



PUBHEHS 5340 – Air Contaminants and Public Health

3 credit hours – Fall, 2009

Instructor: Dr. Olorunfemi Adetona

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Class Time and Location: XXXXXX and XXXXXX

Instructor's Office Hours: XXXXXX

TA Name, email, and office hours:

TA responsibilities: The TA assigned to the course will hold regular office hours and lead review sessions for any students who need help with class material. The TA may assist with scoring homework and exams; however, final grades will be assigned by the professor. Any questions regarding grading should be directed to the professor and not the TA.

Course Prerequisite: there are no prerequisite for this course

Course description: Air is essential for human survival, and the degradation of its quality has significant impacts on human health and the environment. Consequently, the regulation of air quality and the control of contaminant emissions into the atmosphere have become major components of efforts to maintain public health and protect the environment in the United States and many other countries. The “*Air Contaminant and Public Health*” course will introduce students to the concept of air quality, and will focus on the relatedness between its pollution and morbidity. Specifically, students will learn about the categories and types of air contaminants, their natural and anthropogenic sources, and the respiratory and extra-pulmonary effects of air pollution. This knowledge will be reinforced by introducing the students to historical, current and emerging air pollution issues in the United States and other parts of the world. Furthermore, students will learn about national (United States) and international frameworks for the management of specific air pollution problems, and will be introduced to tools/approaches for monitoring air contaminants and federal resources for determining air quality.

The content of the course necessarily reinforces an Environmental Health Science (EHS) model (Figure 1). The concept of air quality is primarily motivated by its impact on human health, and its assessment is dependent on the accurate characterization of contaminant sources and concentration in the air matrix. Finally, the determination of the relationship between exposures to air contaminants and adverse health effects is an essential input to the regulation of air quality and the implementation of contaminant controls in order to maintain it (air quality) in a state good enough to sustain a healthy environment and healthy human living.

Class Format: Sessions will consist of lectures, case studies, and in-class discussion of relevant current topics. The course content will introduce, reinforce and complement the required reading relating to the topic.

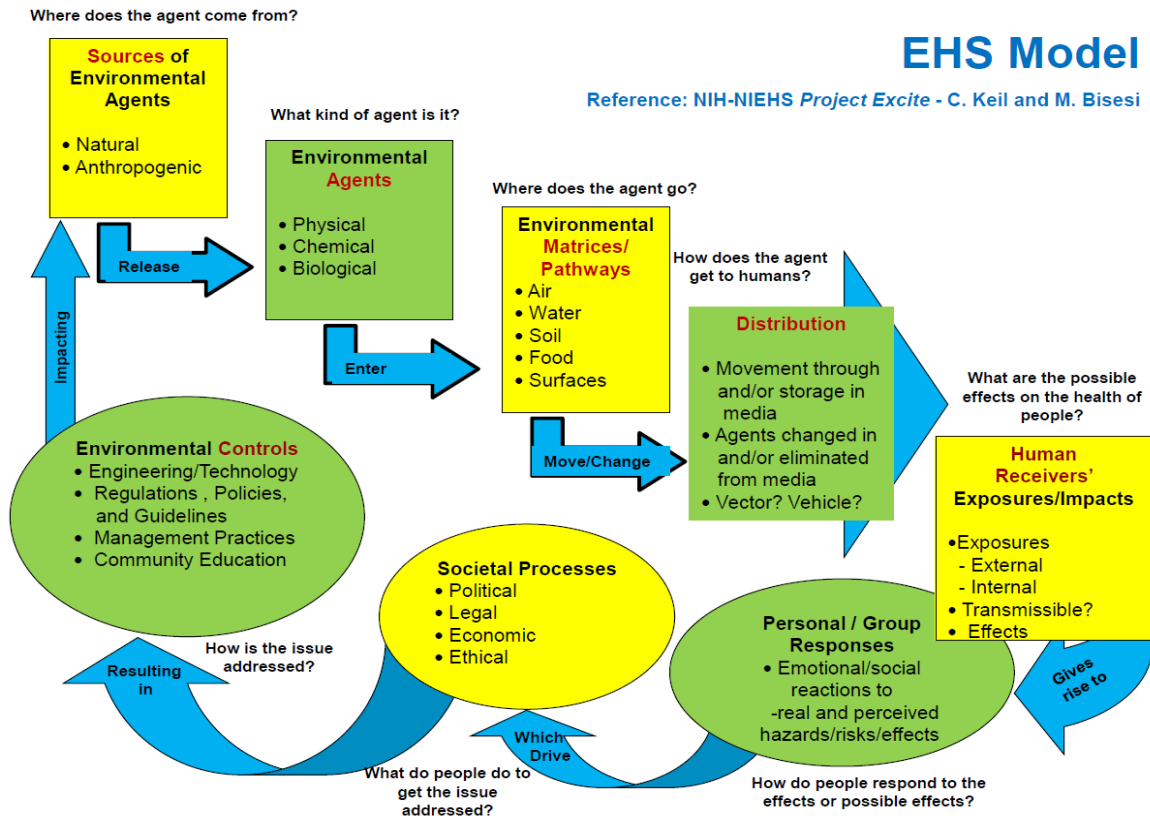


Figure 1. EHS model: components of the EHS model either inform or are informed by the risk assessment process

Course Objectives:

1. Describe the composition of the atmosphere and its relevance to ambient air quality and health
2. Describe the different categories and types of air contaminants, and their sources
3. Summarize major historical and current air pollution episodes and their public health impacts
4. Discuss the issue of disparities as they relate to the adverse health effects of air pollution
5. Identify and discuss appropriate regulatory and technological mechanisms for controlling exposure to air contaminants
6. Discuss approaches for monitoring air quality and exposure to air contaminants
7. Access and use available resources for the determination of ambient air quality
8. Identify and critically assess air pollution issues

Applicable BSPH Cross-Cutting Concepts

6. Independent thinking and a personal work ethic
10. Research methods
12. Teamwork and leadership

Applicable BSPH Foundational Domains

1. The history and philosophy of public health as well as its core values, concepts and functions across the globe and in society
2. The basic concepts, methods and tools of public health data collection, use and analysis and why evidence-based approaches are an essential part of public health practice
3. The concept of population health, and the basic processes, approaches and interventions that identify and address the major health-related needs and concerns of populations

4. The underlying science of human health and diseases, including opportunities for promoting and protecting health across the life course
5. The socioeconomic, behavioral, biological, environmental and other factors that impact human health and contribute to health disparities
9. Basic concepts of public health-specific communication, including technical and professional writing and the use of mass media and electronic technology

Applicable BSPH Foundational Competencies

Upon completion of the course, BSPH degree students should also be able to:

2. Compare and contrast examples of major domestic and international public health issue
3. Discuss approaches and strategies to identify, respond to and intervene with attempt to resolve common public health issues
4. Identify political, cultural, behavioral and socioeconomic factors related to global public health issues
5. Apply fundamental principles of the five core disciplines of public health (biostatistics; environmental health; epidemiology; health administration; health behavior/promotion) to domestic and international populations
6. The ability to communicate public health information, in both oral and written forms, through a variety of media and to diverse audiences

Applicable BSPH Environmental Public Health Specialization Competencies

Upon completion of the course, BSPH degree students with specialization in environmental public health sciences should also be able to:

1. Apply principles of math, chemistry, biology to applied science of environmental public health
2. Use the Environmental Health Science model to explain environmentally-related exposures and human diseases
3. Summarize management, technical measures and approaches to reduce and prevent environmentally-related human disease

Applicable Foundational Public Health Knowledge Objectives for All Graduate Degrees

1. Explain public health history, philosophy and values
3. Explain the role of quantitative and qualitative methods and sciences in describing and assessing a population's health
6. Explain the critical importance of evidence in advancing public health knowledge
7. Explain the effects of environmental factors on a population's health
8. Explain biological and genetic factors that affect a population's health

Applicable MPH Degree Foundational Public Health Competencies

2. Select the quantitative and qualitative data collection methods appropriate for a given public health context
4. Interpret result of data analysis for public health research, policy or practice
19. Communicate audience-appropriate public health content, both in writing and through oral presentation

Applicable MPH EHS Specialization Competencies

Upon completion of the course, MPH degree students with specialization in environmental health sciences should also be able to:

1. Explain the significance of the community and workplace environment to public health.
2. Outline the health threat that natural and anthropogenic contaminants in the environment can pose to population health.
3. Explain the physiological factors that influence human exposure and the uptake of chemical and biological environmental agents.
4. Identify and explain individual and community susceptibility factors that heighten the risk for populations for adverse health outcomes from environmental hazards.

7. Describe federal and state regulatory programs, guidelines and authorities relevant to environmental and occupational health.
8. Access state, federal, and local resources for assessing the environmental and occupational health.
9. Compare the principle components and influencing factors in the exposure continuum from source to disease.
10. Determine the role of exposure assessment in environmental and occupational health.

Applicable MS EPH Competencies

Upon completion of the course, MS students should also be able to:

4. Conduct a research project using appropriate research methods and ethical approaches.
6. Communicate in writing and orally a research project's methods, results, limitations, conclusions and public health relevance.
7. Explain individual and community susceptibility and vulnerability factors that heighten the risk for populations for adverse health outcomes from environmental hazards.
8. Apply the environmental health paradigm (i.e. EHS model) to characterizing hazardous physical, chemical and biological agents relative to sources, categories, exposure matrices/pathways, distribution, human exposures, responses, societal/regulatory actions, and technological controls.

Applicable PhD EPH Competencies

Upon completion of the course, MS students should also be able to:

4. Formulate hypotheses, plan and conduct a research study using appropriate research methods and ethical approaches.
6. Communicate in writing and orally a research project's purpose, methods, results, limitations, conclusions and public health relevance to both informed and lay audiences.
7. Quantify individual and community susceptibility and vulnerability factors that heighten the risk for populations for adverse health outcomes from environmental hazards.
8. Apply the environmental health paradigm (i.e. EHS model) to characterizing hazardous physical, chemical and biological agents relative to sources, categories, exposure matrices/pathways, distribution, human exposures, responses, societal/regulatory actions, and technological controls.

A complete list of College of Public Health Competencies are located in Appendix C of the CPH Graduate Student Handbook that can be found at:

<https://go.osu.edu/cphgradcompetencies>

Text/Readings: Readings are listed in the course schedule and will be posted on Carmen (<https://carmen.osu.edu/#>).

Mandatory Reading:

Air Pollution and Health. 1999. Eds.: Holgate ST, Samet JM, Koren HS, Maynard RL. Academic Press, London, United Kingdom. Book can be downloaded free when connected to OSU wireless network at: <https://www.sciencedirect.com/book/9780123523358/air-pollution-and-health#book-description>

Air Pollution and Health Effects. 2013. Eds.: Nadadur SS and Hollingsworth JW. Humana Press, New Your, USA. Book is available free online at OSU Libraries at: http://osu.worldcat.org/title/air-pollution-and-health-effects/oclc/908685811&referer=brief_results

Optional Reading:

Air Pollution and Health Effects. 2013. Phalen RF and Phalen RN. Jones & Bartlett Learning LLC, New York, USA.

Grading: Grades will be assigned for class participation, short quizzes, group project report, mid-semester and final exams as follows:

Table 1: Point Assignment to Evaluation Activity

Activity	Undergraduate Points Total (100%)	Graduate Points Total (100%)
Attendance/Participation	5	5
Short Quizzes	20	20
Group Project Report	20	20
Group Project Presentation	5	5
Mid-Term Exam	20	15
Final Exam	30	20
Supplemental Activity for Graduate Students – USEPA Publicly Available AQS Data Analysis and Interpretation	N/A	5
Supplemental Activity for Graduate Students – Journal Article Summaries	N/A	10

Class attendance and participation will be monitored and contribute towards final grades as noted above. Full attendance (except for reasons noted in the attendance policy below) and meaningful participation will guarantee a full score for this assessment activity. Mid-semester and final exams will be graded according to the points allocated to each questions in the exams. Students will be awarded the points for each question if it is answered correctly. Group project presentation and report will be graded against the following 10-point scale outlined in Table 2:

Table 2: Rubric for Group Project Presentation and Report and Graduate Student Supplemental Activity for Journal Article Summary

Score	Criteria
10	Exceptional work. . . thorough, complete, and correct; beyond expectation. This is a rare and exceptional grade.
9	Outstanding work. . . thorough, complete, and correct; virtually no error. This is a rare and exceptional grade.
8	Excellent . . . thorough, complete and correct with only very few minor errors or omissions
7	Very good . . . adequately covers the major facets of the topic with respect to the major course content or assignment guidelines; has numerous minor errors or weaknesses.
6	Good. . . adequately covers most of the major facets of the topic with respect to the major course content or assignment guidelines but lacks rigor and completeness with respect to details; has some moderate errors or weaknesses.
5	Satisfactory . . . covers correctly and completely some of the with respect to the major course content or assignment guidelines but with some major omissions. Report is incomplete and carelessly prepared; has a few major errors or weaknesses
<5	Poor. . . incomplete and incorrect; replete with major errors or weaknesses.

Final grades will be assigned according to the **OSU Standard Grade Scheme**.

Table 3: Grading Scheme

Grade	Percentage
A	100-93
A-	92.9-90
B+	89.9-87
B	86.9-83
B-	82.9-80
C+	79.9-77
C	76.9-73
C-	72.9-70
D+	69.9-67
D	66.9-60
E	<60

Exams

The **mid-term and final exams** will be proctored, closed book and will be given in class at the times stated on the class schedule. Questions will include multiple choice and short essays/problems. Students are encouraged to be present and take their exams on the date and time that it is given. Make-up exams will only be given if the instructor is informed about an inability to take exams on the schedule dates at least 48 hours before the exam. Otherwise, allowance will only be given in case of personal emergencies or *extenuating* circumstance (e.g. unforeseen medical issues, death in the family, etc.) that will preclude the student from informing the professor about the inability to take the exam on the scheduled date.

Five (short) online mini-quizzes will be given (via Carmen) after every fourth class (excluding periods around the exams) during the course as outlined in the course schedule. Each mini-quiz will include **eight to ten** multiple-choice questions. The quizzes will be open book, and will be completed individually by each student outside of the classroom, without help from other individuals. The quizzes have to be completed once the test sessions have been started. Make-up quizzes will only be given based on the criteria set for the mid-term and final exams.

Assignments

Students will work in groups of two to three to conduct a group project that will be **submitted as a complete report to the instructor/TA and presented to the class** at the end of the course at the due time specified in the course schedule. Drafts of different sections of the report will also be **due for submission to the instructor/TA** for review during the semester on the dates specified in the class schedule accompanying the syllabus. The project will be designed around instructor-provided or student-selected current or emerging air pollution issues with the goal of examining how concepts learned in class may apply to specific exposure scenarios. An outline for writing the project report will be provided to students. The following items will be evaluated for the project (report and presentation):

- General content: framing of the exposure scenario and its potential health effect, how the exposure and/or the health effect might be quantified or studied, the applicable exposure controls, and the relevance of information and its sources to the topic and environmental health – weighting for scoring is 4
- Clarity and organization – weighting for scoring is 2
- Proper application of the concepts taught in the course – weighting for scoring is 4

These items for both the report and oral presentation will be scored with the rubric outlined in the Grading section of the syllabus.

Supplemental Activities for Graduate Students

In addition to the above exams and assignments, graduate students will be required to:

1. Register for a USEPA Air Quality System (AQS) Data Mart account and download ambient air quality (air contaminant concentration) data. The student will be required to use the data to answer specific questions as directed by the instructor e.g. whether there were exceedances of the national ambient air quality standard for a pollutant based on the criteria set in the standard. The activity will be graded based on the correctness of the data used, the methodology of analysis applied and the conclusion provided. Detailed instruction about the use of AQS and the data analyses required will be provided at the beginning of the course.
2. Summarize research methodology and the major findings of **four** of the (original research, meta-analysis or review) journal articles that will be part of the class reading. The summary should be submitted as a Microsoft Word single-spaced document, typed in New Times Roman font and be at least three quarters of a page long. The student will be required to submit a list of two questions about the research reported in each of the journal articles along with the summary. Some of the questions will be chosen as discussion points for the associated course sessions. This activity will be graded according to the rubric in Table 2.

Carmen

The syllabus, class schedule, class readings (or links to class materials) and lecture slides will be posted on the Carmen/Canvas site for the course.

Attendance Policy

To achieve the objectives of this course and to become a public health professional, attendance is expected in all scheduled classes. If a student has an *extenuating* circumstance (e.g. unforeseen medical issues, death in the family, etc.) that prevents them from attending class, they should please notify the instructor *before* class.

Additional Course Policies

Please note that students are discouraged from using mobile devices while in class, and that the use of computers is only allowed if such use is related to class activities.

Office of Student Life: Disability Services

Any student who feels s/he may need an accommodation based on the impact of a disability should contact me privately to discuss your specific needs. Please contact the Office of Student Life: Disability Services at 614-292-3307 in Room 098 Baker Hall 113 W. 12th Ave. to coordinate reasonable accommodations for students with documented disabilities (<http://www.ods.ohio-state.edu/>).

Mental Health Services

As a student you may experience a range of issues that can cause barriers to learning, such as strained relationships, increased anxiety, alcohol/drug problems, feeling down, difficulty concentrating and/or lack of motivation. These mental health concerns or stressful events may lead to diminished academic performance or reduce a student's ability to participate in daily activities. The Ohio State University offers services to assist you with addressing these and other concerns you may be experiencing. If you or someone you know are suffering from any of the aforementioned conditions, you can learn more about the broad range of confidential mental health services available on campus via the Office of Student Life's Counseling and Consultation Service (CCS) by visiting ccs.osu.edu or calling 614-292-5766. CCS is located on the 4th Floor of the Younkin Success Center and 10th Floor of Lincoln Tower. You can reach an on call counselor when CCS is closed at 614-292-5766 and 24 hour emergency help is also available through the 24/7 National Suicide Prevention Hotline at 1-800-273-TALK or at suicidepreventionlifeline.org.

Academic integrity

Academic integrity is essential to maintaining an environment that fosters excellence in teaching, research, and other educational and scholarly activities. Thus, The Ohio State University, the College of Public Health, and the Committee on Academic Misconduct (COAM) expect that all students have read and understood the University's *Code of Student Conduct* and the School's *Student Handbook*, and that all students will complete all academic and scholarly assignments with fairness and honesty. The *Code of Student Conduct* and other information on academic integrity and academic misconduct can be found at the COAM web pages (<https://oaa.osu.edu/academic-integrity-and-misconduct>). Students must recognize that failure to follow the rules and guidelines established in the University's *Code of Student Conduct*, the *Student Handbook*, and in the syllabi for their courses may constitute "Academic Misconduct."

The Ohio State University's *Code of Student Conduct* (Section 3335-23-04) defines academic misconduct as: "Any activity that tends to compromise the academic integrity of the University, or subvert the educational process." Examples of academic misconduct include (but are not limited to) plagiarism, collusion (unauthorized collaboration), copying the work of another student, and possession of unauthorized materials during an examination. Please note that the use of material from the Internet without appropriate acknowledgement and complete citation is plagiarism just as it would be if the source were printed material. Further examples are found in the *Student Handbook*. Ignorance of the *Code of Student Conduct* and the *Student Handbook* is never considered an "excuse" for academic misconduct.

If I suspect a student of academic misconduct in a course, I am obligated by University Rules to report these suspicions to the University's Committee on Academic Misconduct. If COAM determines that the student has violated the University's *Code of Student Conduct* (i.e., committed academic misconduct), the sanctions for the misconduct could include a failing grade in the course and suspension or dismissal from the University. If you have any questions about the above policy or what constitutes academic misconduct in this course, please contact me.

Course Outline

Week	Class Dates	Topics	Reading Assignments	Assessment Activity Deadlines
1	A: (Date – xxxxxx)	Introduction	<ul style="list-style-type: none"> Explore USEPA website “Air Topics”: https://www.epa.gov/environmental-topics/air-topics 	
	B: (Date – xxxxxx)	Earth’s Atmosphere and Its Physical Characteristics	<ul style="list-style-type: none"> Air Pollution and Health. Eds.: Holgate ST et al. Ch. 3; pp 22-39 	
2	A: (Date – xxxxxx)	Atmospheric Chemistry	<ul style="list-style-type: none"> Air Pollution and Health. Eds.: Holgate ST et al. Ch. 4; pp 51-62 	
	B: (Date – xxxxxx)	Effect of Meteorology and Light on Ambient Air Quality	<ul style="list-style-type: none"> Readings from previous 2 lectures 	Online quiz due by ... pm on ...
3	A: (Date – xxxxxx)	Ambient Air Contaminants and Pollution	<ul style="list-style-type: none"> Air Pollution and Health. Eds.: Holgate ST et al. Ch. 8; pp 115-136 	
	B: (Date – xxxxxx)	Air Pollutant Characteristics, Human Physiology and Health	<ul style="list-style-type: none"> Air Pollution and Health. Eds.: Holgate ST et al. Ch. 13; pp 269-294 	
4	A: (Date – xxxxxx)	Air Pollutants and Health: Respiratory Effects	<ul style="list-style-type: none"> Air Pollution and Health Effects: Nadadur SS and Hollingsworth JW. Ch. 4 and 5; pp 93-104, 119-126 	
	B: (Date – xxxxxx)	Air Pollutants and Health: Established Extra-Pulmonary Effects	<ul style="list-style-type: none"> Air Pollution and Health Effects: Nadadur SS and Hollingsworth JW. Ch. 9; pp 241-268 	Online quiz due by ... pm on ...
5	A: (Date – xxxxxx)	Air Pollutants and Health: Emerging Extra-Pulmonary Effects	<ul style="list-style-type: none"> Air Pollution and Health Effects: Nadadur SS and Hollingsworth JW. Ch. 4 and 5; pp 51-70 	
	B: (Date – xxxxxx)	Air Quality and Health Preceding Regulation: a Historical Perspective	<ul style="list-style-type: none"> Air Pollution and Health. Eds.: Holgate ST et al. Ch. 2; pp 5-18 Journal Article: Anderson HR. 2009. “Air Quality and Mortality: a History.” <i>Atmospheric Environment</i> 43:142-152 	Graduate student to submit a summary of and question about the journal article by Anderson (2009) due by ... pm on ...
6	A: (Date – xxxxxx)	Mid-Term Exam		

	B: (Date – xxxxxx)	The Regulation of Ambient Air Quality	<ul style="list-style-type: none"> • Air Pollution and Health. Eds.: Holgate ST et al. Ch. 43; pp 983-1017 • Students are also encouraged to explore the following USEPA web pages on Criteria Pollutant Regulation: <ul style="list-style-type: none"> • https://www.epa.gov/clean-air-act-overview/clean-air-act-requirements-and-history • https://www.epa.gov/criteria-air-pollutants • https://www.epa.gov/criteria-air-pollutants/process-reviewing-national-ambient-air-quality-standards • https://www.epa.gov/criteria-air-pollutants/naaqs-designations-process • https://www.epa.gov/criteria-air-pollutants/naaqs-implementation-process • https://www.epa.gov/haps/what-are-hazardous-air-pollutants • https://www.epa.gov/haps/reducing-emissions-hazardous-air-pollutants • https://www.epa.gov/airmarkets/acid-rain-program • https://www.epa.gov/ozone-layer-protection/ozone-protection-under-title-vi-clean-air-act • https://www.epa.gov/visibility/regional-haze-program • https://www.epa.gov/clean-air-act-overview/setting-emissions-standards-based-technology-performance • https://www.epa.gov/clean-air-act-overview/setting-emissions-standards-major-sources-toxic-air-pollutants • https://www.epa.gov/fueleconomy/basic-information-fuel-economy-labeling • https://www.epa.gov/vehicle-and-fuel-emissions-testing • https://www.epa.gov/criteria-air-pollutants/naaqs-table • https://airnow.gov/index.cfm?action=aqibasics.aqi • https://aqs.epa.gov/aqsweb/documents/data_mart_welcome.html#queries 	<p>Graduate student to register for USEPA AQS Data Mart Account</p> <p>Analysis and interpretation of the AQS data is due on ... and ...</p>
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7	A: (Date – xxxxxx)	The National Ambient Air Quality Standard and Criteria Pollutants	<ul style="list-style-type: none"> The same textbook reading as for previous class Students are also encouraged to explore the USEPA web pages as for previous class Other USEPA web pages: <ul style="list-style-type: none"> https://gispub.epa.gov/air/trendsreport/2018/#home https://aqs.epa.gov/aqsweb/documents/data_mart_welcome.html#queries 	
	B: (Date – xxxxxx)	Monitoring Ambient Air Quality: the Traditional Approach of Networks of Stationary Land-Based Monitoring Sites	<ul style="list-style-type: none"> Air Pollution and Health. Eds.: Holgate ST et al. Ch. 5; pp 63-81 	
8	A: (Date – xxxxxx)	Monitoring Ambient Air Quality: GIS and Remote Sensing	<ul style="list-style-type: none"> Journal Article: van Donkelaar A et al. 2006. “Estimating Ground-Level PM_{2.5} Using Aerosol Optical Depth Determined from Satellite Remote Sensing.” <i>Journal of Geophysical Research</i> 111:D21201 Journal Article: Vienneau D et al. 2009. “A GIS-Based Method for Modelling Air Pollution Exposures across Europe.” <i>Science of the Total Environment</i> 408:255-266 Journal Article: Shi W et al. 2012. “Analysis of Airborne Particulate Matter (PM_{2.5}) over Hong Kong Using Remote Sensing and GIS.” <i>Sensors</i> 12(6):6825-6836 	<p>Online quiz due by ... pm on ...</p> <p>Graduate student to submit a summary of and question about the journal article by Shi et al. (2012) due by ... on ...</p>
	B: (Date – xxxxxx)	Indoor Air Quality and Chemical Pollutants	<ul style="list-style-type: none"> Available Text Online: WHO Guidelines for Indoor Air Quality for Selected Pollutants. 2010. World Health Organization, Copenhagen, Denmark. Pp 1-13; 15-32; 347-366: http://wedocs.unep.org/bitstream/handle/20.500.11822/8676/Select_pollutants_guidelines.pdf?sequence=2&isAllowed=y 	
9	A: (Date – xxxxxx)	Indoor Air Quality and Pollutants of Biological Origin	<ul style="list-style-type: none"> Journal Article: Nasir ZA and Colbeck I. 2010. “Assessment of Bacterial and Fungal Aerosol in Different Residential Settings.” <i>Water, Air and Soil Pollution</i> 12(6):6825-6836 Journal Article: Perez-Padilla R et al. 2010. “Respiratory Effects of Indoor Air Pollution.” <i>International Journal of Tuberculosis and Lung Diseases</i> 14(9):1079-1086 	

	B: (Date – xxxxxx)	Occupational Air Quality and Regulation	<ul style="list-style-type: none"> Journal Article: Laney SA and Attfield MD. 2010. “Coal Workers’ Pneumoconiosis and Progressive Massive Fibrosis Are Increasingly More Prevalent among Workers in Small Underground Coal Mines in the United States.” <i>Occupational and Environmental Medicine</i> 67(6):428-431 Journal Article: Tsigonia A et al. 2010. “Indoor Air in Beauty Salons and Occupational Health Exposure of Cosmetologists to Chemical Substances.” <i>International Journal of Environmental Research and Public Health</i> 7:314-324 	Graduate student to submit a summary of and question about the journal article by Tsigonia et al. (2010) due by ... on ...
10	A: (Date – xxxxxx)	Smoking, Secondhand Smoke, Air Quality and Health	<ul style="list-style-type: none"> Air Pollution and Health. Eds.: Holgate ST et al. Ch. 12; pp 224-233 Journal Article: Sureda X et al. 2013. “Secondhand Tobacco Smoke Exposure in Open and Semi-Open Settings: a Systematic Review.” <i>Environmental Health Perspectives</i> 121(7):766-773 	Online quiz due by ... pm on ...
	B: (Date – xxxxxx)	Traditional and Emerging Approaches to Monitoring Exposure to Air Pollutants	<ul style="list-style-type: none"> Journal Article: Steinle S et al. 2012. “Quantifying Human Exposure to Air Pollution: Moving from Static to Spatio-Temporally Resolved Personal Exposure Assessment.” <i>Science of the Total Environment</i> 211:367-377 	
11	A: (Date – xxxxxx)	Historical Air Pollution Issues: Acid Rain, the Ozone Hole, and Leaded Gasoline	<ul style="list-style-type: none"> Journal Article: Nriagu JO. 1990. “The Rise and Fall of Leaded Gasoline.” <i>Science of the Total Environment</i> 92:13-28 Read the following USEPA web pages and USEPA-linked web pages: <ul style="list-style-type: none"> https://www.epa.gov/acidrain/what-acid-rain https://www.epa.gov/acidrain/effects-acid-rain https://www3.epa.gov/airmarkets/progress/reports/index.html https://www.epa.gov/ozone-layer-protection/basic-ozone-layer-science https://ozonewatch.gsfc.nasa.gov/facts/hole.html https://www.epa.gov/ozone-layer-protection/international-treaties-and-cooperation 	

	B: (Date – xxxxxx)	Current Air Pollution Issues: Greenhouse Gases and Global Warming	<ul style="list-style-type: none"> • Read the following USEPA web pages: <ul style="list-style-type: none"> • https://www.epa.gov/ghgemissions/overview-greenhouse-gases • https://www.epa.gov/ghgemissions/sources-greenhouse-gas-emissions • https://www.epa.gov/ghgemissions/global-greenhouse-gas-emissions-data • https://www.epa.gov/climate-indicators/greenhouse-gases • https://www.epa.gov/environmental-economics/economics-climate-change 	
12	A: (Date – xxxxxx)	Current Air Pollution Issues: The Multi-Pollutant Problem	<ul style="list-style-type: none"> • Journal Article: Dominici F et al. 2012.” Protecting Human Health from Air Pollution: Shifting from a Single-Pollutant to a Multi-Pollutant Approach.” <i>Epidemiology</i> 21(2):187-194 	Online quiz due by ... pm on ...
	B: (Date – xxxxxx)	Current Air Pollution Issues: Particulate Matter and How Low is Low Enough	<ul style="list-style-type: none"> • Journal Article: Pope et al. 2009. “Cardiovascular Mortality and Exposure to Airborne Fine Particulate Matter and Cigarette Smoke.” <i>Circulation</i> 120:941-948 • Journal Article. 2010. Smith KR and Peel JL. “Mind the Gap.” <i>Environmental Health Perspectives</i> 118:1643-1645 	Graduate student to submit a summary of and question about the journal article by Pope et al (2009) due by ... on ...
13	A: (Date – xxxxxx)	Current Air Pollution Issues: Household Air Pollution	<ul style="list-style-type: none"> • Air Pollution and Health Effects: Nadadur SS and Hollingsworth JW. Ch. 14; pp 355-380 	
	B: (Date – xxxxxx)	Air Quality Disparities: Distribution, Susceptibility and Vulnerability Issues	<ul style="list-style-type: none"> • Journal Article: Makri A and Stilianakis N. 2008. “Vulnerability to Air Pollution Health Effects.” <i>International Journal of Hygiene and Environmental Health</i> 211:326-336 • Journal Article. 2013. Bell ML et al. “Evidence of Vulnerability and Susceptibility to Health Risks Associated with Short-Term Exposure to Particulate Matter: a Systematic Review and Meta-Analysis.” <i>American Journal of Epidemiology</i> 178(6):865-876 	
14	A: (Date – xxxxxx)	Class Presentations		
	B: (Date – xxxxxx)	Class Presentations		
15	A: (Date – xxxxxx)	Final Exam		

Alignment of Course Topics, Assignments, Course Learning Objectives, and Core/Specialization Competencies

Topics	Course Objectives	BSPH Foundational Domains	BSPH Foundational Competencies	BSPH EPH	All Graduate Degrees Foundational	MPH Degree Foundational	MPH EHS	MS	PhD	Student Evaluation Activity
Introduction	1, 2, 8	4	5	2	7		2	8	8	Class participation tailored towards student's understanding of the topic from assigned reading and other materials or experience – discussion will be guided by the application of the EHS model (Figure 1) to the issue of air pollution
Earth's Atmosphere and Its Physical Characteristics	1	5	5	1	7		9	8	8	Quiz, Exams - questions will probe the understanding of the students about the atmosphere's role as both a matrix and a modifier of air contaminants that are detrimental to environmental health
Atmospheric Chemistry	1	5	5	1	7		9	8	8	
Effect of Meteorology and Light on Ambient Air Quality	1	5	5	1	7		9	8	8	
Ambient Air Contaminants and Pollution	2, 8	5	5	1, 2	7		2, 9	8	8	Quiz, Exams - questions will evaluate knowledge about the environmental health impacts of major air pollution exposures in the United States and internationally, the major contributing biological factors to exposure and health effects, and the application of these to control of air pollution
Air Pollutant Characteristics, Human Physiology and Health	2, 4, 8	4, 5	5	1, 2	7, 8	4	3, 4, 9	7, 8	7, 8	Group Projects – students will be expected to address expected health effects of the exposure scenario that is assigned and how this information might inform control of exposure in the scenario
Air Pollutants and Health: Respiratory Effects	3, 8	4, 5	5	1, 2	7, 8	4	2, 3, 9	8	8	
Air Pollutants and Health: Established Extra-Pulmonary Effects	3, 8	4, 5	5	1, 2	7, 8	4	2, 3, 9	8	8	
Air Pollutants and Health: Emerging Extra-Pulmonary Effects	3, 8	4, 5	5	1, 2	7, 8	4	2, 3, 9	8	8	

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Air Quality and Health Preceding Regulation: a Historical Perspective	3, 8	4, 5	5	2	1, 3, 7		2, 9	8	8	<p>Quiz, Exams - questions will evaluate knowledge about the environmental health impacts of air pollution exposures in the United States and internationally</p> <p>Supplemental for Graduate Student: Journal Article Summary – the journal article relates to the environmental health effects of historical air pollution episodes in the United States and internationally; the summaries will be graded according to the rubric in Table 2</p>
The Regulation of Ambient Air Quality	5, 7	3	3	2, 3	3, 6	4	7, 8, 9	8	8	<p>Quiz, Exams – questions will probe the knowledge of regulation as an EHS component and one of the</p>
The National Ambient Air Quality Standard and Criteria Pollutants	5, 7	3	3	2, 3	3, 6	4	7, 8, 9	8	8	

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Monitoring Ambient Air Quality: Traditional Approaches	5, 6, 7	2	3, 5	2	3, 6	2	10	6, 8	6, 8	<p>public health policy approaches for intervening to control and resolve air pollution; questions will also test on knowledge about the role of the data collection method to monitor and enforce compliance with air pollution regulation</p> <p>Supplemental for Graduate Students: USEPA Publicly Available AQS Data Analysis and Interpretation – activity will involve data collection and analysis to answer compliance related questions</p>

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Monitoring Ambient Air Quality: GIS and Remote Sensing	5, 6, 7	2	3, 5	2	3, 6	2	10	6, 8	6, 8	<p>Quiz, Exams – questions will probe the knowledge of regulation as an EHS component and one of the public health policy approaches for intervening to control and resolve air pollution; questions will also test on knowledge about the role of the data collection method to monitor and enforce compliance with air pollution regulation</p> <p>Supplemental for Graduate Student: Journal Article Summary – the journal article relates to data collection methodology for quantifying air pollution; the summaries will be graded according to the rubric in Table 2</p>
Indoor Air Quality and Chemical Pollutants	2, 8	5	5	2	7		1, 2, 9	8	8	<p>Quiz, Exams - questions will probe the knowledge of indoor air as an exposure pathway that is important for environmental health and the contributory biological factors to their health effects</p>
Indoor Air Quality and Pollutants of Biological Origin	2, 8	5	5	2	7		1, 2, 9	8	8	<p>Group Projects – students will be expected to identify the importance of this pathway as an environmental health component where applicable in their group projects</p>

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Occupational Air Quality and Regulation	2, 8	3, 4, 5	3, 5	2	1, 3, 6, 7		1, 2, 9	8	8	<p>Quiz, Exams – questions will probe the knowledge of regulation as an EHS component and one of the public health policy approaches for intervening to control and resolve air pollution; questions will test on knowledge about the role of the data collection method to monitor and enforce compliance with air pollution regulation; questions will also test the occupational environment as an exposure pathway that is important for environmental health in relation to air pollution</p> <p>Group Projects – students will be expected to identify the importance of this pathway as an environmental health component where applicable in their group projects</p> <p>Supplemental for Graduate Student: Journal Article Summary – the journal article relates to the contribution of the occupation as an important exposure pathway for air contaminants and an integral component of environmental health</p>

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Smoking, Secondhand Smoke, Air Quality and Health	2, 8	4, 5	5	2	7		1, 2, 9	8	8	<p>Quiz, Exams – questions will be tailored towards the identification of smoking as an important behavioral factor and a pathway of exposure to air pollution</p> <p>Group Projects – students will be expected to identify the importance of this pathway as an environmental health component where applicable in their group projects</p>
Traditional and Emerging Approaches to Monitoring Exposure to Air Pollutants	5, 6, 7	2	3, 5	2	3, 6	2	10	6, 8	6, 8	<p>Quiz, Exams – questions will evaluate knowledge about exposure monitoring as a essential data collection method in environmental health and its application to identifying, respond and resolve air pollution as a public health issue</p> <p>Group Projects – students will be expected to describe applicable monitoring approaches to quantify air pollution exposures for the scenarios that are assigned to them</p>
Historical Air Pollution Issues: Acid Rain, the Ozone Hole, and Leaded Gasoline	2, 8	3, 4, 5	2, 3, 5	2, 3	1, 7		2	8	8	<p>Quiz, Exams – questions will evaluate knowledge of historical and current environmental public health air pollution issues both domestically and</p>
Current Air Pollution Issues: Greenhouse Gases and Global Warming	2, 3, 5, 8	3, 4, 5	2, 3, 5	2, 3	1, 7		2	8	8	

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Current Air Pollution Issues: The Multi-Pollutant Problem	2, 3, 5, 8	3, 4, 5	2, 3, 5	2, 3	1, 7		2	8	8	internationally; the approaches being used to identify, respond and resolve them In-class Discussion: based on reading materials – the reading materials that are assigned address domestic and international environmental public health air pollution issues and approaches to address them

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Current Air Pollution Issues: Particulate Matter and How Low is Low Enough	2, 3, 5, 8	3, 4, 5	2, 3, 5	2, 3	1, 7		2	8	8	<p>Quiz, Exams – questions will evaluate knowledge of historical and current environmental public health air pollution issues both domestically and internationally; the approaches being used to identify, respond and resolve them</p> <p>In-class Discussion: based on reading materials – the reading materials that are assigned address domestic and international environmental public health air pollution issues and approaches to address them</p> <p>Supplemental for Graduate Student: Journal Article Summary – the journal article address domestic and international environmental public health air pollution issues and approaches to address them; the summary will be graded based on the rubric outlined in Table 2</p>
Current Air Pollution Issues: Household Air Pollution	2, 3, 5, 8	3, 4, 5	2, 3, 4, 5	2, 3	1, 7		2	8	8	Quiz, Exams – questions will evaluate knowledge of

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Air Quality Disparities: Distribution, Susceptibility and Vulnerability Issues	4, 8	3, 4, 5	4, 5	2	7, 8	2	4, 9	4, 8	4, 8	historical and current environmental public health air pollution issues both domestically and internationally; the approaches being used to identify, respond and resolve them; and the political, cultural, social, behavioral and biological factors that may contribute towards disparities in the effect of air pollution In-class Discussion: based on reading materials – the reading materials address and the political, cultural, social, behavioral and biological factors that may contribute towards disparities in the effect of air pollution
Presentation		9	6			19		4, 6	4, 6	
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