

Small Wastewater System Operation & Maintenance, Vol. I
Office of Water Programs
California State University, Sacramento
(9.0 Continuing Education Units)

COURSE OBJECTIVE

This course is designed to train operators in the daily aspects of safely operating and maintaining small wastewater collection, treatment, and effluent discharge systems. The manual focuses on specific knowledge and skills needed to operate and maintain small wastewater systems as efficiently and effectively as possible. Process descriptions reflect the best current practices and procedures actually being used to operate and maintain small wastewater systems.

SCOPE

This course describes the roles and responsibilities of the operator and presents detailed descriptions of the equipment and processes commonly used in small community wastewater systems, including septic tanks, effluent and grinder pumps, and gravity, pressure, and vacuum collection systems. Treatment and disposal options discussed include sand and gravel filters, leach fields, seepage pits, mounds, and evapotranspiration systems. Other topics geared to the needs of small utility agencies include how to develop a maintenance program and how to set rates.

COURSE OUTLINE

The course uses *Small Wastewater System Operation & Maintenance, Vol. I* training manual.

CHAPTER 1. THE SMALL WASTEWATER SYSTEM OPERATOR

Following completion of Chapter 1, students should be able to:

1. Explain the type of work done by small wastewater system or on-site system operators.
2. Describe where to look for jobs in this profession.
3. Find sources of further information on how to do the jobs performed by small wastewater system or on-site system operators.

This chapter is designed to fire up the students' interest in being small wastewater system or on-site system operators and learning how to do the job properly and safely.

CHAPTER 2. SMALL COLLECTION, TREATMENT, AND DISPOSAL SYSTEMS

Following completion of Chapter 2, students should be able to:

1. Identify the major classifications of waste materials.
2. List the different types of solids in wastewater.
3. Explain the effects of waste discharges on humans and the environment.
4. Explain the purposes of on-site systems, small wastewater collection, treatment, and disposal systems.
5. Identify and describe the types of collection systems commonly used in small wastewater treatment systems.
6. Describe the typical wastewater flow pattern through conventional treatment processes.
7. Recognize and describe various types of wastewater package treatment plants.
8. Explain how wastewater can be disinfected.
9. Recall and list several common effluent and solids disposal methods.

The purpose of this chapter is to give students an overview of the various types of individual, on-site wastewater treatment and disposal methods as well as the types of wastewater collection, treatment, and disposal methods commonly used by small wastewater agencies.

CHAPTER 3. SAFETY

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

1. Identify the types of hazards you may encounter operating an on-site or a small wastewater system.
2. Recognize unsafe conditions and correct them whenever they develop.
3. Avoid physical injuries, infections, and diseases.
4. Identify confined space hazards.
5. Take necessary precautions prior to entering a confined space.
6. Inspect safety features of vehicles and equipment.
7. Drive vehicles defensively and safely.
8. Route traffic around a job site.
9. Protect yourself from electrical hazards.
10. Safely handle hazardous chemicals.
11. Use suitable methods to prevent excavation cave-ins.
12. Extinguish fires.
13. Protect yourself from excessive noise, dusts, fumes, mists, gases, and vapors.
14. Develop the habit of always thinking safety and working safely.

The purpose of this chapter is to make operators aware of the hazards associated with small on-site and wastewater systems and of the importance of always using safe procedures.

CHAPTER 4. SEPTIC TANKS AND PUMPING SYSTEMS

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

1. Describe the main components of a septic tank effluent pump (STEP) system.
2. Describe the main components of a grinder pump system.
3. Operate and maintain a STEP system.
4. Operate and maintain grinder pump (GP) systems.
5. Troubleshoot septic tank effluent pump and grinder pump system problems.
6. Develop a maintenance program for your system.
7. Safely perform your duties.

The purpose of this chapter is to teach operators how to operate, maintain, and troubleshoot septic tanks and septic tank pumping systems, including STEP (septic tank effluent pump) and GP (grinder pump) systems.

CHAPTER 5. WASTEWATER TREATMENT AND EFFLUENT DISPOSAL METHODS

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

1. Explain how sand filters work.
2. Safely operate and maintain a sand filter.
3. Safely operate and maintain a recirculating gravel filter.
4. Describe subsurface infiltration systems and how they work.
5. Monitor and control a subsurface leaching system.
6. Monitor and control seepage beds and pits.
7. Operate and maintain absorption mounds.
8. Operate and maintain evapotranspiration systems.
9. Safely perform your duties.

The purpose of this chapter is to teach operators how to safely operate and maintain intermittent and recirculating sand filters and recirculating gravel filters. It also explains how to operate and maintain subsurface wastewater infiltration systems, seepage beds and pits, absorption mounds and evapotranspiration systems.

CHAPTER 6. COLLECTION SYSTEMS

Following completion of Chapter 6, students should be able to:

1. Identify and describe the components of gravity, pressure, and vacuum collection systems.
2. Describe how gravity, pressure, and vacuum collection systems work.
3. Operate and maintain a small-diameter gravity sewer (SDGS) system, a pressure collection system, and a vacuum collection system.
4. Develop a maintenance program for your system.
5. Perform preventive and emergency maintenance on your system.
6. Troubleshoot problems in your system.
7. Accurately record and evaluate operation, maintenance, and cost information.
8. Safely perform your duties.

The purpose of this chapter is to teach operators how to operate and maintain four types of wastewater collection systems, including conventional gravity systems, small-diameter gravity systems, pressure systems, and vacuum systems. Operators will also learn how to troubleshoot a variety of common wastewater collection system problems.

CHAPTER 7. MAINTENANCE AND TROUBLESHOOTING

Following completion of Chapter 7, students should be able to:

1. Develop a preventive maintenance program for your on-site system, wastewater collection and/or treatment system.
2. Set up a maintenance recordkeeping system.
3. Use a systematic approach when troubleshooting equipment or system problems.
4. Recognize the serious consequences that could occur when inexperienced, unqualified or unauthorized persons attempt to troubleshoot or repair electrical panels, controls, circuits, wiring, or equipment.
5. Properly select and safely use the following pieces of equipment (if qualified and authorized):
 1. Multimeter
 2. Ammeter
 3. Megger
 4. Ohmmeter
6. Communicate effectively with electricians.

NOTE: Previous chapters present special maintenance information for specific types of collection systems and treatment processes. This chapter focuses on two key elements of a small wastewater utility operator's job. First, it focuses on the importance of establishing a maintenance program for a utility and provides guidelines for developing an effective program. Second, this chapter teaches operators a strategy for

troubleshooting problems in their wastewater systems, with particular emphasis on electrical problems.

CHAPTER 8. SETTING RATES FOR SMALL WASTEWATER UTILITIES

Following completion of Chapter 8, students should be able to:

1. Determine revenue needs for a small utility.
2. Itemize various system expenses.
3. Relate costs to level of service.
4. Distribute costs to customers.
5. Keep accurate records of costs and sources of revenues.
6. Develop rates for a small wastewater utility.
7. Provide stable financial management for a small utility.
8. Determine where and how to look for sources of financial assistance.

The purpose of this chapter is to teach operators how to evaluate the financial stability of their utility, determine the revenue needs of the utility, and develop a fair and equitable rate structure that generates sufficient revenue.

TIME ASSIGNMENT

Text Pages: The course uses the training manual *Small Wastewater System Operation and Maintenance, Volume I* (506 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 12 wastewater treatment math problems. Projected average time to solve each math problem is three minutes.

Questions: The course contains 264 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 117 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 146 comprehensive review questions. Projected average response time is one minute per question.

Objective test questions: The course contains 345 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	506	2,024
Math problems	3	12	36
Questions	2	264	528
Discussion questions	2	117	234
Review questions	1	146	146
Objective test questions	1	345	345
Total (minutes)			3,313
Total (hours)			55