

Environmental Analytical Chemistry
(ENERGY, POWER AND ENVIRONMENT)
CHEM 6284/CHEM 4803
Fall 2010
3 credit hours

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Since the dawn of history the development of society has been intertwined with production and consumption of energy. As the global population grows, so does the demand for energy and power. Strictly speaking, the total amount of energy in the Universe is constant and its origin is entirely nuclear. The issue is therefore the energy transformation from one usable form to another and the environmental cost of this transformation and usage. The balance between demand for energy and the environmental impact calls for hard choices in the social sphere. Unfortunately, those choices are often driven by political expediency and/or irrational emotions rather than by the sound scientific principles. Since its large-scale introduction half a century ago, intense and often confrontational dialog has developed around the military and the civilian aspects of nuclear energy and power. The science and engineering have played a key role in making the nuclear energy available. At the same time nuclear energy has created extraordinary responsibilities for scientists and engineers to deal with the consequences of this development.

The aim of this course is to discuss nuclear energy, both civilian and military, from the scientific perspective and to examine its environmental, health, and socio-economic impacts. The basics of nuclear physics, radiochemistry, radioanalytical chemistry, environmental transport of radionuclides and biological effects of radiation will be reviewed in the **“Radiation Bootcamp”**. The difference between military and civilian nuclear waste will be examined and the options for nuclear waste disposal will be discussed. The material will be presented objectively and will draw uniformly from the official reports. Views of advocates and opponents of nuclear energy will be discussed. The students will be encouraged to contribute with their opinions and debate using sound scientific principles. Chemistry occupies central position in discussion of any environmental issues. Its role will be examined at every step of this course. Because this is very much a “current topic” Internet and daily news will be used heavily in this course.

Class Hours: Tuesday, Thursday 9.35-10.55 am; Boggs, Room 2-28

Prerequisite: General Chemistry or equivalent

Grading: Midterm (40%); Class Presentation & Final Essay (30%); Course participation (30%)

Course Text: Handouts & Class notes (posted)
Internet

Recommended:

Alan E. Waltar: "America The Powerless", Cogito Books, 1995

Karl Heinrich Lieser, Nuclear and Radiochemistry, VCH Publishers, Inc., 1997

USDOE Report: "Linking Legacies - Environmental Impact of the Cold War

Howard Hu, et al., Plutonium, Deadly Gold of the Nuclear Age, IPP, 1992

SCHEDULE

8/24-31	Introduction; energy, population and environmental priorities, scales of things
9/2-30	Radiation bootcamp; origins of radiation: cosmic/anthropogenic; basics of radiation physics; decay laws; units of radioactivity; types of radiation; detector physics; measurement of radiation; radioanalytical chemistry
10/5-14	Timeline; Manhattan project, (movie);
10/21	Midterm
10/26-28	Reprocessing; military production sites (movie: Hanford today)
11/2-4	Nuclear Energy production (civilian); Safe reactor designs
11/9	Civilian/military waste; disposal options and economics;
11/11	Proliferation and terrorism
11/16	Accidental releases;
11/18	Environmental transport
11/23	Health effects of radiation
11/30	Regulations and public perception
12/2-7	Class presentations
12/9	Responsibility of scientists