

**Southern Connecticut State University****Department of Chemistry**

**Instructor:** Dr. Gregory S. Kowalczyk

Office: 315 Jennings Hall

Phone: 203-392-6268

E-Mail: KowalczykG1@Southernct.edu

Web Page: <http://www.geocities.com/kowalczg>

**Course Title:** CHE 547 - Special Topics in Analytical Chemistry: Environmental Chemistry

**Prerequisite:** Undergraduate Physical Chemistry

**Lectures:** M: 5:30 - 8:00 pm (314 Jennings Hall)

**Office Hours:** M, W, F: 10:00 - 11:00 am

M: 3:00 - 5:00 pm

**Course Description:** This course will examine a number of topics in environmental chemistry in detail emphasizing the analytical chemistry of the topic. This course is designed to give students a working knowledge of environmental chemistry in the industrial and regulatory environment. The textbook for this course is suggested but not required. Topics in this course will be discussed in much further detail than in the textbook. Realizing that most students enrolled in this course have not taken undergraduate environmental chemistry, this course is designed to take that into account. However, knowledge of physical chemistry including chemical equilibrium, kinetics and thermodynamics is required. References applicable to material covered in class will be given when topics are discussed.

**Course Objectives:** Upon completion of this course, students will:

1. Have an understanding of the analytical methods for analysis of various types of environmental samples.
2. Know how to conduct proper environmental sampling methodology.
3. Become familiar with federal regulations governing hazardous waste, site remediation and sampling methodology.
4. Learn analytical procedures required for proper certification of sample results.
5. Adapt procedures and regulations to environmental problem solving.

**Modes of Instruction:**

The course will be conducted as primarily a lecture. In addition to lectures by the professor, guest speakers from industry will present talks relevant to topics being discussed in class. These talks are designed to give the students an opportunity to see how class topics are applied in the corporate and regulatory environment. Students are expected to participate in discussions and class problem solving.

**Course Outline:**

Week 1, 2: Review of analytical instrumentation used in modern laboratories for analysis of environmental samples

Week 3, 4, 5: Sampling methodology and analysis protocol of environmental samples

Week 6, 7: Municipal and Industrial Wastewater Operations, Clean Water act

Week 8, 9: Hazardous waste analysis, Resource Conservation and Recovery Act

Week 10, 11: Environmental transport of pollutants, heterogeneous equilibrium in the environment

Week 12, 13: Atmospheric chemistry, criteria pollutants, Clean Air Act

Week 14, 15: Environmental remediation, Superfund sites, Comprehensive Environmental Response, Compensation and Liability Act

**Course Requirements:**

Students are expected to attend all classes. Much of the reading material for this course will be from a variety of regulatory publications such as the *Code of Federal Register* and analytical references such as *Standard Methods for the Examination of Water and Wastewater* (See Bibliography). There will be several written assignments during the semester. These will contain a combination of calculation and research problem solving.

There will be take-home mid-term and final exams.

A paper written on any aspect of environmental chemistry is required for this course. The paper is to be 10-15 pages in length including footnotes and bibliography and must be typed. A minimum of five primary references must be used. The topic of the paper is chosen by the student but must be approved by the instructor no later than the fourth meeting of the class. All papers are due no later than class time on the last day of class. The subject matter of the paper must discuss the chemistry of the topic. Some suggestions for the paper are listed below, but feel free to choose your own topic. No two students may write on the same topic.

Formation of Secondary Aerosols in the Atmosphere

Decomposition Products of (pesticides, PAHs, etc.) in (soils, water).

Aerobic (and/or) Anaerobic Decomposition of Biomass

Photolysis reactions of (OM, PAH, IM, Terpenes) in the Environment

The Environmental Chemistry of (PAH, heavy metals, Cu) in (air, water, soil)

Microbiologically Mediated Reactions in Aquatic Systems

Artifact Formation in Air Sampling

Sources of contamination (and/or) spurious reactions during aquatic sampling

The Role of Colloids in Environmental Chemistry

Metal Speciation in Aquatic Systems

## Matrix Effects of Environmental Sampling

Aerobic/Anaerobic bioremediation of (PAH, HC, PCB, OM)

### **Evaluation:**

Assignments: 20%

Mid-term exam: 25%

Written Paper: 30%

Final exam: 25%

The final grade in the course will be based on the Southern Connecticut State University grading scale.

### **Bibliography:**

1. Office of the Federal Register, *Code of Federal Regulations*; U.S. Government Printing Office: Washington, DC.
2. United States Environmental Protection Agency, *SW-846 Manual*;  
<http://www.epa.gov/epaoswer/hazwaste/test/sw846.htm>.
3. Keith, Lawrence H., *Compilation of EPA Sampling and Analysis Methods, Second Edition*; CRC Press: Boca Raton, 1996.
4. Clesceri, Lenore S., *Standard Methods for the Examination of Water and Wastewater, Twentieth Edition*; American Public Health Association: Washington, DC, 1998.
5. Keith, Lawrence H., *Environmental Sampling and Analysis: A Practical Guide*; Lewis Publishers: Chelsea, MI, 1991
6. vanLoon, Gary W., Duffy, Stephen J., *Environmental Chemistry A Global Perspective*; Oxford University Press: Oxford, UK, 2000.