

# ABC Need-to-Know Criteria for Very Small Water System Operators



# ABC

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- Jess Jones (Chair), Operator Training Committee of Ohio
- Richard Bond, Colorado Springs (CO) Utilities
- Don Jackson, South Carolina Environmental Certification Board
- Ken Kerri, California State University, Sacramento, Office of Water Programs
- Thomas Rothermich, City of St. Louis (MO) – Water Division
- Russ Glaser, Clark Public Utilities, Vancouver, Washington
- Martin Nutt, Arkansas Drinking Water Advisory and Operators Licensing Committee
- Wes Haskell, Old Town Water District, Old Town, Maine
- Shawn Bradford, Aquarion Water Company
- Cindy Cook, Minnesota Department of Health, Drinking Water Protection



## **Introduction**

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As part of the development of very small water system certification exams, the Association of Boards of Certification (ABC) conducted a job analysis of very small water system operators during 1998. The definition of a very small water system used during the job analysis was a system serving a maximum population of 500 with no treatment other than disinfection. The Need-to-Know Criteria was developed from the results of ABC's 1998 very small water system operator job analysis.

In 2005, ABC's Distribution Validation and Examination (V&E) Committee revised the need-to-know criteria to reflect current terminology used in the item bank. The information in this document reflects the essential job tasks performed by operators and their requisite capabilities. This document is intended to be used by certification programs and trainers to help prepare operators for entry into the profession.

## **How the Need-to-Know Criteria Was Developed**

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In 1998, a seven-member job analysis committee was formed to provide technical assistance in the development of the very small water system operator job analysis. During their meeting, this committee developed the list of the important job tasks performed by very small water system operators. The committee also verified the technical accuracy, clarity, and comprehensiveness of the job tasks. The committee then identified the capabilities (i.e., knowledge, skills, and abilities) required to perform the identified job tasks. Identification of capabilities was done on a task by task basis, so that a link was established between each task statement and requisite capability. This process resulted in a final list of 238 job tasks and 178 capabilities.

### *Task Inventory*

A task inventory was developed from the data collected during the committee meeting. The inventory included 8-point rating scales for frequency of performance and seriousness of inadequate or incorrect performance. These two rating scales were used because they provide useful information (i.e., how critical each task is and how frequently each task is performed) pertaining to certification. The task inventory was sent to 220 certified very small water system operators throughout the United States and Canada. Ninety-three out of the 220 inventories mailed were returned for a response rate 42%.

### *Analysis of Ratings*

The mean, standard deviation, and the percentage of respondents performing each task statement were computed. The mean was used to determine the importance of items and the standard deviation was used to identify items with a wide variation in responses. The percentage of respondents performing each task statement was used to identify tasks and capabilities commonly performed by operators throughout the United States and Canada.

A criticality value of  $2(\text{mean seriousness rating}) + \text{mean frequency rating}$  was calculated for each item on the inventory. This formula gives extra weight to the seriousness rating in determining critical items and was appropriate because it emphasized the purpose of certification—to provide competent operators.

## **Core Competencies**

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The criticality ratings and percentage of operators reporting that they performed the tasks were used to determine what is covered on the very small water system exam. The essential tasks and capabilities that were identified through this process are called the core competencies. The following pages list the core competencies for very small water system operators. The core competencies are clustered into the following job duties:

- Operate System
- Water Quality Parameters and Sampling
- Operate Equipment
- Install, Maintain and Evaluate Equipment
- Perform Safety Duties
- Perform Administrative and Compliance Duties

## Core Competencies for Very Small Water System Operators

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### Operate System

#### System Design

- Assess system demand
- Flushing program
- System layout
- System map
- Perform pressure readings
- Read blueprints, readings, and maps
- Select materials
- Select type of pipes
- Size mains

#### System Inspection

- Cross connection surveys/control
- Sample site plan
- Sanitary surveys
- Well inspection

#### Chlorine Disinfection

- Monitor disinfection process
  - Evaluate disinfection process
  - Adjust disinfection process
- 

#### Required capabilities:

- Ability to adjust flow patterns and system units
  - Ability to communicate verbally and in writing
  - Ability to diagnose/troubleshoot system units
  - Ability to discriminate between normal and abnormal conditions
  - Ability to evaluate system units
  - Ability to inspect pumps
  - Ability to maintain system in normal operating condition
  - Ability to monitor and adjust equipment
  - Ability to perform basic math
  - Knowledge of blueprint readings
  - Knowledge of cathodic protection
  - Knowledge of different types of joints, restraints and thrust blocks
  - Knowledge of disinfection concepts and design parameters
  - Knowledge of disinfection process
  - Knowledge of fireflow requirements
  - Knowledge of general chemistry, biology and physical science
  - Knowledge of general electrical and hydraulic principles
  - Knowledge of hydrology
  - Knowledge of measuring instruments
  - Knowledge of monitoring requirements
  - Knowledge of piping material, type and size
  - Knowledge of principles of measurement
  - Knowledge of regulations
  - Knowledge of sampling procedures and requirements
  - Knowledge of sanitary survey process
  - Knowledge of standards
  - Knowledge of start-up and shut-down procedures
  - Knowledge of testing instruments
  - Knowledge of well drilling principles
  - Knowledge of well-head protection
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## Core Competencies (continued)

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### Water Quality Parameters and Sampling

- Chlorine demand/residual/dosage
  - Coliforms
  - pH
  - Temperature
  - Turbidity
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#### Required capabilities:

- Ability to calibrate instruments
  - Ability to follow written procedures
  - Ability to interpret Material Safety Data Sheets
  - Ability to perform basic math
  - Ability to recognize normal and abnormal analytical results
  - Knowledge of basic laboratory equipment
  - Knowledge of chemical handling and storage
  - Knowledge of general biology, chemistry and physical science
  - Knowledge of normal characteristics of water
  - Knowledge of principles of measurement
  - Knowledge of public notification requirements
  - Knowledge of quality control/quality assurance practices
  - Knowledge of regulations
  - Knowledge of reporting requirements
  - Knowledge of safety procedures
  - Knowledge of sampling procedures
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### Operate Equipment

- Blowers and compressors
  - Centrifugal pumps
  - Chemical feeders
  - Chlorinators
  - Hydrants
  - Hydraulic equipment
  - Instrumentation
  - Leak detectors
  - Positive-displacement pumps
  - Valves
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#### Required capabilities:

- Ability to monitor, evaluate and adjust equipment
- Knowledge of drinking water concepts
- Knowledge of function of tools
- Knowledge of general electrical and mechanical principles
- Knowledge of hydraulic and pneumatic principles
- Knowledge of regulations
- Knowledge of safety procedures
- Knowledge of start-up and shut-down procedures
- Knowledge of system operation and maintenance

## Core Competencies (continued)

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### Install, Maintain and Evaluate Equipment

#### Install and maintain equipment:

- Backflow prevention devices
- Chemical feeders
- Chlorinators
- Corrosion control
- Electric motors
- Hydrants
- Meters
- Pipe repair
- Pumps
- Service connection
- Storage tanks
- Taps
- Valves
- Water mains

#### Evaluate operation of equipment:

- Inspect equipment for abnormal conditions
- Read charts
- Read meters
- Read pressure gauges
- Troubleshoot electrical equipment

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#### Required capabilities:

- Ability to calibrate equipment
  - Ability to diagnose/troubleshoot equipment
  - Ability to differentiate between preventive and corrective maintenance
  - Ability to discriminate between normal and abnormal conditions
  - Ability to evaluate and adjust equipment
  - Ability to follow written procedures
  - Ability to order necessary spare parts
  - Ability to perform general maintenance
  - Ability to record information
  - Knowledge of corrosion control processes
  - Knowledge of dechlorination and disinfection processes
  - Knowledge of different types of cross-connections and approved backflow methods and devices
  - Knowledge of general electrical, mechanical, hydraulic and pneumatic principles
  - Knowledge of lubricant and fluid characteristics
  - Knowledge of pipe fittings and joining methods
  - Knowledge of piping material, type and size
  - Knowledge of regulations
  - Knowledge of start-up and shut-down procedures
  - Knowledge of system operation and maintenance
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## Core Competencies (continued)

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### Perform Safety Procedures

- Chemical handling
  - Confined space entry
  - Electrical hazards
  - Fire safety
  - Lock-out/tag-out
  - Personal protective equipment
  - Traffic/work zone
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#### Required capabilities:

- Ability to communicate verbally and in writing
  - Ability to interpret Material Safety Data Sheets
  - Ability to recognize unsafe work conditions/safety hazards
  - Ability to select and operate safety equipment
  - Knowledge of emergency plans
  - Knowledge of potential causes and impact of system disasters
  - Knowledge of risk management
  - Knowledge of safety procedures
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### Perform Administrative and Compliance Duties

#### Administrative and Security

- Administer compliance, emergency preparedness and safety program
- Develop budget
- Develop operation and maintenance plan
- Plan and organize work activities
- Record and evaluate data
- Respond to complaints
- Write regulatory authority reports

#### Comply with Drinking Water Regulations

##### United States Exams –

- Code of Federal Regulations, Title 40, Part 141 - National Primary Drinking Water Regulations:
  - Subpart A - General definitions
  - Subpart B - Maximum contaminant levels
  - Subpart C - Monitoring and analytical requirements
  - Subpart D - Reporting and recordkeeping
  - Subpart I - Control of lead and copper
  - Subpart Q - Public notification of drinking water violations

##### Canadian Exams

- Provincial and territorial regulations
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#### Required capabilities:

- Ability to assess likelihood of disaster occurring
  - Ability to communicate verbally and in writing
  - Ability to coordinate emergency response with other organizations
  - Ability to generate written policies and procedures
  - Ability to interpret and transcribe data
  - Ability to organize information and review reports
  - Ability to perform basic math
  - Ability to perform impact assessments
  - Ability to translate technical language into common terminology
  - Knowledge of emergency plans
  - Knowledge of local codes and ordinances
  - Knowledge of monitoring and reporting requirements
  - Knowledge of potential causes and impact of system disasters
  - Knowledge of principles of finance
  - Knowledge of principles of management
  - Knowledge of principles of public relations
  - Knowledge of public notification requirements
  - Knowledge of public participation process
  - Knowledge of recordkeeping function and policies
  - Knowledge of regulations
  - Knowledge of risk management
  - Knowledge of system operation and maintenance
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## Very Small Water System Certification Exam

The very small water system certification exam evaluates an operator's knowledge of tasks related to the operation of small water systems. The content of the exam was determined from the results of the job analysis. To successfully take an ABC exam, an operator must demonstrate knowledge of the core competencies in this document.

The very small water system exam consists of 50 multiple-choice questions. The specifications for the exams are based on a weighting of the job analysis results so that they reflect the criticality of tasks performed on the job. The specifications list the percentage of questions on the exam that fall under each job duty. For a list of tasks and capabilities associated with each job duty, please refer to the list of core competencies on the previous pages.

### ABC Very Small Water System Exam Specifications

Job Duty	Percent of Exam
Operate System	22%
Water Quality Parameters and Sampling	20%
Operate Equipment	10%
Install, Maintain and Evaluate Equipment	16%
Perform Safety Duties	14%
Perform Administrative and Compliance Duties	18%

### Suggested References

The following are approved as reference sources for the ABC very small water system examination. Operators should use the latest edition of these reference sources to prepare for the exam.

#### American Water Works Association (AWWA)

- *Water Transmission and Distribution*
- *Water Quality*
- *Basic Science Concepts and Applications*
- *Water Distribution Operator Training Handbook*
- *Water System Security, A Field Guide*

To order, contact: American Water Works Association  
6666 West Quincy Ave.  
Denver, CO 80235

Web site: [www.awwa.org](http://www.awwa.org)  
Phone: (800) 926-7337  
Fax: (303) 347-0804  
E-mail: [custsvc@awwa.org](mailto:custsvc@awwa.org)

California State University, Sacramento (CSUS) Foundation, Office of Water Programs

- *Water Distribution System Operation and Maintenance*
- *Small Water System Operation and Maintenance*
- *Utility Management*
- *Manage for Success*

To order, contact: Office of Water Programs  
California State University, Sacramento  
6000 J Street  
Sacramento, CA 95819-6025

Web site: [www.owp.csus.edu](http://www.owp.csus.edu)

Phone: (916) 278-6142

Fax: (916) 278-5959

E-mail: [wateroffice@owp.csus.edu](mailto:wateroffice@owp.csus.edu)

**Regulations**

For United States exams:

- *Code of Federal Regulations*, Title 40, Part 141 ([www.gpo.gov](http://www.gpo.gov))
- State regulations (contact information for state certification programs is available on the Certification Contacts page of ABC's web site, [www.abccert.org](http://www.abccert.org))

For Canadian exams:

- *Guidelines for Canadian Drinking Water Quality*. Federal-Provincial-Territorial Subcommittee on Drinking Water. Ottawa, ON: Health Canada ([www.hc-sc.gc.ca/waterquality](http://www.hc-sc.gc.ca/waterquality))
- Provincial and territorial regulations (contact information for provincial/territorial certification programs is available on the Certification Contacts page of ABC's web site, [www.abccert.org](http://www.abccert.org))