

BAE 495
Special Topics in BAE – Air Quality
Belgium Study Abroad Program

Course Description and Prerequisites

Overview of federal and state environmental regulations focusing on permitting requirements for agricultural operations; operation of air pollution abatement systems to include cyclones, bag filters, and scrubbers; dispersion modeling; National Ambient Air Quality Standards.

Prerequisite: Junior or Senior Classification

Learning Outcomes or Course Objectives

Course Objectives:

Successful completion of this class should:

1. Enable students to operate their facilities in compliance with applicable environmental regulations.
 - a. U.S. and European practice will be compared.
2. Introduce students to the Clean Air Act, National Ambient air quality standards, New Source Performance standards and the permitting process.
3. Allow students to gain an understanding of pollution emissions and state of the art control equipment and best operating practices.

Learning Outcomes:

At the end of this course, students should be able to:

1. Function as basic permit writers with consulting firms, regulatory agencies, or industrial sources of air pollutants.
2. Ensure proper design, operation, and maintenance of air pollution control systems for their facilities.
3. Apply fundamental knowledge of the air pollution regulatory process.
4. Estimate the cost of air pollution controls for their facilities.

Instructor Information

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Office hrs/location	TBD; Leuven, Belgium

Required Text

Air Pollution Control – A Design Approach by C. David Cooper and F.C. Alley. Waveland Press, Inc. (Fourth Edition), 2010

ABB Steam Tables

Grading Policy

Grading:		Scale:	
Exams (2)	40%	90-100	A
Homework Assignments	20%	80-89	B
Field trip reports	30%	70-79	C
Seminar reports	10%	60-69	D
	100%	0 - 60	F

Attendance:

Attendance will be taken during each class. It is the student's responsibility to learn the material and make up any assignments missed. In the event that you must miss an exam, it is the student's responsibility to arrange a time to make up the test.

No assignments will be accepted after graded assignments have been published, unless you have an excuse that meets University criteria.

Homework Policy:

Homework assignments will be considered late if not turned in at the beginning of class. Late assignments will be assessed a 20% reduction.

8½ x 11 paper may be used for homework assignments. **Spiral notebook paper is not acceptable.** Engineering paper is preferred. Use only one side of the paper for work to be graded. Assignments should be folded **vertically** with your **name, homework #, row #, and seat #**. All assignments need to be stapled. **Students who fail to follow these directions will automatically have points deducted from their homework assignments!** Working in study groups on homework assignments is not only permitted but encouraged. However, the TEAM XEROX approach is not allowed. Anyone copying another's homework will be given a **ZERO as will the person allowing their work to be copied.**

Sample Format

NAME	
DATE	
SEAT #	
Homework <i>Number</i> (1,2,3,)	
<u>Given:</u> Briefly summarize information given in the problem.	
<u>Find:</u> Specify the variables and information to be determined.	
<u>Assumptions:</u> List all assumptions made	
<u>Solution:</u> Show all work. All homework solutions where calculations are not included will not be given credit. The calculations must include appropriate units.	
Answers must be boxed! Neatness counts.	

Students who fail to follow this format will automatically have points deducted from their homework assignments!

Testing:

Questions on the exams will be from the lecture material, reading assignments, homework problems, seminars, and field trip investigations.

Field Trip Reports

Four field trips to tour European processing or energy production sites and the technology used to control emissions in Belgium and the Netherlands will be conducted. A comprehensive field trip report will be required for each field trip. The report must include, 1) a discussion of the process or facility, and 2) a discussion of the air pollution control technology involved. Each report must include discussion of how the field trip related to the topics covered in this course. Reporting requirements will be provided in a separate handout. ***Late field trip reports will receive a maximum of half credit.***

Seminar Reports

Two seminars will be presented by EU or Belgian environmental officials relating to this course. A brief report summarizing each seminar, its relationship to the course, and a comparison of practices in Europe with those in the U.S. will be required. Reporting requirements will be provided in a separate handout. ***Late seminar reports will receive a maximum of half credit.***

Pop quizzes:

Five-minute pop quizzes will be given throughout the semester. These quizzes will be worth a homework grade. Pop quizzes cannot be made up! If you have an unexcused absence when a pop quiz is given, you will be assigned a grade of zero for that quiz.

Tentative Class Schedule

1. Ch 1 & 2. Basic Thermodynamics and Fluid Mechanics - Psychometrics, Ideal Gas Law, Air Density, Conservation of Mass and Energy.
2. Ch 1. Air Pollution Legislation - Federal Clean Air Act, Terminology, and Emissions Standards.
3. Ch 3. Particulate Matter (PM) – TSP, PM₁₀, PM_{2.5}, particle size distributions, mass median diameter (MMD), geometric standard deviation (GSD), measurement, samplers, emission factors. / **Seminar 1**
4. Field Trip 1
5. Permitting. The permitting process, TCEQ, standard permits, Permit by rule, amendments, NSR.
6. Ch 4. Cyclones –Design approaches, performance characteristics, efficiencies, cut-point, slope, and Costs. **Seminar 2**
7. Field Trip 2
8. Ch 6. Fabric Filters – Theory of operation and Costs. Dust Explosions – Causal factors, Testing methods, Prevention, Design Considerations. **Exam 1**
9. Ch 15. Power plant emissions and controls. – Scrubbers: design, controls, costs, operation. **Seminar 3**
10. Field Trip 3
11. Ch 5. Electrostatic precipitators. Design, operation, costs.
12. Ch 19. Meteorology. **Seminar 4**
13. Field Trip 4
14. Ch 20. Dispersion Modeling. Theory, Application, Gaussian equation, and AERMOD.
15. **Exam 2**

Note: This course has been assigned three credit hours based upon the work represented by verifiable student achievement of institutionally established learning outcomes, direct faculty instruction, and academically engaged time.

Additional Accommodations:

The Americans with Disabilities Act (ADA) is a federal anti-discrimination statute that provides comprehensive civil rights protection for persons with disabilities. Among other things, this legislation requires that all students with disabilities be guaranteed a learning environment that provides for reasonable accommodation of their disabilities. If you believe you have a disability requiring an accommodation, please contact the Disability Resource Office at: <https://dro.dasa.ncsu.edu/> . If any student in this class requires accommodation related to a unique circumstance, please make an appointment to see me as soon as possible. Appropriate arrangements will be made.

Academic Integrity

The slides and handouts used in this course are copyrighted. By “handout”, I mean all materials generated for this class, which include but are not limited to syllabi, in-class materials, and handouts. Because these materials are copyrighted, you do not have the right to copy the handouts, unless I expressly grant permission.

As commonly defined, plagiarism consists of passing off as one’s own the ideas, words, writings, etc., which belong to another. In accordance with this definition, you are committing plagiarism if you copy the work of another person and turn it in as your own, even if you should have the permission of that person. Plagiarism is one of the worst academic sins, for the plagiarist destroys the trust among colleagues without which research cannot be safely communicated.

The NCSU Code of Student Conduct will be strictly followed. Please review the Code of Student Conduct at: <https://studentconduct.dasa.ncsu.edu/code/> .

