# Welcome to Montana's Operator Certification Program

The study material in this packet is designed to offer you a basic knowledge of the subject areas you need to be familiar with in order to take the operator certification exams successfully. Montana uses ABC (Association of Boards of Certification) standardized exams for testing. This ensures up-to-date exams based on national standards and EPA requirements.

Because Montana's water treatment and water distribution classification system is not labeled the same as ABC's, you will need to determine which levels you are studying for by using the following chart:

| Montana Water Treatment Exam | ABC Water Treatment Equivalent |
|---|---|
| Class 2B | Class II |

Remember that this material is supplemental and it is recommended that you consider the suggested reference materials listed on the last page of the Need-to-Know Criteria booklet. Also ***highly*** recommended:

- Water Operator Certification Study Guide
  - AWWA publication (see contact and order information on last page or go to www.awwa.org)

If you have any questions concerning these study materials or anything about Operator Certification, please feel free to contact the operator certification program at 406-444-4584.

ABC
Association of
Boards of Certification

2017

# Need-to-Know Criteria

## Water Treatment Operator Class II

*A Need-to-Know Guide when preparing for the*
*ABC Water Treatment Operator Class II Certification Exam*

# Before You Dive In…

## What is ABC's *Need-to-Know Criteria*?

This *ABC Water Treatment Operator Class II Need-to-Know Criteria* was developed to assist operators in understanding the content that will be covered in ABC's 2017 Standardized Water Treatment Operator Class II exam. During 2014-2016, a methodical and comprehensive international investigation was conducted to determine the most significant job tasks performed by water treatment operators. The content covered on the exam represents the job tasks identified through this research as essential operator competencies, and is not limited to the practices of your system/facility. The following pages organize these job tasks into Content Areas and identify the amount of the test devoted to each area.

## Is this *Need-to-Know Criteria* relevant to MY exam?

ABC offers a variety of standardized and customized exam services. This document is reflective only of the 2017 edition of the ABC Standardized Water Treatment Operator Class II exam; older editions of the standardized exam and various customized exams are also administered by various certification programs. Please contact your certifying authority to determine whether they have implemented this exam for your program.

## Pre-Test Questions

Your exam may include up to 10 extra questions that have not been used on previous versions of the exam. These are known as "pre-test" questions and allow ABC to gather valuable data about the new questions before they are included in future tests. Pre-test questions are unidentified and scattered throughout the exam so you will answer them with the same care in which you address scored questions. The pre-test questions are not included in your final score.

## Exam Preparation Resources

Visit www.abccert.org to access the formula/conversion table administered with this exam, a list of approved references, information on purchasing study guides available from partner organizations, and more.

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# Water Treatment Operator Class II *Need-to-Know Criteria*

## Exam Content

The Water Treatment Operator Class II exam will test you on essential job tasks. These job tasks have been categorized into the Content Areas detailed in the following pages. The table below summarizes the areas that are included on the exam, the number of test questions in each of these areas, and the complexity of the test questions in each area.

Just as water treatment operator job duties vary in their complexity, so will the questions you are asked on the exam. Some will be more simple and routine, whereas others will be more complex, or cognitively demanding. The following three levels are used to describe the complexity of the questions you will encounter on this exam:

**Recall** – tasks at this level typically require the simple recall or recognition of specific facts, concepts, processes, or procedures, with little to no problem-solving involved. You may be asked to identify, illustrate, recall, and/or recognize specific information.

**Application** – tasks at this level will involve some basic problem solving, calculations, or the interpretation and application of data. You may be asked to calculate, categorize, classify, compare, differentiate, explain, specify, translate, and/or apply knowledge.

**Analysis** – tasks at this level may involve higher level problem solving, evaluation, or the fitting together of a variety of elements into a meaningful whole; they will usually require many steps in the thought process. You may be asked to analyze, evaluate, formulate, generalize, judge, predict, and/or use inductive or deductive reasoning to arrive at a solution.

### Exam Content Outline

| Number of Questions | Content Area | Job Task Complexity Levels |
|---|---|---|
| 31 | Treatment Process | 8<br>17<br>6 |
| 14 | Laboratory Analysis | 5<br>8<br>1 |
| 24 | Equipment Operation & Maintenance | 7<br>15<br>2 |
| 11 | Source Water Characteristics | 2<br>7<br>2 |
| 20 | Security, Safety, Compliance, & Administrative Procedures | 9<br>11<br>0 |
| 100* | Total | 31<br>58<br>11 |

This exam includes 10 calculation questions

*Your exam may contain up to 10 extra unscored pre-test questions (see *Before You Dive In* for more details).


## Treatment Process

### Job Tasks Included in this Content Area:

1. Calculate and/or record:
    a. Plant residuals
    b. Backwash water
    c. Daily flow rates
    d. Chemical levels and previous days usage
    e. Filter performance data
    f. Online analyzers data
2. Calculate chemical dosages
3. Interact with HMI and SCADA
4. Determine correct disinfectant dosage and contact time to maintain desired level of residual in system
5. Control treatment plant processes, chemical dosages, and equipment used to treat water
6. Determine and adjust plant flows to meet system demands
7. Troubleshoot malfunctions and problems in plant process and equipment
8. Identify trends and abnormal operation in plant processes by interpreting data from gauges, meters, charts, and graphs
9. Interpret facility and process control water meters
10. Maintain records of operation of treatment facilities:
    a. Daily testing logs
    b. Daily equipment logs
    c. Daily intake and production
    d. Daily maintenance management reports and notes
    e. Microbiological sampling and testing
11. Make appropriate changes in plant processes to optimize performance and efficiency
12. Mix batches of chemical solutions
13. Add chemicals to hoppers and feed equipment
14. Monitor filter performance and backwash filters
15. Monitor the transmission and distribution system
16. Monitor, evaluate, and adjust:
    a. Pretreatment
    b. Coagulation and flocculation (e.g., flocculation tanks, rapid mix units)
    c. Filtration (e.g., biofiltration, diatomaceous earth filters, direct and conventional filtration, membranes, microscreens, slow sand, Greensand, pressure, upflow, rapid sand, cartridge)
    d. Iron/manganese treatment
    e. Ion exchange
    f. Chemical feed pumps
    g. Online instrumentation
17. Operate and control electric motors, pumps, and valves to regulate flow of water at the treatment facility
18. Perform calculations related to process monitoring
19. Ensure the proper handling, storage and use of chemicals:
    a. Acids
    b. Bases
    c. Oxidants
    d. Chemical disinfectants
    e. Corrosion control chemicals


## Laboratory Analysis

### Job Tasks Included in this Content Area:

1. Calibrate and repair laboratory instrumentation to ensure proper operation
2. Collect water samples
3. Perform sample preservation and documentation for laboratory samples
4. Perform lab tests, record results, and interpret data
5. Use equipment to evaluate water quality
6. Perform analyses:
    a. Color
    b. Turbidity
    c. Free Cl2 residual
    d. Total Cl2 residual
    e. pH
    f. Hardness
    g. Aluminum
    h. Alkalinity
    i. Iron
    j. Temperature


# Equipment Operation & Maintenance

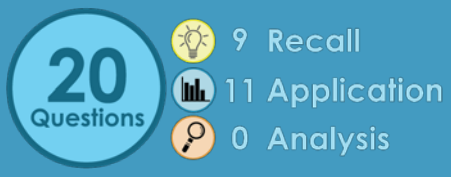
## Job Tasks Included in this Content Area:

1. Adjust pumps to meet demand
2. Perform facility startup and shutdown per SOP
3. Calibrate inline instrumentation (e.g., pH, turbidimeters, Cl analyzer)
4. Complete equipment maintenance and repair records, including work orders
5. Ensure the operation and maintenance of equipment at the water treatment facility:
    a. Chlorine disinfection system
    b. Filter systems (e.g., biofiltration, diatomaceous earth filters, direct and conventional filtration, membranes, microscreens, slow sand, Greensand, pressure, upflow, rapid sand, cartridge)
    c. Treated water storage tanks
    d. Clearwell
    e. Programmable Logic Control (PLC) System
    f. SCADA
    g. Raw and treated water pumping systems
    h. Water intake equipment
    i. Pumps
    j. Chemical feed equipment
    k. Chemical mixing equipment (e.g., rapid mix, flocculators, static mixers)
    l. Water quality analyzers
    m. Valves
    n. Injectors
6. Inspect, exercise, and maintain valves
7. Maintain facility and process control water meters
8. Install and maintain facility piping (e.g., air, water, chemical)
9. Lubricate pumps, motors, chains, conveyors, and other machinery and equipment
10. Operate and maintain pumps, drivers, and auxiliary equipment
11. Operate and maintain onsite backup power generator
12. Perform calibration of chemical feeders
13. Perform preventive and corrective maintenance to the auxiliary water treatment plant equipment:
    a. Electric motors
    b. Gas and electric powered pumps
    c. Air compressors
    d. Emergency systems
    e. Power generation systems
    f. Pressure and flow regulators
    g. Online analyzers
    h. Filters (e.g., air, oil)
    i. Chemical feed systems
14. Perform routine maintenance of grounds machinery, structures, equipment, and piping systems (e.g., cleaning, painting)
15. Perform inspections on clear well covers, hatches, access covers, vents, and overflows
16. Backwash filters


## Source Water Characteristics

Job Tasks Included in this Content Area:

1. Evaluate the following source water characteristics:
    a. Biological (bacterial, protozoa, viruses)
    b. Chemical
    c. Potential sources of source water contamination
    d. Physical
2. Measure static water level and pumping levels of wells
3. Measure and monitor raw water source
4. Perform inspections of ground water well sites and report any issues that may affect water quality (e.g., contamination, flooding, well head protection)
5. Determine if wells are under the direct influence of surface water (GWI)
6. Educate community on source water protection and conservation




# Security, Safety, Compliance, & Administrative Procedures

## Job Tasks Included in this Content Area:

1. Accept chemical shipments
2. Advise on need to order chemicals, repair parts, and tools
3. Advise system staff and/or contractors of potential problems and alarms
4. Inspect plant safety equipment (e. g., fire extinguishers, AED, smoke and gas detectors)
5. Comply with safety requirements of the facility and1 actively promote safe work practices
6. Develop and maintain standard operating procedures
7. Determine materials, labor, and cost needed for operation, maintenance, and repairs
8. Procure materials, labor, and cost needed for operation, maintenance, and repairs
9. Investigate consumer complaints regarding water quality and take remedial action
10. Take delivery of chemicals by unloading by hand or with equipment such as fork lifts and cranes (e.g., chlorine cylinders, bulk liquids, and dry bagged chemicals)
11. Inspect chemical containers and security tags before taking delivery (e.g., review SDS's)
12. Comply with lockout tagout procedures
13. Determine if water quality violations have occurred
14. Ensure compliance with regulatory agency standards
15. Manage safety and environmental issues in compliance with appropriate regulatory agencies (e.g., Hazardous Waste Disposal and Air Quality Standards)
16. Monitor and control residual effluents to comply with regulatory permit limits
17. Monitor the use of energy and chemicals
18. Complete monthly reports
19. Track and maintain inventory (e.g., equipment, chemical, and general supplies)
20. Evaluate operating records and trends
21. Maintain facility operation records
22. Conduct confined space entries according to appropriate regulatory guidelines
23. Notify the public when reportable maximum contaminant levels are exceeded
24. Perform facility and perimeter security checks
25. Use, handle, and dispose of chemicals according to safety standards
26. Perform safety procedures (e.g., calibration of atmospheric testing devices, chemical hazards and chemical spill response, pathogens, personal protective equipment)
27. Perform supervisory duties:
    a. Determining and assigning work schedules and tasks
    b. Enforcing policies and safety procedures
28. Plan water treatment operations:
    a. Production
    b. Treatment and storage
29. Review and update facility emergency response plans
30. Respond to emergencies (e.g., facility upset, major spill response, natural disasters, system contamination)

## Supporting Knowledge

The chart below outlines several types of knowledge that support the performance of the job tasks on which you may be tested. These types of knowledge are rated at one of three levels to represent the extent of knowledge needed to perform the job tasks assigned to each Content Area:

**Basic** – A fundamental or lower level of knowledge is required. Operators performing tasks requiring this level of knowledge will be able to do so with some training; this level of knowledge may also be acquired and developed through job experience. Such tasks may be routine, utilizing established procedures, and have a low level of complexity. Not having this level of knowledge will have minimal impact or significance on the performance of the tasks listed in the Content Area, or on public safety and welfare.

**Intermediate** – A level of knowledge beyond the basic level is required. Operators performing tasks requiring this level of knowledge will be able to do so with training beyond that of the basic level. The operator will not only be able to apply required fundamental concepts, but will be able to understand and discuss the application and implications of changes to processes, policies, and procedures within the Content Area. Not having this level of knowledge will have a significant impact on the performance of the job and on public safety and welfare.

**Advanced** – A very high level of knowledge/job expertise is required and the operator will be functioning at an expert level. The operator can apply all fundamental, as well as highly developed or complex concepts, and will be able to design, review, and evaluate processes, policies, and procedures within the Content Area. Not having this level of knowledge will have a serious impact on the performance of the job and will be very harmful to public safety and welfare.

| Supporting Knowledge Type | Treatment Process (31%)* | Laboratory Analysis (14%)* | Equipment Operation & Maintenance (24%)* | Source Water Characteristics (11%)* | Security, Safety, Compliance, & Administrative Procedures (20%)* |
|---|---|---|---|---|---|
| Arithmetic (e.g., measurements and calculations) | Intermediate | Intermediate | Intermediate | Intermediate | Intermediate |
| Biology (e.g., pathogenic organisms) | Basic | Intermediate | | Intermediate | |
| Chemistry (e.g., water chemistry) | Intermediate | Intermediate | | Intermediate | |
| Chemical dosing (coagulants, oxidants, disinfectants, acids and bases) | Intermediate | | | | |
| Chemical feed equipment (e.g., liquid, solid, gases) | | | Intermediate | | |
| Chemical properties (e.g., reactivity, compatibility, pH) | Intermediate | Intermediate | Intermediate | | |
| Contaminants (e.g., organic, inorganic) | Intermediate | Intermediate | | Intermediate | |
| Disciplinary procedures | | | | | |
| General electrical principles (e.g. troubleshooting breakers, relays, circuits) | | | Intermediate | | |
| Internal combustion engines | | | Intermediate | | |
| Laboratory equipment (e.g., glassware) | | Intermediate | | | |
| Laboratory instrumentation (e.g., operation and calibration) | | Intermediate | | | |

| Supporting Knowledge Type | Treatment Process (31%)* | Laboratory Analysis (14%)* | Equipment Operation & Maintenance (24%)* | Source Water Characteristics (11%)* | Security, Safety, Compliance, & Administrative Procedures (20%)* |
|---|---|---|---|---|---|
| Laboratory procedures and protocols (e.g., Standard Methods) | | Advanced | | | |
| Laboratory techniques | Intermediate | Intermediate | | | |
| Legislative process | | | | | |
| Mechanical principles (e.g., mixing, solids compression) | Intermediate | | Intermediate | | |
| Pneumatics (e.g., actuators, compressors, valves) | | | Intermediate | | |
| Prime mover of water (e.g., pumps) | | | Intermediate | | |
| Principles of finance | | | | | |
| Principles of hydraulics (e.g. mass flow balance, detention time, loading, velocity) | Intermediate | | | Basic | |
| Principles of hydrology (e.g., hydraulic cycle, aquifers) | | | | Intermediate | |
| Principles of public relations (e.g., water quality concerns, rate increases) | | | | Basic | Intermediate |
| Process control instrumentation (e.g., pH, turbidity, temperature, etc.) | Intermediate | | Intermediate | Intermediate | |
| Proper chemical handling and storage | | Intermediate | Intermediate | | Intermediate |
| Proper lifting procedures | | | | | Basic |
| Proper sampling procedures (e.g., chain of custody, storage and preservation) | | Intermediate | | | Intermediate |
| Public administration procedures | | | | Basic | Intermediate |
| Quality control/quality assurance practices | | Intermediate | | | Basic |
| Recordkeeping policies | | Intermediate | | | Intermediate |
| Reporting requirements (e.g., violations, annual reports) | | | | | Intermediate |
| Risk management | | | | Basic | |
| Safety Data Sheets | Intermediate | Intermediate | Intermediate | | Intermediate |
| Safety equipment (e.g., personal protective equipment, safety showers and eye washes) | Advanced | Advanced | Intermediate | | Advanced |
| Safety procedures and regulations (e.g., lockout tagout, confined space) | | | | | Basic |
| Storage (e.g., clearwells, reservoirs) | Basic | | Intermediate | | |
| Valve operation and maintenance | | | Intermediate | | |
| Watershed protection | | | | Intermediate | |

***Percent of exam associated with the Content Area***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# Water Treatment Operator Exam References

The following are approved as reference sources for the 2017 ABC standardized water treatment operator exams. Reference lists for prior generations of ABC standardized exams are included in the respective *Need-to-Know Criteria*.

## American Water Works Association (AWWA)

**https://www.awwa.org/store/books.aspx**
1-800-926-7337

- **WSO: Water Treatment Series (Grade 1, Grade 2, Grades 3 & 4)*
- **WSO: Water Distribution Series (Grades 1 & 2, Grades 3 & 4)*
- *Basic Science Concepts and Applications*
- *Water Quality*
- *Water Sources*
- *Water System Security, A Field Guide*

*These WSO texts replace previous AWWA titles *Water Treatment* and *Water Transmission and Distribution.* Visit www.awwa.org/wso to learn more about transitioning between the guides.

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

**https://www.asdwa.org/security/security-vulnerability-assessment-guides/**
1-703-812-9505

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

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

**http://www.owp.csus.edu/courses/drinking-water.php**
**(916) 278-6142**

- *Manage for Success*
- *Water Treatment Plant Operation, Volume I and II*