



## 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 wastewater 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 Municipal Wastewater Exam	ABC Wastewater Equivalent
Class 1C	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:

- Wastewater Operator Certification Study Guide
  - AWWA publication (see contact and order information on last page or go to [www.awwa.org](http://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.



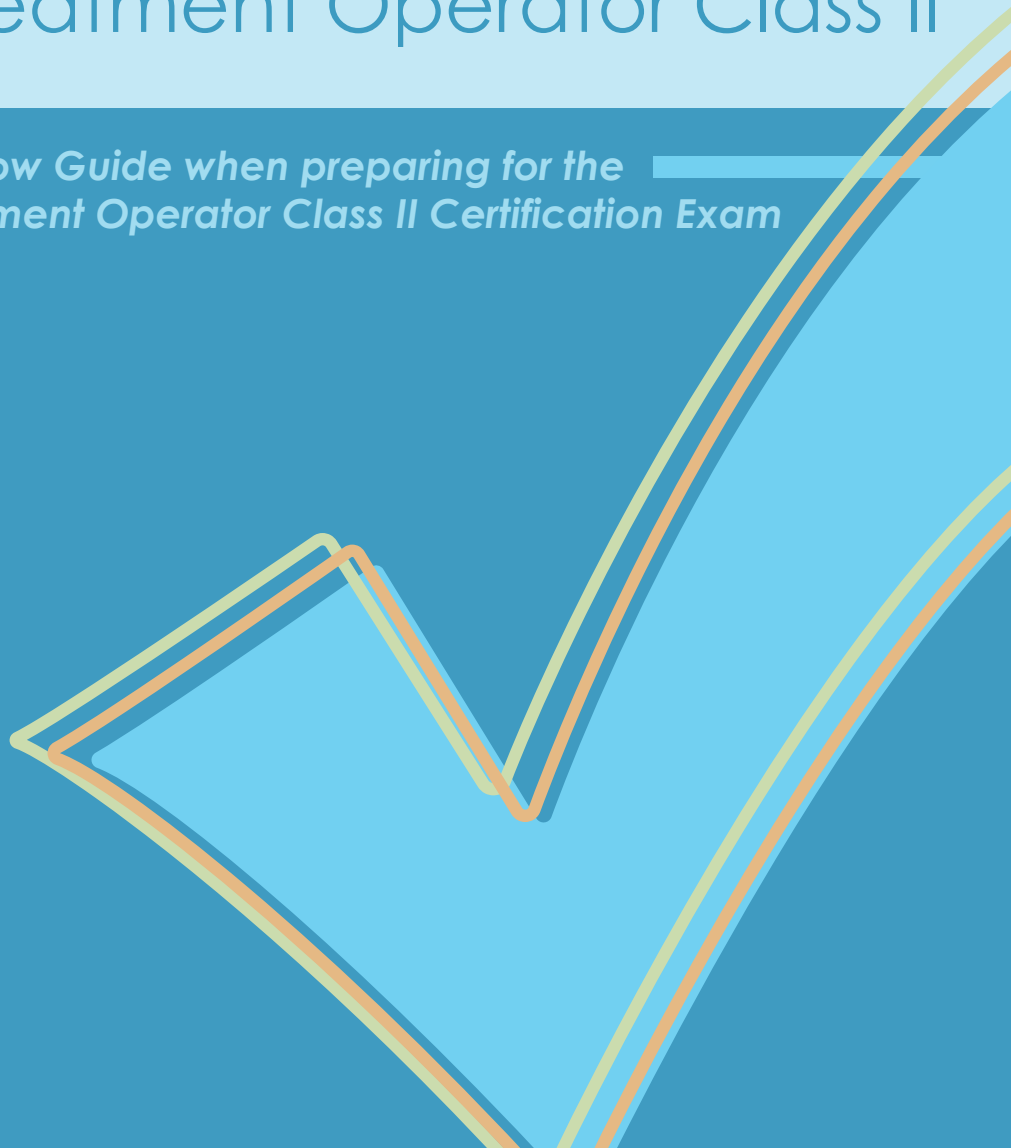
# ABC

Association of  
Boards of Certification

# Need-to-Know Criteria

## Wastewater Treatment Operator Class II

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



## Before You Dive In...

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

This *ABC Wastewater Treatment Operator Class II Need-to-Know Criteria* was developed to assist operators in understanding the content that will be covered in ABC's Standardized Wastewater Treatment Operator Class II exam. A methodical and comprehensive international investigation was conducted to determine the most significant job tasks performed by wastewater 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 ABC Standardized Wastewater 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](http://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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# Wastewater Treatment Operator Class II Need-to-Know Criteria

## Exam Content

The Wastewater 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 wastewater 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
15	Laboratory Analysis	 3  9  3
20	Equipment Evaluation & Maintenance	 8  9  3
25	Equipment Operation	 5  15  5
30	Treatment Process Monitoring, Evaluation, & Adjustment	 5  10  15
10	Security, Safety, & Administrative Procedures	 6  4  0
100*	Total	 27  47  26

This exam includes **12** calculation questions



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



3 Recall



9 Application



3 Analysis

## Laboratory Analysis

### Job Tasks Included in this Content Area:

1. Follow laboratory Standard Operating Procedures (SOPs)
2. Collect samples for the following:
  - a. Bacteriological analyses
  - b. Biological analyses (e.g., BOD, CBOD)
  - c. Chemical analyses (e.g., COD, nutrients, metals)
  - d. Physical analyses (e.g., pH, temperature, DO, settleable solids)
3. Conduct the following:
  - a. Bacteriological analyses
  - b. Biological analyses (e.g., BOD, CBOD)
  - c. Chemical analyses (e.g., COD, nutrients, metals)
  - d. Physical analyses
  - e. Process control laboratory testing
  - f. Required regulatory laboratory testing
4. Interpret data from the following:
  - a. Bacteriological analyses
  - b. Biological analyses (e.g., BOD, CBOD)
  - c. Chemical analyses (e.g., COD, nutrients, metals)
  - d. Physical analyses (e.g., pH, temperature, DO, settleable solids)



8 Recall



9 Application



3 Analysis

## Equipment Evaluation & Maintenance

### Job Tasks Included in this Content Area:

1. Calibrate meters (e.g., flow, pressure sensors)
2. Follow safety rules and guidelines when working with chemical equipment
3. Follow safety rules and guidelines when working with mechanical equipment
4. Monitor flowmeters
5. Monitor telemetry systems
6. Perform basic electrical troubleshooting
7. Perform preventative maintenance on equipment
8. Inspect the following equipment:
  - a. Aeration basins
  - b. Aeration systems (e.g., blowers, surface aerators, diffusers)
  - c. Aerobic digesters
  - d. Air compressors
  - e. Analyzers (e.g., DO, pH, H<sub>2</sub>S, ORP)
  - f. Attached growth / fixed film (e.g., RBC, trickling filter)
  - g. Bar screens
  - h. Chemical feed systems (e.g., polymer, ferric)
  - i. Chlorination systems
  - j. Clarifiers / sedimentation basins
  - k. Dechlorination systems
  - l. Disinfection equipment (e.g., UV, ozone)
  - m. Flow equalization systems
  - n. Gates and valves
  - o. Generators
  - p. Grit removal processes
  - q. Hand tools
  - r. Heavy equipment
  - s. Hoists and cranes
  - t. Instrumentation (e.g., flow, pressure, telemetry)
  - u. Mechanical dewatering equipment (e.g., presses, centrifuges)
  - v. Mixers
  - w. Motors
  - x. Power tools
  - y. Pumps - centrifugal
  - z. Pumps - positive displacement
  - aa. SCADA systems
  - bb. Solids thickening processes (e.g., DAF, belt, rotary drum)
  - cc. Suspended growth (e.g., activated sludge, MBR, SBR)
9. Maintain the following equipment:
  - a. Aeration basins
  - b. Aeration systems (e.g., blowers, surface aerators, diffusers)
  - c. Aerobic digesters
  - d. Air compressors
  - e. Analyzers (e.g., DO, pH, H<sub>2</sub>S, ORP)
  - f. Attached growth / fixed film (e.g., RBC, trickling filter)
  - g. Bar screens
  - h. Chemical feed systems (e.g., polymer, ferric)
  - i. Chlorination systems
  - j. Clarifiers / sedimentation basins
  - k. Dechlorination systems
  - l. Disinfection equipment (e.g., UV, ozone)
  - m. Gates and valves
  - n. Generators

- o. Grit removal processes
- p. Hand tools
- q. Heavy equipment
- r. Hoists and cranes
- s. Instrumentation (e.g., flow, pressure, telemetry)
- t. Mechanical dewatering equipment (e.g., presses, centrifuges)
- u. Mixers
- v. Motors
- w. Power tools
- x. Pumps - centrifugal
- y. Pumps - positive displacement
- z. SCADA systems
- aa. Suspended growth (e.g., activated sludge, MBR, SBR)



5 Recall



15 Application



5 Analysis

## Equipment Operation

### Job Tasks Included in this Content Area:

1. Analyze data to evaluate and adjust equipment
2. Check filters for proper operation
3. Conduct wastewater pipe repairs
4. Follow safety rules and guidelines when working with chemical equipment
5. Follow safety rules and guidelines when working with mechanical equipment
6. Follow Standard Operating Procedures (SOPs)
7. Monitor lift stations to ensure equipment is operating properly
8. Monitor motor control center
9. Transport biosolids offsite for disposal / reuse
10. Operate the following:
  - a. Aeration basins
  - b. Aeration systems (e.g., blowers, surface aerators, diffusors)
  - c. Aerobic digesters
  - d. Air compressors
  - e. Analyzers (e.g., DO, pH, H<sub>2</sub>S, ORP)
  - f. Attached growth / fixed film (e.g., RBC, trickling filter)
  - g. Bar screens
  - h. Chemical feed systems (e.g., polymer, ferric)
  - i. Chlorination systems
  - j. Clarifiers / sedimentation basins
  - k. Dechlorination systems
  - l. Disinfection equipment (e.g., UV, ozone)
  - m. Filtration and exchange units (e.g., sand, membranes)
  - n. Flow equalization systems
  - o. Gates and valves
  - p. Generators
  - q. Grit removal processes
  - r. Hand tools
  - s. Heavy equipment
  - t. Hoists and cranes
  - u. Instrumentation (e.g., flow, pressure, telemetry)
  - v. Mechanical dewatering equipment (e.g., presses, centrifuges)
  - w. Mixers
  - x. Motors
  - y. Odor control devices (e.g., biofilters, scrubbers)
  - z. Power tools
  - aa. Pumps - centrifugal
  - bb. Pumps - positive displacement
  - cc. SCADA systems
  - dd. Solids thickening processes (e.g., DAF, belt, rotary drum)
  - ee. Suspended growth (e.g., activated sludge, MBR, SBR)





5 Recall



10 Application



15 Analysis

## Treatment Process Monitoring, Evaluation, & Adjustment

Job Tasks Included in this Content Area:

1. Add chemicals to disinfect and deodorize water and other liquids (e.g., ammonia, chlorine, lime)
2. Analyze laboratory data to evaluate and adjust processes
3. Follow industry safety rules and guidelines applicable to treatment processes
4. Implement changes as indicated by laboratory results
5. Operate chemical feed systems (e.g., polymer, ferric)
6. Operate odor control systems (e.g., biofilters, scrubbers)
7. Operate SCADA systems
8. Operate the preliminary treatment processes (e.g., screening, grit, flow equalization)
9. Operate the primary clarification / sedimentation processes
10. Operate the following secondary treatment processes:
  - a. Attached growth / fixed film processes (e.g., RBC, trickling filter)
  - b. Secondary clarification / sedimentation processes
  - c. Extended aeration processes (e.g., package, SBR, oxidation ditch)
  - d. Conventional activated sludge processes (e.g., step feed, plug flow, complete mix, MBR)
11. Operate the nutrient removal systems
12. Operate the following disinfection treatment processes:
  - a. Chlorination processes
  - b. Dechlorination processes
  - c. Disinfection processes (e.g., UV, ozone)
13. Operate the following solids treatment processes:
  - a. Aerobic digestion process
  - b. Mechanical dewatering processes (e.g., presses, centrifuges)



6 Recall



4 Application



0 Analysis




## Security, Safety, & Administrative Procedures

### Job Tasks Included in this Content Area:

1. Adhere to established safety procedures (e.g., lock-out / tag-out, confined space, hazard communication, fall protection)
2. Complete operation reports
3. Complete required regulatory reports
4. Conduct routine security checks
5. Ensure compliance with all applicable regulations
6. Generate maintenance reports (e.g., daily, monthly, annual)
7. Implement spill notification policy
8. Inspect SCBA equipment
9. Receive chemical deliveries and store
10. Schedule routine activities (e.g., maintenance, operations)
11. Update Standard Operating Procedures (SOPs)

## 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	Laboratory Analysis (15%)*	Equipment Evaluation & Maintenance (20%)*	Equipment Operation (25%)*	Treatment Process Monitoring, Evaluation & Adjustment (30%)*	Security, Safety, & Administrative Procedures (10%)*
Aeration principles (e.g. mixing, mechanical, diffusers)		Basic	Basic	Basic	Basic
Bacteriological laboratory testing (e.g. coliform, fecal, E coli)	Intermediate			Basic	Basic
Biological laboratory testing (e.g. BOD, SOUR, CBOD)	Intermediate			Basic	Basic
Biosolids disposal and monitoring requirements	Basic			Basic	Basic
Chemical handling and storage		Basic	Basic		Basic
Chemical laboratory testing (e.g. ammonia, phosphorous, alkalinity)	Intermediate			Basic	Basic
Chlorinators (e.g. gas, liquid)		Basic	Basic	Basic	Basic
Clarifiers		Basic	Basic	Basic	Basic
Comminuters		Basic	Basic	Basic	Basic
Conveyors		Basic	Basic	Basic	Basic
Dewatering equipment (e.g. centerfuges, presses, drying beds)		Basic	Basic	Basic	Basic
Documentation and record keeping	Basic	Basic		Basic	Basic

Supporting Knowledge Type	Laboratory Analysis (15%)*	Equipment Evaluation & Maintenance (20%)*	Equipment Operation (25%)*	Treatment Process Monitoring, Evaluation & Adjustment (30%)*	Security, Safety, & Administrative Procedures (10%)*
Effluent disposal and monitoring requirements	Intermediate			Intermediate	Basic
Electrical principles (e.g. troubleshooting breakers, relays, circuits)		Basic	Basic		Basic
Emergency preparedness		Basic	Basic		Basic
Flow measuring devices (e.g. parshal flumes, mag meter, venturis)		Basic	Basic	Basic	
Grit removal processes (e.g. grit chamber, aeration, cyclone)		Basic	Basic	Basic	Basic
Heavy equipment (e.g. operation, preventative maintenance)		Basic	Basic		Basic
Hydraulic principles (e.g. mass flow balance, detention time, loading, velocity, HRT)			Basic	Basic	
Industry safety practices (e.g. PPE, confined space, fall arrest, lock-out/tag-out)	Basic	Basic	Basic		Basic
Influent monitoring and waste characteristics	Basic			Basic	Basic
Maintenance practices (e.g. preventive, reactive, predictive)		Basic	Basic		Basic
Ozone generation equipment		Basic	Basic	Basic	Basic
Physical laboratory testing (e.g. temperature, solids, DO)	Intermediate			Basic	Basic
Pneumatic principles (e.g. troubleshooting actuators, compressors, sprayers)		Basic	Basic	Basic	Basic
Primary treatment processes (e.g. ponds, sedimentation basins)		Basic	Basic	Intermediate	Basic
Principles of asset management (e.g. preventive, reactive, predictive maintenance)		Basic	Basic	Basic	Basic
Process control instrumentation (e.g. PLCs, SCADA, continuous online monitoring)	Basic	Basic	Basic	Basic	
Quality control / quality assurance practices	Basic			Basic	Basic
Screening technology (e.g. bar screens, micro screens)		Basic	Basic	Basic	Basic
Secondary treatment processes (e.g. activated sludge, MBR, SBR)		Basic	Basic	Intermediate	Basic
Solids treatment concepts (e.g. dewatering, digestion, thickening)		Basic	Basic	Basic	
Tertiary treatment processes (e.g. media filtration, disinfection, post aeration, reclaimed recharge)		Basic	Basic	Basic	Basic
Treatment equipment (e.g. pumps, motors, generators)		Basic	Basic	Basic	Basic
Wastewater treatment practices (e.g. sludge age, SRT, MCRT, F/M ratio)	Intermediate			Basic	

\*Percent of exam associated with the Content Area



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## Wastewater Treatment Operator Exam References

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

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

**<http://www.owp.csus.edu/courses/wastewater.php>**

(916) 278-6142

- *Advanced Waste Treatment*
- *Operation of Wastewater Treatment Plants, Volume I and II*

### **Water Environment Federation (WEF)**

**<https://www.wef.org/resources/publications/books/>**

1-800-666-0206

- *Activated Sludge - Manual of Practice OM-9*
- *Basic Laboratory Procedures for the Operator-Analyst*
- *Chlorination/Dechlorination Handbook*
- *Operation of Extended Aeration Package Plants*
- *Operation of Municipal Wastewater Treatment Plants - Manual of Practice No. 11*
- *Operation of Nutrient Removal Facilities*
- *Wastewater Biology: The Microlife*

### **APHA, AWWA, WEF**

**<https://www.standardmethods.org/Buy/index.htm>**

APHA 1-202-777-2742

AWWA 1-800-926-7337

WEF 1-800-666-0206

- *Standard Methods for the Examination of Water and Wastewater*