Water Treatment Plant Operation, Volume 2
California State University, Sacramento
(9.0 Continuing Education Units)

COURSE DESCRIPTION

This course is designed to train operators in the practical aspects of operating and maintaining water treatment plants emphasizing safe practices and procedures. Information is presented on drinking water regulations (including the Safe Drinking Water Act), iron and manganese control, fluoridation, softening, trihalomethanes, demineralization, handling and disposal of process wastes, maintenance, and instrumentation. In addition, management duties including organizational planning and organizing; staffing; internal and external communication; financial stability; operation, maintenance, emergency response, safety, and water and energy conservation programs; and recordkeeping are covered.

COURSE OUTLINE

This manual builds on the information offered in Volume 1 to provide operators with the knowledge and skills to properly operate, maintain, inspect, and manage water treatment plant systems.

Chapter 1, Producing Safe Water in a Safe Workplace

Learning Objectives

1. Identify the basic types of water systems.
2. Explain the Total Coliform Rule and Surface Water Treatment Rules.
3. Describe the National Primary and Secondary Drinking Water Regulations.
4. Prepare a consumer confidence report.
5. Explain safety duties and responsibilities of management and operators in water treatment facilities.
6. Identify and correct treatment facility hazards such as unsafe conditions, fire hazards, and electrical hazards.
7. Describe the safety aspects of O&M processes for equipment, facilities, vehicles, and systems.

The main purposes of this chapter are to give an overview of water treatment regulations and to inform operators of safe procedures and how to implement them in a water treatment plant.

Chapter 2, Softening

Learning Objectives

1. Explain what makes water hard and the advantages of softening.
2. Operate and maintain the processes used to soften water. Start up and shut down water softening units. Blend softened waters with unsoftened waters for delivery to consumers.
3. Safely handle softening chemicals, determine proper dosages using jar tests and calculations, and prepare chemical doses to soften water.
4. Dispose of process sludges and brines.
5. Maintain accurate softening records.

The main purpose of this chapter is to train operators in the basic operation and maintenance of softening processes at water treatment plants.

Chapter 3, Specialized Treatment Processes

Learning Objectives

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1. Safely operate, maintain, and troubleshoot treatment processes to control iron and manganese, arsenic, and disinfection byproducts.
2. Determine whether there is a feasible, effective option to prevent iron and manganese, arsenic, and disinfection byproducts from entering source water or forming during treatment.
3. Collect samples for analysis of regulated constituents.
4. Properly dispose of process wastes from water treatment processes that control regulated constituents.
5. Record and report data to maintain operational control and regulatory compliance.

The main purpose of this chapter is to train operators in the basic operation and maintenance of treatment processes to control iron and manganese, arsenic, and disinfection byproducts at water treatment plants.

Chapter 4, Fluoridation

Learning Objectives

1. Describe the reason for fluoridating drinking water and how fluoridation programs are implemented.
2. List the compounds used to furnish fluoride ion. Safely handle fluoride compounds.
3. Review designs and specifications of fluoridation equipment and inspect fluoridation equipment.
4. Start up, operate and maintain, and shut down a chemical feeder.
5. Calculate fluoride dosages and prepare fluoride solutions. Prevent overfeeding of fluoride.
6. Develop and keep accurate fluoride log sheets.

The main purpose of this chapter is to train operators in the basic operation and maintenance of fluoridation processes at water treatment plants.

Chapter 5, Membrane Treatment Processes

Learning Objectives

1. Describe common membrane technologies used to treat water and their processes.
2. Safely operate and maintain membrane filtration treatment plants, including reverse osmosis and electrodialysis plants.
3. Keep accurate and appropriate records for a membrane filtration plant.
4. Develop, implement, and maintain a membrane filtration plant maintenance program.
5. Describe demineralizing processes and explain how they work.

The main purpose of this chapter is to train operators in the basic operation and maintenance of membrane treatment processes for water treatment.

Chapter 6, Process Wastes

Learning Objectives

1. Explain how process wastes are generated and handled at water treatment plants.
2. Safely operate and maintain sludge handling, discharge, and disposal equipment.
3. Understand the different options for discharge and disposal of process wastes and the regulatory requirements for those options.
4. Monitor and report on the discharge and disposal of process wastes.

The main purpose of this chapter is to train operators in the handling, discharge, and disposal of process wastes generated during water treatment.

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Chapter 7, Instrumentation and Control Systems

Learning Objectives

1. Describe and explain the uses of instruments and control systems.
2. Identify, avoid, and correct safety hazards associated with instrumentation work.
3. Explain how measured values are used by sensors and instruments.
4. Read instruments and make proper adjustments in the operation of water treatment facilities.
5. Identify symptoms of measurement and control system problems.

The main purpose of this chapter is to train operators in the basic operation and maintenance of instrumentation and control system used in water treatment plants.

Chapter 8, Plant Maintenance

Learning Objectives

1. Safely perform and document maintenance for plant facilities, including electrical and mechanical equipment, internal combustion engines, chemical storage facilities, chemical feeders, tanks and reservoirs, and buildings, as described and scheduled in a water treatment plant maintenance program or manufacturers' instructions.
2. Safely maintain and investigate problems with electrical equipment and determine whether a qualified electrician is required to safely troubleshoot and repair electrical panels, controls, circuits, wiring, or equipment.
3. Identify the parts of pumps, identify different types of pumps and their applications, and maintain a variety of pumps, including properly starting and stopping pumps.
4. Maintain and lubricate mechanical equipment throughout the plant, including valves and compressors.

The main purpose of this chapter is to train operators in the safe and effective maintenance of equipment and facilities in water treatment plants.

Chapter 9, Management

Learning Objectives

1. Identify the functions of a manager.
2. Describe the elements of an employment policy that cover the employment process starting from the application process.
3. Communicate effectively within the organization, with media representatives, and with the community using such methods as reports, presentations, plant tours, and educational materials.
4. Prepare plans for financial stability, operation and maintenance, emergencies, security, safety, and water and energy conservation.
5. Collect, organize, use, and dispose of plant records.

The main purpose of this chapter is to train water treatment professionals in the basic duties and responsibilities of managing water treatment plants.

TIME ASSIGNMENT

Text pages: The content from the training manual used in this course, *Water Treatment Plant Operation*, Volume 2, includes 854 pages. The average word count on a page from the training manual is 524 words. The training manual used for this course contains text, tables, graphs, illustrations, math example problems, section questions, and chapter review questions to enhance the presentation of information and the student learning experience. The course is designed for students to spend the same amount of

time reading the tables, graphs, and illustrations as they spend reading the equivalent amount of related chapter text. Therefore, each page is assumed to contain the equivalent of 524 words. The average reading speed is 130 words per minute; therefore, each page is projected to require four minutes of student time for each reading.

Math example problems: The course contains 176 math example problems. The projected average time to solve each math problem is three minutes.

Section questions: The course contains 552 section questions, located in the "Check Your Understanding" sections integrated throughout the chapter text. These questions enable students to self-assess their understanding of a section's material before proceeding to the next section. The projected average response time is 2 minutes per question.

Chapter review questions: The course contains 285 review questions, located in the "Chapter Review" at the end of each chapter. Question types include fill-in, multiple choice, and matching. The projected average response time is 2 minutes per question.

Objective test questions: The course contains 350 test questions. There is 1 objective test per chapter. The projected average response time is 2 minutes per question.

Course component	Number of component units		Minutes required to complete component unit		Total time assignment for component
Text pages	854	×	4	=	3,416
Math example problems	176	×	3	=	528
Section questions	552	×	2	=	1,104
Chapter review questions	285	×	2	=	570
Objective test questions	350	×	2	=	700
					6,318 minutes
					105.3 or 105 hours

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