Industrial Waste Treatment, Volume II
Office of Water Programs
California State University, Sacramento
(9.0 Continuing Education Units)

COURSE DESCRIPTION

This course is designed to train operators the practical aspects of operating and maintaining industrial wastewater treatment plants, emphasizing safe practices and procedures. Topics covered include the importance and responsibilities of an industrial treatment plant operator, fixed growth processes (trickling filters and rotating biological contactors), activated sludge process control, sequencing batch reactors, enhanced biological treatment (including nitrogen and phosphorus removal), anaerobic treatment, residual solids management, and plant and equipment maintenance. Operators will learn how to control these treatment processes under normal and abnormal conditions and how to analyze and solve operational problems.

COURSE OUTLINE

The course uses *Industrial Waste Treatment, Volume 2* training manual.

CHAPTER 1. THE INDUSTRIAL PLANT OPERATOR
OBJECTIVES

Following completion of Chapter 1, students should be able to:
1. Explain the type of work done by an industrial wastewater treatment plant operator.
2. Describe where to look for jobs in this profession.
3. List and describe the general types of contaminants found in the wastewaters from various industries.
4. Find sources of training and further information on how to do the jobs performed by industrial treatment plant operators.

This chapter is designed to fire up the students' interest in being industrial wastewater treatment plant operators and learning how to do the job properly and safely.

CHAPTER 2. FIXED GROWTH PROCESSES (TRICKLING FILTERS AND ROTATING BIOLOGICAL CONTACTORS)
OBJECTIVES

Following completion of Chapter 2, students should be able to:
1. Explain why fixed growth processes (trickling filters, rotating biological contactors, and combined processes) are used to treat wastewater.
2. Describe a trickling filter and a rotating biological contactor and the purpose of each important part.
3. Safely start up, operate, and shut down fixed growth and combined treatment processes.
4. Maintain and troubleshoot fixed growth and combined processes.
5. Identify abnormal operating conditions when they occur and take appropriate corrective action.
6. Describe several common problems associated with fixed growth processes and possible solutions for correcting them.

7. Determine the loading rates for a fixed growth process.

The purpose of this chapter is to teach operators how to safely start up, operate, shut down, and maintain trickling filters and rotating biological contactors as well as processes that combine fixed growth and suspended growth principles. The chapter describes the components and operation of trickling filters and RBCs. Operators will also learn how to solve problems commonly associated with fixed growth systems and how to calculate process loadings.

CHAPTER 3. ACTIVATED SLUDGE PROCESS CONTROL

OBJECTIVES

Following completion of Chapter 3, students should be able to:

1. Explain the principles of the activated sludge process and the factors that influence and control the process.
2. Identify the common modifications of the activated sludge process.
3. Describe the various methods of determining return sludge and waste sludge rates and select the best method for their plant.
4. Operate an activated sludge process that must treat both municipal and industrial wastes.
5. Operate an activated sludge process that must treat strictly an industrial waste.
6. Conduct their duties in a safe fashion.

The purpose of this chapter is to teach students how to control an activated sludge process by controlling the return activated sludge (RAS) and waste activated sludge (WAS) rates. The chapter contains several sections written by industrial wastewater treatment facility operators. These sections describe the operators' own experiences in using activated sludge processes to treat wastewaters from various types of industries.

CHAPTER 4. SEQUENCING BATCH REACTORS

OBJECTIVES

Following completion of Chapter 4, students should be able to:

1. Describe each of the process stages used to treat wastewater in a sequencing batch reactor (SBR).
2. Place a new sequencing batch reactor in service.
3. Collect and analyze samples and make appropriate process adjustments during start-up and normal operation.
4. Safely operate and maintain a sequencing batch reactor.
5. Explain the main differences between a typical SBR and an intermittent cycle extended aeration system (ICEAS).
6. Review plans and specifications for a sequencing batch reactor.

The purpose of this chapter is to teach operators how to safely start up, operate, shut down, and maintain a sequencing batch reactor (SBR), including the intermittent cycle extended aeration system (ICEAS) modification of the standard SBR process. Operators will also learn what to look for when reviewing plans and specifications for an SBR installation.

CHAPTER 5. ENHANCED BIOLOGICAL TREATMENT

OBJECTIVES

Following completion of Chapter 5, students should be able to:

1. Explain how an enhanced biological treatment system can be used to improve biological treatment process control and performance.

2. Describe the luxury uptake of phosphorus process.
3. Safely start up, operate, and shut down a luxury uptake process.
4. Place a biological nitrogen removal system in service.
5. Safely operate a biological nitrogen removal system.
6. Sample influent and effluent, interpret lab results, and make appropriate adjustments in enhanced biological treatment processes.
7. Identify abnormal operating conditions, determine the cause, and take corrective action to ensure proper performance.
8. Review plans and specifications for an enhanced biological treatment system.

The purpose of this chapter is to show students how various modifications of the activated sludge process can be used to remove nitrogen and phosphorus from wastewaters and to enhance overall treatment results. Removal of phosphorus by the luxury uptake method is described in detail. The chapter also explains how to set priorities when it is necessary to accomplish more than one objective with a biological treatment system. System flexibility is an important consideration in enhanced biological treatment; therefore, this chapter presents an extensive review of the factors that should be considered when reviewing plans and specifications for such a system.

CHAPTER 6. ANAEROBIC TREATMENT

OBJECTIVES

Following completion of Chapter 6, students should be able to:
1. Explain the basic steps in anaerobic digestion.
2. Describe various types of anaerobic treatment systems.
3. List and discuss the factors that influence anaerobic treatment.
4. Start up, operate, and shut down an anaerobic treatment unit.
5. Troubleshoot the cause of an anaerobic process upset.
6. Conduct the basic laboratory tests used to monitor anaerobic treatment process performance.
7. Perform their duties in a safe manner.

The purpose of Chapter 6 is to explain how the anaerobic treatment process works. Students will learn the principles of anaerobic digestion and what factors affect digester performance. This chapter describes how to safely start up, operate, and shut down an anaerobic reactor, how to recognize abnormal operating conditions, and how to troubleshoot and correct problems. The chapter describes variations of attached growth (fixed film) systems as well as the components and operation of an upflow anaerobic sludge blanket (UASB) system.

CHAPTER 7. RESIDUAL SOLIDS MANAGEMENT

OBJECTIVES

Categories of residual solids management processes contained in this chapter include thickening, stabilization, conditioning, dewatering, volume reduction, and solids disposal. Following completion of Chapter 7, with regard to the processes in these solids handling and disposal categories, students should be able to:
1. Explain the purposes of the processes.
2. Properly start up, operate, shut down, and maintain these processes.
3. Develop operating procedures and strategies for both normal and abnormal operating conditions.
4. Identify potential safety hazards and conduct their duties using safe procedures.
5. Troubleshoot when a process does not function properly.

6. Review plans and specifications for the processes.

The purpose of Chapter 7 is to teach students about several of the most widely used methods for handling and disposing of wastewater treatment residual materials. The chapter teaches students how to operate thickening, stabilization, conditioning, dewatering, and volume reduction processes. It also describes methods for disposing of both liquid and solid industrial waste residuals and discusses the regulations that govern disposal of the wastes.

CHAPTER 8. MAINTENANCE

OBJECTIVES

Following completion of Chapter 8, 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.

TIME ASSIGNMENT

Text Pages: The course uses the training manual *Industrial Waste Treatment, Volume 2* (811 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.

Questions: The course contains 557 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 197 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 178 comprehensive review questions. Projected average response time is one minute per question.

Objective test questions: The course contains 357 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	811	3,244
Questions	2	557	1,114
Discussion questions	2	197	394
Review questions	1	178	356
Objective test questions	1	357	357
Total (minutes)			**5,465**
Total (hours)			**91**