
ABC Need-to-Know Criteria for Distribution Operators

Association of Boards of Certification

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- Don Jackson (Chair), South Carolina Environmental Certification Board
- Richard Bond, Colorado Springs (CO) Utilities
- Louise Cordova, State of Wyoming Operator Certification Program
- Jess Jones, Operator Training Committee of Ohio
- Ken Kerri, California State University, Sacramento, Office of Water Programs
- Thomas Rothermich, City of St. Louis (MO) – Water Division

Introduction

As part of the development of its certification exams, the Association of Boards of Certification (ABC) conducted a job analysis of water distribution operators in 2000. As part of this process, ABC conducted a national survey of distribution operators. In 2003, ABC's Distribution Validation and Examination (V&E) Committee re-evaluated the results of the job analysis. This Need-to-Know Criteria was developed from the results of the re-evaluation of ABC's 2000 distribution operator job analysis.

How the Need-to-Know Criteria Was Developed

Review of Task Survey

The results of the 2000 task survey were provided to the ABC Distribution V&E Committee. In the task survey, operators rated job tasks and capabilities 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. Of the 154 operators who completed the survey, 24% were class I operators, 39% were class II operators, 21% were class III operators, and 16% were class IV operators.

Committee Ratings

The Distribution V&E Committee, along with a group of additional subject matter experts, met in January 2003 to begin development of the new Need-to-Know Criteria. During their meeting, the committee rated the job tasks and capabilities found in the job analysis as essential, useful or not need-to-know and identified the level of knowledge (i.e., comprehension, application, analysis) required by operators for each task.

Analysis of Ratings

The committee ratings were combined with the operator ratings from the task survey to form a composite criticality rating. The composite criticality ratings and percentage of operators reporting that they performed the tasks were used to determine what is covered on each level of certification exam.

Core Competencies

The essential tasks and capabilities that were identified through this process are called the core competencies. The following pages list the core competencies for distribution operators. The core competencies are clustered into the following job duties:

- System Design
- Comply with Drinking Water Regulations
- Monitor, Evaluate and Adjust Disinfection
- Water Quality Parameters and Sampling
- System Inspection
- Install Equipment
- Operate Equipment
- Evaluate and Maintain Equipment
- Perform Security, Safety and Administrative Duties

The level of knowledge (i.e., comprehension, application, analysis) required for each task is also identified in the following pages.

- **Comprehension** is the most basic level of understanding and remembering. Items written at the comprehension level require examinees to recognize, remember, or identify important ideas.
- Items written at the **application** level require examinees to interpret, calculate, predict, use or apply information and solve problems.
- Items written at the **analysis** level require examinees to compare, contrast, diagnose, examine, analyze, and relate important concepts.

The level of knowledge is a hierarchy from basic comprehension to analysis. The level of knowledge tested is cumulative. Therefore, tasks identified as application may include questions written at both the application and comprehension levels. Tasks identified as analysis may include questions written at the comprehension, application and analysis levels.

Core Competencies for Distribution Operators

System Design	Class I	Class II	Class III	Class IV
Assess system demand	Application	Application	Analysis	Analysis
Design joint restraints	Comprehension	Application	Analysis	Analysis
Design shoring	Application	Application	Analysis	Analysis
Design thrust blocks	Application	Application	Analysis	Analysis
Flushing program	Application	Application	Application	Application
System layout	Comprehension	Application	Analysis	Analysis
System map	Comprehension	Application	Analysis	Analysis
Perform pressure readings	Application	Application	Analysis	Analysis
Read blueprints, readings, and maps	Application	Application	Analysis	Analysis
Select materials	Application	Application	Analysis	Analysis
Select type of pipes	Application	Application	Analysis	Analysis
Size mains		Application	Analysis	Analysis
Write plans (e.g., operations and maintenance plans)		Comprehension	Application	Analysis

Required capabilities:

- Ability to diagnose/troubleshoot system units
- Ability to discriminate between normal and abnormal conditions
- Ability to monitor and adjust equipment
- Knowledge of blueprint readings
- Knowledge of cathodic protection
- Knowledge of different types of joints, restraints and thrust blocks
- Knowledge of general electrical, mechanical, hydraulic and pneumatic principles
- Knowledge of fireflow requirements
- Knowledge of measuring instruments
- Knowledge of piping material, type and size
- Knowledge of regulations
- Knowledge of start-up and shut-down procedures
- Knowledge of testing instruments

Comply with Drinking Water Regulations	Class I	Class II	Class III	Class IV
United States Exams – Code of Federal Regulations , Title 40, Part 141 - National Primary Drinking Water Regulations:				
Subpart A - General definitions	Comprehension	Comprehension	Comprehension	Comprehension
Subpart B - Maximum contaminant levels	Comprehension	Comprehension	Comprehension	Comprehension
Subpart C - Monitoring and analytical requirements	Comprehension	Comprehension	Comprehension	Comprehension
Subpart D - Reporting and recordkeeping	Comprehension	Comprehension	Comprehension	Comprehension
Subpart I - Control of lead and copper	Comprehension	Comprehension	Comprehension	Comprehension
Subpart Q - Public notification of drinking water violations	Comprehension	Comprehension	Comprehension	Comprehension
Canadian Exams				
Provincial and territorial regulations	Comprehension	Comprehension	Comprehension	Comprehension

Core Competencies (continued)

Monitor, Evaluate and Adjust Disinfection	Class I	Class II	Class III	Class IV
Chlorine disinfection	Application	Application	Analysis	Analysis

Required capabilities:

- Ability to adjust flow patterns and system units
- Ability to diagnose/troubleshoot system units
- Ability to evaluate system units
- Ability to maintain system in normal operating condition
- Ability to perform basic math
- Knowledge of disinfection concepts and design parameters
- Knowledge of disinfection process
- Knowledge of general chemistry, biology and physical science
- Knowledge of general electrical and hydraulic principles
- Knowledge of principles of measurement
- Knowledge of regulations

Water Quality Parameters and Sampling	Class I	Class II	Class III	Class IV
Chlorine demand/residual/dosage	Application	Application	Analysis	Analysis
Coliforms	Application	Application	Analysis	Analysis
Conductivity	Application	Application	Application	Application
Lead/copper	Application	Application	Analysis	Analysis
pH	Application	Application	Analysis	Analysis
Temperature	Application	Application	Analysis	Analysis
Turbidity	Application	Application	Analysis	Analysis

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

Core Competencies (continued)

System Inspection	Class I	Class II	Class III	Class IV
Cross connection surveys/control	Application	Application	Application	Analysis
Sample site plan	Application	Analysis	Analysis	Analysis
Sanitary surveys	Analysis	Analysis	Analysis	Analysis
Well inspection	Analysis	Analysis	Analysis	Analysis

Required capabilities:

- Ability to communicate verbally and in writing
- Ability to discriminate between normal and abnormal conditions
- Ability to inspect pumps
- Knowledge of hydrology
- Knowledge of monitoring requirements
- Knowledge of sampling procedures and requirements
- Knowledge of sanitary survey process
- Knowledge of standards
- Knowledge of well drilling principles
- Knowledge of well-head protection

Install Equipment	Class I	Class II	Class III	Class IV
Backflow prevention devices	Comprehension	Comprehension	Application	Application
Hydrants	Comprehension	Application	Application	Analysis
Meters	Application	Application	Application	Analysis
Piping and fitting	Application	Application	Application	Analysis
Rigging	Application	Application	Application	Application
Service connections	Application	Application	Application	Analysis
Shoring	Application	Application	Application	Analysis
Taps	Application	Application	Application	Analysis
Valves	Application	Application	Application	Analysis
Water mains	Application	Application	Application	Analysis

Required capabilities:

- Ability to follow written procedures
- Knowledge of approved backflow prevention devices
- Knowledge of facility operation and maintenance
- Knowledge of function of tools
- 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

Core Competencies (continued)

Operate Equipment	Class I	Class II	Class III	Class IV
Blowers and compressors	Application	Application	Application	Analysis
Cathodic protection devices		Comprehension	Application	Analysis
Centrifugal pumps	Application	Application	Analysis	Analysis
Chemical feeders	Analysis	Analysis	Analysis	Analysis
Chlorinators	Comprehension	Application	Analysis	Analysis
Computers		Comprehension	Application	Application
Electrical motors	Comprehension	Comprehension	Application	Application
Engines	Application	Application	Analysis	Analysis
Generators	Application	Application	Analysis	Analysis
Hydrants	Analysis	Analysis	Analysis	Analysis
Hydraulic equipment	Application	Application	Application	Application
Instrumentation	Comprehension	Comprehension	Comprehension	Comprehension
Leak correlators/detectors	Comprehension	Comprehension	Application	Analysis
Pipe and valve locators	Comprehension	Application	Application	Application
Positive-displacement pumps	Comprehension	Application	Analysis	Analysis
Power tools	Application	Application	Application	Application
SCADA system/RTU/Telemetry/GIS			Application	Application
Tapping equipment	Comprehension	Application	Application	Analysis
Valves	Analysis	Analysis	Analysis	Analysis

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

Evaluate and Maintain Equipment	Class I	Class II	Class III	Class IV
Evaluate operation of equipment:				
Inspect equipment for abnormal conditions	Analysis	Analysis	Analysis	Analysis
Read charts	Comprehension	Comprehension	Analysis	Analysis
Read meters	Analysis	Analysis	Analysis	Analysis
Read pressure gauges	Analysis	Analysis	Analysis	Analysis
Troubleshoot electrical equipment	Analysis	Analysis	Analysis	Analysis
Maintain equipment:				
Backflow prevention devices	Comprehension	Application	Analysis	Analysis
Blowers and compressors	Application	Application	Application	Analysis

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Core Competencies (continued)

Evaluate and Maintain Equipment (continued)	Class I	Class II	Class III	Class IV
Maintain equipment (continued):				
Cathodic protection devices		Comprehension	Application	Analysis
Chemical feeders	Analysis	Analysis	Analysis	Analysis
Chlorinators	Comprehension	Application	Analysis	Analysis
Corrosion control		Comprehension	Application	Analysis
Electric motors	Comprehension	Comprehension	Application	Application
Engines	Application	Application	Analysis	Analysis
Fittings	Application	Application	Analysis	Analysis
Generators	Comprehension	Application	Analysis	Analysis
Hydrants	Analysis	Analysis	Analysis	Analysis
Hydraulic equipment	Comprehension	Application	Application	Application
Instrumentation		Comprehension	Comprehension	Comprehension
Joints	Comprehension	Application	Analysis	Analysis
Leak detection	Comprehension	Application	Analysis	Analysis
Meters	Application	Application	Analysis	Analysis
Pipe repair	Application	Application	Analysis	Analysis
Pressure sensors	Comprehension	Application	Application	Application
Pumps	Application	Application	Analysis	Analysis
Service connection	Comprehension	Application	Analysis	Analysis
Valves	Comprehension	Application	Analysis	Analysis
Water storage facility	Application	Application	Analysis	Analysis

Required capabilities:

- Ability to assign work to proper trade
- 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 safety regulations
- Knowledge of start-up and shut-down procedures
- Knowledge of system operation and maintenance

Core Competencies (continued)

Perform Security, Safety and Administrative Duties	Class I	Class II	Class III	Class IV
Perform security and safety procedures related to:				
Chemical handling	Application	Application	Analysis	Analysis
Confined space entry	Application	Application	Analysis	Analysis
Contamination	Application	Application	Analysis	Analysis
Electrical hazards	Comprehension	Comprehension	Comprehension	Comprehension
Excavation	Application	Application	Analysis	Analysis
Fire safety	Application	Application	Application	Application
Lock-out/tag-out	Application	Application	Analysis	Analysis
Personal protective equipment	Application	Application	Analysis	Analysis
Shoring	Application	Application	Analysis	Analysis
System failure	Application	Application	Analysis	Analysis
Traffic/work zone	Application	Application	Analysis	Analysis
Trenching	Application	Application	Analysis	Analysis
Perform administrative procedures, such as:				
Administer compliance, emergency preparedness and safety program	Application	Application	Analysis	Analysis
Develop budget	Comprehension	Comprehension	Application	Analysis
Develop operation and maintenance plan	Application	Application	Analysis	Analysis
Plan and organize work activities	Application	Application	Analysis	Analysis
Record and evaluate data	Application	Application	Analysis	Analysis
Respond to complaints	Analysis	Analysis	Analysis	Analysis
Write regulatory authority reports	Application	Application	Analysis	Analysis

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 interpret Material Safety Data Sheets
- Ability to organize information and review reports
- Ability to perform basic math
- Ability to perform impact assessments
- Ability to recognize unsafe work conditions/safety hazards
- Ability to select and operate safety equipment
- 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 safety procedures
- Knowledge of system operation and maintenance

ABC Distribution Certification Exams

The ABC distribution certification exams evaluate an operator's knowledge of tasks related to the operation of distribution systems. The ABC Distribution V&E Committee determined the content of each exam based on the results of the national job analysis. To successfully take an ABC exam, an operator must demonstrate knowledge of the core competencies in this document.

Four levels of certification exams are offered by ABC, with class I being the lowest level and class IV the highest level. 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 example, 10% of the questions on the ABC class I exam relate to "System Design." 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 Distribution Exam Specifications

	Exam Level			
	Class I	Class II	Class III	Class IV
System Design	10%	13%	13%	15%
Comply with Drinking Water Regulations	10%	10%	10%	10%
Monitor, Evaluate, and Adjust Disinfection	5%	5%	5%	5%
Water Quality Parameters and Sampling	15%	15%	15%	15%
System Inspection	5%	5%	5%	5%
Install Equipment	11%	9%	9%	9%
Operate Equipment	15%	16%	16%	16%
Evaluate and Maintain Equipment	14%	12%	7%	5%
Perform Security, Safety and Administrative Duties	15%	15%	20%	20%

Suggested Distribution Exam References

The following are approved as reference sources for the ABC distribution examinations. 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 Distribution Operator Training Handbook*
- *Basic Science Concepts and Applications*
- *Water System Security, A Field Guide*
- *Water Quality*

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

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

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Suggested Distribution Exam References (continued)

Association of State Drinking Water Administrators (ASDWA) and National Rural Water Association (NRWA)

- *Security Vulnerability Self Assessment Guide for Small Drinking Water Systems*

To order, contact: ASDWA
1025 Connecticut Ave NW Ste 903
Washington DC 20036

Available online in PDF format (select “Security”):

Web site: www.asdwa.org
Phone: (202) 293-7655
Fax: (202) 293-7656
E-mail: info@asdwa.org

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

- *Water Distribution System Operation and Maintenance*
- *Small Water System Operation and Maintenance*
- *Water Treatment Plant Operation, Volumes I and II*
- *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
Phone: (916) 278-6142
Fax: (916) 278-5959
E-mail: wateroffice@owp.csus.edu

Regulations

For United States exams:

- *Code of Federal Regulations*, Title 40, Part 141 (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)

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)
- 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)

Study Guides

American Water Works Association, *Operator Certification Study Guide: A Guide to Preparing for Water Treatment and Distribution Operator Certification Exams* (www.awwa.org; complete contact information is on preceding page)