

## RANGE OF KNOWLEDGE/NEED TO KNOW CRITERIA WATER DISTRIBUTION OPERATORS & ASSOCIATES

### PARTNERSHIP

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The California – Nevada Section of the American Water Works Association (CA-NV AWWA) partners with the Association of Boards of Certification (ABC) to provide Water Distribution Examinations throughout California and Nevada.

Below is the detailed Need to Know Criteria developed by ABC. If you have any questions, please contact the Certification department at the California – Nevada Section of the American Water Works Association, (909) 481-7200

## Introduction

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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 2008. As part of this process, ABC conducted a national survey of distribution operators. This *Need-to-Know Criteria* was developed from the results of ABC's 2008 distribution operator job analysis.

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

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### *Review of Task Survey*

The results of the 2008 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 147 operators who completed the survey, 23% were class I operators, 37% were class II operators, 23% were class III operators, and 17% were class IV operators.

### *Committee Ratings*

The Distribution V&E Committee met in September 2008 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

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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
- Monitor, Evaluate and Adjust Disinfection
- Comply with Drinking Water Regulations
- 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	Comprehension	Comprehension	Comprehension	Comprehension
Select materials		Comprehension	Comprehension	Comprehension
System layout		Comprehension	Comprehension	Comprehension
Write plans		Comprehension	Comprehension	Comprehension
System map	Comprehension	Comprehension	Comprehension	Comprehension
Perform pressure readings	Comprehension	Comprehension	Comprehension	Comprehension
Select type of pipes	Comprehension	Comprehension	Comprehension	Comprehension
Wells	Comprehension	Comprehension	Comprehension	Comprehension
Read blueprints, readings, and maps	Comprehension	Comprehension	Comprehension	Comprehension
Install shoring	Comprehension	Application	Application	Analysis
Install joint restraints	Comprehension	Application	Application	Analysis
Install thrust blocks	Comprehension	Application	Application	Analysis

### **Required Capabilities:**

- Ability to adjust equipment
- Ability to diagnose/troubleshoot system units
- Ability to discriminate between normal and abnormal conditions
- Ability to inspect pumps
- Ability to monitor electrical and mechanical equipment
- Knowledge of cathodic protection
- Knowledge of types of joints, restraints and thrust blocks
- Knowledge of fireflow requirements
- Knowledge of general electrical, hydraulic and mechanical principles
- Knowledge of measuring instruments
- Knowledge of piping material, type and size
- Knowledge of pneumatics
- Knowledge of regulations
- Knowledge of standards
- Knowledge of start-up and shut down procedures
- Knowledge of testing instruments
- Knowledge of water reuse
- Knowledge of watershed management
- Knowledge of well drilling principles
- Knowledge of well-head protection

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

### **Required Capabilities:**

- Ability to adjust flow patterns
- Ability to diagnose, troubleshoot and adjust system units
- Ability to evaluate and maintain system units
- Ability to perform basic math
- Knowledge of general chemistry and physical science
- Knowledge of general electrical and hydraulic principles
- Knowledge of principles of measurement
- Knowledge of regulations

## Core Competencies (Continued)

Comply with Drinking Water Regulations	Class I	Class II	Class III	Class IV
<b>United States Exams – Code of Federal Regulations, Title 40, Part 141 – National Primary Drinking Water Regulations:</b>				
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
<b>Canadian Exams</b>				
Provincial and territorial regulations	Comprehension	Comprehension	Comprehension	Comprehension

Water Quality Parameters and Sampling	Class I	Class II	Class III	Class IV
Chlorine demand	Application	Application	Application	Analysis
Chlorine residual	Application	Application	Application	Analysis
pH	Application	Application	Application	Analysis
Temperature	Application	Application	Application	Analysis
Turbidity	Application	Application	Application	Analysis

### **Required Capabilities:**

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

## Core Competencies (Continued)

System Inspection	Class I	Class II	Class III	Class IV
Cross-connection surveys	Comprehension	Comprehension	Application	Application
Sample site plan	Comprehension	Comprehension	Application	Application

### **Required Capabilities:**

- Ability to communicate verbally and in writing
- Ability to discern between normal and abnormal conditions
- Knowledge of hydrology
- Knowledge of monitoring requirements
- Knowledge of proper sampling procedures and requirements
- Knowledge of sanitary survey process
- Knowledge of well-head protection
- Knowledge of safety procedures

Install Equipment	Class I	Class II	Class III	Class IV
Hydrants	Comprehension	Application	Application	Application
Meters	Comprehension	Application	Application	Application
Service piping	Comprehension	Application	Application	Application
Service connections	Comprehension	Application	Application	Application
Shoring	Comprehension	Application	Application	Application
Taps	Comprehension	Application	Application	Analysis
Valves	Comprehension	Application	Application	Analysis
Water mains	Comprehension	Application	Application	Analysis

### **Required Capabilities:**

- Ability to follow written procedures
- Knowledge of backflow prevention assemblies and methods
- 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
- Knowledge of well drilling principles

## Core Competencies (Continued)

Operate Equipment	Class I	Class II	Class III	Class IV
Blowers and compressors	Comprehension	Comprehension	Comprehension	Comprehension
Centrifugal pumps	Comprehension	Comprehension	Comprehension	Analysis
Chlorinators	Comprehension	Comprehension	Application	Application
Computers	Comprehension	Comprehension	Comprehension	Comprehension
Electric motors	Comprehension	Comprehension	Comprehension	Comprehension
Electronic testing equipment	Comprehension	Comprehension	Comprehension	Comprehension
Generators	Comprehension	Comprehension	Comprehension	Comprehension
Hand tools	Comprehension	Comprehension	Comprehension	Comprehension
Heavy vehicles	Comprehension	Comprehension	Comprehension	Comprehension
Hydrants	Comprehension	Application	Application	Application
Instrumentation	Comprehension	Comprehension	Comprehension	Comprehension
Leak correlators/detectors	Comprehension	Application	Application	Application
Pipe locators	Comprehension	Application	Application	Application
Positive-displacement pumps	Comprehension	Application	Application	Analysis
Power tools	Comprehension	Comprehension	Comprehension	Comprehension
Remote terminal units (RTU)	Comprehension	Comprehension	Comprehension	Comprehension
Samplers	Comprehension	Comprehension	Comprehension	Comprehension
SCADA system	Comprehension	Comprehension	Comprehension	Comprehension
Tapping equipment	Comprehension	Application	Application	Analysis
Telemetry system	Comprehension	Comprehension	Comprehension	Comprehension
Valve locators	Comprehension	Comprehension	Comprehension	Comprehension
Valves	Comprehension	Comprehension	Comprehension	Comprehension

### **Required Capabilities:**

- Ability to evaluate and adjust equipment
- Ability to discriminate between normal and abnormal conditions
- Ability to monitor electrical and mechanical equipment
- Knowledge of data acquisition techniques
- Knowledge of function of tools
- Knowledge of general electrical, hydraulic and mechanical principles
- Knowledge of regulations
- Knowledge of safety procedures and emergency plans
- Knowledge of start-up and shut-down procedures

## Core Competencies (Continued)

Evaluate and Maintain Equipment	Class I	Class II	Class III	Class IV
<b>Evaluate Operation of Equipment</b>				
Check speed of equipment	Comprehension	Comprehension	Application	Analysis
Inspect equipment for abnormal conditions	Comprehension	Comprehension	Comprehension	Comprehension
Measure temperature of equipment	Comprehension	Comprehension	Comprehension	Comprehension
Read charts	Comprehension	Comprehension	Comprehension	Comprehension
Read gauges	Comprehension	Comprehension	Comprehension	Comprehension
Read meters	Comprehension	Comprehension	Comprehension	Comprehension
<b>Maintain Equipment</b>				
Backflow prevention methods and assemblies	Comprehension	Application	Application	Analysis
Blowers and compressors	Comprehension	Comprehension	Comprehension	Comprehension
Cathodic protection devices	Comprehension	Comprehension	Comprehension	Application
Chlorinators	Comprehension	Application	Application	Application
Corrosion control	Comprehension	Comprehension	Comprehension	Application
Electric motors	Comprehension	Comprehension	Comprehension	Comprehension
Fittings	Comprehension	Comprehension	Application	Application
Generators	Comprehension	Comprehension	Comprehension	Comprehension
Hydrants	Comprehension	Application	Application	Analysis
Hydraulic equipment	Comprehension	Comprehension	Comprehension	Application
Instrumentation	Comprehension	Comprehension	Comprehension	Comprehension
Pipe Joints	Comprehension	Application	Application	Application
Leak detection programs	Comprehension	Comprehension	Comprehension	Comprehension
Meters	Comprehension	Application	Application	Analysis
Service pipes	Comprehension	Comprehension	Application	Application
Pressure sensors instruments	Comprehension	Comprehension	Comprehension	Comprehension
Pumps	Comprehension	Comprehension	Application	Application
Service connections	Comprehension	Application	Application	Analysis
Valves	Comprehension	Application	Application	Analysis
Water mains	Comprehension	Application	Application	Analysis
Water storage facility	Comprehension	Application	Application	Analysis

### **Required Capabilities:**

- Ability to assign work to proper trade
- Ability to calibrate equipment
- Ability to diagnose/troubleshoot equipment
- Ability to differentiate between preventive & corrective maintenance
- Ability to discriminate between normal and abnormal conditions
- Ability to follow written procedures
- Ability to order necessary spare parts
- Ability to perform general maintenance
- Ability to record information
- Knowledge of backflow prevention, methods and assemblies
- Knowledge of corrosion control process
- Knowledge of dechlorination process
- Knowledge of different types of cross-connections
- Knowledge of disinfection process
- Knowledge of facility operation and maintenance
- Knowledge of general electrical, hydraulic and mechanical principles
- Knowledge of pipe fittings and joining methods
- Knowledge of piping material, type and size
- Knowledge of pneumatics
- Knowledge of protective coatings and paints
- Knowledge of regulations and standards
- Knowledge of start-up and shut-down procedures

## Core Competencies (Continued)

<b>Perform Security, Safety and Administrative Duties</b>				
	<b>Class I</b>	<b>Class II</b>	<b>Class III</b>	<b>Class IV</b>
<b>Perform security and safety procedures related to:</b>				
Chemical handling	Application	Application	Application	Application
Confined space entry	Application	Application	Application	Application
Electrical grounding	Application	Application	Application	Application
Excavation	Application	Application	Application	Application
Facility inspection	Application	Application	Application	Application
Fire safety	Application	Application	Application	Application
Lifting	Application	Application	Application	Application
Lock-out/tag-out	Application	Application	Application	Application
Personal protection equipment	Application	Application	Application	Application
Public protection	Application	Application	Application	Application
Shoring	Application	Application	Application	Application
Slips, trips, and falls	Application	Application	Application	Application
Tailgate safety session	Application	Application	Application	Application
Terrorism	Application	Application	Application	Application
Traffic/work zone	Application	Application	Application	Application
Trenching	Application	Application	Application	Application
Contamination	Comprehension	Comprehension	Application	Application
Facility upset	Comprehension	Comprehension	Application	Application
Natural disaster	Comprehension	Comprehension	Application	Application
Power outage	Comprehension	Application	Application	Application
Spill response	Comprehension	Comprehension	Application	Analysis
Vandalism	Comprehension	Comprehension	Comprehension	Comprehension
<b>Perform administrative procedures, such as:</b>				
Administer safety & compliance program	Comprehension	Comprehension	Comprehension	Comprehension
Develop budget	Comprehension	Application	Application	Application
Develop operation and maintenance plan	Comprehension	Application	Application	Application
Organize work activities	Comprehension	Comprehension	Comprehension	Comprehension
Plan work activities	Comprehension	Analysis	Analysis	Analysis
Train employees	Comprehension	Comprehension	Comprehension	Comprehension
Write internal reports	Comprehension	Comprehension	Comprehension	Comprehension
Write state/provincial reports	Analysis	Analysis	Analysis	Analysis
Make oral presentations	Comprehension	Comprehension	Comprehension	Comprehension
Respond to complaints	Comprehension	Comprehension	Comprehension	Comprehension
Restore private property	Comprehension	Comprehension	Comprehension	Comprehension
Restore traffic	Comprehension	Comprehension	Comprehension	Comprehension



## Core Competencies (Continued)

Perform Security, Safety and Administrative Duties (continued)				
	Class I	Class II	Class III	Class IV
Promote customer service program	Comprehension	Comprehension	Comprehension	Comprehension
Promote media relations program				Comprehension
Promote public information program	Comprehension	Comprehension	Comprehension	Comprehension

### Required Capabilities:

- Ability to assess likelihood of disaster occurring
- Ability to communicate verbally and in writing
- Ability to conduct meetings and training programs
- Ability to coordinate emergency response with other organizations
- Ability to demonstrate safe work habits and identify potential safety hazards/unsafe work conditions
- Ability to develop a staffing plan and work unit
- Ability to evaluate facility performance
- Ability to organize information and follow written procedures
- Ability to generate written safety procedures and capital plans
- Ability to interpret data and review reports
- Ability to interpret Material Safety Data Sheets
- Ability to obtain unbiased data
- Ability to perform basic math
- Ability to perform impact assessments
- Ability to prepare and evaluate proposals
- Ability to select and operate safety equipment
- Ability to translate technical language into common terminology
- Knowledge of emergency plans
- Knowledge of facility operation and maintenance practices
- Knowledge of local codes and ordinances
- Knowledge of memorandums of understanding and agreements
- Knowledge of monitoring and reporting requirements
- Knowledge of policies and procedures
- Knowledge of potential causes of disasters in facility
- Knowledge of principles of finance
- Knowledge of principles of general communication
- Knowledge of principles of management
- Knowledge of principles of public relations
- Knowledge of public notification requirements and public participation process
- Knowledge of record keeping policies
- Knowledge of regulations
- Knowledge of risk management
- Knowledge of safe Drinking Water Act
- Knowledge of safety procedures

## **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, 7 to 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	7% - 10%	10% -13%	13% - 16%	15% - 18%
Monitor, Adjust & Evaluate Disinfection	5%	5%	5%	5%
Comply with Drinking Water Regulations	10% - 13%	10% - 13%	10% - 13%	10% - 13%
Water Quality Parameters & Sampling	12% - 15%	12% - 15%	12% - 15%	12% - 15%
System Inspection	5%	5%	5%	5%
Install Equipment	11% - 14%	9% - 12%	9% - 12%	6% - 9%
Operate Equipment	15% - 18%	16% - 19%	13% - 16%	13% - 16%
Evaluate & Maintain Equipment	14% - 17%	12% - 15%	7% - 10%	5%
Perform Security, Safety & Administrative Duties	12% - 15%	12% - 15%	17% - 20%	20% - 23%

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

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](http://www.asdwa.org)  
Phone: (202) 293-7655  
Fax: (202) 293-7656  
E-mail: [info@asdwa.org](mailto: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*
- *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))

**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](http://www.awwa.org); complete contact information is on preceding page)