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Need-to-Know Criteria

Water Treatment

Operator Class I

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

Water Treatment Operator Class I Certification Exam

WPI WATER PROFESSIONALS INTERNATIONAL
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Before You Dive In…

What is the Need-to-Know Criteria?

This Water Treatment Operator Class I Need-to-Know Criteria was developed to assist operators in understanding the content that will be covered in the 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 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 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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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 displayed on Page 4 of this document summarizes the areas that are included on the exam, the number of test questions in each of these areas, the cognitive format of the test questions, and the number of calculation questions in each area.

Just as operator job duties vary in their complexity, so will the questions you are asked on the exam. Some will be simpler, whereas others will be more complex or cognitively demanding. The following two cognitive levels are used to describe the format of the questions you will encounter on this exam:

Recall – Tasks at this cognitive 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. An example of a Recall type item follows:

Although the required contact time for chlorine to kill bacteria may vary depending on certain water characteristics, the typical industry standard is:

A. 15 minutes
B. 30 minutes
C. 45 minutes
D. 60 minutes

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. An example of an Application type item follows:

In the activated sludge process, some of the activated sludge MUST be wasted to:

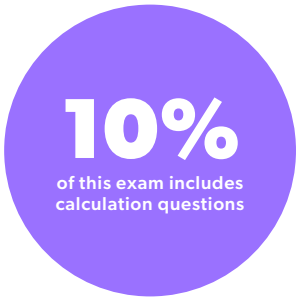
A. increase digester gas production
B. prevent excessive solids build-up
C. prevent clogging of the sludge return line
D. prevent overloading of sludge return pumps

Exam Content Continued

Units for Calculations – This exam requires numerical calculations. The number of calculation items is detailed in the Exam Content Outline below. WPI's standardized examinations are designed to be utilized in both the United States and Canada, therefore calculation items are presented in both US Standard units and Metric units. Each item is solvable in both units independently. The US Standard units will appear first in the question followed by the metric units in parentheses. An example of a Calculation item follows:

If a water reservoir 12 ft (4 m) in diameter has a static water level of 21 ft (7 m) what is the pressure on the bottom of the tank?

A. 6 psi (46 kPa)
B. 9 psi (69 kPa)
C. 12 psi (92 kPa)
D. 21 psi (161 kPa)



NUMBER OF QUESTIONS	CONTENT AREA	COGNITIVE FORMAT OF JOB TASK EXAM CONTENT
31	Treatment Process	10 21 07
16	Laboratory Analysis	09 07 00
26	Equipment Operation and Maintenance	07 19 02
15	Source Water Characteristics	09 06 01
12	Security, Safety, and Administrative Procedures	05 07 00
100	Total	

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

Exam References

Each question on the standardized Water Treatment Class I Examination is referenced to widely accepted, peer-reviewed publications from California State University, Office of Water Programs, American Water Works Association, or the Water Environment Federation. A complete listing of references used for the development of this exam can be found on WPI's website at: https://www.gowpi.org/services/abc-testing/exam-references/

In order to assist with exam preparation, the table below provides both primary and secondary reference materials for each content area on this examination. Please note that exam questions may be referenced to any WPI approved source, however, the following matrix identifies the two most prominent sources in each content area.

NUMBER OF QUESTIONS	CONTENT AREA	PRIMARY REFERENCE	SECONDARY REFERENCE
31	Treatment Process	AWWA WSO Water Treatment Grade 1	CSUS Water Treatment Plant Operation, Volume 1
16	Laboratory Analysis	AWWA WSO Water Treatment Grade 1	CSUS Water Treatment Plant Operation, Volume 1
26	Equipment Operation and Maintenance	CSUS Water Treatment Plant Operation Volume 1	AWWA WSO Water Treatment Grade 1
15	Source Water Characteristics	AWWA WSO Water Treatment Grade 1	AWWA Basic Science Concepts and Applications, 4th Edition
12	Security, Safety, and Administrative Procedures	AWWA WSO Water Treatment Grade 1	No other references

Treatment Process

Calculate and/or record

- Chemical levels and daily usage
- Chemical dosages
- Online analyzers data
- Filter performance data
- Backwash data
- Plant residuals
- Daily flow rates
- Process monitoring

Interact with Supervisory Control and Data Acquisition (SCADA) systems

- Data communication integration
- Programmable Logic Controller (PLC) programming and maintenance
- Human Machine Interface (HMI) operation

Monitor, evaluate, and adjust

- Source water treatment (e.g., algae control, aeration, mixing)
- Pretreatment
- Coagulation and flocculation (e.g., flocculation tanks, rapid mix units)
- Clarification and sedimentation (e.g., inclined-plate, tube, upflow solids-contact)
- Conventional filtration (e.g., slow and rapid sand, upflow)
- Direct filtration (e.g., pressure direct filtration, cartridge)
- Membrane filtration
- Filter performance
- Residuals disposal (e.g., lagoons, sludge drying beds, land application, on-site disposal, solids composting)
- Iron/manganese treatment
- Chemical feed pumps
- Online instrumentation
- Transmission and distribution system

Control treatment plant processes, chemical dosages, and equipment used to treat water

Determine and adjust plant flows to meet system demands

Determine correct disinfectant dosage and contact time needed to maintain desired level of residual in system

Troubleshoot malfunctions and problems in plant process and equipment

Identify trends and abnormal operation in plant processes by interpreting data from gauges, meters, charts, and graphs

Interpret facility and process control water meters

Maintain records of operation of treatment facilities:

- Laboratory results
- Equipment logs
- Intake and production
- Maintenance management reports and notes
- Water quality sampling results

Make appropriate changes in plant processes to optimize performance and efficiency

Mix batches of chemical solutions

Add chemicals to hoppers and feed equipment

Operate and control electric motors, pumps, and valves to regulate flow of water at the treatment facility

In the treatment process, ensure the proper use of

- Acids (e.g., hydrochloric, sulfuric, citric, CO2)
- Bases (e.g., sodium hydroxide, lime, soda ash)
- Oxidants (e.g., permaganates, ozone, chlorine)
- Coagulants (e.g., aluminum sulfate, ferric chloride)
- Disinfectants (e.g., UV, chlorine, ozone, chloramines)

Laboratory Analysis

Ensure proper operation of laboratory equipment (e.g., calibration, verification, maintenance)

Collect water samples

Perform sample preservation and documentation for laboratory samples

Perform analyses, record results, and interpret data

- Color
- Taste and odor
- Turbidity
- Free Cl2 residual
- Total Cl2 residual
- pH
- Hardness
- Alkalinity
- Iron
- Manganese
- Temperature
- Disinfection Byproducts (DBPs)
- Bacteria
- TSS

Equipment Operation and Maintenance

Inspect, maintain, and operate

- Raw water intake, screening, and pumping
- Chemical mixing equipment (e.g., rapid mix, flocculators, static mixers)
- Conventional filtration (e.g., slow and rapid sand, upflow)
- Chemical feed equipment
- Chlorine disinfection system
- Water storage tanks
- Programmable Logic Control (PLC) System
- SCADA
- Potable water pumping
- Water quality analyzers
- Valves (e.g., backflow, control valve, isolating, throttling, pressure regulation)
- Electric motors
- Air compressors
- Emergency systems
- Power generation systems
- Blowers

Adjust pumps to meet demands

Calibrate inline instrumentation (e.g., pH, turbidimeters, Cl analyzer)

Complete equipment maintenance and repair records, including work orders

Perform corrective, preventative, and predictive maintenance

Conduct asset management

Maintain facility and process control water meters

Install and maintain facility piping (e.g., air, water, chemical)

Operate and maintain pumps, drivers, and auxiliary equipment

Operate and maintain onsite backup power generator

Source Water Characteristics

Evaluate the following source water characteristics

- Biological (bacterial, protozoa, viruses)
- Chemical
- Physical
- Potential sources of source water contamination
- Supply

Measure static water level and pumping levels of wells

Inspect ground water sources for issues that may affect water quality (e.g., contamination, flooding, well head protection)

Follow source water protection plans and watershed management plans

12 Questions

5 Recall

7 Application

0 Calculation Items

Water Treatment Operator Class I *Examination Outline*

Security, Safety, and Administrative Procedures

Inspect, accept, and safely unload chemical containers

Use, handle, and dispose of chemicals according to the Safety Data Sheets (SDS)

Train staff/contractors on safety requirements of the facility and safe work practices

Inspect plant safety equipment (e.g., Personal Protective Equipment (PPE), fire extinguishers, atmosphere detectors)

Comply with safe work practices (e.g., confined space entry, lockout/tagout, electrical, chemical spills)

Review and update facility emergency response plans

Respond to emergencies (e.g., facility upset, equipment failure, spill response, natural disasters, system contamination)

Perform facility and perimeter security

Perform cyber security according to industry standards

Determine if water quality violations have occurred

Ensure compliance with regulatory agency standards

Manage safety and environmental issues in compliance with appropriate regulatory agencies (e.g., Hazardous Waste Disposal and Air Quality Standards)

Monitor and control residual effluents to comply with regulatory permit limits

Notify the public according to regulatory requirements

Develop and maintain Standard Operating Procedures (SOPs)

Respond to consumer complaints

Optimize the use of energy and chemicals

Track and maintain inventory (e.g., equipment, chemical, and general supplies)

Evaluate and maintain operating records

Monitor and record weather readings

Complete reports on plant operation

Perform supervisory duties

- Enforcing policies and safety procedures

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