

Operation of Wastewater Treatment Plants, Volume II
Office of Water Programs
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 wastewater treatment plants, emphasizing safe practices and procedures. Topics covered include conventional activated sludge processes, sludge digestion and solids handling, effluent disposal, plant safety and good housekeeping, plant and equipment maintenance, laboratory procedures and chemistry, use of computers for plant operation and maintenance, analysis and presentation of data, and records and report writing. Operators also learn to analyze and solve operational problems and to perform mathematical calculations relating to wastewater treatment process control.

COURSE OUTLINE

The course uses *Operation of Wastewater Treatment Plants, Volume 2* training manual.

Chapter 11 – Activated Sludge (Operation of Conventional Activated Sludge Plants)

OBJECTIVES

The activated sludge process is a very important wastewater treatment process. For this reason, the chapters on activated sludge have been divided into three parts and will be presented in three separate manuals.

I. Package Plants and Oxidation Ditches (Volume I)

II. Operation of Conventional Activated Sludge Plants (Volume II)

III. Pure Oxygen Plants and Operational Control Options (*ADVANCED WASTE TREATMENT*)

If you are the operator of a package plant or oxidation ditch, Volume I will provide you with the information you need to know to operate your plant. Volume II and the *ADVANCED WASTE TREATMENT* manual will help you better understand your plant and do a better job. If you operate a conventional activated sludge plant or a modification, Volume I will help you understand the activated sludge process and Volume II will tell you how to operate your plant. The *ADVANCED WASTE TREATMENT* manual will explain to you alternative means of operational control that may work very well for your plant. If you operate a pure oxygen plant, the *ADVANCED WASTE TREATMENT* manual will tell you what you need to know to operate the pure oxygen system. All three parts contain information important to the proper operation of your plant. The *ADVANCED WASTE TREATMENT* manual also contains information helpful to operators using the activated sludge process to treat special wastes such as industrial wastes. The following objectives apply to the treatment plants covered in each of the three parts. After completion of the appropriate part on activated sludge, students should be able to:

1. Explain the principles of the activated sludge process and the factors that influence and control the process.
2. Inspect a new activated sludge facility for proper installation.
3. Place a new activated sludge process into service.
4. Schedule and conduct operation and maintenance duties.

5. Collect samples, interpret lab results, and make appropriate adjustments in treatment processes.
 6. Recognize factors that indicate an activated sludge process is not performing properly, identify the source of the problem, and take corrective action.
 7. Conduct their duties in a safe fashion.
 8. Determine aerator loadings and understand the application of different loading guidelines.
 9. Keep records for an activated sludge plant.
 10. Identify the common modifications of the activated sludge process.
 11. Review plans and specifications for an activated sludge plant.
 12. Describe each of the process stages used to treat wastewater in a sequencing batch reactor (SBR).
 13. Place a new sequencing batch reactor in service.
 14. Collect and analyze samples and make appropriate process adjustments during start-up and normal operation.
 15. Safely operate and maintain a sequencing batch reactor.
 16. Review plans and specifications for a sequencing batch reactor.
- The main purpose of this chapter is to teach operators how to safely start up, operate, shut down, and maintain an activated sludge plant.

Chapter 12 – Sludge Digestion and Solids Handling

OBJECTIVES

Following completion of Chapter 12, students should be able to:

1. Explain how a sludge digester works and what factors influence and control the digestion process.
2. Inspect new sludge digesters and solids handling facilities for proper installation.
3. Place a new sludge digester into operation.
4. Schedule and conduct operation and maintenance duties.
5. Collect samples, interpret lab results, and make appropriate adjustments in the sludge digestion and solids handling processes.
6. Recognize factors that indicate the sludge digestion and solids handling processes are not performing properly, identify the source of the problem, and take corrective action.
7. Discuss the various methods of solids handling and know how to operate and maintain these processes.
8. Determine loadings on sludge digesters and solids handling facilities.
9. Conduct their duties in a safe fashion.
10. Keep records for the sludge digestion and solids disposal processes.
11. Develop an operational strategy for a sludge digester.
12. Review plans and specifications for a sludge digester.

The main purpose of this chapter is to teach operators how to safely start up, operate, shut down, and maintain sludge digestion and solids handling facilities.

Chapter 13 – Effluent Disposal

OBJECTIVES

Following completion of Chapter 13, students should be able to:

1. Properly reclaim and reuse plant effluents for beneficial uses.
2. Develop an operational strategy for effluent discharge, reclamation, and reuse.

3. Troubleshoot an effluent discharge, reclamation, and reuse system.
 4. Develop a receiving water monitoring program.
 5. Select the proper locations to collect samples.
 6. Determine when and how often samples should be collected.
 7. Collect representative samples.
 8. Conduct an effluent monitoring program in a safe fashion.
 9. Review plans and specifications for an effluent discharge, reclamation, and reuse system.
- The main purpose of this chapter is to teach operators how to properly discharge plant effluents in receiving waters and how to safely develop and conduct a receiving water monitoring program.

Chapter 14 – Plant Safety

OBJECTIVES

Following completion of Chapter 14, students should be able to:

1. Identify the types of hazards they may encounter operating a wastewater treatment plant.
2. Recognize unsafe conditions and correct them whenever they develop.
3. Organize regular “tailgate” safety meetings.
4. Develop the habit of always “thinking safety and working safely.”

NOTE: Special safety information is given in other chapters because of the importance of safety considerations at all times. The purpose of this chapter is to teach operators how to identify safety hazards and unsafe conditions and do their jobs safely.

Chapter 15 – Maintenance

OBJECTIVES

Following completion of Chapter 15, students should be able to:

1. Develop a maintenance program for their plant, including equipment, buildings, grounds, channels, and tanks.
2. Start a maintenance recordkeeping system that will provide them with information to protect equipment warranties, to prepare budgets, and to satisfy regulatory agencies.
3. Schedule maintenance of equipment at proper time intervals.
4. Perform maintenance as directed by manufacturers.
5. Recognize symptoms that indicate equipment is not performing properly, identify the source of the problem, and take corrective action.
6. Start and stop pumps.
7. Unplug pipes, pumps, and valves.
8. Explain the operation and maintenance of sensors, transmitters, receivers, and controllers.
9. Determine when they need assistance to correct a problem.

NOTE: Special maintenance information is given in the previous chapters on treatment processes where appropriate. The purpose of this chapter is to teach operators how to develop a maintenance program, keep maintenance records, schedule maintenance at the proper time intervals, and perform maintenance.

Chapter 16 – Laboratory Procedures and Chemistry

OBJECTIVES

Following completion of Chapter 16, students should be able to:

1. Work safely in a laboratory.
2. Operate laboratory equipment.
3. Collect representative samples of influents to and effluents from a treatment process as well as sample the process.
4. Prepare samples for analysis.
5. Perform plant control tests.
6. Analyze plant effluent in accordance with NPDES permit requirements.
7. Recognize shortcomings or precautions for the plant control and NPDES tests.
8. Record laboratory test results.

The main purpose of this chapter is to teach operators how to work safely in a laboratory, collect representative samples, accurately analyze samples, and properly record laboratory test results.

Chapter 17 – Applications of Computers for Plant O & M

OBJECTIVES

Following completion of Chapter 17, students should be able to:

1. List the uses of computers in treatment plants.
2. Identify tasks in their treatment plant that could be performed by computers.
3. Provide reasons that justify purchasing and using computers.
4. Recognize cautions that must be exercised by operators using computers.
5. Evaluate both computer hardware and software.

The main purpose of this chapter is to inform operators of the tasks that can be performed by computers, thus freeing operators to do more important work.

Chapter 18 – Analysis and Presentation of Data

OBJECTIVES

Following completion of Chapter 18, students should be able to:

1. Identify causes of the variations in results.
2. Read manometers, gauges, and charts.
3. Analyze and present data using:
 - a. Charts and graphs
 - b. Tables
 - c. Numbers
4. Calculate arithmetic mean, range, median, mode, geometric mean, moving average, variance, and standard deviation.
5. Apply prediction equations, trends, and correlations to the analysis of data.

The main purpose of this chapter is to teach operators how to analyze and present data.

Chapter 19 – Records and Report Writing

OBJECTIVES

Following completion of Chapter 19, students should be able to:

1. Explain the importance of and need for records.
2. Identify the different types of records.
3. Evaluate records.

4. Organize a report.
5. Write a report.

The main purpose of this chapter is to teach operators how to evaluate records and write reports.

Chapter 20 – Treatment Plant Administration

OBJECTIVES

Following completion of Chapter 20, students should be able to:

1. Identify the functions of a manager.
2. Describe the benefits of short-term, long-term, and emergency planning.
3. Define the following terms:
 - a. Authority
 - b. Responsibility
 - c. Delegation
 - d. Accountability
 - e. Unity of command
4. Read and construct an organizational chart identifying lines of authority and responsibility.
5. Write a job description for a specific position within the utility.
6. Write good interview questions.
7. Conduct employee evaluations.
8. Describe the steps necessary to provide equal and fair treatment to all employees.
9. Prepare a written or oral report on the plant's operations.
10. Communicate effectively within the organization, with media representatives, and with the community.
11. Describe the financial strength of their utility.
12. Calculate their utility's operating ratio, coverage ratio, and simple payback.
13. Prepare a contingency plan for emergencies.
14. Set up a safety program for their utility.
15. Collect, organize, file, retrieve, use, and dispose of plant records.
16. Describe the difference between illegal activities and ethical situations.
17. Explain why ethical behavior is important for operators.

The main purpose of this chapter is to introduce to students the important aspects of administration.

TIME ASSIGNMENT

Text Pages: The course uses the training manual *Operation of Wastewater Treatment Plants, Volume 2* (857 pages). The average word count on a page from the training manual is 950 words. Some pages contain tables, graphs, or illustrations to enhance the presentation of information. It is assumed that readers spend equal time studying tables, graphs, and illustrations as they would spend reading the equivalent amount of text. Therefore, each page is assumed to contain the equivalent of 950 words. Accepted average adult reading speed is 200 – 250 words per minute. Therefore, each page is projected to require four minutes of student time for each reading.

Math problems: The course contains 29 wastewater treatment math problems. Projected average time to solve each math problem is three minutes.

Questions: The course contains 556 assessment questions integrated into the reading. Each question requires a written response consisting one or more sentences. Projected average review question time is two minutes per question.

Discussion questions: The course contains 293 discussion questions. Each discussion question requires a written response consisting one or more sentences. Projected average discussion question time is two minutes per question.

Review questions: The course contains 203 comprehensive review questions. Projected average response time is one minute per question.

Objective test questions: The course contains 424 objective test questions. Projected average response time is one minute per question.

Component	Minutes per Component Unit	Number of Component Units	Time to Complete Units
Text pages	4	857	3,428
Math problems	3	29	87
Questions	2	556	1,112
Discussion questions	2	293	586
Review questions	1	203	406
Objective test questions	1	424	424
Total (minutes)			6,043
Total (hours)			101