Spring 2019 • PH290-002 • CC#18015 • 2 units

Global air quality & health:
A survey of research methods and recent findings

Time Period	Spring 2019
Time	F – 8:00a – 10:00a
Place	Berkeley Way West 1205
Website	bCourses
Units	2

INSTRUCTORS

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COURSE DESCRIPTION

Globally, between 5.5 and 7 million deaths per year are attributed to air pollution, making it one of the most prominent contributors to the global burden of disease. This survey course will provide an overview of global ambient and household air pollution, a brief background on atmospheric processes relevant to air pollution; the implications of air pollution on public health, with a focus on recent clinical, toxicological, and epidemiological evidence, and emergent issues in air pollution epidemiology, measurement, and policies. Health impacts and policy implications of exposures to household and ambient pollution as well as occupational exposures and exposures to environmental tobacco smoke will be examined.

EVALUATION

Grades in this course will be based on

- **Air pollution event analysis (30%)**. In small groups, students will pick a significant domestic or international air pollution event of interest and describe its impact on air pollutant concentrations (e.g. emissions control strategies during the Beijing Olympics) and health, if applicable. Students will present their findings to the class and submit a two-page summary of findings.

- **Review of air pollution health effects (30%)**. Students will be assigned to groups of 2-3 and will create 20 minute presentations reviewing the associations between air pollution exposure and respiratory, reproductive, cardiovascular, and neurological outcomes.

- **Class participation (20%) + problem set (20%)**

LEARNING OBJECTIVES + CORE COMPETENCIES
By the end of this course, students will be expected to:

- Describe key air pollutants, their sources, their fate and transport in the environment, and their impact on human health

- Identify resources for reliable, publicly available air pollution data

- Describe methods of measuring and modeling air pollutants, with an understanding of the pros and cons of each type of sampling and modeling method

- Understand and describe the difference between emissions sampling, ambient and micro-environmental sampling, and personal exposure assessment

- Understand the ways air pollutant health effects are evaluated and quantified.

- Understand how air pollutant control policies have evolved over time, particularly in California

CAMPUS CODE OF CONDUCT
Any test, paper or report submitted by you and that bears your name is presumed to be your own original work that has not previously been submitted for credit in another course unless you obtain prior written approval to do so from your instructor. In all of your assignments, including your homework or drafts of papers, you may use words or ideas written by other individuals in publications, web sites, or other sources, but only with proper attribution. If you are not clear about the expectations for completing an assignment or taking a test or examination, be sure to seek clarification from your instructor beforehand. Finally, you should keep in mind that as a member of the campus community, you are expected to demonstrate integrity in all of your academic endeavors and will be evaluated on your own merits. The consequences of cheating and academic dishonesty include a formal discipline file, possible loss of future internship, scholarship, or employment opportunities, and denial of admission to graduate school.

DISABILITIES
Accommodation will be made for those with disabilities. Please reach out to the instructors as soon as possible, and contact the Disabled Students' Program

(http://dsp.berkeley.edu/), 260 César Chávez Student Center, 642-0518 (p), 642-6376 (tty) for more information.

SCHEDULE CONFLICTS

The Academic Senate has established Guidelines Concerning Scheduling Conflicts with Academic Requirements to address the issue of conflicts that arise between extracurricular activities and academic requirements. These policies specifically concern the schedules of student athletes, student musicians, those with out-of-town interviews, and other students with activities (e.g., classes missed as the result of religious holy days) that compete with academic obligations. The guidelines assign responsibilities as follows: It is the instructor's responsibility to give students a schedule, available on the syllabus in the first week of instruction, of all class sessions, exams, tests, project deadlines, field trips, and any other required class activities. It is the student's responsibility to notify the instructor(s) in writing by the second week of the semester of any potential conflict(s) and to recommend a solution, with the understanding that an earlier deadline or date of examination may be the most practicable solution. It is the student's responsibility to inform him/herself about material missed because of an absence, whether or not he/she has been formally excused.

ACCOMODATION OF RELIGIOUS CREED

In compliance with California Education Code, Section 92640(a), it is the official policy of the University of California at Berkeley to permit any student to undergo a test or examination, without penalty, at a time when that activity would not violate the student's religious creed, unless administering the examination at an alternative time would impose an undue hardship that could not reasonably have been avoided. Requests to accommodate a student's religious creed by scheduling tests or examinations at alternative times should be submitted directly to the faculty member responsible for administering the examination by the second week of the semester. Reasonable common sense, judgment and the pursuit of mutual goodwill should result in the positive resolution of scheduling conflicts. The regular campus appeals process applies if a mutually satisfactory arrangement cannot be achieved.

COURSE SCHEDULE

#	Week	Description
1	1/25	**Course Introduction (Balmes, Pillarisetti, and Smith)** Introduction to air quality / pollution Prominent air pollution episodes in history Domestic and global air quality trends Env. Health Pathway <u>Readings</u> *When Smoke Ran Like Water, Chapter 1* *P. Brimblecombe, Air Pollution Episodes, In Encyclopedia of Environmental Health, edited by J.O. Nriagu,, Elsevier, Burlington,*

		2011, Pages 39-45, ISBN 9780444522726, http://dx.doi.org/10.1016/B978-0-444-52272-6.00058-1.
2	2/1	**Air Pollutants (Pillarisetti)** Characterizing air pollution: scales, sources, characteristics, effects Pollutants of concern & their quantification NAAQS & Regulations Readings *George D. Thurston, Outdoor Air Pollution: Sources, Atmospheric Transport, and Human Health Effects, In International Encyclopedia of Public Health (Second Edition), edited by Stella R. Quah, Academic Press, Oxford, 2017, Pages 367-377.*
3	2/8	**Atmospheric Chemistry (Alex Turner)** Photochemical processes, sulfur compounds Defining and characterizing particles Particle size distributions, composition, formation Meteorology Readings *S.C. Pryor, P. Crippa and R.C. Sullivan, Atmospheric Chemistry, In Reference Module in Earth Systems and Environmental Sciences, Elsevier, 2015, ISBN 9780124095489, http://dx.doi.org/10.1016/B978-0-12-409548-9.09177-6.* **Problem Set 1 Distributed: Unit conversions and estimating air pollution concentrations**
4	2/15	**Measuring Air Pollution I: Theory & Principles (Pillarisetti)** Exposure assessment overview Exposure pathways Direct vs indirect, Active vs passive Biomarkers of exposure, effect Microenvironmental monitoring & time-activity diaries Remote sensing overview Indoor Single Compartment Box Model Readings *C. Cocheo, P. Sacco and L. Zaratin, Assessment of Human Exposure to Air Pollution, In Encyclopedia of Environmental Health, edited by J.O. Nriagu,, Elsevier, Burlington, 2011, Pages 230-237, ISBN 9780444522726, http://dx.doi.org/10.1016/B978-0-444-52272-6.00061-1.* *Liu X, Cheng S, Liu H, Hu S, Zhang D, Ning H. A Survey on Gas Sensing Technology. Sensors (Basel, Switzerland). 2012;12(7):9635-9665. doi:10.3390/s120709635.*

5	2/22	**Measuring Air Pollution II: Practical Implications & Hands-on (Pillarisetti)** Methods for measuring gasses Methods for measuring particles <u>Exercise</u> Carrying temperature, CO, or PM monitors for 1 week with time-activity diary <u>Readings</u> *Slides from Household Air Pollution trainings in Bhutan*
6	3/1	**Student Presentations: Air Pollution Health Effects**
7	3/8	**Air Pollution Epidemiology (Balmes)** Epidemiologic study designs and their strengths and weaknesses Review of findings Introduction to the Integrated Exposure-Response curves <u>Exercise</u> Design an epidemiologic study of air pollution <u>Readings</u> *J. Schwartz, Long-Term Effects of Particulate Air Pollution on Human Health, In Encyclopedia of Environmental Health, edited by J.O. Nriagu,, Elsevier, Burlington, 2011, Pages 520-527, ISBN 9780444522726, http://dx.doi.org/10.1016/B978-0-444-52272-6.00062-3.* *K. Katsouyanni, A. Gryparis and E. Samoli, Short-Term Effects of Air Pollution on Health, In Encyclopedia of Environmental Health, edited by J.O. Nriagu,, Elsevier, Burlington, 2011, Pages 51-60, ISBN 9780444522726, http://dx.doi.org/10.1016/B978-0-444-52272-6.00060-X.*
8	3/15	**Air Pollution & Occupational Health (Balmes)** Air pollution risks in occupational settings The co-evolution of workers' rights & occupational hygiene instrumentation Occupational health regulations and exposure limits <u>Readings</u> *https://www.osha.gov/dsg/annotated-pels/* *Torén K, Bergdahl IA, Nilsson T, et al. Occupational exposure to particulate air pollution and mortality due to ischaemic heart disease and cerebrovascular disease. Occupational and Environmental Medicine 2007;**64:**515-519.*

9	3/22	**Remote Sensing of Air Pollution (Jason Su)**
10	4/5	**Household Air Pollution (Balmes, Pillarisetti, Smith)** Global solid fuel use Exposure comparisons Woodsmoke – natural and deadly State of the science <u>Readings</u> *Smith, K. R., Bruce, N., Balakrishnan, K., Adair-Rohani, H., Balmes, J., Chafe, Z., et al. (2014). Millions Dead: How Do We Know and What Does It Mean? Methods Used in the Comparative Risk Assessment of Household Air Pollution. Annual Review of Public Health, 35(1), 185–206. doi:10.1146/annurev-publhealth-032013-182356*
11	4/12	**Recent Air Pollution Episodes: California and beyond (Smith, Balmes, and Pillarisetti)**
12	4/19	**Transportation and Air Pollution (Chelsea Preble)**
13	4/26	**Secondhand tobacco and marijuana smoke exposures (Suzaynn Schick)** <u>Readings</u> *Legislative smoking bans for reducing harms from secondhand smoke exposure, smoking prevalence and tobacco consumption. Frazer K, Callinan JE, McHugh J, van Baarsel S, Clarke A, Doherty K, Kelleher C. Cochrane Database Syst Rev. 2016 Feb 4;2:CD005992.* *Risk of all-cause mortality and cardiovascular disease associated with secondhand smoke exposure: a systematic review and meta-analysis. Lv X, Sun J, Bi Y, Xu M, Lu J, Zhao L, Xu Y. Int J Cardiol. 2015 Nov 15;199:106-15.*
14	5/3	**Air Pollution in California (Balmes)** <u>Readings</u> *Gauderman WJ, Urman R, Avol E, Berhane K, McConnell R, Rappaport E, Chang R, Lurmann F, Gilliland F. Association of improved air quality with lung development in children. N Engl J Med. 2015 Mar 5;372(10):905-13* *Jerrett M, Burnett RT, Beckerman BS, Turner MC, Krewski D, Thurston G, Martin RV, van Donkelaar A, Hughes E, Shi Y, Gapstur SM, Thun MJ, Pope CA 3rd. Spatial analysis of air*

pollution and mortality in California. Am J Respir Crit Care Med. 2013 Sep 1;188(5):593-9.

15	5/10	**Student presentations: Event Analysis**