



Course Description

Explores an in-depth study of advanced air quality control science and management practices. Addresses health effects, environmental impacts, monitoring, modeling, and treatment.

Course Textbook

Godish, T., Davis, W. T., & Fu, J. S. (2015). *Air quality* (5th ed.). Boca Raton, FL: CRC Press.

Course Learning Outcomes

Upon completion of this course, students should be able to:

1. Describe methods for monitoring air pollution.
2. Critique air pollutant modeling equations and/or software.
3. Assess health effects of air pollution.
4. Examine causes of indoor and outdoor air pollution.
5. Evaluate health risks of air pollution exposure.
6. Estimate the impact of air pollution on the environment.
7. Evaluate air pollution control technologies.

Credits

Upon completion of this course, the students will earn three (3) hours of college credit.

Course Structure

1. **Study Guide:** Each unit contains a Study Guide that provides students with the learning outcomes, unit lesson, required reading assignments, and supplemental resources.
2. **Learning Outcomes:** Each unit contains Learning Outcomes that specify the measurable skills and knowledge students should gain upon completion of the unit.
3. **Unit Lesson:** Each unit contains a Unit Lesson, which discusses lesson material.
4. **Reading Assignments:** Each unit contains Reading Assignments from one or more chapters from the textbook and/or outside resources.
5. **Suggested Reading:** A Suggested Reading is listed in Unit II. Students are encouraged to read the resource listed if the opportunity arises, but they will not be tested on their knowledge of the Suggested Reading.
6. **Discussion Boards:** Discussion Boards are part of all CSU term courses. More information and specifications can be found in the Student Resources link listed in the Course Menu bar.
7. **Unit Assessments:** This course contains four Unit Assessments, one to be completed at the end of Units I, III, V, and VII. Assessments are composed of written-response questions.
8. **Unit Assignments:** Students are required to submit for grading Unit Assignments in Units II-VIII. Specific information and instructions regarding these assignments are provided below. Grading rubrics are included with each assignment. Specific information about accessing these rubrics is provided below.
9. **Ask the Professor:** This communication forum provides you with an opportunity to ask your professor general or course content related questions.
10. **Student Break Room:** This communication forum allows for casual conversation with your classmates.

CSU Online Library

The CSU Online Library is available to support your courses and programs. The online library includes databases, journals, e-books, and research guides. These resources are always accessible and can be reached through the library webpage. To access the library, log into the myCSU Student Portal, and click on “CSU Online Library.” You can also access the CSU Online Library from the “My Library” button on the course menu for each course in Blackboard.

The CSU Online Library offers several reference services. E-mail (library@columbiasouthern.edu) and telephone (1.877.268.8046) assistance is available Monday – Thursday from 8 am to 5 pm and Friday from 8 am to 3 pm. The library’s chat reference service, *Ask a Librarian*, is available 24/7; look for the chat box on the online library page.

Librarians can help you develop your research plan or assist you in finding relevant, appropriate, and timely information. Reference requests can include customized keyword search strategies, links to articles, database help, and other services.

Unit Assignments

Unit II Mini Project

Over the course of these remaining seven units, we will be developing a course project. We will do a single section of the course project in every unit, completing one section of the course project in each unit, and then adding the subsequent work in the following unit. This unit work will be in the form of mini projects, and in Unit VIII, you will submit the entire project. Throughout the course, your instructor will provide you with feedback on every unit you submit; therefore, it is important to implement the feedback you receive in the upcoming unit(s). You will be required to integrate an online resource in your final submission. The Business Continuity & Disaster Recovery Reference Center is a good online database for this course project.

Our course project will be to develop a document titled *A Permit By Rule (PBR) Application for an Interior Surface Coating Facility* that will serve as a simulation of our work as a contract environmental engineer to a small vehicle body shop located in the state of Texas.

The Scenario:

You have been contracted with a vehicle body repair shop named Texas Car Body Repairs, USA to engineer and write a state (Texas) air permit application for a carefully designed interior lining (painting) facility. According to Texas state laws and EPA laws, the facility must have an air permit before construction begins. Once the facility is completed, the construction air permit will then become the operational air permit for the facility. As a result, your client wants the air permit application to automatically align the interior surface coating facility into operational compliance with state and federal air quality laws. Consequently, it is extremely important for you to write the air permit application to meet the air permit criteria using the state guidance document and considering the equipment and chemicals already planned for the facility operations.

Your client has presented you with the following specifications regarding the facility operations plan:

Interior Liner Coating Material	10 gallons coating/vehicle	2 gallons of solvent/vehicle
Vehicle Lining Application	Apply interior liners to two (2) vehicles/day	Work five (5) hours/day and four (4) days/week
Vehicle Lining Curing	Cure interior liners of two (2) vehicles/day	Work five (5) hours/day and four (4) days/week

Interior Liner Cure	Heater fuel source is natural gas-fired drying oven	Heater generates 2.1 million (MM) Btu/hr at maximum 2,500 hrs/year
Vehicle Lining Design	Cross-draft air plenum	Vehicle interior is the spray area
Exhaust Fan	10,000 ft ³ /min (CFM)	1 exhaust fan
Air Makeup Unit	5760 ft ³ /min (CFM)	1 air makeup unit
Filter Openings	20.0 ft ² each	Two (2) filter openings
Coating W_V	VOC content	2.8 lb/gal coating
Coating V_M	Coating volume	1.0 gal
Water Content	Per gal/coating	1.0 lb/gal
Water Density	Per gal/water	8.34 lb/gal
Coating V_W	Water volume	Calculation
Exempt-solvent Content	Per gal/coating	0.5 lb/gal
Exempt-solvent Density	Per gal/exempt solvent	6.64 lb/gal
Coating V_{es}	Exempt solvent volume	Calculation

The client has designed an interior coating spray painting system that allows the interior of a vehicle to be coated (such as for new vehicles, or vehicles being restored after fire damage or other catastrophic interior damage). The operations will involve a stripped-down vehicle body being brought into the facility's shop. The shop is a steel building with a finished concrete floor and a paint booth for each vehicle. The vehicle will be placed in the spray booth. The booth will be opened at one end of the booth for makeup air. The exhaust air will flow through an exhaust chamber at the other end of the vehicle (see Cross-Draft Automotive Spray Booth in Appendix F of the TCEQ Regulatory Guidance Document). For each vehicle, once the liner application operations are completed the forced curing (drying) operations will immediately commence.

Instructions

1. Closely read the Required Reading assignment from your textbook, Appendix B and Appendix K of the Texas Commission on Environmental Quality (TCEQ) Regulatory Guidance document (Click [here](#) to access the document), and the Unit Lesson within the Study Guide. Consider reading the Suggested Reading.
2. Using APA style (title page, abstract page, body with level 1 headings, and a reference page) for a research paper, begin drafting a proposal document. You will add to this document in every unit with another level 1 heading.
3. Make your Unit II work your first level 1 heading titled "General Considerations for Operation," and describe the scenario that is presented above. You may find it convenient to present the tabulated information in your General Considerations section of the permit for future reference throughout the rest of the course. This submission (and every submission through Unit VII) needs to be a minimum of at least a one page in length, double-spaced.

NOTE: In the following units (Units III through VIII), the unit lessons will contain information related to the interior surface coating operation by means of practical examples. Consequently, it is imperative that you read the unit lessons within the study guide every week, use the TCEQ's (2011) regulatory guidance document, and consider the current (as well as previous) material from your textbook in every unit. This project will serve as a comprehensive demonstration of your applied learning of engineering air quality.

Information about accessing the Grading Rubric for this assignment is provided below.

Unit III Mini Project

As a continuation of our course project due in Unit VIII, *A Permit By Rule (PBR) Application for an Interior Surface Coating Facility*, complete the next section, "VOC and ES Content per Vehicle," of your proposal by following the instructions carefully, and then submit your continued draft for grading.

Instructions

1. Closely read the Required Reading assignment from your textbook, the TCEQ (2011) document, and the Unit Lesson in the Study Guide.
2. Open your proposal draft from Unit II and make any improvements to your draft using your professor's feedback from the Unit II project assignment.
3. Open the Unit III Study Guide, read the Unit III Lesson, and review the calculations demonstrated and explained regarding VOC and ES weights per gallon and per vehicle for our scenario.
4. Make your Unit III work your second level 1 heading titled "VOC and ES Content per Vehicle." Describe and demonstrate (illustrate) the calculations for both the VOC and ES weights for this section of your project.

You are required to describe and demonstrate the VOC and ES calculations in a minimum one-page, double-spaced document.

Information about accessing the Grading Rubric for this assignment is provided below.

Unit IV Mini Project

As a continuation of our course project due in Unit VIII, *A Permit By Rule (PBR) Application for an Interior Surface Coating Facility*, complete the next section, "Operational Air Emission Rates," of your proposal by following the instructions carefully, and then submit your continued draft for grading.

Instructions

1. Closely read the Required Reading assignment from your textbook, the TCEQ (2011) document, and the Unit Lesson in the Study Guide.
2. Open your proposal draft from Unit III and make any improvements to your draft using your professor's feedback from the Unit III project assignment.
3. Open the Unit IV Study Guide, read the Unit IV Lesson, then review the calculations demonstrated and explained regarding emission rate calculations and "potential to emit" statistical model calculations for our scenario.
4. Make your Unit IV work your third level 1 heading titled "Operational Air Emission Rates." Describe and demonstrate (illustrate) the calculations for the following for this section of your project: (a) calculating maximum hourly and annual emission rates, (b) emission rate averaged over a five-hour period, and (c) potential to emit.

You are required to describe and demonstrate the "Operational Air Emission Rates" in a minimum one-page, double-spaced document.

Information about accessing the Grading Rubric for this assignment is provided below.

Unit V Mini Project

As a continuation of our course project due in Unit VIII, *A Permit By Rule (PBR) Application for an Interior Surface Coating Facility*, complete the next section, "Operational Face and Filter Velocities," of your proposal by following the instructions carefully, and then submit your continued draft for grading.

Instructions

1. Closely read the Required Reading assignment from your textbook, the TCEQ (2011) document, and the Unit Lesson in the Study Guide.
2. Open your proposal draft from Unit IV and make any improvements to your draft using your professor's feedback from the Unit IV project assignment.
3. Open the Unit V Study Guide, read the Unit V Lesson, then review the calculations demonstrated and explained regarding face velocity calculations and filter velocity calculations for our scenario.
4. Make your Unit V work your fourth level 1 heading titled "Operational Face and Filter Velocities." Describe and demonstrate (illustrate) the calculations for the following for this section of your project: (a) calculate the face velocity and (b) filter velocity of the spray booth in a minimum one-page, double-spaced document.

Information about accessing the Grading Rubric for this assignment is provided below.

Unit VI Mini Project

As a continuation of our course project due in Unit VIII, *A Permit By Rule (PBR) Application for an Interior Surface Coating Facility*, complete the next section, "VOC Content Minus Water and Exempt Solvent," of your proposal by following the instructions carefully, and then submit your continued draft for grading.

Instructions

1. Closely read the Required Reading assignment from your textbook, the TCEQ (2011) document, and the Unit Lesson in the Study Guide.
2. Open your proposal draft from Unit V and make any improvements to your draft using your professor's feedback from the Unit V project assignment.
3. Open the Unit VI Study Guide, read the Unit VI Lesson, then review the calculations demonstrated and explained regarding VOC content minus water and exempt solvent calculations for our scenario.
4. Make your Unit VI work your fifth level 1 heading titled "VOC Content Minus Water and Exempt Solvents." Describe and demonstrate (illustrate) the calculations for the following for this section of your project: (a) calculate the gallons of water in one gallon of coating and (b) pounds of VOC in one gallon of coating (without the water and exempt solvent). This submission should be in a minimum one-page, double-spaced document.

Information about accessing the Grading Rubric for this assignment is provided below.

Unit VII Mini Project

As a continuation of our course project due in Unit VIII, *A Permit By Rule (PBR) Application for an Interior Surface Coating Facility*, complete the next section, "Heater and Oven Combustion Emissions," of your proposal by following the instructions carefully, and then submit your continued draft for grading.

Instructions

1. Closely read the Required Reading assignment from your textbook, the TCEQ (2011) document, and the Unit Lesson in the Study Guide.
2. Open your proposal draft from Unit VI and make any improvements to your draft using your professor's feedback from the Unit VI project assignment.
3. Open the Unit VII Study Guide, read the Unit VII Unit Lesson, then review the calculations demonstrated and explained regarding calculations for emissions of products of combustion from heaters and ovens for our scenario.
4. Make your Unit VII work your sixth level 1 heading titled "Heater and Oven Combustion Emissions." Describe and demonstrate (illustrate) the calculations for the following for this section of your project: (a) nitrous oxides (NO_x), (b) carbon monoxide (CO), (c) particulate matter (PM), (d) volatile organic compounds (VOC), and (e) sulfur dioxide (SO₂) for BOTH hourly emissions (short-term) in lbs./hr. AND annual (long-term) emissions in tons/year. Your response should be in a minimum one-page, double-spaced document.

Information about accessing the Grading Rubric for this assignment is provided below.

Unit VIII Project

To finish our course project due in this Unit VIII, *A Permit By Rule (PBR) Application for an Interior Surface Coating Facility*, complete the final two sections, “Pollution Control Technologies” and “Process Flow Diagram” of your proposal by following the instructions carefully, and then submit the completed, final draft of your proposal for grading.

Instructions

1. Closely read the Required Reading assignment from your textbook, the TCEQ (2011) document, and the Unit Lesson in the Study Guide.
2. Open your proposal draft from Unit VII and make any improvements to your draft using your professor’s feedback from the Unit VII project assignment.
3. Open the Unit VIII Study Guide, read the Unit VIII Lesson, then consider the control technology options available for our scenario.
4. Make your first Unit VIII section your seventh level 1 heading titled “Pollution Control Technologies.” Select appropriate control technologies to be used in the final exhaust air from the spray booth for the following pollutants: (a) gases and vapors, (b) aerosol particles, and (c) noise levels of 90 dBA at 1,000 Hz. Be sure to defend your suggested engineering controls with literature.
5. Make your second Unit VIII section your eighth (final) level 1 heading titled “Process Flow Diagram.” Map out the entire process by developing a drawing of the process. You might consider reviewing the drawings located within Appendix G and Appendix J in the TCEQ (2011) document and Figure 10.12 on page 381 of your textbook as good examples of clear and understandable process drawings to help you construct your own Process Flow Diagram.
6. Be sure that your Abstract and References pages are updated before you submit your final project for a grade.

NOTE: Please compile (Units II-VIII) and submit your entire project as one document. Include an article reference from the CSU Online Library within your final project submission that is tied to the course project. The Business Continuity & Disaster Recovery Reference Center online database is a good online database for this course project.

Information about accessing the Grading Rubric for this assignment is provided below.

APA Guidelines

The application of the APA writing style shall be practical, functional, and appropriate to each academic level, with the primary purpose being the documentation (citation) of sources. CSU requires that students use APA style for certain papers and projects. Students should always carefully read and follow assignment directions and review the associated grading rubric when available. Students can find CSU’s Citation Guide by clicking [here](#). This document includes examples and sample papers and provides information on how to contact the CSU Success Center.

Grading Rubrics

This course utilizes analytic grading rubrics as tools for your professor in assigning grades for all learning activities. Each rubric serves as a guide that communicates the expectations of the learning activity and describes the criteria for each level of achievement. In addition, a rubric is a reference tool that lists evaluation criteria and can help you organize your efforts to meet the requirements of that learning activity. It is imperative for you to familiarize yourself with these rubrics because these are the primary tools your professor uses for assessing learning activities.

Rubric categories include: (1) Discussion Board, (2) Assessment (Written Response), and (3) Assignment. However, it is possible that not all of the listed rubric types will be used in a single course (e.g., some courses may not have Assessments).

The Discussion Board rubric can be found within Unit I’s Discussion Board submission instructions.

The Assessment (Written Response) rubric can be found embedded in a link within the directions for each Unit Assessment. However, these rubrics will only be used when written-response questions appear within the Assessment.

Each Assignment type (e.g., article critique, case study, research paper) will have its own rubric. The Assignment rubrics are built into Blackboard, allowing students to review them prior to beginning the Assignment and again once the

Assignment has been scored. This rubric can be accessed via the Assignment link located within the unit where it is to be submitted. Students may also access the rubric through the course menu by selecting “Tools” and then “My Grades.”

Again, it is vitally important for you to become familiar with these rubrics because their application to your Discussion Boards, Assessments, and Assignments is the method by which your instructor assigns all grades.

Communication Forums

These are non-graded discussion forums that allow you to communicate with your professor and other students. Participation in these discussion forums is encouraged, but not required. You can access these forums with the buttons in the Course Menu. Instructions for subscribing/unsubscribing to these forums are provided below.

[Click here for instructions on how to subscribe/unsubscribe and post to the Communication Forums.](#)

Ask the Professor

This communication forum provides you with an opportunity to ask your professor general or course content questions. Questions may focus on Blackboard locations of online course components, textbook or course content elaboration, additional guidance on assessment requirements, or general advice from other students.

Questions that are specific in nature, such as inquiries regarding assessment/assignment grades or personal accommodation requests, are NOT to be posted on this forum. If you have questions, comments, or concerns of a non-public nature, please feel free to email your professor. Responses to your post will be addressed or emailed by the professor within 48 hours.

Before posting, please ensure that you have read all relevant course documentation, including the syllabus, assessment/assignment instructions, faculty feedback, and other important information.

Student Break Room

This communication forum allows for casual conversation with your classmates. Communication on this forum should always maintain a standard of appropriateness and respect for your fellow classmates. This forum should NOT be used to share assessment answers.

Grading

Discussion Boards (8 @ 2%)	= 16%
Assessments (4 @ 8%)	= 32%
Mini Projects (6 @ 7%)	= 42%
Unit VIII Project	= 10%
Total	= 100%

Course Schedule/Checklist (PLEASE PRINT)

The following pages contain a printable Course Schedule to assist you through this course. By following this schedule, you will be assured that you will complete the course within the time allotted.

By following this schedule, you will be assured that you will complete the course within the time allotted. Please keep this schedule for reference as you progress through your course.

Unit I	The Atmosphere and Atmospheric Pollutants
Review:	<input type="checkbox"/> Unit Study Guide
Read:	<input type="checkbox"/> Chapter 1: Atmosphere <input type="checkbox"/> Chapter 2: Atmospheric Pollution and Pollutants <input type="checkbox"/> Additional Reading Assignment(s): See Study Guide
Discuss:	<input type="checkbox"/> Discussion Board Response: Submit your response to the Discussion Board question by Saturday, 11:59 p.m. (Central Time) <input type="checkbox"/> Discussion Board Comment: Comment on another student's Discussion Board response by Tuesday, 11:59 p.m. (Central Time)
Submit:	<input type="checkbox"/> Assessment by Tuesday, 11:59 p.m. (Central Time)
Notes/Goals:	

Unit II	Engineering for Outdoor Air Quality
Review:	<input type="checkbox"/> Unit Study Guide
Read:	<input type="checkbox"/> Chapter 4: Atmospheric Effects <input type="checkbox"/> Additional Reading Assignment(s): See Study Guide <input type="checkbox"/> Suggested Reading: See Study Guide
Discuss:	<input type="checkbox"/> Discussion Board Response: Submit your response to the Discussion Board question by Saturday, 11:59 p.m. (Central Time) <input type="checkbox"/> Discussion Board Comment: Comment on another student's Discussion Board response by Tuesday, 11:59 p.m. (Central Time)
Submit:	<input type="checkbox"/> Mini Project by Tuesday, 11:59 p.m. (Central Time)
Notes/Goals:	

Unit III	Engineering for Indoor Air Quality
Review:	<input type="checkbox"/> Unit Study Guide
Read:	<input type="checkbox"/> Chapter 11: Indoor Air Quality <input type="checkbox"/> Additional Reading Assignment(s): See Study Guide
Discuss:	<input type="checkbox"/> Discussion Board Response: Submit your response to the Discussion Board question by Saturday, 11:59 p.m. (Central Time) <input type="checkbox"/> Discussion Board Comment: Comment on another student's Discussion Board response by Tuesday, 11:59 p.m. (Central Time)
Submit:	<input type="checkbox"/> Assessment by Tuesday, 11:59 p.m. (Central Time) <input type="checkbox"/> Mini Project by Tuesday, 11:59 p.m. (Central Time)
Notes/Goals:	

Unit IV	Engineering for Indoor Air Quality, Part Two
Review:	<input type="checkbox"/> Unit Study Guide
Read:	<input type="checkbox"/> Chapter 5: Health Effects <input type="checkbox"/> Chapter 12: Environmental Noise <input type="checkbox"/> Additional Reading Assignment(s): See Study Guide
Discuss:	<input type="checkbox"/> Discussion Board Response: Submit your response to the Discussion Board question by Saturday, 11:59 p.m. (Central Time) <input type="checkbox"/> Discussion Board Comment: Comment on another student's Discussion Board response by Tuesday, 11:59 p.m. (Central Time)
Submit:	<input type="checkbox"/> Mini Project by Tuesday, 11:59 p.m. (Central Time)
Notes/Goals:	

Unit V	Engineering Air Quality for Ecological and Structural Health
Review:	<input type="checkbox"/> Unit Study Guide
Read:	<input type="checkbox"/> Chapter 6: Welfare Effects <input type="checkbox"/> Additional Reading Assignment(s): See Study Guide
Discuss:	<input type="checkbox"/> Discussion Board Response: Submit your response to the Discussion Board question by Saturday, 11:59 p.m. (Central Time) <input type="checkbox"/> Discussion Board Comment: Comment on another student's Discussion Board response by Tuesday, 11:59 p.m. (Central Time)
Submit:	<input type="checkbox"/> Assessment by Tuesday, 11:59 p.m. (Central Time) <input type="checkbox"/> Mini Project by Tuesday, 11:59 p.m. (Central Time)
Notes/Goals:	

Unit VI	Engineering Air Quality Monitoring Systems
Review:	<input type="checkbox"/> Unit Study Guide
Read:	<input type="checkbox"/> Chapter 7: Air Quality and Emissions Assessment <input type="checkbox"/> Chapter 8: Regulation and Public Policy <input type="checkbox"/> Additional Reading Assignment(s): See Study Guide
Discuss:	<input type="checkbox"/> Discussion Board Response: Submit your response to the Discussion Board question by Saturday, 11:59 p.m. (Central Time) <input type="checkbox"/> Discussion Board Comment: Comment on another student's Discussion Board response by Tuesday, 11:59 p.m. (Central Time)
Submit:	<input type="checkbox"/> Mini Project by Tuesday, 11:59 p.m. (Central Time)
Notes/Goals:	

Unit VII		Statistical Modeling for Engineered Air Quality
Review:	<input type="checkbox"/>	Unit Study Guide
Read:	<input type="checkbox"/>	Chapter 7: Air Quality and Emissions Assessment, pp. 269-277
	<input type="checkbox"/>	Chapter 3: Atmospheric Dispersion, Transport, and Deposition, pp. 77-98
	<input type="checkbox"/>	Additional Reading Assignment(s): See Study Guide
Discuss:	<input type="checkbox"/>	Discussion Board Response: Submit your response to the Discussion Board question by Saturday, 11:59 p.m. (Central Time)
	<input type="checkbox"/>	Discussion Board Comment: Comment on another student's Discussion Board response by Tuesday, 11:59 p.m. (Central Time)
Submit:	<input type="checkbox"/>	Assessment by Tuesday, 11:59 p.m. (Central Time)
	<input type="checkbox"/>	Mini Project by Tuesday, 11:59 p.m. (Central Time)
Notes/Goals:		

Unit VIII		Utilizing Pollution Control Technologies for Engineered Air Quality Control
Review:	<input type="checkbox"/>	Unit Study Guide
Read:	<input type="checkbox"/>	Chapter 9: Control of Motor Vehicle Emissions
	<input type="checkbox"/>	Chapter 10: Control of Emissions from Stationary Sources
	<input type="checkbox"/>	Additional Reading Assignment(s): See Study Guide
Discuss:	<input type="checkbox"/>	Discussion Board Response: Submit your response to the Discussion Board question by Saturday, 11:59 p.m. (Central Time)
	<input type="checkbox"/>	Discussion Board Comment: Comment on another student's Discussion Board response by Tuesday, 11:59 p.m. (Central Time)
Submit:	<input type="checkbox"/>	Project by Tuesday, 11:59 p.m. (Central Time)
Notes/Goals:		