## Florida Department of Environmental Protection

# Water, Wastewater, & Water Distribution Operator Knowledge Base Manual

**Florida Operator Certification Program**

DEP Form 62-602.230, Water, Wastewater, and Distribution Operator Knowledge Base Manual incorporated by reference in rule 62-602.230, F.A.C., (September 30, 2025)

# Preface

In any profession, you must start somewhere. Moreover, "Where do I start?" is a question we all have asked of many others and ourselves. If we can get this answered, then the next questions are, "What do I need to know?" and "Who will help me get there?" It is hoped that this document may be a sound source of information to assist in the answering of these and other questions.

As I gathered the included information, I became more and more amazed and awed at what outstanding groups of people the water, wastewater, and distribution operators in the State of Florida truly are. The depth of knowledge needed to do their jobs is enormous. As one moves up the levels and classes of licensing, it just becomes more demanding. My previous respect for Operators increases more and more every day I am in contact with them and their work.

The knowledge base herein is designed not only to answer the questions posed above, but also to assist in developing curricula and course content for the many courses offered by the educational and professional organizations in our State. Knowing what is needed is the first step to developing a package that will deliver it.

The information upon which the knowledge base was built has been compiled over the years through many hours of volunteer time given by our licensees. Particularly, I would like to thank the following organizations for working with the Department of Environmental Protection's Operator Certification Program: The Florida Water and Pollution Control Operators Association; Florida Rural Water Association; Florida Water Environment Association; and the Florida Section of the American Water Works Association. In addition, I would like to thank the Florida Department of Education for their guidance in developing and compiling this knowledge base manual.

As always, none of this could come about without the input and output of the entire staff here at the OCP offices and all those at DEP who watch over us and keep us on our toes. Thanks to each one of you.

Operator Certification Program
Florida Department of Environmental Protection

**Florida Operator Certification Program**

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**Florida Department of Environmental Protection**
**Water, Wastewater & Distribution**
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# I. Purpose of Operator Knowledge Base Manual

The purpose of this manual is to assist and provide guidance in the preparation for licensure/certification by providing pertinent information to the training of water and wastewater treatment plant operators and drinking water distribution operators, in accordance with Chapter 62-602, Florida Administrative Code. This knowledge base establishes the minimal knowledge to be attained by an operator who would be licensed in a particular discipline and inherent class and/or level.

This manual covers the D, C, B, A classes of water and wastewater treatment and 4, 3, 2, 1 levels of water distribution system operators.

# II. Introduction to Water/Wastewater Treatment Operator Licensure

The Class D level water and wastewater licensure is designed primarily as a test of the most basic level of training, where the examinees are students and owners of small, privately owned water and wastewater treatment systems. This examination level measures the examinees knowledge of the basic principles of water and wastewater treatment plant operation, maintenance of treatment facility equipment and a limited range of process control test procedures.

The Class C level license is considered the starting point for operators of municipally owned treatment facilities, and the level of training is higher than that required for the Class D license. Class C level coursework introduces students to many principles of water and wastewater treatment operation, expanded maintenance activities of treatment facility equipment and a full range of process control test procedures. A Class C student should have basic knowledge and demonstrate comprehension of the required course material.

At the Class B level, emphasis is placed on developing a complete understanding of operational process control and troubleshooting. Students at this level are expected to have a thorough knowledge of the material necessary for Class C level certification, and be able to show basic problem solving skills. The class B student is also required to show knowledge of advanced treatment techniques. A class B student should be able to apply the skills learned in class C coursework.

At the Class A level, an emphasis is placed on the student's ability to recognize a problem and use available resources and experience to apply problem-solving skills. A Class A student will also use supervision and management coursework to develop and demonstrate managerial skills. A Class A

student should be able to apply the problem solving skills he/she learned during tenure as a Class C and B operator.

# III. Introduction to Water Distribution System Operator Licensure

The Level 4 water distribution system operator license qualifies the operator to serve the distribution system connected to a Class A, B, or C water treatment plant serving less than 1,000 persons. The exam is designed primarily as a test of the most basic level of training. It measures the examinee's knowledge of the basic principles of water distribution system operations and facilities maintenance.

The Level 3 water distribution system operator license qualifies the licensee to serve the distribution system connected to a Class A, B, or C water treatment plant serving at least 1,000 persons and less than 10,000 persons. The exam level measures the examinee's knowledge of storage facilities, distribution system facilities, distribution system operation and maintenance, distribution system mathematics, disinfection and safety. A Level 3 student should have basic knowledge required for certification and demonstrate comprehension of the required course material.

The Level 2 water distribution system operator license qualifies the licensee to serve the distribution system connected to a Class A, B, or C water treatment plant serving at least 10,000 persons and less than 100,000 persons. The exam level measures the examinee's knowledge of the topics listed above under Level 3 at a more advanced level than for Level 3 licensure. A Level 2 operator should have a thorough knowledge of the material necessary for Level 3 certification and be able to demonstrate basic problem-solving skills. The Level 2 student should be able to apply the skills learned in Level 3 coursework.

The Level 1 water distribution system operator license qualifies the licensee to serve the distribution system connected to a Class A, B, or C water treatment plant serving 100,000 or more persons. The exam measures the examinee's knowledge of the topics listed above for Level 2 operators plus distribution system administration, supervision, management, and budgeting skills. The Level 1 operator should have a thorough understanding of the coursework of the lower levels and be able to apply the problem-solving skills learned through lower level coursework and through tenure at the lower level(s).

# IV. Major Concepts/Content of Curriculum Required for Operator Training Relating to Exams/Licensure

The purpose of the operator training described in this manual is to prepare students for employment or advanced training in the water and wastewater treatment and water distribution systems industry in accordance with Chapters 62-550, 555, 560, 600, 602, 640 and 699, Florida Administrative Code (F.A.C.), as approved by the Florida Department of Environmental Protection (DEP).

## A. Water and Wastewater Treatment Plant Operation

The Class D is the fundamental level of training; students are introduced to the principles of water treatment, operation, and maintenance of treatment facility equipment, and a full-range of process

control procedures. Since Class D training covers a broad range of subjects that may be entirely new to the student, the amount of detail that can be taught is limited, in terms of the depth of study, but is actually comprehensive in terms of the range of facility operating skills covered.

Classes B and C are the intermediate levels of training. At the Class C level, the student already should be familiar with treatment plants and plant operations. Emphasis throughout Classes C and B will be on developing a more thorough understanding of operational process control. Class A is the most advanced level and preparation for it will emphasize the application of problem solving skills through facility management.

The content covered in all classes may cover other topics, but must include source water or influent characteristics; treatment facility unit processes and operational techniques; water quality and identification; identifying treatment goals and measuring their achievement; disinfection; process control techniques; sampling, testing, and laboratory analysis; supervision; operation maintenance and inspection of facility equipment; application of current DEP rules and standards; facility administration and management techniques; and troubleshooting operational control problems. The emphasis is on skills that are needed for effective treatment process control and troubleshooting.

## B. Water Distribution System Operation

The Level 4 is the fundamental level of training; students are introduced to the principles of water distribution system operation and maintenance of water distribution system equipment. Since Level 4 training covers a broad range of subjects, which may be entirely new to the student, the amount of detail, which can be taught, is limited in terms of the depth of study, but is actually comprehensive in terms of the range of facility operating skills covered.

Level 3 and 2 are the intermediate levels of training. Students will study and comprehend more advanced training on safety, the proper installation, maintenance, and repair of a water distribution system. This will include its structure, appurtenances, and equipment while protecting water quality by using accepted disinfection and monitoring practices to protect the health and welfare of the system's users. The Level 1 water distribution operator license is the most advanced water distribution system license. Preparation should emphasize the application of problem-solving skills and facility management. Please refer to the Introduction to Distribution System Operator Licensure section above for more information on Levels 3, 2, and 1 operation curricula.

# V. Curriculum Structure

When a recommended sequence of study is followed, this structure will allow students to complete specified portions of the program for employment or knowledge advancement. Reinforcement of basic skills in English, mathematics and science appropriate for the job preparatory programs is provided through career and technical classroom instruction and applied laboratory procedures or practice. This program focuses on broad, transferable skills and stresses understanding and demonstration of the following elements of the public service industry: planning, management, finance, technical, and production skills, underlying principles of technology, labor issues, community issues and health, safety and environmental issues.

# VI. Laboratory Activities

Laboratory and water/wastewater treatment facility activities are an integral part of this program. In-plant testing and treatment process activities are essential.

# VII. Special Notes

Water Treatment Plant Operator licenses Class D, C, B, A, Wastewater Treatment Plant Operator licenses Classes D, C, B, and A and Water Distribution System operator certificates Level 4, 3, 2 and 1 will be issued by the Department of Environmental Protection upon completion of the required course work, experience, and the passing of the appropriate certification examination.

Instructional strategies for this program must include methods that require students to identify, organize, and use resources appropriately; to work with each other cooperatively and productively; to acquire and use information; to understand social, organizational, and technological systems; and to work with a variety of tools and equipment. Instructional strategies must also incorporate the methods to improve students' personal qualities and higher-order thinking skills.

# VIII. Required Knowledge Bases and Details of Content Areas

Within the categories of water treatment plant operator, wastewater treatment plant operator, and water distribution system operator, the curriculum for each class or level includes the curriculum of the lower class(es) or level(s). For instance, the curriculum for a Class C water treatment plant operator includes the elements for Class C operator and Class D operator.

## *Water Treatment Plant Operators*

## Content Areas and Details per Class

## CLASS D AND C WATER TREATMENT PLANT OPERATORS

**Demonstrate a general knowledge and understanding of the overall water treatment process:**

--The student will be able to:

Describe the operation of storage facilities.
Describe the operation of distribution facilities.
Describe overall water distribution system operation and maintenance needs and techniques.

**Identify scientific concepts common in water treatment:**

--The student will be able to:

Identify chemical symbols used in water treatment.
Describe the hydrologic cycle.
Describe the basic concepts of the pH scale and its importance in the treatment process.
Identify the differences between mixtures, elements, and compounds, and organic and inorganic chemicals.
Identify principal states of matter: liquid, solid, and gas.
Identify the basic nitrogen, phosphorous, and carbon cycles.

**Identify chemical, biological, and physical constituents of water entering the water treatment facility or distribution systems:**

--The student will be able to:

Determine which constituents are inherent to groundwater and/or surface water.
Describe the relationship between turbidity and the microbiological quality of water.
Describe the uses of chemical analysis in water treatment operations.
Identify symbols and common names for elements and chemical compounds.
Select the primary constituents to be measured and the most commonly used units of measurement for each.
Explain the importance of water treatment for the control of coliform bacteria and algae.

**Identify safety hazards associated with water technologies:**

--The student will be able to:

Identify the types of hazards common to water technology facilities.
Recognize unsafe conditions and prescribe corrective measures.
Identify and safely handle hazardous chemicals common to water technology facilities.
Recognize electrical hazards.
Recognize fire hazards, identify types of fires, and describe appropriate extinguishing techniques.

**Identify federal, state, and local regulations for the handling, storage, and use of toxic and hazardous materials:**

--The student will be able to:

Identify the kinds of information presented on Material Safety Data Sheets.
Describe requirements for in-plant training and the accessibility of information on hazardous and toxic substances.

**Solve basic math problems common to water technologies:**

--The student will be able to:

- Perform basic arithmetic problems, including addition, subtraction, multiplication, division, fractions, decimals, percentages, rounding (significant figures), graphing, etc.
- Identify metric measurements and perform conversions.
- Perform calculations that involve areas, volumes, capacities, retention times, pounds, mg/L, velocities, flow rates, pressure, and head.

**Define pumping and basic hydraulics:**

--The student will be able to:

- Identify types of pumps.
- Discuss application and use of different types of pumps.
- Identify components/characteristics of pumps including pump operation and basic pump curves including centrifugal pumps, positive displacement pumps, and airlift pumps.
- Identify types of pipes, valves, and fittings.
- Define cross connections.
- Identify the appropriate equipment used in the treatment processes.

**Define principles of disinfection:**

--The student will be able to:

- List the need/reasons for disinfection (list of waterborne diseases).
- Define concepts related to disinfection.
- List methods and chemicals used in disinfection.
- Define the physical properties of chlorine.
- List kinds of disinfection equipment used.

**Define and identify sampling techniques and explain the significance of the steps:**

--The student will be able to:

- Define the reasons for sampling and types of samples.
- Define methods of sample collection and handling.
- Define the basic procedure for quality control and quality assurance in sampling.
- Define the chain of custody for samples.
- Perform chlorine residual analysis.
- Perform pH analysis.
- Identify the laboratory tests that are commonly performed by operators in Florida water treatment facilities, including those required by the Safe Drinking Water Act and DEP rules.
- Define pathogenic organisms, including bacteria, protozoa, and viruses, and describe their disease associations.
- Describe the laboratory test performed for the presence of bacteria.
- Describe the correct procedure for obtaining a bacteriological sample.
- Describe correct sample collection procedures for inorganic and organic analyses.

Describe the laboratory quality control checks and required documentation.
Identify the chain of custody for a sample.

**Define federal, state, and local regulations that apply to water technologies:**

--The student will be able to:

List regulatory agencies and their roles in monitoring the water technology field.
Define regulations associated with the appropriate federal, state, or local agencies.
Define training and certification requirements for water technology workers.

**Demonstrate employability skills:**

--The student will be able to:

Conduct a job search.
Secure information about a job.
Identify documents that may be required for a job application.
Complete a job application.
Demonstrate competence in job interview techniques.
Identify or demonstrate appropriate responses to criticism from employer, supervisor, or other persons.
Identify acceptable work habits.
Demonstrate knowledge of how to make job changes appropriately.
Demonstrate acceptable employee health habits for the treatment facility environment.
Identify materials and documents needed for a professional library.
Demonstrate productive and positive customer interactions.
Demonstrate effective interpersonal communication skills.

**Describe the principles, operational, and troubleshooting practices of the aeration process:**

--The student will be able to:

Describe the aeration and air stripping processes, and explain how they differ.
Identify the types of aeration systems.
Identify the benefits of aeration.
Describe the components of an air-stripping system.
Troubleshoot aeration and air stripping processes.

**Describe the principles, operational, and troubleshooting practices of the mixing, coagulation, and flocculation processes:**

--The student will be able to:

Define concepts such as turbidity, color, coagulation, and flocculation.
Define the difference between sweep and enhanced coagulation.
Identify the kinds of equipment used in the coagulation process.
Identify coagulant chemicals used in water treatment facilities.
Identify the steps of coagulation, in order.
Identify the specific sampling locations for process control in a coagulation process.

Identify factors that would contribute to poor floc formation.
Compute the feed rate in pounds per day (lbs/d) when the chemical coagulant (mg/L) and flow rate (MGD) are known.
Compute the dosage (mg/L) of coagulant when the rate of flow (MGD) and the feed rate (lbs/day) of the chemical coagulant are known.
Compute the dosage rate that is needed to treat a different flow (MGD) at the current dosage when the current rate of flow (MGD) and the current coagulant feed rate (lbs/d) are known.
Describe troubleshooting techniques for basic mixing, coagulation, and flocculation processes.

**Describe the principles, operational, and troubleshooting practices of the sedimentation process:**

--The student will be able to:

Describe an upflow clarifier and basin sedimentation.
Identify factors that affect efficient sedimentation.
Identify the measures that would be effective in preventing or controlling algae growth on surfaces of coagulation and sedimentation basins.
Identify methods of sludge removal from sedimentation basins.
Describe troubleshooting techniques for sedimentation and upflow clarifier processes.

**Describe the principles, operational, and troubleshooting practices of the filtration process:**

--The student will be able to:

Explain concepts related to filtration, including types of filters, filter system components, and the steps for normal filtration operations.
Explain common problems of filtering systems, including head loss, mudballs, and filter media loss.
Determine when to backwash a filter.
Identify the steps for backwashing a filter.
Describe troubleshooting techniques for filtration processes.

**Describe the principles, operational, and troubleshooting practices of the water-softening process:**

--The student will be able to:

Describe the two types of hardness.
Identify the appropriate chemical(s) to use in chemical precipitation softening processes for the two kinds of hardness.
Describe alkalinity and its components.
Identify treatment processes used for water softening.
Calculate the distribution of bicarbonate, carbonate, and/or hydroxide ions when given the total alkalinity and phenolphthalein alkalinity.
Describe selective carbonate removal.
Identify the important zones of an upflow clarifier unit.
Describe the lime soda ash softening process, including its control.
Compute lime demand from raw water analyses.

Describe the reasons for recarbonation.
Compute carbon dioxide demands for recarbonation.
Compute hardness removal when the ion exchange capacity is known.
Describe troubleshooting techniques for water softening processes.

**Describe the principles, operational, and troubleshooting practices of the stabilization process:**

--The student will be able to:

Identify the chemicals used in stabilization.
Identify two stabilization indices.
Determine water stability, using the Langelier index and the marble test.
Troubleshoot stabilization processes.

**Describe the principles, operational, and troubleshooting practices of the corrosion control process:**

--The student will be able to:

Identify the factors that influence corrosion.
Describe the problems that can be created by corrosive waters.
Describe the basic concepts related to electrolysis.
Define electrochemical reaction.
Identify the chemicals used in corrosion control.
Describe the conditions for calcium carbonate film formation.
Define cathode film formation.
Define cathodic protection and describe its application in water treatment facilities.
Describe troubleshooting techniques for corrosion-control processes.

**Describe the principles, operational, and troubleshooting practices of the disinfection process:**

--The student will be able to:

Identify the chemicals used in primary disinfection.
Identify commonly used chlorinators and hypochlorinators.
Determine the maximum amount of chlorine gas (in pounds) that may be taken from a cylinder in a 24-hour period.
Identify proper maintenance procedures for equipment chlorination.
Identify terminology related to chlorination and disinfection.
Identify common safety problems or emergencies that might occur during chlorination.
Identify the properties of chlorine and describe its use in water treatment.
Explain the points at which chlorine is applied most effectively in water treatment.
Compute the feed rate (lbs/d) when given the rate of flow (MGD) and dosage of chlorine (mg/L).
Compute the feed rate (lbs/d) of a hypochlorite compound that contains a given percentage of available chlorine when given a problem where the rate of flow (MGD) and the chlorine dosage (mg/L) are known.
Compute the new rate of flow and the feed rate that will be needed to maintain the current dosage when given the current rate of flow (MGD), the current chlorine feed rate (lbs/d), and the amount by which the rate of flow is to be increased or decreased.

Compute the feed rate needed to treat a given amount of water when given a chlorine demand and the desired chlorine residual.
Describe troubleshooting techniques for disinfection processes.

**Describe the principles, operational, and troubleshooting practices for the control and treatment of trihalomethanes:**

--The student will be able to:

Describe the formation of total trihalomethanes (TTHM).
Identify the specific procedure for collecting samples to determine trihalomethane levels.
Compute the quarterly average and the annual TTHM measurements when sample results are given.
Identify processes that remove trihalomethane precursors.
Identify processes that remove trihalomethanes after they are formed.
Identify the benefits of alternate disinfectants.
Describe chloramination as a control of TTHM.
Describe troubleshooting techniques for the control and treatment of trihalomethanes.

**Describe the principles, operational, and troubleshooting practices of the iron and manganese removal processes:**

--The student will be able to:

Explain the occurrence of iron and manganese in source water and in treated water.
Describe the importance of controlling iron and manganese.
Describe sample-collection and analysis procedures for iron and manganese.
Describe remedial processes for controlling iron and manganese.
Compute the potassium permanganate dosage for a known concentration of iron and manganese in the water being treated.
Describe troubleshooting techniques for iron and manganese removal processes.

**Describe the principles, operational, and troubleshooting practices for taste and odor control:**

--The student will be able to:

Identify common types of complaints about water quality.
Identify causes of tastes and odors.
Describe how microbial growths affect tastes and odors.
Describe how eutrophication contributes to surface water tastes and odors.
Describe a cross-connection.
Identify the chemicals used in the control and treatment of tastes and odors.
Describe the Threshold Odor Number (TON) test.
Determine the TON when dilution volumes and positive samples are given.
Describe troubleshooting techniques for taste and odor control.

**Describe the principles, operational, and troubleshooting practices of the demineralization processes:**

--The student will be able to:

- Define concepts related to demineralization, such as reverse osmosis (RO), flux, feedwater, permeate, and salinity.
- Describe the structure, composition, and performance of an RO membrane.
- Describe feedwater impurities, physical parameters, and conditions potentially harmful to the RO process.
- Identify items included in a typical RO facility operation checklist.
- Describe the common causes of membrane damage.
- Describe the procedure for membrane cleaning.
- Compute the percent of recovery when product flow and feed flow are known.
- Compute the percent of mineral rejection when total dissolved solids are known for the feedwater and product water.
- Describe the basic concepts of electrodialysis (ED), such as the cathode and anode relationship and the removal of typical inorganic salts.
- Describe the most common problem of ED operation in a facility.
- Explain how the cation membrane and the anion membrane differ.
- Describe the multi-compartment unit used in the ED process.
- Describe ED operating procedures in detail.
- Describe the two most common chemical solutions used to flush ED stack membranes.
- Describe troubleshooting techniques for demineralization processes.

**Describe the principles, operational, and troubleshooting practices of the fluoridation process:**

--The student will be able to:

- Define the basic concepts related to fluoridation, including its purpose and the kinds of chemicals used.
- Identify the properties of fluoride and describe its use.
- Identify the types of equipment used in fluoridation.
- Describe proper maintenance procedures for fluoridation equipment.
- Describe potential safety problems or emergencies in the fluoridation process, and ways to avoid them.
- Compute the feed rate of chemicals used in the fluoridation process.
- Describe troubleshooting techniques for the fluoridation processes.

**Identify facility operational problems:**

--The student will be able to:

- Respond to customer questions about taste or odor in the water.
- Respond to customer questions about red water or rust stains.
- Identify the probable cause(s) for a sudden change in chlorine demand; take corrective action.

**Describe basic hydraulics and pumping operations:**

--The student will be able to:

Describe the relationship between the system head and pressure, and make conversions between them.
Describe three types of head, i.e., pressure, suction, and atmospheric.
Describe proper operation of centrifugal and displacement pumps.
Describe causes and methods that are effective in preventing "water hammer."
Troubleshoot pump operations.

**Identify appropriate federal, state, and local regulations for the operation and maintenance of a public water system:**

--The student will be able to:

Complete the Drinking Water Bacteriological Analysis Form correctly.
Complete the DEP daily operation report (DOR) form correctly.
Complete the DEP monthly operation report (MOR) form correctly.
Identify the DEP requirements for the operation of standby and emergency equipment.
Identify the DEP requirements for microbiological monitoring and analyses.
Identify the DEP requirements for sampling and testing.

**Perform equipment inspection, and identify basic maintenance for the treatment train, treatment residuals disposal, and solids management:**

--The student will be able to:

Identify the appropriate equipment used in the treatment train, treatment residuals disposal, and solids management.
Describe a preliminary site inspection of the equipment used in the treatment train, treatment residuals disposal, and solids management.
Identify the maintenance needs of equipment used in the treatment train, treatment residuals disposal, and solids management, including safe procedures for maintenance.
Describe proper record keeping for preventive and corrective maintenance.
Describe preventive and corrective maintenance procedures for equipment used in the treatment process, treatment residuals disposal, and solids management.

# CLASS B WATER TREATMENT PLANT OPERATOR

**Analyze the constituents of water and select the appropriate treatment:**

-The student will be able to:

Describe the water treatment processes common in Florida.
Describe those processes that may reduce or control a contaminant for which maximum contaminant levels (MCLs) exist.

**Identify advanced sampling techniques, and interpret the results;**

--The student will be able to:

Demonstrate the need for chemical analyses in water treatment.
Select the appropriate treatment for a problem identified through laboratory testing.
Determine whether the finished water is acceptable or unacceptable according to laboratory results.

**Solve algebra, ratio, and proportion problems in the water treatment process;**

--The student will be able to:

Perform advanced math problems including ratio and proportion.
Identify metric measurements and perform conversions.
Perform algebraic calculations essential to water treatment, when given values for components.

**Demonstrate process optimization for water treatment;**

--The student will be able to:

Describe the advanced principles and operational practices of sweep and enhanced coagulation and flocculation.
Describe the advanced principles and operational practices of sedimentation.
Describe the advanced principles and operational practices of disinfection.
Describe the advanced principles and operational practices of filtration.
Describe the advanced principles and operational practices of corrosion control.
Describe the advanced principles and operational practices of taste and odor control.
Describe the advanced principles and operational practices of iron and manganese control.
Describe the advanced principles and operational practices of fluoridation.
Describe the advanced principles and operational practices of softening.
Describe the advanced principles and operational practices of demineralization.
Describe the advanced principles and operational practices of trihalomethanes.
Demonstrate process optimization for coagulation and flocculation.
Demonstrate process optimization for sedimentation.
Demonstrate process optimization for disinfection.
Demonstrate process optimization for filtration.
Demonstrate process optimization for corrosion control.
Demonstrate process optimization for taste and odor control.
Demonstrate process optimization for iron and manganese control.
Demonstrate process optimization for fluoridation.
Demonstrate process optimization for softening.
Demonstrate process optimization for demineralization.
Demonstrate process optimization for trihalomethanes.

**Analyze and correct facility operational problems:**

--The student will be able to:

Demonstrate troubleshooting techniques and corrective action for sweep and enhanced coagulation and flocculation.
Demonstrate troubleshooting techniques and corrective action for sedimentation.
Demonstrate troubleshooting techniques and corrective action for disinfection.
Demonstrate troubleshooting techniques and corrective action for filtration.
Demonstrate troubleshooting techniques and corrective action for corrosion control.
Demonstrate troubleshooting techniques and corrective action for taste and odor control.
Demonstrate troubleshooting techniques and corrective action for iron and manganese control.
Demonstrate troubleshooting techniques and corrective action for fluoridation.
Demonstrate troubleshooting techniques and corrective action for softening.
Demonstrate troubleshooting techniques and corrective action for demineralization.
Demonstrate troubleshooting techniques and corrective action for trihalomethanes.

**Demonstrate equipment inspection and preventive maintenance procedures:**

--The student will be able to:

Identify the components of a preventive maintenance plan.
Use trend analysis in preventive maintenance.
Perform a site inspection.
Develop a training plan (for a new employee) for inspection of equipment.

**Apply appropriate federal, state, and local regulations for the operation and maintenance of a public potable-water facility:**

--The student will be able to:

Explain the rules in Chapter 62-602, F.A.C., covering duties, responsibilities, certification requirements, testing, renewal, staffing, and facility classification.
Explain the rules in Chapter 62-550, F.A.C. concerning samples and analyses at water treatment facilities.
Explain DEP rules that apply to procedures such as reclaiming water and managing residuals.
Apply rules concerning facility management.
Apply rules concerning samples and analyses.
Apply rules concerning laboratory management.

**Apply federal, state, and local regulations for the handling, storage, and use of toxic and hazardous materials:**

--The student will be able to:

Identify the reporting requirements as specified in SARA Title III and Chapter 252, F.S.
Describe the responsibilities toward the community as specified in SARA Title III and Chapter 252, F.S.

**Describe energy conservation, and identify ways to conserve energy in the water treatment plant:**

--The student will be able to:

Identify the causes of energy loss.
Rank various pieces of equipment in order of energy consumption.
Describe procedures for performing an energy survey.
Describe methods to conserve energy, such as equipment and process adjustments.

**Demonstrate supervisory skills:**

--The student will be able to:

Identify supervisory skills and various leadership styles.
Delegate responsibility and assign tasks to employees.
Follow the proper procedure for handling employee grievances.
Follow the proper procedure for disciplining employees.
Follow staffing guidelines in planning.
Conduct an orientation of a new employee, and follow the training program.
Evaluate employees objectively.
Identify emergencies and respond appropriately.
Identify the components of the budgeting process.
Demonstrate inventory control procedures.
Explain the importance of ethics in supervision.
Identify the role of the supervisor in a facility safety program.
Identify the role of the supervisor in customer relations.

# CLASS A WATER TREATMENT PLANT OPERATOR

**Describe theoretical facility management skills:**

--The student will be able to:

Describe the principles of management and supervision.
Describe concepts related to management and supervision.

**Demonstrate methods of organization and control:**

--The student will be able to:

Demonstrate organizational methods.
Develop an organizational chart.
Develop a staffing pattern.
Identify formal and informal lines of communication.

**Develop a plan for cost management:**

--The student will be able to:

Identify the costs of operation, such as personnel, inventory, operations, energy consumption, and equipment maintenance.
Perform cost surveys.
Develop a plan for efficient operations.
Explain system efficiency balance.

**Prepare budgets and personnel assignments:**

--The student will be able to:

Identify budget activities and categories of expense accounts related to water or wastewater treatment plants.
Identify techniques of budget control.
Prepare a budget, including long-range projections.
Prepare a staffing schedule, including the appropriate levels of staff for all required shifts.

**Develop standard operating procedures for the training and orientation of new employees:**

--The student will be able to:

Develop a written plan for an in-house orientation program for new employees.
Identify information that a supervisor should give new employees, including leave procedures, insurance procedures, safety procedures, chain of command, etc.
Develop a written plan for an in-house training program that includes safety measures and hazardous or toxic materials in the work place.
Develop a written plan for a cross-training program in facility operations.

**Demonstrate personnel selection and discipline:**

--The student will be able to:

Identify appropriate interviewing and hiring practices.
Develop a job description.
Identify control factors that are important in an organizational plan and that set limits on delegated authority.
Identify appropriate actions of the supervisor, the employee, and others in a grievance procedure.
Identify characteristics important to the role of a supervisor.
Determine requirements for a new position.
Advertise for the position, including the job description, job responsibilities, education requirements, and job conditions.
Analyze job applications to select qualified candidates to interview.
Conduct interviews.
Notify interviewees of the results, and conduct follow-up activities.
Use appropriate human relations and communication skills.

Train, evaluate, and discipline employees objectively.
Identify appropriate actions of a supervisor in evaluating personnel performance.

**Demonstrate contingency planning:**

--The student will be able to:

Analyze potential emergencies that can occur in a facility.
Develop a plan for handling problems caused by emergencies, including what equipment would be used and what sampling would be needed.
Develop procedures for responding to customer complaints.
Develop procedures to ensure employee safety.
Develop procedures to ensure continuous operations, including preventive maintenance, alternative procedures, etc.

**Develop a plan for energy conservation:**

--The student will be able to:

Describe concepts related to energy conservation.
Identify energy conservation measures.

**Describe record keeping and use of computer applications in planning:**

--The student will be able to:

Develop a plan for inventory control.
Develop a plan for an analysis of operation and maintenance (O&M) logs and for the optimum operation of equipment.
Identify the various types of facility automation.
Review available hardware and software, based on record-keeping needs.

**Describe process optimization for water treatment facilities:**

--The student will be able to:

Develop a plan for process control to achieve efficient, energy-saving, cost-effective operation.
Develop a plan for testing and analyzing the treatment operations for use in long-range facility operations.
Develop a plan for the systematic troubleshooting of operational problems.
Develop a plan for documenting operations and problems in order to anticipate and avoid potential problems.

**Interpret permits and blueprints:**

--The student will be able to:

Read and interpret blueprints for water facilities.
Read the facility construction and operating permits, and relate permit requirements to facility operations.

**Develop a laboratory plan for process control:**

--The student will be able to:

Identify laboratory equipment for process control.
Develop a plan for equipment calibration and maintenance.
Develop a laboratory staffing plan.
Determine whether in-house laboratory operations are cost effective.
Review procedures for quality assurance/quality control in a facility laboratory.
Review procedures for obtaining certification for a facility laboratory.
Develop a sampling/analysis schedule for effective process control.

**Employ public-relations skills in community interactions:**

--The student will be able to:

Plan facility tours for the public.
Demonstrate how to handle press and public inquiries appropriately.
Demonstrate how to inform the public if a potential emergency arises.

## *Wastewater Treatment Operators*

## Content Areas and Details per Class

## CLASS D & C WASTEWATER TREATMENT PLANT OPERATORS

**Identify professions related to the wastewater technology field:**

--The student will be able to:

List duties of water technology workers such as wastewater operator, water operator, systems operator, stormwater operator, residual (bio-solids) hauler operator, cross connection operator, pretreatment operator, and meter reading/maintenance operator.
Identify the basic terms and concepts involved in processes used in these professions.
List potential employers in the water technology field: federal, municipal, county, state, and private.
Identify resources to assist in finding employment in the field.

Identify professional organizations related to the water technology field.
Identify career ladder levels in the water technology field: trainee, C Level, B Level, A Level.

**Identify scientific concepts common in wastewater treatment:**

--The student will be able to:

Identify chemical symbols used in water and wastewater treatment.
Describe the hydrologic cycle.
Describe the basic concepts of the pH scale and its importance in the treatment process.
Identify the differences between mixtures, elements, and compounds, and organic and inorganic chemicals.
Identify principal states of matter: liquid, solid, and gas.
Identify the basic nitrogen, phosphorous, and carbon cycles.

**Identify safety hazards associated with wastewater technologies:**

--The student will be able to:

Identify the types of hazards common to water technology facilities.
Recognize unsafe conditions and prescribe corrective measures.
Identify and safely handle hazardous chemicals common to water technology facilities.
Recognize electrical hazards.
Recognize fire hazards, identify types of fires, and describe appropriate extinguishing techniques.

**Identify federal, state, and local regulations for the handling, storage, and use of toxic and hazardous materials:**

--The student will be able to:

Identify the kinds of information presented on Material Safety Data Sheets (MSDS).
Describe requirements for in-plant training and the accessibility of information on hazardous and toxic substances (Chapter 442, F.S.).

**Solve basic math problems common to wastewater technologies:**

--The student will be able to:

Perform basic arithmetic problems, including addition, subtraction, multiplication, division, fractions, decimals, percentages, rounding (significant figures), graphing, etc.
Identify metric measurements and perform conversions.
Perform calculations that involve areas, volumes, capacities, retention times, pounds, mg/L, velocities, flow rates, pressure, and head.

**Define pumping and basic hydraulic principals:**

--The student will be able to:

Identify types of pumps.
Discuss application and use of different types of pumps.
Identify components/characteristics of pumps including pump operation and basic pump curves including centrifugal pumps, positive displacement pumps, and airlift pumps.
Identify types of pipes, valves, and fittings.
Define cross connections.
Identify the appropriate equipment used in the treatment processes.

**Define principals of disinfection:**

--The student will be able to:

List the need/reasons for disinfection (list of waterborne diseases).
Define concepts related to disinfection.
List methods and chemicals used in disinfection.
Define the physical properties of chlorine.
List kinds of disinfection equipment used.

**Define sampling techniques:**

--The student will be able to:

Define the reasons for sampling and types of samples.
Define methods of sample collection and handling.
Define the basic procedure for quality control and quality assurance in sampling.
Define the chain of custody for samples.
Perform chlorine residual analysis.
Perform pH analysis.

**Define federal, state, and local regulations that apply to wastewater technologies:**

--The student will be able to:

List regulatory agencies and their roles in monitoring the water technology field.
Define regulations associated with the appropriate federal, state, or local agencies.
Define training and certification requirements for water technology workers.

**Demonstrate employability skills:**

--The student will be able to:

Conduct a job search.
Secure information about a job.
Identify documents that may be required for a job application.
Complete a job application.
Demonstrate competence in job-interview techniques.

Identify or demonstrate appropriate responses to criticism from employer, supervisor, or other persons.
Identify acceptable work habits.
Demonstrate knowledge of how to make job changes appropriately.
Demonstrate acceptable employee health habits for the treatment facility environment.
Identify materials and documents needed for a professional library.
Demonstrate productive and positive customer interactions.
Demonstrate effective interpersonal communication skills.

**Identify the basic characteristics and principals of wastewater treatment:**

--The student will be able to:

Identify the sources of wastewater and the objectives of wastewater treatment.
Identify terms used in wastewater treatment.
Identify the impact of wastewater on receiving bodies of water.
Identify biological organisms present in treatment processes.
Identify waterborne diseases.
Identify commonly measured wastewater parameters.
Identify factors affecting raw wastewater.
Correlate treatment processes to types of facility influent and solids.

**Identify sampling techniques and interpret the results:**

--The student will be able to:

Identify the reasons for sampling and the types of samples (e.g., simple, representative, grab, composite).
Describe methods of sample collection and handling.
Identify specific samples (biological or chemical) and determine the significance of sample results required for process quality control, for compliance with standards, and for reporting.
Identify representative sampling points.
Identify the significance of the flow measurement on process control.

**Describe the sources of wastewater and the types of collection systems:**

--The student will be able to:

Describe the types of wastewater collection systems.
Identify flow variations and conditions that affect plant treatment, including infiltration, inflow, and lift stations.
Identify methods to detect and correct infiltration.
Identify dissolved gases in wastewater and the effect of their presence/absence on treatment.

**Describe the process and the operational principals for the preliminary, primary, secondary, and tertiary treatment (the treatment train); effluent disposal; and solids management:**

--The student will be able to:

Describe concepts related to preliminary and primary treatment.

Describe the types of preliminary treatment equipment, the way they function, and the relationship of each to the treatment train.
Describe the types of primary treatment equipment, the way they function, and the relationship of each to the treatment train.
Describe concepts related to secondary treatment, including attached growth processes, suspended growth processes, aeration, and clarification.
Describe the types of secondary treatment equipment, the way they function, and the relationship of each to the treatment train.
Describe concepts related to tertiary treatment processes, including sand filtration, chemical phosphorus precipitation, nitrification/denitrification, oxic/anoxic, activated carbon, and artificial wetlands.
Describe the types of tertiary treatment equipment, the way they function, and the relationship of each to the treatment train.
Describe concepts related to disinfection and effluent disposal, including surface water, reuse reclamation, deep well, and ocean outfall.
Describe the types of disinfection and the types of effluent-disposal equipment, the way they function, and the relationship of each to the system.
Describe concepts related to solids management, including thickening, aerobic and anaerobic digestion, stabilization, de-watering, and reuse.
Describe the types of solids management equipment, the way they function, and the relationship of each to the system.

**Perform treatment-process control and troubleshooting for the treatment train, effluent disposal, and solids management:**

--The student will be able to:

Describe the grit removal process and the operational efficiency of each step.
Describe the laboratory tests performed on influent.
Describe the primary clarifier removal efficiencies, including settleable solids, suspended solids, total solids, BOD, and bacteria.
Describe sampling points, frequency of sampling, and the laboratory tests and results that are used for the proper operation of the primary clarifier.
Select and plot on a trend chart the parameters for primary clarification.
Use the operational data required to evaluate the performance of secondary treatment processes, including attached growth, suspended growth, aeration, and clarification.
Describe sampling points, the frequency of sampling, and the laboratory tests and results used for proper operation of the secondary treatment processes.
Select and plot on a trend chart the parameters for secondary clarification.
a. Describe how nitrification affects secondary processes and clarification.
b. Describe how denitrification affects secondary processes and clarification.
Use operational data to evaluate the performance of sand filtration.
Describe sampling points, the frequency of sampling, and the laboratory tests and results used for checking the proper operation of sand filtration. Select and plot on a rend chart the parameters for sand filtration.
Use operational data to evaluate chemical phosphorus precipitation.
Use operational data to evaluate the nitrification/denitrification process.
Use operational data to evaluate the performance of effluent disposal processes, including disinfection and dechlorination.
Describe sampling points, the frequency of sampling, and the laboratory tests used for checking the proper operation of effluent disposal.

Select and plot on a trend chart the parameters for effluent disposal.
Describe various methods of effluent disinfection including UV, chlorination, and ozonation.
Describe the chemical and physical properties of chlorine, and describe the reactions of chlorine with water, ammonia compounds, and sulfides.
Describe the safe storage and handling of chlorine, including the use of testing compounds.
Explain the points of application of chlorine in wastewater treatment.
Describe the methods of dechlorination.
Describe the methods commonly used to dispose of wastewater effluents, including reuse applications.
Describe the laboratory tests commonly used on the reuse of effluent.
Describe the types of sludge and their characteristics.
Use operational data to evaluate the performance of solids management, including sludge thickening, digestion, de-watering, and disposal processes.
Describe sampling points, the frequency of sampling, and the laboratory tests and results used for checking the proper operation of solids management and for compliance with Chapter 62-640, F.A.C.

**Perform equipment inspection, and identify basic maintenance for the treatment train, effluent disposal, and solids management:**

--The student will be able to:

Identify the appropriate equipment used in the treatment train, effluent disposal, and solids management.
Describe a preliminary site inspection of the equipment used in the treatment train, effluent disposal, and solids management.
Identify the maintenance needs of equipment used in the treatment train, effluent disposal, and solids management, including safe procedures for maintenance.
Describe proper record keeping for preventive and corrective maintenance.
Describe preventive and corrective maintenance procedures for equipment used in the treatment process, effluent disposal, and solids management.

**Identify and correct facility operational problems:**

--The student will be able to:

Describe common facility operational problems in the treatment train, effluent disposal, and solids management.
Describe methods to evaluate operational problems in preliminary, primary, secondary, and tertiary treatment, effluent disposal, and solids management.
Select appropriate corrective actions for common problems in preliminary, primary, secondary, and tertiary treatment, effluent disposal, and solids management.
Describe the methods for monitoring results of corrective action taken for common problems in preliminary, primary, secondary, and tertiary treatment, effluent disposal, and solids management.

**Identify appropriate federal, state, and local regulations:**

--The student will be able to:

- Identify federal, state, and local regulations that apply to the operation of a wastewater treatment facility.
- Describe the operator's duties and responsibilities, certification requirements, testing, renewal, staffing, and facility classification (sections of Chapter 62-602, F.A.C.).
- Explain and describe the contents of an operating permit.
- Identify state regulations that apply to procedures such as reclaimed water, reuse, and residuals management.

**Describe federal, state, and local laws for the handling, storage, and use of toxic and hazardous materials:**

--The student will be able to:

- Identify the kinds of information presented on the MSDS.
- Describe requirements for in-plant training and the accessibility of information on hazardous and toxic substances (Chapter 442, F.S.).
- Identify the reporting requirements as specified in SARA Title III and Chapter 252, F.S.
- Describe the responsibilities toward the community as specified in SARA Title III and Chapter 252, F.S.

# CLASS B WASTEWATER TREATMENT PLANT OPERATOR

**Identify the constituents of influent and its effects on the treatment process:**

--The student will be able to:

- Explain the significance of dissolved gases in the influent and the effects of dissolved gases on treatments.
- Explain the sources of infiltration and inflow, and discuss the effects of infiltration and inflow on treatment processes.
- Explain the effect of lift station performance on the overall treatment process.
- Describe solutions for lift station problems, such as surging flows, septic conditions, and power outages.

**Identify the constituents of wastewater, and select the appropriate treatment:**

--The student will be able to:

- Identify the specific physical, chemical, and biological characteristics of wastewater.
- Describe respiration, gas production, aerobic and anaerobic conditions, different methods of effluent disposal, and solids management.
- Identify levels of wastewater treatment and limits on facility discharges.

**Demonstrate advanced sampling techniques and interpret the results:**

--The student will be able to:

- Develop standard operating procedures for taking samples for process quality control, for compliance with standards, and for reporting requirements.
- Identify microorganisms present in wastewater, and discuss the significance of changes in their populations.
- Demonstrate laboratory quality-control/quality assurance procedures and required documentation.
- Demonstrate the reasons for measuring the flows of treated and untreated wastewater, and the effects of those flows on process control.

**Describe process optimization for preliminary, primary, secondary, and tertiary treatment (the treatment train); effluent disposal; and solids management:**

--The student will be able to:

- Interpret laboratory data commonly obtained on incoming wastewater to monitor the efficiency of the selected treatment.
- Describe possible adjustments to achieve process optimization for handling influent.
- Interpret laboratory data commonly obtained on wastewater during primary treatment to monitor the efficiency of the selected treatment.
- Describe possible adjustments to achieve process optimization for handling primary treatment.
- Interpret laboratory data commonly obtained on wastewater during secondary treatment to monitor the efficiency of the selected treatment.
- Describe possible adjustments to achieve process optimization for secondary treatment.
- Interpret laboratory data commonly obtained on wastewater during tertiary treatment to monitor the efficiency of the selected treatment.
- Describe possible adjustments to achieve process optimization for tertiary treatment.
- Interpret laboratory data commonly obtained on reclaimed water during disinfection and disposal to monitor the efficiency of the selected treatment.
- Describe possible adjustments to achieve process optimization for disinfection and disposal processes.
- Interpret laboratory data commonly obtained during solids management, including solids-content tests, to monitor the efficiency of the selected treatment.
- Describe possible adjustments to achieve process optimization in solids management.
- Describe options for solids disposal, based on the analysis of constituents, including all accountability records, and the costs.

**Describe advanced treatment process control for the treatment train, effluent disposal, and solids management:**

--The student will be able to:

- Describe concepts related to advanced laboratory tests taken in the secondary-treatment processes.
- Describe concepts related to advanced laboratory tests taken in advanced or tertiary treatment.

Describe concepts related to advanced laboratory tests for disinfection, effluent disposal, and solids management.

**Describe advanced equipment inspection and preventive maintenance for the treatment train, effluent disposal, and solids management:**

--The student will be able to:

Describe a preventive maintenance plan for a specific piece of equipment and/or unit process.
Describe trends analysis used in preventive maintenance planning.
Describe the monitoring of facility equipment operation and usage with remote sensing equipment.

**Describe and correct facility operational problems:**

--The student will be able to:

Describe troubleshooting techniques to locate operational problems.
Select appropriate corrective actions for advanced operational problems.
Describe advanced methods of monitoring results of corrective actions taken.
Describe actions that should be taken to prevent recurrence of identified advanced operational problems.

**Apply federal, state, and local regulations governing wastewater technologies:**

--The student will be able to:

Describe supervisory tasks related to duties, responsibilities, certification requirements, testing, renewal, staffing, and facility classification (Chapter 62-602 F.A.C.).
Apply rules concerning samples and analyses at wastewater treatment facilities (Chapter 62-601, F.A.C.).
Complete the DEP Monthly Operating Report (MOR) Form correctly.
Complete a National Pollution Discharge Elimination System (NPDES) MOR form.
Follow DEP rules that apply to procedures such as reclaiming and reusing water and managing residuals.
Follow federal rules that apply to the operation of a wastewater treatment facility.

**Apply federal, state, and local laws for the handling, storage, and use of toxic and hazardous materials:**

--The student will be able to:

Identify the kinds of information presented on the MSDS.
Demonstrate requirements for in-plant training and the accessibility of information on hazardous and toxic substances (Chapter 442, F.S.).
Identify the reporting requirements as specified in SARA Title III and Chapter 252, F.S.
Describe the responsibilities toward the community as specified in SARA Title III and Chapter 252, F.S.

**Describe energy conservation, and demonstrate ways to conserve energy in the wastewater treatment facility:**

--The student will be able to:

Identify the causes of energy loss.
Rank various pieces of equipment in order of energy consumption.
Demonstrate procedures for performing an energy survey.
Demonstrate methods to conserve energy, such as equipment and process adjustments.

**Demonstrate supervisory skills:**

--The student will be able to:

Identify supervisory skills and various leadership styles.
Delegate responsibility and assign tasks to employees.
Follow the proper procedure for handling employee grievances.
Follow the proper procedure for disciplining employees.
Follow staffing guidelines in planning.
Conduct an orientation of a new employee, and follow the training program.
Evaluate employees objectively.
Identify emergencies and respond appropriately.
Identify the components of the budgeting process.
Demonstrate inventory control procedures.
Explain the importance of ethics in supervision.
Identify the role of the supervisor in a facility safety program.
Identify the role of the supervisor in customer relations.

# CLASS A WASTEWATER TREATMENT PLANT OPERATOR

**Discuss facility-management skills:**

--The student will be able to:

Describe the principles of management and supervision.
Describe concepts related to management and supervision.

**Demonstrate methods of organization and control:**

--The student will be able to:

Demonstrate organizational methods.
Develop an organizational chart.
Develop a staffing pattern.
Identify formal and informal lines of communication.

**Develop a plan for cost management:**

--The student will be able to:

Identify the costs of operation such as personnel, inventory, operations, energy consumption, and equipment maintenance.
Perform cost surveys.
Develop a plan for efficient operations.
Explain system efficiency balance.

**Prepare budgets and personnel assignments:**

--The student will be able to:

Identify budget activities and categories of expense accounts related to water or wastewater treatment facilities.
Identify techniques of budget control.
Prepare a budget, including long-range projections.
Prepare a staffing schedule, including the appropriate levels of staff for all required shifts.

**Develop standard operating procedures for the training and orientation of new employees:**

--The student will be able to:

Develop a written plan for an in-house orientation program for new employees.
Identify information that a supervisor should give new employees, including leave procedures, insurance procedures, safety procedures, chain of command, etc.
Develop a written plan for an in-house training program that includes safety measures and hazardous or toxic materials in the work place.
Develop a written plan for a cross-training program in facility operations.

**Demonstrate personnel selection and discipline:**

--The student will be able to:

Identify appropriate interviewing and hiring practices.
Develop a job description.
Identify control factors that are important in an organizational plan and that set limits on delegated authority.
Identify appropriate actions of the supervisor, the employee, and others in a grievance procedure.
Identify characteristics important to the role of a supervisor.
Determine requirements for a new position.
Advertise for the position, including the job description, job responsibilities, education requirements, and job conditions.
Analyze job applications to select qualified candidates to interview.
Conduct interviews.
Notify interviewees of the results, and conduct follow-up activities.
Use appropriate human-relations and communication skills.

Train, evaluate, and discipline employees objectively.
Identify appropriate actions of a supervisor in evaluating personnel performance.

**Demonstrate contingency planning:**

--The student will be able to:

Analyze potential emergencies that can occur in a facility.
Develop a plan for handling problems caused by emergencies, including what equipment would be used and what sampling would be needed.
Develop procedures for responding to customer complaints.
Develop procedures to ensure employee safety.
Develop procedures to ensure continuous operations, including preventive maintenance, alternative procedures, etc.

**Develop a plan for energy conservation:**

--The student will be able to:

Describe concepts related to energy conservation.
Identify energy conservation measures.

**Demonstrate record keeping and use of computer applications in planning:**

--The student will be able to:

Develop a plan for inventory control.
Develop a plan for an analysis of operation and maintenance (O&M) logs and for the optimum operation of equipment.
Identify the various types of facility automation.
Review available hardware and software, based on record-keeping needs.

**Demonstrate process optimization for wastewater treatment facilities:**

--The student will be able to:

Develop a plan for process control to achieve efficient, energy-saving, cost-effective operation.
Develop a plan for testing and analyzing the treatment operations for use in long-range facility operations.
Develop a plan for the systematic troubleshooting of operational problems.
Develop a plan for documenting operations and problems in order to anticipate and avoid potential problems.

**Interpret permits and blueprints:**

--The student will be able to:

Read and interpret blueprints for wastewater facilities.

Read the facility construction and operating permits, and relate permit requirements to facility operations.

**Develop a laboratory plan for process control:**

--The student will be able to:

Identify laboratory equipment for process control.
Develop a plan for equipment calibration and maintenance.
Develop a laboratory-staffing plan.
Determine whether in-house laboratory operations are cost-effective.
Review procedures for quality assurance/quality control in a facility laboratory.
Review procedures for obtaining certification for a facility laboratory.
Develop a sampling/analysis schedule for effective process control.

**Employ public-relations skills in community interactions:**

--The student will be able to:

Plan facility tours for the public.
Demonstrate how to handle press and public inquiries appropriately.
Demonstrate how to inform the public if a potential emergency arises.

## *Water Distribution System Operator*

## Content Areas and Details per Level

## LEVEL 4 & 3 WATER DISTRIBUTION SYSTEM OPERATORS

**Identify Professions Related to the Water Technology Field:**

--The student will be able to:

Explain the type of work done by water distribution system operators.
Explain the responsibilities of a water distribution system operator.
Describe where to seek employment in the water distribution profession.
Find sources of further information on how to do work task performed by water distribution system operators.
Define what a water supply system is.
Explain the water sources.
Demonstrate employability skills.

**Understand and Operate Storage Facilities:**

--The student will be able to:

Understand the purpose of storage facilities.

Identify the various types of storage facilities.
Understand the application of storage facilities.
Properly perform storage facility inspections.
Understand the process of taking a storage facility out of service and retuning it back to service.
Operate and maintain storage facilities in a safe manner.
Understand the methods and applications of storage facility corrosion control.
Apply interior and exterior protective coatings to a storage facility.
Understand the operation and use of altitude control valves.
Understand how to maintain water quality in a storage facility.
Understand how to troubleshoot water quality problems in a storage facility.
Understand disinfection processes and methods for storage facilities.
Disinfect a storage facility.
Collect samples from a storage facility.
Understand federal, state, and local regulations for storage facilities.
Understand booster pumping for storage facilities.
Understand AWWA specifications and standards for storage facilities.
Maintain landscaping and aesthetics of storage facilities.
Maintain records for storage facilities.

**Understand and Operate Water Distribution System Facilities:**

--The student will be able to:

Explain the purpose of a water distribution system.
Explain distribution system hydraulics.
Understand water distribution system pressure requirements.
Understand the causes of friction losses within a distribution system.
Understand water distribution transmission systems.
Explain the different water distribution system layouts.
Understand water main pipe features and requirements.
Explain the different types of piping materials.
Explain the different type of pipe joints and their applications.
Understand the different type of corrosion control used to protect pipe.
Understand and perform water main installation task.
Understand application of pipe fittings.
Install pipe fittings.
Understand the requirements of the “ONE CALL” system.
Explain water main separation requirements.
Understand excavation spoil set backs.
Understand sheeting and shoring requirements.
Understand trenchless technology.
Define a “Competent person”.
Understand the responsibilities of a “competent person”.
Explain the need and application of thrust blocks.
Properly install harnessed joints.
Understand the correct process of backfilling an excavation.
Perform a hydrostatic pressure and leakage test.
Disinfect a pipeline using accepted standards.
Understand the application and operation of the different type water distribution system valves.

Install water distribution system valves.
Understand inspection and maintenance of distribution valves.
Understand the operation of fire hydrants.
Install a fire hydrant.
Understand inspection and maintenance requirements for fire hydrants.
Repair and maintain fire hydrants.
Understand the process of repairing a water main while it is under pressure.
Understand the process of taking a water main out of service, repairing it and returning it to service.
Explain the purpose of water meters.
Define the different type of meters.
Read a water meter.
Understand the application of water meters.
Understand the need for testing and calibrating water meters.
Understand backflow prevention and cross-connection.
Explain the different type of backflow prevention assemblies.
Explain the application for the different types of backflow prevention assemblies.
Explain what a "Degree of Hazard" is.
Understand the requirements for installing backflow prevention assemblies.
Understand the testing and maintenance requirements of backflow prevention assemblies.
Make a tap on a water main while under pressure.
Safely operate machinery and equipment.
Read and understand the use of gauges:
PSIG (gauge).
PSIA (Absolute).
PSID (Differential).
Install, read, and monitor pressure-recording gauges.
Read and understand water distribution system mapping.

**Understand Water Quality Consideration in a Water Distribution System:**

--The student will be able to:

Define specific terms used for water quality.
Understand the importance of water quality.
Understand water quality standards.
Understand the types of contaminants that affect water quality.
Understand the sources of contaminants.
Understand causes of water quality degradation in water distribution systems.
Understand how to maintain water quality within a water distribution system.
Perform water-monitoring test for pH.
Perform water-monitoring test for disinfectant residuals.
Understand the process and need for collecting samples from a distribution system.
Collect samples from a water distribution system.
Troubleshoot water quality complaints.
Perform flushing activities for maintaining water quality.

**Understand Water Distribution System Operations and Maintenance Needs and Techniques:**

--The student will be able to:

Explain the need for system operation and maintenance.
Explain the different types of maintenance.
Understand water distribution system surveillance programs.
Understand water quality-monitoring programs for a water distribution system.
Understand and conduct a cross-connection control inspection.
Understand and conduct bacteriological sampling.
Understand lead and copper monitoring and sampling procedures.
Determine and understand booster-pumping needs in a water distribution system.
Understand booster pumping maintenance requirements.
Connect water pipes together using different types of pipe joints.
Read water distribution maps to locate buried pipes and appurtenances.
Locate water main leaks.
Understand and use leak detection equipment.
Understand the different types of water main repair clamps and fittings.
Make repairs on water main leaks.
Flush pipes.
Set up a flushing program.
Understand pipe-cleaning operations.
Understand pipelining technology.
Understand and use the required equipment for making a service connection to a water main.
Understand how a water meter is installed.
Understand testing and calibrating water meters.
Understand and perform flow testing.
Explain field disinfection requirements and methods.
Disinfect a new water main and storage facilities.
Understand record keeping requirements.
Keep accurate operation and maintenance records of a water distribution system.
Understand and interpret water distribution mapping.
Understand engineering design and profile drawings.
Make accurate “as-built” drawings.
Understand landscaping needs.
Understand restoration requirements.
Develop and use proper public relation skills.
Safely operate and maintain a water distribution system.

**Describe the Principles and Practices of Disinfection in Water Distribution Systems:**

--The student will be able to:

Define technical terms relating to disinfection in water distribution systems.
Understand the purpose of disinfection.
Understand disinfection rules, regulations, and standards.
Describe factors that influence disinfection.
Understand the removal processes for microorganisms.
Understand the formation of disinfection-by-products.
Understand the processes for disinfection-by-product control.

Describe disinfection processes.
Explain accepted practices and standards for disinfection in a distribution system.
Understand hypochlorites.
Describe the properties of chlorine.
Understand the disinfection action of chlorine when added to water.
Describe breakpoint chlorination.
Describe the method for producing chloramines.
Understand nitrification within a distribution system when using chloramines as a disinfect.
Understand the minimum disinfection requirements in a water distribution system.
Understand disinfection residual testing.
Perform disinfection-monitoring testing in a distribution system.
Calculate chlorine dosages.
Prepare a hypochlorite solution for disinfecting a new main, storage facility, pump, or well.
Disinfect new and existing wells.
Disinfect pumps.
Disinfect new and existing water mains.
Disinfect new and existing storage facilities.
Perform emergency and/or maintenance disinfection.
Understand the operation and maintenance of hypochlorinators.
Troubleshoot disinfection equipment.
Understand the hazards of chlorine and other disinfection chemicals.
Understand the safe handling and storage of disinfection chemicals.
Conduct a chlorine safety inspection.

**Describe the Principles and Practices of Safety Relating to Water Distribution System Operation:**

--The Student will be able to:

Understand safety programs for a water distribution system.
Safely operate and maintain pumps and wells with attention to the safety of operators and consumers.
Understand "Lock-out" and "Tag-out" requirements.
Inspect vehicles and equipment for safety features and/or defects.
Operate vehicles defensively and safely.
Operate construction equipment in a safe manner.
Understand and operate pneumatic tools safely.
Understand and operate hydraulic tools safely.
Apply proper application and use of personal protective equipment.
Understand work zone safety.
Describe an MOT (Maintenance of Traffic) set-up through a work zone.
Define terms used for work zone traffic control.
Understand signage requirements for work zone traffic control.
Understand "Right-To-Know" laws.
Understand and know what information is obtained from "Material Safety Data Sheets."
Understand and use atmosphere-testing equipment.
Understand what a confined space is.
Safely enter confined spaces.
Apply all safety rules and regulations for excavations.
Understand and use proper sheeting and shoring for trench safety.
Conduct safety inspections of water distribution facilities.

**Understand and Solve Water Distribution System Mathematical Problems:**

--The student will be able to:

- Add, subtract, multiply, and divide whole numbers.
- Add, subtract, multiply, and divide fractions.
- Add, subtract, multiply, and divide decimals.
- Calculate percentages.
- List from memory basic conversion factors.
- List from memory basic formulas used in water distribution.
- Solve basic mathematical formulas used in water distribution for:
  - Areas.
  - Volumes.
  - Circumferences.
  - Flow rates and velocities.
  - Chemical dosages.
  - Temperature conversions.
  - Force, pressures, and head.
- Understand pump characteristics and pump curves.

**Understand and Apply Principles of Water Distribution System Administration:**

--The student will be able to:

- Understand the functions of a manager.
- Understand the responsibilities of a supervisor.
- Accurately record information on a work order.
- Describe the benefits of short-term, long-term, and emergency planning.
- Understand how to conduct an employee evaluation.
- Prepare written or oral reports on a distribution system's operations.
- Communicate effectively within the organization and with the community.
- Understand a contingency plan for emergencies.
- Understand record keeping requirements.
- Understand requirements for disposal of distribution system records.

# LEVEL 2 WATER DISTRIBUTION SYSTEM OPERATORS

**Identify Operational Needs and Maintenance of Storage Facilities:**

--The student will be able to:

- Identify locations for proper placement of storage facilities.
- Take a storage facility off line and put it back on line.
- Identify the standards and specifications for storage facility coatings.
- Identify and take corrective action for water quality problems in storage facilities.
- Develop and implement maintenance schedules for storage facilities.
- Determine and implement corrosion control for storage facilities.
- Inspect the work being performed by contractors on a storage facility.
- Explain federal, state and local rules and regulations operating and maintaining storage facilities.

**Identify Operating and Maintenance Needs for Water Distribution System Facilities:**

--The student will be able to:

Explain hydraulic concerns and performance within a distribution system.
Explain and determine hydraulic gradient lines.
Determine and implement changes in a distribution system that would improve system hydraulics.
Develop protocols for "best practice" methods for the installation of system piping and appurtenances.
Develop and implement programs for inspection and maintenance of fire hydrants.
Develop and implement programs for inspection, maintenance, and calibration of water meters.
Develop and implement programs for inspection and maintenance of distribution valves.
Develop and implement programs for the inspection, testing, and maintenance of backflow prevention assemblies.
Explain and apply federal, state, and local rules and regulations for distribution facility installation and maintenance.
Identify equipment needs for operating and maintaining distribution systems.
Interpret and review engineering design drawings and make field changes when necessary.
Read and interpret distribution system mapping.
Train operators in safe practices for maintaining and operating distribution system facilities.
Develop and implement a water distribution system surveillance program.
Tests and calibrate a water meter.
Make proper applications of water meters.
Determine specifications for equipment used to install and maintain distribution piping and appurtenances.
Develop and implement corrosion control methods for distribution piping .
Develop and implement pipe-cleaning operations.
Schedule preventive maintenance activities.
Develop and implement programs for corrective maintenance activities.
Direct activities for new pipe line installation.
Determine material requirements for performing distribution system operations and maintenance activities.
Determine labor requirements for performing distribution system operations and maintenance activities.
Determine equipment requirements for performing distribution system operations and maintenance activities.
Understand the use of Supervisory Control and Data Acquisition systems.

**Identify Water Quality Concerns and Disinfection Needs in a Water Distribution System:**

--The student will be able to:

Explain and apply federal, state, and local rules and regulations pertaining to water quality and disinfection in a distribution system.
Develop and implement a flushing program for maintaining water quality in a distribution system.
Determine and implement improvements and changes that would improve water quality within a distribution system.
Develop and implement a bacteriological sampling program.

Develop and implement a lead and copper sampling program.
Develop and implement heterotrophic plate count sampling program.
Develop and implement nitrite and nitrate sampling program.
Explain the different types of disinfection processes.
Explain how each disinfection process affects water quality within a distribution system.
Develop protocols for disinfection of new and existing water mains.
Develop protocols for disinfection of storage facilities.
Develop protocols for disinfection of pumps and wells.
Develop protocols for prevention and control of nitrification in a distribution system when using chloramines as a disinfect.
Develop and implement field-testing programs for pH.
Develop and turbidity, temperature and disinfection residuals.
Develop and implement programs for the safe handling and use of chemicals used in water distribution.
Develop and implement a backflow prevention and cross-connection control program.
Use proper public relation skills when dealing with consumers concerning water quality issues.
Train operators to prepare for and respond to emergencies that would affect water quality in a distribution system.

**Identify Principles and Practices of Safety Relating to Water Distribution System Operations:**

--The student will be able to:

Understand and apply federal, state, and local rules and regulations for safe practices when working on water distribution systems.
Develop and implement safety program for a water distribution system.
Install sheeting and shoring for excavation safety.
Perform inspections of work sites for safe conditions.
Perform safety inspection of tools and equipment.
Instruct distribution employees on safe work practices.
Develop plans for follow-up to insure the use of personal protective equipment by employees.
Implement safety-training programs for distribution system operators.
Inspect "Work Zone" set-ups.
Perform the responsibilities of a "Competent Person."
Develop protocols for handling and storage of hazardous chemicals.

**Apply Principles of Water Distribution System Administration:**

--The student will be able to:

Understand the utilities organizational chart.
Understand and write job descriptions for a specific position within the utility.
Plan and prepare maintenance and work schedules.
Maintain employee time records.
Conduct employee performance assessments.
Prepare and conduct technical training for distribution system employees.
Review technical specifications for materials.
Review technical specifications for tools and equipment.
Prepare a budget.
Prepare job cost estimates.

Interview job applicants.
Understand and apply federal, state, and local rules and regulations for record keeping.
Maintain water distribution system records.
Prepare written or oral reports on distribution operations.
Describe the financial strength of your distribution system.
Develop and implement contingency plans for emergencies.
Understand the security plans for your utility's facilities.

**Demonstrate and Apply Supervisory Skills:**

--The student will be able to:

Understand and define:
- Authority.
- Responsibility.
- Delegation.
- Accountability.
- Unity of Command.

Demonstrate supervisory and leadership skills.
Supervise the activities of assigned work force.
Describe the steps necessary to provide equal and fair treatment to all employees.
Effectively utilize disciplinary actions to correct employee behavior.
Follow proper procedures for disciplining employees.
Delegate responsibility and assign work tasks.
Follow proper process for handling employee grievances.
Identify emergency situations and respond appropriately.
Identify components of the budgeting process.
Demonstrate inventory control procedures.
Identify the supervisor's role in customer relations.
Identify the supervisor's role within the organizational structure.
Communicate effectively within the organization and the community.
Effectively handle conflict resolution.

# LEVEL 1 WATER DISTRIBUTION SYSTEM OPERATORS

**Demonstrate Water Distribution System Management and Organizational Skills:**

--The student will be able to:

Describe and implement principles of management and supervision.
Describe the concepts relating to management and supervision.
Demonstrate organizational skills and methods.
Develop an organizational chart.
Develop a staffing pattern.
Identify goals and objectives for the distribution system.
Identify lines of communication within the organization and the community.

**Develop Cost Effective Management:**

--The student will be able to:

Identify and evaluate operational cost for:
- Personnel staffing.
- Material warehousing inventory.
- Equipment inventory.
- System operations.
- Equipment maintenance.
- Safety and training programs.

Perform cost analysis and surveys.
Develop a plan for "best practice" efficient operations.

**Prepare Water Distribution System Budgets:**

--The student will be able to:

Identify budget activities and categorizes expenses related to water distribution systems operation and maintenance.
Develop budget monitoring and control techniques.
Develop long-range capital improvement planning for future budgeting needs.

**Develop Standard Operating Procedures for Training of Water Distribution System Operators:**

--The student will be able to:

Develop procedures to ensure employee safety.
Develop a written plan for in-house training of employees for:
- Safety training:
  - "Right-to-Know" training.
  - "M.S.D.S." training.
  - "Competent Person" training.
  - "Confined Space Entry" training.
- Technical training.
- Equipment operation training.

Develop a written plan for employees obtaining certification certificates and licenses.
Develop a written plan for cross training of employees within the utility.
Develop a plan for providing basic employment information to new employees.

**Demonstrate Personnel Selection and Discipline:**

--The student will be able to:

Identify appropriate interviewing and hiring practices.
Develop job descriptions for specific positions.
Develop job performance task for new positions.
Identify characteristics important to the role of a supervisor and how they will support the organizations goals.
Review and analyze job applications to select qualified candidates for interviews.
Conduct interviews.
Use appropriate communication skills.
Train and evaluate employees objectively and fairly.
Evaluate and apply disciplinary actions objectively and fairly.

Mediate conflict resolutions objectively and fairly.
Conduct supervisory performance assessments.

**Develop and Demonstrate Contingency Planning:**

--The student will be able to:

Recognize and analyze potential emergency situations that can occur in a water distribution system.
Develop a written plan for dealing with emergency situations, which would include personnel assignments and equipment requirements.
Develop protocols for responding to customer complaints and inquiries.
Develop protocols to ensure continuous coverage of operations and maintenance of a water distribution system, including after hours, holidays, and weekend coverage.
Develop protocols in the event of natural disasters.

**Demonstrate Record-Keeping and Computer Technology Applications in Planning:**

--The student will be able to:

Develop a plan for inventory control.
Develop a plan to analyze operation and maintenance of the distribution system and equipment.
Evaluate and develop flow charts for the handling and control of distribution system records.
Review computer hardware and software, based on record-keeping needs.

**Interpret and Apply Federal, State and Local Rules and Regulations Concerning Water Distribution Systems and Employees:**

--The student will be able to:

Identify reporting requirements of federal, state and local regulatory agencies.
Develop a plan for submitting required reports to regulatory agencies in the required time frame.
Identify permitting requirements for distribution system improvements, expansion, and maintenance of a water distribution system.
Develop a plan to acquire necessary permitting.
Develop protocols for conforming to permitting requirements.
Develop protocols for distribution system mapping.
Develop protocols for handling liability claims.
Evaluate results of a sanitary survey.

**Demonstrate Public-Relation Skills in Community Interactions;**

--The student will be able to:

Demonstrate the ability to handle adverse and difficult situations with the public.
Demonstrate the ability to handle the media and public inquiries appropriately.
Demonstrate the ability to inform the media and public if a potential emergency situation arises.

**Florida Operator Certification Program**