University Curriculum Development for Decentralized Wastewater Treatment

Water Reuse

Suggested Course Materials

Dr. Bruce Lesikar
Byonghi Lee
Don Waller
Erin Lyons

Final

September 22, 2003

Acknowledgements

This work was supported [in part] by the National Decentralized Water Resources Capacity development Project with funding provided by the U.S. Environmental Protection Agency through a Cooperative Agreement (EPA No. CR827881-01-0) with Washington University in St. Louis. The views expressed in these materials are solely those of NCSU, and University of Arkansas and EPA and Washington University in St. Louis do not endorse any products or commercial services mentioned in the materials.

Water Reuse
Suggested Course Materials

Table of Contents

Water Reuse
Agenda

UNDER DEVELOPMENT

Water Reuse
Overview

This module provides students a basic understanding of the mechanisms for reclaiming wastewater to reduce fresh water usage. The concepts of wastewater recovery, wastewater recycling and wastewater reuse are presented. Examples of each type of wastewater reclamation is discussed in an effort to assist the student gain a better understanding of each concept and development of a functional knowledge of the processes.

Decentralized wastewater treatment systems can effectively reclaim water in the hydrologic cycle. The various technologies discussed in other modules are capable of treating and dispersing this resource into the environment. This module can build the interest of the students for learning about the available technologies.

Since wastewater contains constituents with potential health and environmental risks, proper management is essential for safe and effective use of this resource. Design, management, and operational requirements are necessary to ensure the safe implementation of these processes.

Water Reuse

Outline

I. Wastewater as a Resource

- A. The Hydrologic Cycle
- B. Fresh Water Supply and Demand
- C. Water Recycling Possibilities

II. Applications for Reclaimed Water

- A. Wastewater Recovery
  - 1. Greywater Reuse
  - 2. Sudsaver
- B. Wastewater Recycling
  - 1. In-facility use
  - 2. Total Recycle/Non-Discharging/Closed Loop
- C. Water Reuse
  - 1. Irrigation
    - a. Agricultural Irrigation
    - b. Landscape Irrigation
    - c. Golf Courses
    - d. Sports Fields
  - 2. Water Features
  - 3. Parks
  - 4. Snow Generation
  - 5. Groundwater Recharge
    - a. Surface Spreading
    - b. Direct Injection

6. Preventing Saltwater Intrusion

7. Aquifer Storage and Recover (ASR)

8. Construction Uses

9. Fire Protection

a. Greenbelts

b. Storage

III. Design Considerations

A. System Reliability and Redundancy

B. Site Loading

IV. Management

A. Record-keeping

B. Signage

C. Cross-connection Control

V. Operation

A. Certified Operators

B. Sampling and Testing

VI. Public Health Considerations

A. Inorganic and Organic Constituents in Wastewater

B. Emerging Organics

Pathogenic Organisms

C. Infective doses

D. Inactivation of Pathogens

VII. Public Education

VIII. Definitions

Water Reuse
Goals

The goal for this module is to provide students a basic understanding of the mechanisms for reusing wastewater to reduce fresh water usage. Since wastewater contains constituents with potential health and environmental risks, proper management is essential for safe and effective use of this resource.

Water Reuse
Learning Objectives

Upon completing this module, students will have:

a. A fundamental understanding of how wastewater can be reused,
b. An understanding of potential health risks associated with wastewater reuse
c. A functional knowledge of the mechanisms for reuse and the critical constituents to be evaluated to see if the wastewater is suitable for reuse through that mechanism.

Water Reuse
Prerequisites

Water Reuse
Evaluation Form

Reviewer: _____

We are requesting your assistance in reviewing the modules developed through the On-Site Consortium curriculum project. Please complete the following form while reviewing the materials

With a rating scale of 1 (Disagree) to 5 (Agree), please respond to the following questions

Review of printed materials:

	Disagree Agree
The text completely covers the topic area.	1 2 3 4 5
The visuals completely cover the topic area.	1 2 3 4 5
The discussion notes completely cover the topic area.	1 2 3 4 5

Review of learning objectives:

I gained a better understanding of how wastewater can be reused.	1 2 3 4 5
I gained a better understanding of potential health risks associated with reuse.	1 2 3 4 5
I gained a better understanding of critical contaminants needing treatment.	1 2 3 4 5

What specific recommendations would you provide for the text. _____
_____
_____
_____

What specific recommendations would you provide for the visuals._____
_____
_____
_____

What specific recommendations would you provide for the notes. _____
_____
_____
_____

Please give specific positive comments on the topic/module. _____
_____
_____

Water Reuse
Problem Sets

Water Reuse
Problem Sets with Answers