The program has been organized to offer advanced instruction and research training in environmental chemistry and environmental technology leading to the doctor of philosophy. A doctoral minor in environmental chemistry and technology is also offered. The program trains candidates for careers in teaching, research, resource management, environmental consulting, and private sector/industrial positions. Areas of work include the development of advanced technologies and materials for air and water purification and for the saving and storage of energies, alternative energy technologies, water and air pollution control, soil and sediment remediation, environmental technology, chemical limnology, and groundwater chemistry.

The Ph.D. degree is designed for students who have a strong background in chemistry and who desire graduate training in applying chemistry to environmental systems. Individual programs are tailored to meet the candidate's interests through selection of a specialization and elective courses. Areas of specialization include aquatic chemistry, air pollution chemistry, terrestrial chemistry, and chemical- and bio-technology development.

The Environmental Chemistry and Technology Program faculty is composed of an interdepartmental committee. Several committee members who have appointments in the Department of Civil and Environmental Engineering are located in the Water Science and Engineering Laboratory. Other members are located in their respective departments.

The environmental chemistry and technology area occupies over 10,000 square feet of office and laboratory space in the Water Science and Engineering Laboratory. Facilities include offices, conference room, classrooms, computer facilities, and over 8,000 square feet devoted to research. The research areas, including trace element and mercury clean laboratories, are designed for research in aquatic chemistry, air pollution chemistry, and environmental technology. Shop facilities (electronics/mechanical) allow fabrication of specialized equipment tailored to the particular field and laboratory research needs. Other specialized facilities include areas for investigations of air pollution chemistry, ceramic membrane technologies, hazardous material remediation, and development of energy storage devices.

In addition to the Water Science and Engineering Laboratory, students also have access to numerous facilities on the UW–Madison campus, including laboratories in the Departments of Soil Science, Chemical and Biological Engineering, Materials Science and Engineering, Chemistry, Geoscience, Civil and Environmental Engineering, the Center for Limnology, and the State Laboratory of Hygiene.

Students seeking admission should have a background in the fundamental areas of general, organic, physical, and analytical chemistry. In addition, students should have some background in applied sciences which can be fulfilled with a minimum of 6 credits in natural sciences such as botany, zoology, bacteriology, earth science, material science, biochemistry, or engineering. Students who have not met these requirements must do so prior to the completion of the master’s degree.

The application deadline is January 1 for the fall term. Late applications may not be reviewed for funding opportunities.

Required materials
1. All applicants must use the UW–Madison Graduate School online application system.
2. Three letters of recommendation
4. Please send GRE and TOEFL scores electronically to UW–Madison, institution code 1846.
5. All items should be submitted through the online application. Please do not mail or e-mail materials directly to our program at the time of application. If you are admitted to our program, we will request an official copy of your transcript at that time.

GRADUATE SCHOOL ADMISSIONS
Graduate admissions is a two-step process between academic degree programs and the Graduate School. Applicants must meet requirements of both the program(s) and the Graduate School. Once you have researched the graduate program(s) you are interested in, apply online (https://grad.wisc.edu/admissions).

FUNDING
GRADUATE SCHOOL RESOURCES
Resources to help you afford graduate study might include assistantships, fellowships, traineeships, and financial aid. Further funding information is available from the Graduate School. Be sure to check with your program for individual policies and processes related to funding.

PROGRAM RESOURCES
Students accepted into the program can expect to be fully funded through fellowships, teaching assistant-ships, or research assistant-ships on research projects. Admission decisions are based on the student’s qualifications and research interests, the availability of funding, and the focus of funded research projects. Funding includes a waiver of tuition (excluding segregated fees), health benefits (including family coverage), and a yearly stipend.

REQUIREMENTS
MINIMUM GRADUATE SCHOOL REQUIREMENTS
Review the Graduate School minimum academic progress and degree requirements (http://guide.wisc.edu/graduate/#policiesandrequirementstext), in addition to the program requirements listed below.
MAJOR REQUIREMENTS

MODE OF INSTRUCTION

<table>
<thead>
<tr>
<th>Face to Face</th>
<th>Evening/Weekend</th>
<th>Online</th>
<th>Hybrid</th>
<th>Accelerated</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
</tbody>
</table>

Mode of Instruction Definitions

Evening/Weekend: These programs are offered in an evening and/or weekend format to accommodate working schedules. Enjoy the advantages of on-campus courses and personal connections, while keeping your day job. For more information about the meeting schedule of a specific program, contact the program.

Online: These programs are offered primarily online. Many available online programs can be completed almost entirely online with all online programs offering at least 50 percent or more of the program work online. Some online programs have an on-campus component that is often designed to accommodate working schedules. Take advantage of the convenience of online learning while participating in a rich, interactive learning environment. For more information about the online nature of a specific program, contact the program.

Hybrid: These programs have innovative curricula that combine on-campus and online formats. Most hybrid programs are completed on-campus with a partial or completely online semester. For more information about the hybrid schedule of a specific program, contact the program.

Accelerated: These on-campus programs are offered in an accelerated format that allows you to complete your program in a condensed time-frame. Enjoy the advantages of on-campus courses with minimal disruption to your career. For more information about the accelerated nature of a specific program, contact the program.

CURRICULAR REQUIREMENTS

Minimum Credit Requirement

- Minimum Residence Credit Requirement: 32 credits

Minimum Graduate Coursework Requirement

- Half of degree coursework (26 credits out of 51 total credits) must be completed graduate-level coursework; courses with the Graduate Level Coursework attribute are identified and searchable in the university’s Course Guide.
- Overall Graduate GPA Requirement: 3.00 GPA required.

Other Grade Requirements

- Students must earn a B or above in all courses counting toward degree requirements.

Assessments and Examinations

- Doctoral students are required to take a comprehensive preliminary exam by the end of their fifth semester of study in the Ph.D. program. A final oral exam of the doctoral dissertation is required. Deposit of the doctoral dissertation in the Graduate School is required.
- Language Requirements: No language requirements.

Doctoral Minor/Breadth Requirements

- All doctoral students are required to complete a minor.

REQUIRED COURSES

Students are required to develop a plan of courses with their advisor.

All incoming EC&T students should have basic preparation in the fundamental areas of general, organic, physical and analytical chemistry. Students should also have previous coursework in the natural sciences, which can include botany, bacteriology, zoology, earth science, material science, biochemistry or engineering. Note that CIV ENGR 500 Water Chemistry or equivalent material is a prerequisite for many of the core EC&T courses. If these requirements have not been met prior to entering the program, this should be considered when planning the coursework.

### Core Courses

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CIV ENGR 703</td>
<td>Environmental Inorganic Chemistry</td>
<td>1-3</td>
</tr>
<tr>
<td>or GEOSCI 875</td>
<td>Advanced Topics in Geology</td>
<td></td>
</tr>
<tr>
<td>CIV ENGR 502</td>
<td>Environmental Organic Chemistry</td>
<td>3</td>
</tr>
<tr>
<td>or CIV ENGR 704</td>
<td>Environmental Chemical Kinetics</td>
<td></td>
</tr>
<tr>
<td>CIV ENGR/ CIV ENGR 701</td>
<td>The Chemistry of Air Pollution</td>
<td>1-3</td>
</tr>
<tr>
<td>ATM OCN 701</td>
<td>Selected Topics in Analytical Chemistry</td>
<td></td>
</tr>
<tr>
<td>or CHEM 630</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Additional Coursework

- CIV ENGR 909 Graduate Seminar - Environmental Chemistry & Technology ¹

  ¹ Students must enroll in CIV ENGR 909 Graduate Seminar - Environmental Chemistry & Technology each semester. Ph.D. students should present a seminar once per academic year, either fall or spring semester.

Graduate-Level Chemistry Requirement

Students must take two 500-level or above chemistry courses. A partial list of potential courses is included below. Other courses may be substituted for this requirement with approval of the student’s academic advisor and the approval of the EC&T Academic Planning Committee.

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOCHEM 501</td>
<td>Introduction to Biochemistry</td>
<td>3</td>
</tr>
<tr>
<td>BIOCHEM 507</td>
<td>General Biochemistry I</td>
<td>3</td>
</tr>
<tr>
<td>BIOCHEM 508</td>
<td>General Biochemistry II</td>
<td>3-4</td>
</tr>
<tr>
<td>BIOCHEM 800</td>
<td>Practical Nuclear Magnetic Resonance Theory</td>
<td>2</td>
</tr>
<tr>
<td>BIOCHEM/ BOTANY 621</td>
<td>Plant Biochemistry</td>
<td>3</td>
</tr>
<tr>
<td>BIOCHEM 801</td>
<td>Biochemical Applications of Nuclear Magnetic Resonance</td>
<td>2</td>
</tr>
<tr>
<td>CBE 547</td>
<td>Introduction to Colloid and Interface Science</td>
<td>3</td>
</tr>
<tr>
<td>CHEM 613</td>
<td>Chemical Crystallography</td>
<td>3</td>
</tr>
<tr>
<td>CHEM 624</td>
<td>Electrochemistry</td>
<td>2-3</td>
</tr>
<tr>
<td>CHEM 625</td>
<td>Separations in Chemical Analysis</td>
<td>2-3</td>
</tr>
<tr>
<td>CHEM 628</td>
<td>Chemical Instrumentation: Design and Control Applications</td>
<td>3</td>
</tr>
</tbody>
</table>
Environmental Chemistry and Technology, Ph.D.

CHEM 636  Topics in Chemical Instrumentation: Introduction to NMR  2
CHEM 637  Topics in Chemical Instrumentation: Advanced Methods in NMR  1-2
CHEM 638  Topics in Chemical Instrumentation: Introduction to Mass Spectrometry  1
CHEM 652  Chemistry of Inorganic Materials  3
CHEM 653  Chemistry of Nanoscale Materials  3
CHEM/BIOCHEM 665  Biophysical Chemistry  4
CHEM 668  Biophysical Spectroscopy  2-3
CHEM 777  Physical Chemistry of Surfaces  2-3
CIV ENGR 501  Water Analysis-Intermediate  3
CIV ENGR 609  Special Topics in Water Chemistry  1-3
CIV ENGR 700  Chemistry of Natural Waters  3
M S & E 748  Structural Analysis of Materials  3
M S & E 758  Transmission Electron Microscopy Laboratory  1
SOIL SCI 621  Soil Chemistry  3
SOIL SCI 875  Special Topics  1-4

POLICIES

GRADUATE SCHOOL POLICIES
The Graduate School's Academic Policies and Procedures (https://grad.wisc.edu/acadpolicy) provide essential information regarding general university policies. Program authority to set degree policies beyond the minimum required by the Graduate School lies with the degree program faculty. Policies set by the academic degree program can be found below.

MAJOR-SPECIFIC POLICIES
GRADUATE PROGRAM HANDBOOK
A Graduate Program Handbook containing all of the program's policies and requirements is forthcoming from the program.

PRIOR COURSEWORK

Graduate Work from Other Institutions
With program approval, students may be to count credits of graduate coursework from other institutions. Coursework earned ten years or more prior to admission to a doctoral degree is not allowed to satisfy requirements.

UW–Madison Undergraduate
With program approval, 7 credits from a UW–Madison undergraduate degree are allowed to count toward the degree.

UW–Madison University Special
With program approval, 15 credits taken as a UW–Madison Special student are allowed toward minimum coursework requirements.

PROBATION
A semester GPA below 3.0 will result in the student being placed on academic probation. If a semester GPA of 3.0 is not attained during the subsequent semester of enrollment the student may be dismissed from the program or allowed to continue for one additional semester based on advisor appeal to the Graduate School.

ADVISOR / COMMITTEE
All incoming students are assigned an advisor. Students are expected to meet with their advisor on a regular basis.

CREDITS PER TERM ALLOWED
15 credits

TIME CONSTRAINTS
A candidate for a doctoral degree who fails to take the final oral examination and deposit the dissertation within five years after passing the preliminary examination may be required to take another preliminary examination and to be admitted to candidacy a second time.

A candidate for a doctoral degree who fails to take the final oral examination and deposit the dissertation within five years after passing the preliminary examination may be required to take another preliminary examination and to be admitted to candidacy a second time.

OTHER
Admitted students will be contacted directly by faculty regarding funding opportunities.

PROFESSIONAL DEVELOPMENT

GRADUATE SCHOOL RESOURCES
Take advantage of the Graduate School's professional development resources (https://grad.wisc.edu/pd) to build skills, thrive academically, and launch your career.

LEARNING OUTCOMES
1. Articulate research problems, potentials, and limits with respect to theory, knowledge, or practice within the field of environmental chemistry and technology.
2. Formulate ideas, concepts, and/or techniques beyond the current boundaries of knowledge in environmental chemistry and technology.
3. Create research or scholarship that makes a substantive contribution.
4. Demonstrate breadth within their learning experiences.
5. Advance contributions to the field of environmental chemistry.
6. Communicate complex ideas in a clear and understandable manner.
7. Fosters ethical and professional conduct.

PEOPLE

Civil and Environmental Engineering Faculty: Professors Noyce (chair), Adams, Bahia, Cramer, Feigl, Hanna, Harrington, Holloway, Hurley, Karthikeyan, Lee, Likos, Long, McMahon, Noguera, Park, Parra-Montesinos (director), Pedersen, Potter, Ran, Russell, Schauer, Wu; Associate Professors Ahn, Fratta, Hurley, Loheide, Pincheira, Tinjum; Assistant Professors Block, Gadiokta, Ginder-Vogel, Hedegaard, Hicks,
Prabhakar, Remucal, Sone, Wang, Wright. See also CEE faculty (http://directory.engr.wisc.edu/cee/faculty).

**Geological Engineering Faculty:** Professors Likos (director) (Civil and Environmental Engineering), Anderson (Geoscience), Bahr (Geoscience), Feigl (Geoscience), Goodwin (Geoscience), Holloway (Nelson Institute), Thurber (Geoscience), Tikoff (Geoscience), Tobin (Geoscience), Wang (Geoscience), Wu (Civil and Environmental Engineering); Associate Professors Fratta (Civil and Environmental Engineering), Loheide (Civil and Environmental Engineering), Tinjum (Engineering Professional Development); Assistant Professors Cardiff (Geoscience), Ginder-Vogel (Civil and Environmental Engineering), Hicks (Civil and Environmental Engineering), Sone (Civil and Environmental Engineering), Zoet (Geoscience); Affiliate Professors Kung (Soil Science), Lowery (Soil Science), Plesha (Engineering Physics), Potter (Civil and Environmental Engineering). See also GLE faculty (https://www.engr.wisc.edu/geological-engineering/people).

**Environmental Chemistry and Technology:** Professors Hurley (director) (Civil and Environmental Engineering), Bertram (Chemistry), Bleam (Soil Science), Ginder-Vogel (Civil and Environmental Engineering), Gadikota (Civil and Environmental Engineering), Harrington (Civil and Environmental Engineering), Karthikeyan (Biological Systems Engineering), McMahon (Civil and Environmental Engineering/ Bacteriology), Pedersen (Soil Science), Remucal (Civil and Environmental Engineering), Roden (Geoscience), Root (Chemical and Biological Engineering), Schauer (Civil and Environmental Engineering), Thompson (Biological Systems Engineering). See also ECT Faculty (https://www.engr.wisc.edu/academics/graduate-academics/environmental-chemistry-technology).