

ABC Need-to-Know Criteria for Distribution Operators



ABC

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Boards of Certification

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Acknowledgment

The Association would like to thank the members of the 2008 Distribution Validation and Examination Committee for their effort in conducting the job analysis and developing the *ABC Need-to-Know Criteria for Distribution Operators*. 2008 committee members included:

- Jess Jones, Cincinnati OH, Chair
- Martin Nutt, Little Rock, AR, ABC Distribution Division Director
- Tom Arnbrister, Shelton, WA
- Richard Bond, Florissant, CO
- Shawn Bradford, Goodyear, AZ
- Audrey Buchanan, Sydney, NS
- Cindy Cook, Santa Barbara, CA
- Russ Glaser, Vancouver, WA
- Wes Haskell, Bangor, ME
- Don Jackson, Ware Shoals, SC
- Ray Olson, Castle Rock, CO
- Thomas Rothermich, St. Louis, MO

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 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

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

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 |
|---|---------------|---------------|---------------|---------------|
| 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 |

| 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 |
|--|---------------|---------------|---------------|---------------|
| Evaluate Operation of Equipment | | | | |
| 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 |
| Maintain Equipment | | | | |
| 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)

| 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 | 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 |
| Perform administrative procedures, such as: | | | | |
| 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
Phone: (800) 926-7337
Fax: (303) 347-0804
E-mail: 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
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*
- *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)