



# NEED-TO-KNOW CRITERIA

## Water Treatment Operator Class I

A Need-to-Know Guide when preparing for the:

**ABC Water Treatment Operator Class I Certification Exam**



The Associated Boards  
of Certification

*Superior Water Starts Here™*

# Before You Dive In...

## **What is the Need-to-Know Criteria?**

This **ABC Water Treatment Operator Class I** Need-to-Know Criteria was developed to assist operators in understanding the content that will be covered in the ABC Standardized Water Treatment Operator Class I exam. 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?**

WPI offers a variety of standardized and customized exam services. This document is reflective only of the ABC Standardized Water Treatment Operator Class I 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 WPI 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 [gowpi.org](http://gowpi.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 I *Need-to-Know Criteria*

## EXAM CONTENT

The Water Treatment Operator Class I 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.



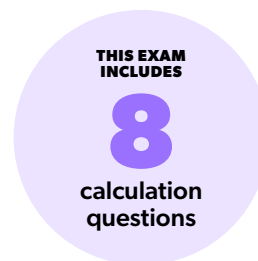
**Application** – tasks at this level will involve some basic problem solving, calculations, or the interpretation and application of data. You may be asked to calculate, categorize, classify, compare, differentiate, explain, specify, translate, and/or apply knowledge.



**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
30	Treatment Process	12 18 0
13	Laboratory Analysis	5 8 0
27	Equipment Operation & Maintenance	11 16 0
10	Source Water Characteristics	4 6 0
20	Security, Safety, Compliance, & Administrative Procedures	9 11 0
100*	Total	41 59 0



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



12 Recall



18 Application



0 Analysis

## Treatment Process

### Job Tasks Included in this Content Area:

**1. Calculate and/or record:**

- a. Plant residuals
- b. Daily flow rates
- c. Chemical levels and previous days usage
- d. Filter performance data
- e. Online analyzers data

**2. Calculate chemical dosages**

**3. Interact with HMI and Supervisory Control and Data Acquisition (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. Pre-treatment
- b. Filtration  
(e.g., biofiltration, diatomaceous earth filters, direct and conventional filtration, membranes, microscreens, slow sand, greensand, pressure, upflow, rapid sand, cartridge)
- c. Ion exchange
- d. Chemical feed pumps
- e. 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. Oxidants
- c. Chemical disinfectants



-  5 Recall
-  8 Application
-  0 Analysis

# 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. Turbidity
  - b. Free Cl<sub>2</sub> residual
  - c. Total Cl<sub>2</sub> residual
  - d. pH



11 Recall



16 Application



0 Analysis

## Equipment Operation & Maintenance Job Tasks Included in this Content Area:

- 1. Adjust pumps to meet demand**
- 2. Perform facility start up and shut down per SOP**
- 3. Calibrate in-line 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. Treated water storage tanks
  - c. Clearwell
  - d. Supervisory Control and Data Acquisition (SCADA)
  - e. Raw and treated water pumping systems
  - f. Water intake equipment
  - g. Pumps
  - h. Chemical feed equipment
  - i. Chemical mixing equipment  
(e.g., rapid mix, flocculators, static mixers)
  - j. Water quality analyzers
  - k. Valves
  - l. 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. Emergency systems
  - d. Pressure and flow regulators
  - e. 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**



4 Recall



6 Application



0 Analysis

# 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. Educate community on source water protection and conservation**



9 Recall



11 Application



0 Analysis

# 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 and 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 cranes**  
(e.g., chlorine cylinders, bulk liquids, dry bagged chemicals)
- 11. Inspect chemical containers and security tags before taking delivery**  
(e.g., review SDSs)
- 12. Comply with lock-out tag-out 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, 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, general supplies)
- 20. Evaluate operating records and trends**
- 21. Maintain facility operation records**
- 22. Monitor and record daily weather readings**
- 23. Conduct confined space entries according to appropriate regulatory guidelines**
- 24. Notify the public when reportable maximum contaminant levels are exceeded**
- 25. Perform facility and perimeter security checks**
- 26. Use, handle, and dispose of chemicals according to safety standards**
- 27. Perform safety procedures**  
(e.g., calibration of atmospheric testing devices, chemical hazards and chemical spill response, pathogens, Personal Protective Equipment)
- 28. Perform supervisory duties - enforcing policies and safety procedures**
- 29. Plan water treatment operations such as:**
  - Production
  - Treatment and storage
- 30. Review and update facility emergency response plans**
- 31. 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 (30%)*	Laboratory Analysis (13%)*	Equipment Operation & Maintenance (27%)*	Source Water Characteristics (10%)*	Security, Safety, Compliance, & Administrative Procedures (20%)*
Arithmetic (e.g., measurements and calculations)	Basic	Basic	Basic	Basic	Basic
Biology (e.g., pathogenic organisms)	Basic	Basic		Basic	
Chemistry (e.g., water chemistry)	Basic	Basic		Basic	
Chemical dosing (e.g., coagulants, oxidants, disinfectants, acids, bases)	Basic				
Chemical feed equipment (e.g., liquid, solid, gas)			Basic		
Chemical properties (e.g., reactivity, compatibility, pH)	Intermediate	Basic	Basic		
Contaminants (e.g., organic, inorganic)	Basic	Basic		Basic	
Disciplinary procedures					
General electrical principles (e.g., troubleshooting breakers, relays, circuits)			Basic		
Internal combustion engines			Basic		
Laboratory equipment (e.g., glassware)		Basic			

Supporting Knowledge Type	Treatment Process (30%)*	Laboratory Analysis (13%)*	Equipment Operation & Maintenance (27%)*	Source Water Characteristics (10%)*	Security, Safety, Compliance, & Administrative Procedures (20%)*
Laboratory instrumentation (e.g., operation and calibration)		Basic			
Laboratory procedures and protocols (e.g., Standard Methods)		Intermediate			
Laboratory techniques	Basic	Basic			
Legislative process					
Mechanical principles (e.g., mixing, solids compression)	Basic		Basic		
Pneumatics (e.g., actuators, compressors, valves)			Basic		
Prime mover of water (e.g., pumps)			Basic		
Principles of finance					
Principles of hydraulics (e.g., mass flow balance, detention time, loading, velocity)	Basic			Basic	
Principles of hydrology (e.g., hydraulic cycle, aquifers)				Basic	
Principles of public relations (e.g., water quality concerns, rate increases)				Basic	Intermediate
Process control instrumentation (e.g., pH, turbidity, temperature, etc.)	Basic		Basic	Basic	
Proper chemical handling and storage		Basic	Basic		Basic
Proper lifting procedures					Basic
Proper sampling procedures (e.g., chain of custody, storage and preservation)		Basic			Basic
Public administration procedures				Basic	Basic
Quality control/quality assurance practices		Intermediate			Basic
Recordkeeping policies		Intermediate			Basic
Reporting requirements (e.g., violations, annual reports)					Basic
Risk management				Basic	
Safety Data Sheets	Intermediate	Intermediate	Intermediate		Intermediate
Safety equipment (e.g., Personal Protective Equipment, safety showers and eye washes)	Intermediate	Intermediate	Basic		Intermediate
Safety procedures and regulations (e.g., lock-out/tag-out, confined space)					Basic
Storage (e.g., clearwells, reservoirs)	Basic		Basic		
Valve operation and maintenance			Basic		
Watershed protection				Basic	

\*Percent of exam associated with the Content Area

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