

# CEE4320 Hazardous Substance Remediation

Credits: 3-0-3

Fall 2026

## Instructor Information

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## General Course Information

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### Description

Welcome to CEE 4320 where you will learn the technical aspects of hazardous waste management and treatment, including legislation, exposure and risk assessment, contaminant fate and transport, waste treatment methods, and remediation technologies.

### Course Learning Outcomes

After the first part of this course (Fundamentals), students will be able to:

- Explain how hazardous wastes came to be regulated. Describe major environmental regulations including CERCLA/Superfund and RCRA. Understand the legal definition of a hazardous waste (as compared to hazardous substances).
- Identify common chemicals of concern (COC). Convert concentration and mass in various environmental media (liquid, soil, air). Understand how different COCs partition in different phases in the environment.
- Design a sampling approach for soil and groundwater. Know how to identify Applicable or Relevant and Appropriate Requirements (ARARs) for a site. Understand factors important in plume migration and how to estimate migration velocity of a dissolved plume. Understand (via hands-on experience) how to sample VOAs, bail a well, and test for oil/water interface in a monitoring well.
- Conduct a basic Risk Assessment: Complete hazard identification, dose-response, and exposure assessments.

By the end of this course (Treatment Methods and Site Remediation), students will be able to describe and conduct calculations to remediate media including:

- Vadose Zone Soil Remediation – excavation, soil vapor extraction, soil bioremediation, chemical oxidation, soil washing, and solidification/stabilization.

- Groundwater Remediation – pump & treat, ex-situ remediation (activated carbon adsorption, air stripping, advanced oxidation, chemical precipitation), in-situ remediation (air sparging, bioremediation, chemical oxidation)
- Natural attenuation.

Long-term monitoring and sustainability issues will be discussed at the end of the Semester. If additional calculation review is found to be advisable earlier in the semester, these latter sections may be shortened.

### Required Course Materials

Two books (“Site Assessment” and “Dark Glasses”) are used for this class as follows:

- “Site Assessment and Remediation for Environmental Engineers” by Surbeck and Kuo, part of the Fundamentals of Environmental Engineering Series from CRC Press, 2021. This book is available for free through the library at this link.  
[https://galileo-gatech.primo.exlibrisgroup.com/permalink/01GALI\\_GIT/gmaiv3/alma9915077865102947](https://galileo-gatech.primo.exlibrisgroup.com/permalink/01GALI_GIT/gmaiv3/alma9915077865102947)  
The above link will state two versions are available, but both appear to be the same 2021 version. While you could rely on simply accessing the link each time you need the content, I recommend you download the entire pdf via download button on the right.
- “How to Recognize a Hazardous Waste (even if it’s wearing dark glasses) - A Concise Training and Reference Guide for RCRA Compliance” by Gary Crouth, 2012 edition. (\$26.67 Amazon prime 2-day paperback; students have previously advised that the Kindle version had formatting issues, thus recommend the paperback).  
A copy of this book is available at the library, but I recommend each student secure their own copy as we will have homework assignments on each chapter.

An additional book consisting solely of example problems and solutions is: “Practical Design Calculations for Groundwater and Soil Remediation”, by Jeff Kuo, Second Edition, CRC Press, 2014. As Kuo was the co-author of the Site Assessment book, the practical calculations sometimes appear (verbatim) in the Site Assessment book. The GT library has one e-license/click “view full text” at:

[https://galileo-gatech.primo.exlibrisgroup.com/discovery/fulldisplay?context=L&context=L&vid=01GALI\\_GIT:GT&vid=01GALI\\_GIT&docid=cdi\\_askewsholts\\_vlebooks\\_9781466585249&tab=default\\_tab&lang=en](https://galileo-gatech.primo.exlibrisgroup.com/discovery/fulldisplay?context=L&context=L&vid=01GALI_GIT:GT&vid=01GALI_GIT&docid=cdi_askewsholts_vlebooks_9781466585249&tab=default_tab&lang=en)

If you are the type of student who likes to deep dive into extra problems, you may find the “Practical Design Calculations” book helpful, but that book is not required nor needed for class. Only the “Site Assessment” and “Dark Glasses” books are required.

### Grading Policy:

#### *Assignments*

- 10% - Class Attendance, Participation, Preparation, Contribution
- 4% - Q&A Homework Response to Chapter Qs – “How to Recognize...Dark Glasses”
- 18% - Homework Assignments
- 26% - Midterm

- 16% - Group Project (4% report, 4% slide deck, 4% presentation, 4% handout)
- 26% - Final Exam

### **Description of Graded Components**

Presence and active input during class time activities and discussions will be considered in evaluating the participation grade. A sign-in sheet will be placed near the classroom entrance; ensure you sign-in each class. Reading assignments should be read before class.

Homework will be assigned throughout the semester, with most being instructor-graded (basis for homework grade) and several being self-graded (posted answers, practice only).

For the “How to Recognize Book” the 8 chapters each conclude with brief multiple choice questions (3 to 13 Qs), but the book contains the answers with explanations. The “Q&A Homework Response” assessment is for each student to read the assigned chapter and record your answers to the Qs. I fully expect students will answer some Qs wrong even after reading the chapter, and consider this homework to be an informal polling of knowledge (before you read the answers!). The purpose is for me to identify which Q’s students struggled with, so that I can provide additional explanation. I will not be judging any student based on the # right or wrong on these chapters; credit is based on participation (truthful submission of your answer).

The Semester Project will be a group project, with two students per group, possibly adjusted depending on the final class enrollment. Each group will be assigned a topic, to delve into via research on three case studies (plus the technology as a whole), to prepare a 7 to 8-page, single-spaced typed report, including figures and tables. References shall be listed at end but do not count towards the pages. Each group will also give an oral presentation (timed, 6 to 7 minutes, adjusted based on class size) of their work, which will be followed by Q&A. The teams shall also prepare a one page, double-sided technology summary handout to distribute (with copies for the class).

The Mid-Term and Final Exam will both allow one (single sided) 8-1/2x11 page of handwritten notes, except for the “Dark Glasses” portion of the midterm which is closed book. Formula sheets used during class will be made available for the midterm and final. A study guide will be provided for the “Dark Glasses” questions. The Final Exam will not be cumulative (except as to information such as conversions needed when designing treatment methods). I will typically include either a bonus problem or allow “student select one problem to omit” on exams.

## Course Policies

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### **Attendance and/or Participation**

Students are expected to attend class and participation is part of the grade. However, if you are sick, please contact me so that alternative arrangements can be made as to your access to the course materials from that day.

### **Academic Integrity**

Georgia Tech aims to cultivate a community based on trust, academic integrity, and honor. Students are expected to act according to the highest ethical standards. Review [Georgia Tech's Honor Code](#) and the student [Code of Conduct](#).

Any student suspected of cheating or plagiarism on a quiz, exam, or assignment will be reported to the Office of Student Integrity, who will investigate the incident and identify the appropriate penalty for violations.

### **Accommodations for Students with Disabilities**

If you are a student with learning needs that require special accommodation, [contact the Office of Disability Services](#) (404-894-2563) as soon as possible to make an appointment to discuss your special needs and to obtain an accommodations letter. Please also e-mail me as soon as possible in order to set up a time to discuss your learning needs.

### **Student-Faculty Expectations Agreement**

At Georgia Tech, we believe that it is important to strive for an atmosphere of mutual respect, acknowledgement, and responsibility between faculty members and the student body. [The Student-Faculty Expectations](#) articulate some basic expectations that you can have of me and that I have of you. In the end, simple respect for knowledge, hard work, and cordial interactions will help build the environment we seek. Therefore, I encourage you to remain committed to the ideals of Georgia Tech while in this class.

### **Pre- &/or Co-Requisites**

Pre-Req: Math and chemistry, including CHEM 1310 or CHEM 1211K are required.

Standing: Junior or Senior status (graduate students may also enroll).

Do not worry! I review the fundamentals needed for success in this class during lectures. If you need additional review, I am very willing to help any student outside of class as well.

### **Extra Credit Opportunities**

Bonus: +1 for arranging/attending a 15-minute 1:1 office visit during semester.

### **Collaboration, Group Work, and Use of Generative AI**

Homework shall be completed individually, unless the specific assignment is discussed in class as something that may be prepared with peers.

The semester project will be graded on a group basis. However, students will be asked to provide a summary regarding the ways in which each member contributed, and grades may be adjusted accordingly based on individual contribution.

The use of spell checker, thesaurus, Grammarly, and similar programs is allowed. However, the use of AI such as ChatGPT to create your project is not. For clarity: programs that correct your original content are allowed, but programs that generate new content independent of what you wrote are prohibited. You may use AI to identify a path of investigation, but you are responsible for finding and selecting three appropriate case studies, reading them, compiling and consolidating the data, writing your report, and properly citing the original scientific articles. You may, once you have created your report, run it through AI as an experiment on what the AI generates, as long as you submit both versions (the initial non-AI version will be the one graded). As AI is constantly changing, the instructor reserves the right to change the approach to AI during the course of the semester; any changes in what is acceptable will be discussed with the class prior to any affected assignments.

### **Extensions, Late Assignments, & Re-Scheduled/Missed Exams**

Each assignment will include a due date/time when posted. Any assignment handed in late will be docked 5% (1 day), 10% (2 days), and 10% more each additional day (day = 24 hours from original due date/time), including weekends. If a submittal is multiple days late, the student risks a 0 on the assignment, as no credit will be given for submittals received after submittals from other students have been graded and uploaded.

No make-up exams will be given unless the absence is institute approved. If you are sick or have an approved institute activity, please let me know and accommodations will be made. During the course of the semester, if students feel a scheduled due date should be shifted, please raise for class discussion.

### **Inclement Weather and Digital Learning Days**

On-line zoom classes may be utilized in the event that on-campus attendance is interrupted.

### **Student Use of Mobile Devices in the Classroom**

Mobile devices shall be turned off during class, unless being used for notetaking, in which case no other apps are to be open.

## Campus Resources for Students

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### **Undergraduate Student Academic Success Resources:**

Academic Support: Academic Success and Advising (a unit in the Office of Undergraduate Education & Student Success) provides free support for your courses. Students can attend scheduled supplemental review (PLUS) sessions, stop by Drop-In Tutoring, or schedule a one-on-one appointment through Knack. To explore what options work best for you, please visit us online at [success.gatech.edu/tutoring](https://success.gatech.edu/tutoring), email us at [tutoring@gatech.edu](mailto:tutoring@gatech.edu), or come see us at Clough Undergraduate Learning Commons, Suite 283.

### **Graduate Student Academic and Professional Success Resources:**

A list of resources for graduate students is given on the [Office of Graduate and Postdoctoral Education](#) website. Specific information for [current graduate students](#) includes

- [Academic Resources](#) such as the Communications Center, Language Institute, Library, Catalog, Registrar, resources for conducting research, Advocacy and Conflict Resolution resources, and how to manage unexpected situations that may impact your academic performance;
- [Student Resources](#) such as Campus Services, Child Care/Family programs, Health & Wellness, Career Services, and the Student Resource Guide; and
- [Professional Development](#) *such as the programming from the Career Center and other professional development resources and events”*

### **Student Well-Being:**

At Georgia Tech, we are concerned about your overall physical, social, and mental well-being. A [comprehensive list](#) of wellness related resources has been compiled and maintained by the Office of the Vice President for Student Engagement and Well-being ([student-resource-guide](#) [gatech.edu](https://gatech.edu)).