

# Environmental Soil Chemistry

## Help Clean up the Environment and Feed the World

Soil Chemistry is the study of the composition, properties and chemical reactions of soils. Many of the same chemical principles that apply to decontaminating soil also pertain to efficient fertilizer use and optimizing crop growth. This Soils course is cross-listed under Chemistry and Geology which illustrates the interdisciplinary nature and applicability of the subject.

The learning objectives of this class are to describe and articulate

- the solid and liquid phases in soil;
- the chemical reactions and processes that occur between these phases;
- how these processes can be used to promote plant productivity and soil remediation, including techniques and calculations.

### How to Earn a Good Grade...

Grades are based on homework (40%), weekly quizzes (30%), a midterm and comprehensive final exam (15% each). Homework grades will be reduced by 2% per day when past due. Do NOT put your late homework under my office door! Put it in my departmental mailbox in Skeen 127N. Students enrolled in 479 will write a review paper and they may have more in-depth problem sets than 424 students. Letter grades will be assigned according to the following:

90-100% = A; 80-89% = B; 70-79% = C; 60-69% = D

**...do the homework, attend the lectures, and read.**

Attendance in lecture is strongly encouraged. If a student is borderline between letter grades, consideration will be given to class attendance and participation. I welcome questions and discussion for the entire class, but not between individuals. Please be considerate of your classmates and me. **Turn your cell phones off when in class.**

**Grade disputes:** Except for a point tally error, which should be reported immediately, if you have a disagreement with the key or with the amount of partial credit you receive on a problem or assignment, plead your case in writing and submit for a response within one week of the return of your exam or assignment. Include a copy of the problem(s) or assignment in question.

### PREREQUISITES:

- General Chemistry (CHEM 111, 112)
- Introduction to Soil Science (SOIL 252, 252L)

*~If you have not had Introductory Soils then you will be at a disadvantage in this class, if you insist on waiving that prerequisite be prepared to supplement your reading with a good soil science textbook (i.e. Brady and Weil; Singer and Munns)~*

Instructor: **April L. Ulery, Ph.D.**  
Phone: 575-646-2219  
Email: aulery@nmsu.edu  
Office: Skeen Hall N340  
Hours: T & Th 2 - 3 pm;  
or by appointment.

~

## Basic Course Outline

- I. Overview of Soil Chemistry
  - A. Soil Contamination & Remediation
  - B. Chemistry Applied to Soil
- II. Description of Soil Components
  - A. Inorganic Solids and Soil Mineralogy
  - B. Soil Organic Matter
  - C. Soil Solution
- III. Processes and Properties Important in Soils
  - A. Chemical Weathering
  - B. Acidity and pH
  - C. Ion Exchange
    - CEC and AEC
    - pH-dependent charge
  - D. Sorption
    - Inner sphere and outer sphere complexes
    - Sorption isotherms
    - $K_{oc}$ ,  $K_d$ , and partition coefficients
  - E. Redox Chemistry
    - **reduction** and **oxidation** reactions
  - F. Salinity and Alkalinity

### Textbooks and useful references:

- \* \*\*Sparks, D.L. 2003. *Environmental Soil Chemistry* 2<sup>nd</sup> Ed., Academic Press, San Diego, CA
- Essington, M.E. 2004. *Soil and Water Chemistry, An Integrative Approach*. CRC Press. Boca Raton.
- \*\*Bohn, McNeal, O'Connor. 1985 or 2001. *Soil Chemistry* 2<sup>nd</sup> or 3<sup>rd</sup> Ed., Wiley & Sons, New York, NY.
- Sposito, G. 1989. *Chemistry of Soils*, Oxford Univ. Press, New York, NY.
- Evangelou, V.P., 1998. *Environmental Soil and Water Chemistry*, Wiley & Sons, New York, NY.

\*Available in NMSU bookstore or on-line.

\*\*Available in the Branson Library.

Class meets every  
M, W, F  
11:30 am to 12:20 pm  
GT 190

Final Exam is Wed., Dec. 9,  
10:30 am to 12:30 pm

*Holidays:*  
Mon., Sep. 7  
Thanksgiving Holiday:  
Nov. 23 - 27

Last day to add class:  
Tues., Sep. 1

Last day to withdraw:  
Wed., Oct. 14

### Students with Disabilities

If you have, or believe you have, a disability and would benefit from accommodations, you may wish to self-identify. You can do so by providing documentation to the Services for Students with Disabilities (SSD) Office located in Corbett Ctr (phone: voice 646-6840, TTY 646-1918). If you are already registered with the SSD office and need accommodations please provide your "Accommodation Memo" from the SSD within the first two weeks of class.

If you have a condition that may affect your ability to exit safely from the premises in an emergency or that may cause an emergency during class, you are encouraged to discuss this in confidence with the instructor and/or the Coordinator for SSD. All information will be held in strict confidence.

~

### ***Quizzes and Midterm***

Weekly quizzes will be given during the first 10 minutes of every Wednesday class and will cover material from the homework and lectures. I will drop the two lowest quiz scores. Bring calculators to class to work problems. **The midterm exam will be on Wed., Nov. 4.**