COLUMBIA UNIVERSITY
Department of Earth and Environmental Engineering

Course: EAEE E4150 - Air Pollution Prevention, Control and Sustainability
Instructor: V.M. Fthenakis, Tel: (212) 854-8885, Email: vmf5@columbia.edu
Spring 2011: Lecture & Office hrs pending

Topics Covered: Air pollution sources, prevention, atmospheric dispersion, and adverse effects. Monitoring and modeling of air quality. Air pollution prevention and control regulations and guidelines. Air pollution control engineering. Global pollution issues, Sustainability of energy life-cycles, External Costs of Energy,

Textbook:
K. Wark, C.F. Warner and W.T. Davis, *Air Pollution: Its Origin and Control,* 3rd Edition, Addison Wesley, 1998.
Pollution prevention and prevention of accidental releases from process industries, are not covered in the textbook. These will be covered from the reference book and handout notes.

Reference books:
V.M. Fthenakis *Prevention and Control of Accidental Releases of Hazardous Gases*, Van Nostrand Reinhold (Willey), NY, 1993.

Some Interesting Environmental Journals & Magazines
Atmospheric Environment; Chemical Engineering Progress; Chemical Engineering; Environmental Science & Technology; Journal of Loss Prevention in Process Industries; Journal Air & Waste Management Assoc.; Pollution Engineering.

Grading:

Quizzes	20 points
Homeworks	20 points
Mid-term Exam	30 points
Final Exam	30 points

Topics Covered in Each Class
1. Air Pollution Sources & Emissions
    a. Introduction
    b. Air pollution episodes & nature of air pollution problems
    c. Listing of air pollutants
    d. Sources of air pollutants and trends in the US
    e. Health effects of air pollution
2. Pollution Prevention Concepts,
   Examples from the chemical, mining & mineral processing industries
    a. Product and process design
    b. Material substitution
    c. Plant configuration; Integrated processes
    d. Human resources
    e. Research & Development

Prevention of Accidental Releases (Industrial Accidents)
   a. Storage reduction, de-inventory
   b. Isolation
   c. Safety systems
   d. Detection/Monitoring Systems
   e. Procedures
3. Prevention (continue) and Regulations,
   a. History of regulations
   b. Clean Air Act Amendments of 1990
   c. Chemical accident prevention
   - OSHA Process Safety Management / EPA Risk Management Program
   Industry initiatives
4. Meteorology & Basics of Atmospheric Dispersion
   a. Wind circulation, wind velocity profile
   b. Stability conditions
   c. Wind rose
   d. The Box model
   e. The Eddy diffusion model
   f. The Gaussian distribution
5. Basics of Atmospheric Dispersion
   a. Maximum ground-level ambient concentration
   b. The effective height
   c. Line and area releases
   d. Chemical transformations in the atmosphere
6. Atmospheric Dispersion Modeling
7. --- **Mid-term Exam** ---
8. Control of Particulates I
   a. Particulate distributions
   b. Particulate control equipment

----------Spring break-----

9. Control of Particulates II
   a. Particulate control equipment
   b. Comparison of particulate control equipment
10. Control of Gases & Vapors I
   a. Absorption mechanism
   b. Scrubbers: venturi, spray, packed tower
11. Control of Gases & Vapors II
   a. Scrubber design
12. Control of Gases & Vapors III
   a. Adsorption
   b. Incineration
13. Global Issues I
   a. Fuel Life Cycles
   b. External Costs of Energy
   c. Energy and Climate Change Challenges
14. Global Issues II
   a. Sustainability of Energy Scenarios
15. --- Final Exam ---