

ENE 486 Design of Hazardous & Solid Wastes Engineering System

Fall 2010 Course Syllabus

Class	Thursday	6:30-9:10pm	KAP 141
Professor	Rezvan Ramezani		
Office			
Phone	(909) 396-2701 Work — (310) 932-8341 Cell		
Email	rezvanra@usc.edu		
Office Hours	Thursday 5:30-6:30 or by Appointment		
Prerequisites	ENE 400 (Environmental Engineering Principles)		
Textbooks	<ol style="list-style-type: none">1. Hazardous Wastes: Sources Pathways Receptors by Richard J. Watts ISBN: 97804710023832. Hazardous Waste Management, by Wentz. ISBN: 9780070692916		
Supplemental	Additional material will be posted on weekly basis		
Course Objectives	This course is designed to provide students with the necessary background and knowledge pertaining to the engineering design of solid and hazardous waste facilities.		
Learning Objectives	The course consists of three major components. The first component of the class includes three main parts which are devoted to the following: (1) the description of waste generation, effects of improper management, and management options, (2) related legislation and regulations for facility design, and design criteria, and (3) future trends in waste management. The second component is devoted to solid waste engineering, consisting of engineering principles and actual design cases for major solid waste management facilities, such as transfer stations, sanitary landfills, incinerators, material and energy facilities, etc. The third component will be devoted to hazardous engineering, covering related engineering principles and actual design cases for major hazardous management facilities, such as waste minimization, secured landfills, thermal, chemical, physical, and biological treatment facilities, site remediation facilities, and radioactive waste treatment/remediation facilities, etc.		

Synopsis:

In ENE 4846, the course realizes that owing to the fact that there are wide varieties of solid and hazardous waste management facilities available; therefore, the course will focus on major facilities which are widely used currently, and give a general discussions on other relatively less practiced technologies. Type of facilities will include treatment, storage and disposal facilities for both solid and hazardous wastes. For hazardous waste engineering, the “uncontrolled hazardous waste site” remediation facilities will be also included. For major facilities, the theories, parameters, and procedures associated with the design will be presented in detail. Field trips and evaluation of actual design cases will be provided so students can gain practical knowledge on the subject.

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Course Outline and Schedule

PART I. INTRODUCTION

Week (8-26-10)

1. Waste Definition, Generation, Effects, Management Options and Future Trends(1.5 week)
 - General and legal definitions
 - Waste Compositions and classifications
 - Waste generation
 - Effects of in-proper management
 - Management options
 - Future Trends

Week (9-2-10)

2. General Siting and Design Criteria (1.5 week)
 - RCRA-C and D siting and design requirements
 - CERCLA/SARA siting and design requirements
 - Other federal and state legislation and regulation siting and design requirements
 - Summary: Siting criteria
 - Summary: Design criteria

PART II. SOLID WASTE ENGINEERING

Week (9-9-10)

3. Principles and Design of Transfer and Transport Facilities (1/2 week)
 - Objective of transfer stations
 - Types, siting and design criteria of transfer stations
 - Design cases

Week (9-16-10)

4. Principles and Design of Sanitary Landfills (2 weeks)
 - Landfilling methods
 - Design goals, basis, and variables
 - Design of landfill cover and drainage/liner systems
 - Design of landfill gas migration control and recovery systems
 - Design of leachate control and treatment systems
 - Other design variables
 - Design cases

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Week (9-23-10)

5. Principles and Design of Material Recovery Facilities (1 week)
 - Types and objectives of material recovery systems
 - Principles, functions, equipment selection and comparisons, design criteria, and operation of different material recycling processes
 - Integrated and specific recycling plants
 - Design cases

Week (9-30-10)

6. Principles and Design of Energy Recovery Facilities (1 week)
 - Types and principles of energy conversion processes
 - Incinerator design
 - Design of other thermal energy conversion systems
 - Design cases

PART III. HAZARDOUS WASTE ENGINEERING

Week (10-7-10)

7. Principles and Design of Waste Minimization Facilities (1 week)
 - Principles and techniques of Waste minimization
 - Examples of waste types and phase separation processes
 - Design criteria and examples

Week (10-14-10)

8. Principles and Design of Hazardous Waste Landfills (1 week)
 - Design configurations and site selection
 - Design of final cover, intermediate cover and drain/liner systems
 - Design of gas and leachate control and treatment systems
 - Design cases

Week (10-21-10)

9. Principles and Design of Hazardous Waste Storage Facilities (1/2 week)
 - Types and design criteria
 - selection and design of storage facilities
 - Design of containment, run-on/run-off management systems
 - Design examples

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Week (10-28-10)

10. Principles and Design of Thermal Treatment Facilities (1 week)
 - Status, types, principles, equipment used, application ranges, and comparisons of different thermal treatment technologies
 - Design of incinerators
 - Design of other thermal systems
 - Design cases

Week (11-4-10)

11. Principles and Design of Chemical/Physical/Biological Treatment Facilities (1 week)
 - Status, types, principles, equipment used, application ranges, and comparisons of different treatment facilities
 - General design criteria and special requirements
 - Design cases

Week (11-11-10)

12. Principles and Design of Site remediation Facilities (1 week)
 - Status, types, principles, equipment used, application ranges, and comparisons of different site remediation technologies
 - Remedial investigations and feasibility studies
 - Soil remediation design examples
 - Groundwater remediation design examples

Week (11-18-10)

13. Principles and Design of Radioactive Waste Treatment/Site Remediation Facilities (1 week)
 - Status, Types, technologies, principles, applications
 - Treatment Technologies
 - Site Remediation Technologies
 - Case Examples

Week (11-25-10) Thanksgiving Holiday

Week (12- 2 through 16-10)

FIELD TRIPS

TERM PROJECTS

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FINAL EXAM

Final Exam: Thursday, December 2, 6:30 – 9:00 PM

Term Project should be around 10 pages and contain at least 5 references and are due on November 18, 2010. The subject of report should be approved by Lecturer. Each student should present his/her report in the class (15 minutes presentation). More on that as the time gets close.

Students in groups of two to four will be required to work on two term projects (design of complete waste management facilities). Homework problems will be assigned throughout the entire course.

GRADING CRITERIA

Item	% of Final Grade
Class Participation	10%
Homework	20%
Midterm Exam	20%
Final Exam	20%
Term Projects	30%

Statement for Students with Disabilities

Any student requesting academic accommodations based on a disability is required to register with Disability Services and Programs (DSP) each semester. A letter of verification for approved accommodations can be obtained from DSP. Please be sure the letter is delivered to me (or to TA) as early in the semester as possible. DSP is located in STU 301 and is open 8:30 a.m.–5:00 p.m., Monday through Friday. The phone number for DSP is (213) 740-0776.

Statement on Academic Integrity

USC seeks to maintain an optimal learning environment. General principles of academic honesty include the concept of respect for the intellectual property of others, the expectation that individual work will be submitted unless otherwise allowed by an instructor, and the obligations both to protect one's own academic work from misuse by others as well as to avoid using another's work as one's own. All students are expected to understand and abide by these principles. *Scampus*, the Student Guidebook, contains the Student Conduct Code in Section 11.00, while the recommended sanctions are located in Appendix A: <http://www.usc.edu/dept/publications/SCAMPUS/gov/>. Students will be referred to the Office of Student Judicial Affairs and Community Standards for further review, should there be any suspicion of academic dishonesty. The Review process can be found at: <http://www.usc.edu/student-affairs/SJACS/>.

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REFERENCES

1. Legislation: RCRA, CERCLA/SARA and California State related legislation (current issues).
2. Related Code of Federal Regulations and California Code of Regulations (current issues).
3. Kreith, F. (Editor in Chief), Handbook of Solid Waste Management, McGraw-Hill, Inc. (1994).
4. Tchobanoglous, G., Theisen, H., and Eliassen, R., Solid Wastes Engineering Principles and Management Issues, McGraw-Hill, Inc. (1993).
5. Theodore, L., Reynolds, J. P., Introduction to Hazardous Incineration, John Wiley & Son (1987).
6. Freeman, H. M., Standard Handbook of Hazardous Waste Treatment and Disposal, McGraw-Hill, Inc. (1997).
7. Wentz, C. A., Hazardous Waste Management, McGraw-Hill, Inc. (1995).
8. Rossiter, A. P. (Editor), Waste Minimization Through Process Design, McGraw-Hill, Inc. (1995).
9. Wong, J., Nolan, G. L., Design of Remediation Systems, Lewis Publishers, Inc. (1997).
10. Berlin, R. E., Stanton, C. C., Radioactive Waste Management, John Wiley & Sons (1989).
11. Deviny, J. S., Everett, L. G., Lu, J. C., Stollar, R. L., Subsurface Migration of Hazardous Wastes (1990).
12. Lu, J. C., et. al., Production and Management of Leachate from Municipal Landfills: Summary and Assessment.
13. Design cases (to be provided in the class).