

# Virginia Need-to-Know Criteria for Waterworks Operator

## Core Competencies for Virginia Waterworks Operator

| Monitor, Evaluate and Adjust Treatment Processes & System | Class |   |   |   |   |   |
|---|-------|---|---|---|---|---|
|   | 6     | 5 | 4 | 3 | 2 | 1 |
| <b>Source Water Treatment</b>                             |       |   |   |   |   |   |
| Algae control   |       |   |   |   |   | X |
| Pretreatment  |       |   |   |   | X | X |
| <b>Chemical Treatment/Addition</b>                        |       |   |   |   |   |   |
| Chloramines   |       |   |   | X | X | X |
| Chlorine dioxide disinfection                             |       |   |   | X | X | X |
| Chlorine disinfection                                     | X     | X | X | X | X | X |
| Corrosion control   |       |   | X | X | X | X |
| Fluoridation  |       |   |   | X | X | X |
| Ozone disinfection  |       |   |   |   |   | X |
| pH adjustment   |       |   |   | X | X | X |
| <b>Coagulation and Flocculation</b>                       |       |   |   |   |   |   |
| Chemical coagulants                                       |       |   |   | X | X | X |
| Flocculation tanks  |       |   |   | X | X | X |
| Rapid mix units   |       |   |   | X | X | X |
| <b>Clarification/Sedimentation</b>                        |       |   |   |   |   |   |
| Dissolved air flotation                                   |       |   |   | X | X | X |
| Inclined-plate sedimentation                              |       |   |   | X | X | X |
| Sedimentation basins                                      |       |   |   | X | X | X |
| Tube sedimentation  |       |   |   | X | X | X |
| Up-flow solids-contact clarification                      |       |   |   | X | X | X |
| <b>Filtration</b>   |       |   |   |   |   |   |
| Calcite filters   | X     | X | X | X | X | X |
| Cartridge filters   |       |   |   |   | X | X |
| Diatomaceous earth filters                                |       |   |   | X | X | X |
| Direct filtration   |       |   |   | X | X | X |
| Gravity/rapid sand filtration                             |       |   |   | X | X | X |
| Membrane filtration (RO, MF, UF, NF, ED)                  |       |   | X | X | X | X |
| Slow sand filters   |       |   | X | X | X | X |
| <b>Other Treatment Processes</b>                          |       |   |   |   |   |   |
| Activated carbon adsorption                               |       |   | X | X | X | X |
| Aeration  |       |   | X | X | X | X |
| Backwash aids   |       |   |   |   |   | X |
| Coagulation aids  |       |   |   | X | X | X |
| Ion exchange softening                                    |       |   | X | X | X | X |
| Iron and manganese sequestration/removal                  |       |   | X | X | X | X |
| Lime-soda ash softening                                   |       |   |   | X | X | X |

Core Competencies (continued)

| Monitor, Evaluate and Adjust Treatment Processes (continued) | Class |   |   |   |   |   |
|--|-------|---|---|---|---|---|
|  | 6     | 5 | 4 | 3 | 2 | 1 |
| <b>Residuals Disposal</b>                                    |       |   |   |   |   |   |
| Discharge to lagoons   |       |   |   | X | X | X |
| Discharge to lagoons and then surface water                  |       |   |   | X | X | X |
| <b>System Inspection</b>                                     |       |   |   |   |   |   |
| Flow measurement   | X     | X | X | X | X | X |
| Leak detection   | X     | X | X | X | X | X |
| System flushing  | X     | X | X | X | X | X |
| Well inspection  | X     | X | X | X | X | X |

Required capabilities:

- Ability to adjust chemical feed rates
- Ability to adjust flow patterns
- Ability to calculate dosage rates
- Ability to confirm chemical strength
- Ability to diagnose/troubleshoot process units
- Ability to interpret Material Safety Data Sheets
- Ability to maintain processes in normal operating condition
- Ability to measure chemical weight/volume
- Ability to monitor, evaluate and adjust process units
- Ability to perform basic math
- Ability to perform physical measurements
- Ability to perform process control calculations
- Ability to prepare chemicals
- Knowledge of application of chemicals
- Knowledge of chemical handling and storage
- Knowledge of chemical properties
- Knowledge of drinking water regulations
- Knowledge of general biology and chemistry
- Knowledge of general electrical principles
- Knowledge of hydraulic principles
- Knowledge of normal chemical range
- Knowledge of personal protective equipment
- Knowledge of physical science
- Knowledge of principles of distribution repair
- Knowledge of principles of measurement
- Knowledge of water treatment concepts and processes
- Knowledge of water treatment design parameters

| Evaluate Characteristics of Source Water | Class |   |   |   |   |   |
|--|-------|---|---|---|---|---|
|  | 6     | 5 | 4 | 3 | 2 | 1 |
| Bacteriological                          | X     | X | X | X | X | X |
| Biological                               | X     | X | X | X | X | X |
| Chemical                                 | X     | X | X | X | X | X |
| Physical                                 | X     | X | X | X | X | X |

Required capabilities:

- Ability to communicate observations verbally and in writing
- Ability to discriminate between normal and abnormal conditions
- Knowledge of hydrology
- Knowledge of normal characteristics of water
- Knowledge of sanitary survey process
- Knowledge of watershed protection

Core Competencies (continued)

| Collect Samples and Interpret Analyses | Class |   |   |   |   |   |
|--|-------|---|---|---|---|---|
|  | 6     | 5 | 4 | 3 | 2 | 1 |
| Alkalinity                             |       |   |   | X | X | X |
| Carbon dioxide                         |       |   | X | X | X | X |
| Chlorine demand                        |       | X | X | X | X | X |
| Chlorine residual                      | X     | X | X | X | X | X |
| Conductivity                           |       |   |   |   | X | X |
| Disinfectant by-products (THM)         | X     | X | X | X | X | X |
| Fluoride concentration                 |       |   |   | X | X | X |
| Hardness                               |       |   | X | X | X | X |
| Iron/manganese                         |       |   | X | X | X | X |
| Jar test                               |       |   |   | X | X | X |
| Lead/copper                            | X     | X | X | X | X | X |
| Microbiological                        | X     | X | X | X | X | X |
| Nitrate                                | X     | X | X | X | X | X |
| pH                                     | X     | X | X | X | X | X |
| Phosphate                              |       |   |   | X | X | X |
| Temperature                            | X     | X | X | X | X | X |
| Total organic carbon                   |       |   |   | X | X | X |
| Total suspended solids                 |       |   |   |   | X | X |
| Turbidity                              |       |   |   | X | X | X |

Required capabilities:

- Ability to recognize abnormal analytical results
- Knowledge of basic laboratory techniques
- Knowledge of chemical handling and storage procedures
- Knowledge of drinking water regulations
- Knowledge of EPA approved analytical methods
- Knowledge of general biology, chemistry and physical science
- Knowledge of Material Safety Data Sheets
- Knowledge of normal characteristics of water
- Knowledge of principles of measurement
- Knowledge of quality control/quality assurance practices
- Knowledge of safety procedures
- Knowledge of sampling procedures

Core Competencies (continued)

| Perform Process Control Laboratory Analyses | Class |   |   |   |   |   |
|---|-------|---|---|---|---|---|
|   | 6     | 5 | 4 | 3 | 2 | 1 |
| Alkalinity                                  |       |   |   | X | X | X |
| Chlorine demand                             |       | X | X | X | X | X |
| Chlorine residual                           | X     | X | X | X | X | X |
| Conductivity                                |       |   |   |   | X | X |
| Disinfectant by-products                    |       |   |   |   | X | X |
| Fluoride concentration                      |       |   |   |   | X | X |
| Hardness                                    |       |   | X | X | X | X |
| Iron/manganese                              |       |   | X | X | X | X |
| Jar test                                    |       |   |   | X | X | X |
| Lead/copper                                 |       |   |   | X | X | X |
| Nitrate                                     |       |   |   |   | X | X |
| pH  | X     | X | X | X | X | X |
| Temperature                                 |       |   | X | X | X | X |
| Total organic carbon                        |       |   |   | X | X | X |
| Turbidity                                   |       |   | X | X | X | X |

**Required capabilities:**

- Ability to calibrate instruments
- Ability to follow written procedures for analyses
- Ability to perform laboratory calculations
- Ability to recognize abnormal analytical results
- Knowledge of basic laboratory techniques
- Knowledge of drinking water regulations
- Knowledge of general biology, chemistry, and physical science
- Knowledge of EPA approved analytical methods
- Knowledge of laboratory equipment
- Knowledge of Material Safety Data Sheets
- Knowledge of normal characteristics of water
- Knowledge of principles of measurement
- Knowledge of proper chemical handling and storage
- Knowledge of quality control/quality assurance practices
- Knowledge of safety procedures

Core Competencies (continued)

| Operate Equipment                        | Class |   |   |   |   |   |
|--|-------|---|---|---|---|---|
|  | 6     | 5 | 4 | 3 | 2 | 1 |
| Blowers, compressors and pneumatics      |       |   |   | X | X | X |
| Chemical feeders                         | X     | X | X | X | X | X |
| Computers                                |       | X | X | X | X | X |
| Electronic testing equipment             | X     | X | X | X | X | X |
| Generators                               |       | X | X | X | X | X |
| Hydrants                                 |       | X | X | X | X | X |
| Instrumentation                          | X     | X | X | X | X | X |
| Prime movers/drives (engines and motors) | X     | X | X | X | X | X |
| Traps and drains                         | X     | X | X | X | X | X |
| Valves                                   | X     | X | X | X | X | X |
| Water pumps                              | X     | X | X | X | X | X |

Required capabilities:

- Ability to monitor, evaluate and adjust equipment
- Knowledge of drinking water treatment 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

Core Competencies (continued)

| Evaluate and Maintain Equipment           | Class |   |   |   |   |   |
|---|-------|---|---|---|---|---|
|   | 6     | 5 | 4 | 3 | 2 | 1 |
| <b>Evaluate operation of equipment:</b>   |       |   |   |   |   |   |
| Inspect equipment for abnormal conditions | X     | X | X | X | X | X |
| Read charts                               | X     | X | X | X | X | X |
| Read meters                               | X     | X | X | X | X | X |
| Read pressure gauges                      | X     | X | X | X | X | X |
| <b>Perform maintenance:</b>               |       |   |   |   |   |   |
| Backflow prevention devices               | X     | X | X | X | X | X |
| Blowers, compressors and pneumatics       |       |   |   |   | X | X |
| Chemical feeders                          | X     | X | X | X | X | X |
| Electrical equipment                      | X     | X | X | X | X | X |
| Fittings                                  | X     | X | X | X | X | X |
| Instrumentation                           | X     | X | X | X | X | X |
| Mechanical equipment                      |       | X | X | X | X | X |
| Pipes                                     | X     | X | X | X | X | X |
| Prime movers/drives (engines and motors)  | X     | X | X | X | X | X |
| Treatment units                           | X     | X | X | X | X | X |
| Valves                                    | X     | X | X | X | X | X |
| Water pumps                               | X     | X | X | X | X | X |
| Water treatment filters                   |       |   |   | X | X | X |

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 operating conditions
- Ability to evaluate and adjust equipment
- Ability to perform general maintenance
- Ability to record information
- Knowledge of facility operation and maintenance
- Knowledge of general electrical and mechanical principles
- Knowledge of hydraulic and pneumatic principles
- Knowledge of lubricant and fluid characteristics
- Knowledge of process control instrumentation
- Knowledge of safety regulations
- Knowledge of start-up and shut-down procedures

Core Competencies (continued)

| Perform Security, Safety and Administrative Procedures           | Class |   |   |   |   |   |
|--|-------|---|---|---|---|---|
|  | 6     | 5 | 4 | 3 | 2 | 1 |
| Perform security and safety procedures related to:               |       |   |   |   |   |   |
| Chemical handling  | X     | X | X | X | X | X |
| Confined space entry   | X     | X | X | X | X | X |
| Electrical hazards   | X     | X | X | X | X | X |
| Facility upset   | X     | X | X | X | X | X |
| Fire safety  | X     | X | X | X | X | X |
| Lock-out/tag-out   | X     | X | X | X | X | X |
| Pathogens  | X     | X | X | X | X | X |
| Personal protective equipment                                    | X     | X | X | X | X | X |
| Source contamination   | X     | X | X | X | X | X |
| Spill response   | X     | X | X | X | X | X |
| Terrorism  |       | X | X | X | X | X |
| Traffic control  |       | X | X | X | X | X |
| Trenching and shoring  |       | X | X | X | X | X |
| Perform administrative procedures, such as:                      |       |   |   |   |   |   |
| Administer compliance, emergency preparedness and safety program | X     | X | X | X | X | X |
| Administer facility security program                             | X     | X | X | X | X | X |
| Administer quality control program                               | X     | X | X | X | X | X |
| Develop operation and maintenance plan                           | X     | X | X | X | X | X |
| Plan and organize work activities                                | X     | X | X | X | X | X |
| Record and evaluate data   | X     | X | X | X | X | X |
| Respond to complaints  | X     | X | X | X | X | X |
| Write regulatory authority reports                               | X     | X | X | X | X | X |

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 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 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 facility operation and maintenance practices
- Knowledge of local codes, ordinances, and permits
- Knowledge of monitoring and reporting requirements
- Knowledge of potential causes and impact of facility disasters
- Knowledge of principles of finance
- Knowledge of principles of management
- Knowledge of principles of public relations
- Knowledge of procedures to protect plant security
- Knowledge of recordkeeping function and policies
- Knowledge of regulations