Membrane Bioreactors
Office of Water Programs
California State University, Sacramento
(1.0 Continuing Education Units)

COURSE DESCRIPTION

This course is designed to train operators to safely and effectively operate, maintain, and troubleshoot the membrane bioreactor wastewater treatment process.

SCOPE

The membrane bioreactor (MBR) wastewater treatment process uses a suspended growth bioreactor (typically found in activated sludge treatment processes) coupled with a membrane filtration process such as microfiltration or ultrafiltration. This manual describes the MBR process; explains how to operate, maintain, and troubleshoot the process; stresses safe procedures for cost-effective operation and maintenance (O&M); and helps operators develop strategies for correcting MBR failures. The manual covers how computer technology, including SCADA, can be used to perform MBR process control functions. Also included are procedures for implementing a comprehensive start-up, commissioning, and training phase prior to the complete transfer of an MBR plant to O&M staff.

COURSE OUTLINE

The course uses *Membrane Bioreactors* training manual.

TABLE OF CONTENTS:

LEARNING OBJECTIVES:

1. Describe the membrane bioreactor (MBR) wastewater treatment process.
2. Describe the advantages and limitations of MBR systems over conventional biological treatment systems.
3. Explain the biological nutrient removal process.
4. Safely operate and maintain an MBR treatment plant.
5. Apply strategies to correct MBR failure modes.

6. Use computer technology such as a supervisory control and data acquisition (SCADA) system to perform MBR process control functions.
7. Provide a comprehensive start-up, commissioning, and training phase prior to the complete transfer of an MBR plant to the O&M staff.
8. Identify the types of safety hazards at MBR plants and observe precautionary safety measures at all times.

APPENDIX:

- Comprehensive Review Questions and Suggested Answers
- Index

TIME ASSIGNMENT

Text Pages: The course uses the training manual *Membrane Bioreactors* (51 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. 4 X 51 = 204

Questions: The course contains 54 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 20 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 48 comprehensive review questions. Projected average response time is one minute per question.

Objective test questions: The course contains 38 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	51	204
Questions	2	54	108
Discussion questions	2	20	40
Review questions	1	48	48
Objective test questions	1	38	38
Total (minutes)			**438**
Total (hours)			**7.3**