

Introduction to Hazardous Waste Management
CHEE/C E 478/578 (3 units)

Spring 2016



Course

Description: This course covers management, planning, legal and engineering aspects of liquid and solid hazardous waste treatment and disposal.

Lecture: Tuesday & Thursday from 12.30 -1.45 PM; Mines & Metallurgy, Rm 221

Instructor: Dr. Reyes Sierra; room 130, Harshbarger building.
Office hours: by appointment (rsierra@email.arizona.edu)

TA: TBD

Office hours TBD

Web page: D2L

Text book: **Required:** Hazardous Wastes: Sources, Pathways, Receptors
Richard J. Watts
John Wiley & Sons, Inc.; New York; January 1998, ISBN: 0-471-00238-0

Good reference book (not required): Hazardous Waste Management.
LaGrega et al. (2nd Edition). 2001; McGraw-Hill, ISBN. 0-07-039365-6
Readers will be used to supplement some classes. Readers will be posted in the course web site several hours before the class.

Field trips: (1) Local hazardous waste remediation site

Homework: There will a number of homework assignments during the semester, and a due date is provided with each. Homework is due on the due date at the BEGINNING of class. Penalties for homework handed in late are:

- One day or less: 30% off
- 2 to 3 days: 50% off.
- More than 3 days: no credit.

Grading:

| | 400-level | 500-level |
|---------------|------------------|------------------|
| Midterm exams | 25%, 25% | 20%, 20% |
| Final exam | 30% | 30% |
| Homework | 20% | 15% |
| Term paper | | 15% |

Exam Guidelines and Policy

Exam Resources: A **single** 8.5 inch by 11.0 inch sheet of paper may be brought to each exam with any equations, information, worked problems, etc. the student feels useful. The paper may be typed or handwritten, and both sides may be used. One or more sheets of conversion factors, constants, numerical values, etc. will be handed out with the test. These will **NOT** include equations.

Late Exams: No make-up exams will be given except by prior arrangement with the instructor, at least, one week before the scheduled exam time.

IMPORTANT DATES AND DEADLINES

| DATE | Exam or Date due |
|---------------------------|--|
| Febr. 16 (Tu) | Selection of topic for term paper (only 500-level) |
| Febr. 25 (Th) | Exam # 1 |
| March. 8 (Tu) | Turn in list of literature citations for term paper (only 500-level) |
| March 24 (Th) | Turn in outline term paper (only 500-level) |
| April 12 (Tu) | Exam # 2 |
| April 28 (Th) | Written term paper due (only 500-level) |
| April 28 (Th) & May 3 (T) | Graduate student presentations |
| May 11 (W) | Final examination (Lec. 1 to end): 1.00 – 3:00 PM |

PRELIMINARY COURSE SCHEDULE

Topic

- Course outline, policies, overview
 - Case histories of hazardous waste mismanagement
 - Hazardous waste laws and regulations
 - Toxic and hazardous substances : nomenclature and sources
 - Hazardous waste: properties and classification
 - Fate of hazardous substances in the environment:
 - (bio)sorption
 - volatilization
 - abiotic and biotic transformations
 - Hazardous waste toxicology
 - Hazardous waste risk assessment
 - Approaches to hazardous waste minimization, remediation, treatment and disposal
 - Landfill disposal
 - Hazardous waste solidification and immobilization
 - Bioremediation processes
 - Design of sorption processes: granular activated carbon
 - Volatilization design: Stripping
 - Advanced oxidation processes
 - Reactive barrier walls for the remediation of groundwater
 - *Tour of contaminated site and remediation facilities*
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INDIVIDUAL PROJECT (Only 500-level students)

Students must prepare a literature review on a particular hazardous pollutant (or class of pollutants) and a method commonly used for its remediation, treatment or disposal. Students should indicate their preferences not later than **February 16th**. Please consult with the instructor on your decision. You will give an oral presentation on the topic to the class. In addition, you are required to prepare a term paper.

- You should review at least 8 articles from literature (preliminary selection of articles due on **Tuesd., March 8th**)
- Outline of term paper due on **Th March 24th** (one page listing the main topics to be addressed).
- The term paper must be submitted on **Th April 28th**. **8-12 pages** (excluding references, cover page and table of contents). Any appropriate, clearly legible, typeface may be used of 12 point. Lines should be 1.5 spaced. The term paper will be organized as follows:

Cover page
Table of Contents
Abstract/Summary (maximum 1/2 page)

Introduction and background
Objectives: (objectives of your literature study)
Results (what is known from research papers on the topic, design/operation/application of the selected method)
Discussion (what are the potentials and limitations of the treatment system considered, what research still needs to be done)
Conclusions and recommendations
References
Appendices, if any (not to exceed 5 pages)

- Oral report presentation (April 28th and May 3th)
 1. Power Point presentation, approx. 12 minutes
 2. Question/Answers session: max. 3 minutes

Additional Policies, Warranties and Disclaimers:

- 1) Students are expected to attend lectures.
- 2) All holidays or special events observed by organized religions will be honored for those students who show affiliation with that particular religion; Absences pre-approved by the UA Dean of Students (or Dean's designee) will be honored. Also absences due to medical or family emergencies will also be excused.
- 3) Treat speakers with respect and in a professional manner. **Do not arrive late to class** and give the speakers your attention (e.g. no texting, emailing, etc.)
- 4) Cell phones, pagers, and other electronic devices must be turned off before the start of class. If using such devices to take notes, please put switch to airplane mode.
- 5) Integrity is expected of every student in all academic work. Scholastic dishonesty will not be tolerated. Please refer to the [UA Code of Academic Integrity](#) for information about procedures and about what constitutes scholastic dishonesty.
- 6) There is no tolerance for threatening behavior by students: See: [Threatening Behavior by Students](#) and [Disruptive Behavior in an Instructional Setting](#).
- 7) **Accommodations for students with disabilities:** It is the University's goal that learning experiences be as accessible as possible. Students who need special accommodation or services should contact the Disability Resources Center, 1224 East Lowell Street, Tucson, AZ 85721, (520) 621-3268, FAX (520) 621-9423, email: uadrc@email.arizona.edu, <http://drc.arizona.edu/>. You must register and request that the Center or DRC send me official notification of your accommodations needs as soon as possible. Please plan to meet with me by appointment or during office hours to discuss accommodations and how my course requirements and activities may impact your ability to fully participate. *The need for accommodations must be documented by the appropriate office.* Please be aware that the accessible table and chairs in this room should remain available for students who find that standard classroom seating is not usable.
- 8) **Special materials required for the class:** none
- 9) **Confidentiality of Student Records** <http://www.registrar.arizona.edu/ferpa/default.htm>
- 10) **Final Exam Regulations:** <http://www.registrar.arizona.edu/schedule101/exams/examrules.htm>.
- 11) **Subject to Change Statement:** The information contained in the syllabus (except grade and absence policies) may be subject to change with reasonable advance notice, as deemed appropriate by the instructor.