Membrane Bioreactors California State University, Sacramento (2.1 Continuing Education Units)

COURSE DESCRIPTION

This course is designed to train operators in the practical aspects of operating and maintaining membrane bioreactor processes emphasizing safe practices and procedures. Information is presented on membrane bioreactor systems, facility safety, process control parameters, commissioning, treatment trains, preliminary treatment flow equalization, bioreactor configurations and operation, disinfection, sludge handling, system maintenance, and troubleshooting.

COURSE OUTLINE

This course provides wastewater treatment system operators with the knowledge and skills needed to operate and maintain municipal membrane bioreactor facilities safely and effectively.

Chapter 1, Introduction to Membrane Bioreactors

Learning Objectives

- 1. Classify membranes and explain which are most commonly used for municipal wastewater treatment and why.
- 2. Recognize unsafe conditions and know how to address them when they develop.
- 3. Describe process control parameters and explain how to use them to optimize MBR system performance.
- 4. Describe an operator's role in reviewing plans and specifications for, and in commissioning and startup of, an MBR system.

The main purposes of this chapter are to give an overview of municipal membrane bioreactor systems and facility safety and to inform operators about MBR process control parameters, commissioning, and startup.

Chapter 2, Operation and Maintenance

Learning Objectives

- 1. Describe process train components and configurations of MBR systems typically used to treat municipal wastewater.
- 2. Explain the mechanisms of membrane fouling and how it negatively affects MBR system performance.
- 3. Identify cleaning and mitigation strategies commonly used to prevent and remove fouling from membrane surfaces.
- 4. Describe maintenance activities particular to MBR processes that maximize asset operating life and optimize system performance.
- 5. Identify typical MBR troubleshooting and shutdown strategies.

The main purpose of this chapter is to train operators in the basic operation and maintenance of MBR systems.

TIME ASSIGNMENT

Text pages: The content from the training manual used in this course, *Membrane Bioreactors*, includes 166 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 17 math example problems. The projected average time to solve each math problem is 3 minutes.

Section questions: The course contains 78 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 100 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 100 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	166	×	4	=	664
Math example problems	17	×	3	=	51
Section questions	78	×	2	=	156
Chapter review questions	100	×	2	=	200
Objective test questions	100	×	2	=	200
					1,271 minutes
					21.2 or 2.1 hours