financial, and managerial assistance to small water systems.

Acknowledgment

The authors thank the Pennsylvania DEP for its technical and financial assistance in developing the SPWSTAC at Penn State–Harrisburg.

References


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