Short Course on

Air Quality Engineering

Offered By

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COURSE OUTLINE

Air quality engineers apply science and technology to prevent or limit adverse effects of air pollution on human health, human welfare and ecosystems. This course will describe some major aspects of air quality engineering, including an overview of many current air pollution problems; a discussion of air pollutant emissions, emphasizing combustion, which is the most important human activity that contributes to air pollution; a review of some key technologies for controlling emissions of pollutants form sources; and finally a presentation of models that are used to predict air pollutant concentrations. Attendees will also learn how to make air pollutant measurements, including measurements of particles and gases. An assessment of the air quality of the urban regions in Tunisia will be made and control strategies for reducing air pollutant concentrations will be formulated and discussed.

COURSE BENEFITS

After completing the course, you will be able to:

- Describe the science behind current air pollution problems
- Understand the health impacts of major air pollutants
- Characterize and measure air pollutant emissions and concentrations
- Analyze emissions from simple combustion systems
- Be familiar with pollution prevention and treatment technologies
- Predict air pollutant concentrations downwind of sources using available computer models and analytical techniques
- Prepare and present a written assessment of specific air quality problem and develop an appropriate control strategy for solving the problem

LECTURER:

Shelly L. Miller, PhD is an Assistant Professor in the Mechanical Engineering Department at the University of Colorado at Boulder. Dr. Miller investigates sources of indoor air pollution, assesses exposures to air pollutants, and develops and evaluates indoor air quality control measures. Her research has focused on indoor air quality since 1991. Dr. Miller has extensive experience conducting full-scale chamber and field experiments, generating and measuring aerosols and bioaerosols, conducting both single and multiple tracer gas experiments, and indoor air quality modeling including both statistical and physical models. Dr. Miller's current research projects include modeling studies of personal exposure to toxic air contaminants from environmental tobacco smoke, experimental chamber studies of bioaerosol measurement techniques, and an experimental assessment of technological controls to reduce exposures to infectious diseases.

COURSE SCHEDULE

The course is scheduled over five days to be delivered in one morning and one afternoon session. Each session is 2-hours long with one short break. Homework will be assigned on days 2, 3, and 4.

Day	*Session 1 (2 hours)*	*Session 2 (2 hours)*
Day-1	Criteria Pollutants, Hazardous Air Pollutants, Acid Deposition	Photochemical Smog, Global Change including climate change and ozone depletion
Day-2	Indoor Air Quality, Health Effects, Material Balances	Lab 1 – Measuring pH, monitoring criteria pollutants, Instrumentation
Day-3	Characterizing Emissions	Pollutant Generation by Combustion, Motor Vehicle Emissions
Day-4	Air Quality Models, Gaussian Plume Dispersion Modeling	Lab 2 – Measuring and Modeling CO Concentrations Near a Busy Roadway
Day-5	Treatment Technologies, Particle Control Devices, Absorption for Gaseous Pollutant Control	Lab 3 – Assess an air quality problem, develop an appropriate control strategy for solving the problem

COURSE CONTENTS

The topics to be discussed during the short course are outlined below:

DAY 1:

Session 1

- Criteria pollutants – CO, particulate matter, NO_2, O_3, SO_2, lead
- Hazardous air pollutants – suspected carcinogens including dioxins, benzene
- Acid deposition – sulfuric acid, nitric acid, impacts on ecosystems

Session 2

- Photochemical smog – secondary pollutants, formation of ozone, atmospheric chemistry
- Global change – energy balance of the atmosphere, climate change, stratospheric ozone depletion

DAY 2:

Session 1

- Indoor air quality – material balances, combustion byproducts, volatile organic compounds, microbial contaminants
- Homework 1 assigned

Session 2

- Lab 1 – experiments including Measuring pH for acid deposition, monitoring criteria pollutants, getting familiar with instrumentation, data acquitsition and analysis

DAY 3:

Session 1

- Characterizing emissions, measuring emissions from stacks, auto tailpipes, emission inventories
- Discussion of homework 1 and lab 1
- Homework 2 assigned

Session 2

- Pollutant generation by combustion, energy and fuel use, oxides of carbon, sulfur and nitrogen
- Motor vehicle emissions

DAY 4:

Session 1

- Air quality models, Gaussian Plume models, atmospheric stability and dispersion parameters
- Discussion of homework 2
- Homework 3 assigned

Session 2
- Lab 2 – experiments measuring and modeling CO concentrations near a busy roadway
- Computer tool use for gaussian plume modeling

DAY 5:

Session 1
- Treatment technologies, particle control devices, characterizing particle control efficiency, cyclones, electrostatic precipitators, fiber filters, absorption for gaseous pollutant control, flue gas desulferization
- Discussion of homework 3 and lab 2

Session 2
- Lab 3 - assess an air quality problem, develop an appropriate control strategy for solving the problem
- Summary overview of course objectives achieved

COURSE TEXTBOOKS

Air Pollution Control Engineering, N. DE NEVERS, 2d Edition, McGraw Hill, New York, 2000.

Environmental Engineering Science, W. W. Nazaroff and L. Alvarez-Cohen, Wiley, New York, 2001.

COURSE SUPPORT MATERIALS

1. Class notes provided by instructor in advance will be distributed to students
2. Various software packages for student use only
3. 2 CO monitors, 1 optical particle counter, 1 velocity transducer, chemical supplies
4. Personal computers for class sessions with internet access
5. LCD projector for lectures
6. One copy of each textbook listed above