

*Atmospheric Sciences 212 – Autumn Quarter 2009*  
**Air Pollution: From Urban Smog to the Ozone Hole**  
<http://www.atmos.washington.edu/2009Q4/212/>

**Class Meeting Times:** Daily (M-F) 10:30-11:20 am.

**Class Meeting Location:** Atmospheric Sciences/Geophysics (ATG) building room 310c.

**Instructor:** Becky Alexander

Phone: (206) 543-0164

Email: [beckya@u.washington.edu](mailto:beckya@u.washington.edu) (Only email me for personal reasons (e.g. illness). Please use the message board for questions about course material.)

Office: Room 306 in ATG building

Office hours: After classes or by appointment

### Course Description

This course is an introduction to air pollution on local, regional, and global scales. We will focus on the sources, transformation, and dispersion of pollutants responsible for urban smog, acid rain, climate change and the stratospheric ozone hole. We will examine the health and environmental effects of air pollutants, as well as current (or potential) technological solutions and policy regulations.

The class will be divided in three parts:

- **Introduction to air pollution (weeks 1-2).** We will define air pollution and present a brief history of current regional and global air pollution problems. We will discuss the factors controlling the natural composition of the atmosphere.
- **Local and regional pollution issues (weeks 3-8).** In this part of the class we will discuss the sources and fate of pollutants focusing on specific local/regional air pollution issues: urban smog, aerosols and acid rain, visibility, and indoor air pollution. For each of these issues we will discuss the health and environmental effects, technological solutions, as well as current national and international regulations.
- **Global scale pollution issues (weeks 9-10).** We will examine the causes and effects of two major global air pollution issues: stratospheric ozone depletion and climate change. We will discuss projections of future air quality in the U.S. and around the world. Will the future be cleaner? What choices will we make?

The course is intended for non-science, liberal arts majors and fulfills 5 credits of the Natural World (NW) distribution requirement. The course is also designated as a "W" course.

### Prerequisites

None. Open to all undergraduates.

## Textbook

**Required textbook:** *"Earth Under Siege"* by Richard Turco, Oxford University Press, 2002.

The lectures will generally follow the textbook. Each week the students will be given reading assignments directly relevant to the class. In addition, after each class, lecture notes will be posted on the web. These notes will summarize the main topics covered and provide additional material not included in the book (such as links to web sites and additional reading material).

**Other useful textbook:** *"Atmospheric Pollution"* by Mark Z. Jacobson, Cambridge University Press, 2002. This textbook is placed on reserve in the Odegaard Undergraduate Library. Max loan period: 2 hours (no overnight).

## Grading policy

Your grade will be based on exams (two midterms and one final exam), assignments, a research project, and class participation:

**Assignments** 25%

**Research project** 20%

**Midterms** 20%

**Comprehensive final exam** 25%

**Class participation** 10%

You are expected to attend lectures and participate in class. There will be no make-up exams except in extreme circumstances, in which case you must contact the instructors **in advance** of the exam.

## Research project and symposium

Students will research the details of some aspect of air pollution. This is an opportunity for you to explore something of particular interest to you in more detail than we may cover in class. The instructor will suggest some topics. Your grade on the project will be based on a poster presentation scheduled for the last week of class. Examples of appropriate poster format will be provided.

## Assignments

Assignments will require you to answer questions (mostly short answer) drawn from lectures and online resources. Some assignments will be a written critique of an article in the non-scientific media about some aspect of air pollution. We will select a few to be presented orally as a basis for class discussion.

Assignments are due in class at 10:30 am on the day indicated. *Late assignments will not be accepted without advance arrangement.*

## Discussions sections

Discussions sections will generally be held on Fridays. I will either provide an activity that will aid in understanding of some of the more difficult topics covered in class, and/or provide time to work on homework assignments in groups. Homework assignments are generally due in the class following discussions (on Mondays). I also will be available to answer questions about anything covered in lecture, or on homework assignments and exams. I will also make time to chat with each of you individually about your projects to make sure you have selected an appropriate topic and are on track.

**Class schedule**  
(as of 10/09/2009 – please see web site for updates)

Date	Lecture topic	Required reading	Due
<b>PART I. INTRODUCTION TO AIR POLLUTION AND THE COMPOSITION OF THE ATMOSPHERE</b>			
<b>WEEK 1</b>			
W 9/30	Introduction and course overview		
Th 10/1	Health effects of air pollution		
F 10/2	History of air pollution		
<b>WEEK 2 – CLASS CANCELLED ALL WEEK</b>			
M 10/5			
Tu 10/6			
W 10/7			
Th 10/8			
F 10/9			
<b>WEEK 3</b>			
M 10/12	Basic concepts and definitions	Ch. 2 (p. 9-20)	
Tu 10/13	Composition of the present day atmosphere: ingredients and properties		
W 10/14	Evolution of the atmosphere	Ch. 4 (p. 84-88; 91-98; 104-106)	
Th 10/15	Air pressure, density, and temperature structure; Boyle's and Charles' laws	Ch. 2 (p. 24-36)	
Fr 10/16	<i>Discussion</i>		
<b>PART II. LOCAL AND REGIONAL POLLUTION ISSUES</b>			
<b>WEEK 4</b>			
M 10/19	Sources of pollutants to the atmosphere	Ch. 5 (p. 111-113)	PS#1
Tu 10/20	Dispersion of pollutants; effect of meteorology on pollution	Ch. 5 (p. 113-118)	
W 10/21	Vertical transport of pollution	Ch. 5 (p. 118-125; 129-130)	
Th 10/22	Vertical transport of pollution (in class practice)		
Fr 10/23	<b>Midterm #1 (covers weeks 1-4)</b>		
<b>WEEK 5</b>			
M 10/26	Indoor air pollution	Ch. 8 (p. 223-252)	
Tu 10/27	LA Smog and London Smog	Ch. 6 (p.136-140)	
W 10/28	The ingredients of smog; Daily/seasonal variations in smog	Ch. 6 (p.140-158)	
Th 10/29	Catalytic converter; Box model	Ch. 4 (p.88-91)	
Fr 10/30	<i>Discussion – Project topic</i>		
<b>WEEK 6</b>			
M 11/2	Smog and air quality standards		PS#2
Tu 11/3	Particulate Matter (PM)		
W 11/4	Haze and visibility	Ch. 3 (p. 55-68), Ch. 6 (p. 163-174)	
Th 11/5	Sources of acid rain	Ch. 9 (p.259-287)	
Fr 11/6	Effects of acid rain		
<b>WEEK 7</b>			
M 11/9	Alternative fuels	Ch. 6 (p.176-180)	
Tu 11/10	How pollutants affect health / Assessment of health risk	Ch. 7 (p. 183-203, 212-215)	
W 11/11	<b>NO CLASS – University Holiday</b>		
Th 11/12	Air pollution trends / US air quality regulations		
Fr 11/13	<i>Discussion</i>		

**WEEK 8**

M 11/16	Guest lecture: Jeff Johnston, Air Quality Program, WA State Department of Ecology		<b>PS#3</b>
Tu 11/17	The natural ozone layer	Ch. 13 (p. 407-422)	
W 11/18	<i>Midterm review</i>		
Th 11/19	<b>Midterm #2 (covers weeks 5-8)</b>		
Fr 11/20	<i>Discussion - Cost benefit analysis</i>		

**PART III. GLOBAL SCALE POLLUTION ISSUES****WEEK 9**

M 11/23	Human threats to the ozone hole	Ch. 13 (p. 422-437)	
Tu 11/24	The ozone hole	Ch. 13 (p. 437-447)	
W 11/25	Regulation of CFCs	Ch. 13 (p. 447-451)	
Th 11/26	<b>NO CLASS – Thanksgiving Holiday</b>		
Fr 11/27	<b>NO CLASS – Thanksgiving Holiday</b>		

**WEEK 10**

M 11/30	<i>Discussion – The ozone hole</i>		<b>1<sup>st</sup> draft W paper PS#4</b>
Tu 12/1	Climate and the greenhouse effect.	Ch. 11 (p. 320-342)	
W 12/2	Is the earth really warming? Are humans causing climate change?	Ch. 11 (p. 349-359); Ch. 12 (p. 365-380)	
Th 12/3	Climate change policy. What will the future look like? What will be the impacts globally and on the pacific northwest?	Ch. 12 (p. 381-397)	
Fr 12/4	<i>Discussion – climate change</i>		

**WEEK 11**

M 12/7	<b>Project poster presentations</b>		<b>PS#5</b>
Tu 12/8	<b>Project poster presentations</b>		
W 12/9	<b>Project poster presentations</b>		
Th 12/10	<b>Project poster presentations</b>		
Fr 12/11	<i>Review for final exam</i>		<b>W paper</b>

**FINALS WEEK**

M 12/14	<b>COMPREHENSIVE FINAL EXAM 8:30-10:20 am</b>		
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