Aims: This course covers the theoretical and practical bases of detecting, sampling and analyzing gases and vapors through lectures and assignments [EHS 252E] and laboratories [EHS 252F], focusing on the work environment.

Learning Outcomes: Students will be able to distinguish a gas from a vapor relative to sampling and analysis, understand the basic concepts of gases and vapors in theory, the literature, and in the field, and explain the theory and field sampling of gases and vapors. They will be able to provide a critical review of the strengths and weaknesses of an air sampling and analysis method, know why EPA, OSHA, and ACGIH guidelines differ, and will be able to locate and critically evaluate the published literature. They will be able to know the situations to apply direct reading technology relative to time-weighted average sampling. The need for quality assurance and quality control and calibration of instruments will be understood and articulated.

The above learning objectives reflect the following environmental health competencies for Master of Science students: A1 Retrieve and organize literature; synthesize and critically evaluate scientific literature in environmental health, public health and other relevant fields; A2 Use existing databases to provide background information or data to address research questions and draw appropriate inferences/estimates from environmental health data; A3 Evaluate seminars and presentations in environmental health and distill the critical and salient issues from them; B4 Identify potential sources of systematic error (bias) as well as random error; B6 Identify potential sources of systematic error (bias) as well as random error; C1 Use computer systems and analytic software packages; D1 Make reasonable inferences from results of analysis of observational and analytic studies.
The EHS Master of Public Health competencies involved are: C1 Describe major direct and indirect human health and safety effects of major environmental or occupational agents; C3 Describe federal and state regulatory programs, guidelines, and authorities that control environmental health issues; C5 Specify approaches for assessing, preventing and controlling environmental hazards that pose risks to human health and safety; C6 Identify key sources of data and use existing databases to provide background or supportive data to address environmental health questions.

The following cross-cutting public health competencies (CC) are also reflected in the design and content of the course: communication and informatics; leadership; public health biology; professionalism; program planning; systems thinking.

**Format:** One 3-hour lecture a week for EHS252E complimented by the appropriate 3-hour laboratory experiments in EHS252F

**Evaluation:** Evaluation will be by progressive assessment with a final assignment (50% of mark) for EHS 252E being distributed 2 weeks before its due date. THIS WILL ALSO INCLUDE TOPICS FOR THE ORAL EXAMINATION. Students will present designated papers as part of their oral examination at the time designated for the Final Examination.

Assignments will be at intervals of two weeks with two weeks provided to complete each assignment. Late penalties will be administered. Assignments 1-3 comprise 50% of the total marks. Assignment 4 comprises 50% of the total marks with the Oral Qualifying 25% of the total grade.

<table>
<thead>
<tr>
<th>DATE</th>
<th>LECTURE/LABORATORY</th>
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<tbody>
<tr>
<td>Tues</td>
<td>Lect Introduction; definitions</td>
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<tr>
<td>Mar 29</td>
<td>W pp 5-19; M pp 1-32; SQH pp 153-159</td>
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<tr>
<td>Wed 30</td>
<td>Lab Introduction, use of TLVs [CHS 41-235] SQH</td>
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<td>Tues 5</td>
<td>Lect Properties of gases &amp; vapors W pp 21-85; SQH 149-152;160-162;165-167;191-198</td>
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<td>Wed 6</td>
<td>Lab Air flow, pressure, volume measurements [Z]</td>
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<td>Tues 12</td>
<td>Lect Generating known concentrations/calibrations W, pp 163-184; Lodge pp 3-27; SQH, 343-346</td>
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<td>Wed 13</td>
<td>Lab Pump calibration, mass concentration [Z]</td>
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<tr>
<td>Tues 19</td>
<td>Lect Sampling methods; adsorption W,pp 87-110,135-162;Lodge pp 37-42; SQH,198-200,377-390,396-423</td>
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<tr>
<td>Wed 20</td>
<td>Lab Carbon monoxide [SQH]</td>
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<td>Tues 26</td>
<td>Lect Direct reading devices: Organic Vapor Analyzers; M pp 101-156; SQH,329-338,343-361</td>
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<tr>
<td>Wed 27</td>
<td>Lab Impaction,cascade impactor, respirable mass sampling (Z)</td>
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<tr>
<td>Tues 3</td>
<td>Lect Direct reading devices: Detector Tubes/Explosion Meters M pp 33-100; SQH,346-351</td>
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<tr>
<td>Wed 4</td>
<td>Lab Toluene [SQH]</td>
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<td>Tues 10</td>
<td>Lect NIOSH,OSHA, and EPA methods</td>
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</table>
Wed 11 Lab Ozone/Toluene continued [SQH]

Tues 17 Lect Indoor Air Pollution, Occup/Environ Air Monitoring
     18 Lab Condensation particle counter & nanoparticle sampling [Z]

Tues 24 Lect No Lecture –Baltimore AIHCE

Wed 25 Lab No Lab-Baltimore AIHCE

Tues 31 Lect Wrap-up; new developments

Wed June 1 Lab 2 p.m. Asbestos counting [Z];
                3:30 p.m. Organic Mixtures [SQH]

Final Oral Presentations (Final Assignment due) Thursday June 9 11:30a-2:30p
CHS 51-279

TEXTS  (Optional)
3. ACGIH, 2016 TLVs and BEIs: Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices, ACGIH, Cincinnati, OH.

READING AND REFERENCE LIST:
1. ACGIH. Industrial Ventilation, 28th Ed, ACGIH, 2013. The 26th edition is in the COEH Library.
11. CAL OSHA. http://www.dir.ca.gov/DOSHPol/P&PC-91.HTM  ALSO https://www.dir.ca.gov/samples/search/query.htm
VIDEOS: (On Biomedical Library Class Reserve; PLEASE REWIND WHEN FINISHED)

7. Indoor Air Quality, Sutterhealth, 2010 http://www.youtube.com/watch?v=bSCOnFLTzGQ
9. Air Quality 101: The Basics, UPLan (UtahPlanning), 2009 http://www.youtube.com/watch?v=Hx_yWFQvJT4
10. Air Quality: Photochemical Smog, Channel Monster, 2011 http://www.youtube.com/watch?v=ZWF2aMbAcNC
11. Smog: The Sweet Smell of Success. Films for the Humanities and the Sciences, 2006. 30 min