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| **TITLE:** | Introduction to Environmental Chemistry of the Arctic |
| **NUMBER:** | CHEM 194 (on-campus CRN: 78902; Distance CRN: 78905) |
| **CREDITS:** | 3 |
| **PREREQUISITES:** | MATH 107X or higher |
| **LECTURE:** | Monday, Friday 3:30-4:30 pm (Campus: REIC 138; Dist: Blackboard Collaborate) |
| **LABORATORY:** | Wednesday 2:15-5:15 pm (Campus: REIC 203; Distance: lab kit) |
| **DISTANCE:** | Distance: Remotely attend 2 hr synchronous lecture via Blackboard Collaborate or watch lectures asynchronously. Lab experiments and collaboration performed asynchronously. |
| **FINAL EXAM:** | **Friday, December 18 3:15-5:15 pm (student group presentations)** |


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| **Instructors:** | **Dr. Sarah Hayes** | **Dr. Jennifer Guerard** |
| **Office:** | Reichardt 188 | Reichardt 180 |
| **Phone:** | 907-474-7118 | 907-474-5231 |
| **Email:** | s.hayes @alaska.edu | jguerard@alaska.edu |
| **Office Hours:** | M 5-6:30 pm, or by appointment | Th 9-11am, or by appointment |


## COURSE DESCRIPTION

This course introduces students to environmental chemistry through investigating the air, water, and soil quality of the arctic environment as affected by natural and anthropogenic cycling of nutrients and contaminants. The lab component will focus on characterization of natural waters collected around the state. Pre-requisites: MATH 107X or higher

This 3-credit course cannot fulfill the core science requirement. Petitions to request that it counts as the core science requirement will be denied by the registrar.

## EXPANDED COURSE DESCRIPTION

This course introduces students to environmental chemistry through investigating the air, water, and soil quality of the arctic environment as affected by natural and anthropogenic cycling of nutrients and contaminants. The lab component will focus on characterization of natural waters collected around the state through the use of collaborative research teams, made of a combination of distance and on-campus students. All students will have the same lab experiences, except for lab weeks 3 and 4 of the semester, when distance students will sample natural waters and do on-site analysis and on-campus students be exposed to advanced instrumentation that will be used to analyze collected samples. These experiences will be shared between research teams through the use of screencasts (due week 5).

Within each research team, the distance students will be the site experts, while the on-campus students will be instrumentation experts, thereby strengthening the team. Distance students will have the opportunity to share their field sites with their on-campus team through photos, videos, and screencasts, but maintain an inherently better understanding of their unique sampling sites. On-campus students will develop expertise on advanced instrumentation used by the TA to collect data on natural water samples and share that information with the rest of the class, particularly distance students, through screencasts. Although on-campus students will have a more interactive experience with advanced instrumentation because they will have a tour with the TA operating the instruments, distance students will be included asynchronously through virtual tours available to all students. In all cases, students will be provided with equivalent opportunities.

## COURSE GOALS

Students will gain an appreciation of the influence of chemistry in the natural, arctic environment and the implications of human-caused perturbations of these systems and potential remediation strategies.

**STUDENT LEARNING OUTCOMES**

Upon successful completion of this course, students will:

- Understand the basic chemical concepts as they relate to the function of ecosystems and the existence/transformation of contaminants.
- Outline basic metrics for assessing air, water, and soil quality and explain their importance as indicators of environmental health.
- Identify examples of anthropogenic influences of natural cycles and explain how that impacts ecosystem health.
- Evaluate student-generated water quality data from across the state and interpret data to assess anthropogenic perturbation of ecosystems.

**COURSE READINGS/MATERIALS**

Required Textbook: Environmental Science for a Changing World 1st edition. By Karr, Houtman, Interlandi. ISBN:978-1-4641-2938-4

Other required readings are available on Blackboard.

In order to participate in this class, distance students will be provided with a lab kit by mail. When you registered for the course, a refundable $250 deposit was charged to your account for the distance lab kit. **Lab kits will be shipped by the middle of August** and students should receive them by the start of the course. If you drop the course, you must return a complete lab kit (in a condition that is usable by another student) in order to receive a refund of $250. The amount will be credited to your student account after it has been received and inventoried at UAF.

**TECHNICAL REQUIREMENTS FOR COURSE**

Students must have regular access to a computer and the Internet to access online materials in Blackboard. Students will be expected to download course material as well as upload assignments. Students are also expected to regularly use their UAF Gmail accounts, Blackboard, Google Hangouts, and screencast-o-matic as methods of collaboration and sharing of their understanding.

Tablets will be loaned to distance students for the duration of the semseter. Tablets will be preloaded with most required applications and information. At the end of the semester, you will need return the tablet and probes provided in the lab kit to your instructors. Upon arrival, the probes were packaged in an addressed, stamped container. Keep the probes in this box during the semester, when not in use, and use it to return the probes and tablet at the end of the semester. After the tablet and probes have been received at UAF, the $250 lab kit fee will be refunded to your student account.

**INSTRUCTIONAL METHODS**

Course material will be delivered through a combination of lectures incorporating active learning techniques, lab exercises (a combination of virtual, field, and kitchen-based labs), and weekly activities (ie case studies, interviews with experts, developing screencasts, etc). Research teams of on-campus and distance students (2 on-campus for every distance student at max enrollment) will generate lab-based replicate data sets of

surface water quality data from communities across the state. Student groups will work closely and engage in peer mentoring (distance student is the expert on the field site while on-campus students will become instrumentation experts) and build a community of learners across the state of Alaska.

**COURSE SCHEDULE**
See attached.

**COURSE POLICIES**
Continued attendance to class indicates each student agrees to the policies set forth in this syllabus. Distance course attendance will be measured through effort on assignments, collaborative activities, and exams.

Collaboration and Classroom Behavior - Collaboration and working in small groups is a key component of classroom and lab time. Your group is there to support your learning, not do the work for you. Students are expected to conduct themselves in a professional manner at all times. Disrespect of the classroom learning environment, instructors, and fellow students will not be tolerated!

Late work- Assignments will be due at 11:59pm. Late work will be accepted at a 10% per day reduction of the points possible. This is in an effort to keep the entire class moving through the projects efficiently. Emergency situations will be dealt with as needed.

Instructor-Initiated Withdrawals- Any time up to and including the last day to drop with a "W", the professor has the right to withdraw a student that "...has not participated substantially in the course." In CHEM 194 nonparticipation includes:
(1) Either of the first two assignments are not turned in within 1 week of the due date,
(2) Exam I is missed without an excused absence,
(3) one or more lab reports are not turned in within 1 week of the date due, or
(4) completes less than 2/3 of homework assignments.

**EVALUATION POLICIES**
There are **1000 total points available** in this class. Grades are assigned as follows: 1000-900 A, 899-800 B, 799-700 C, etc. The instructors reserve the right to adjust grading scheme to the student's benefit.

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| Reading checks | 10 pts x 14 weeks= 140 points possible | 125 |
| Online discussion | 20 pts x 14 weeks= 280 points possible | 255 |
| Labs | 30 pts x 12 labs = 360 points | 360 |
| Hour exams | 100 pts x 2 exams = 200 points | 200 |
| Final presentation | | 60 |
| **Total points** | | **1000** |

Reading Checks- Each week, 5 pts are available for chapter readings and 5 pts for case study. Reading assessment assignments will be due Mondays and Fridays at 12pm, before class begins. Of the 140 points possible, only 125 will be counted toward the final grade.
Online Discussion- Each week, 15 points are available for posting to online discussion topics (due Friday at 12pm) and 5 pts are available for replying thoughtfully to others posts (Due Mondays at 12pm). A total of 280 points are possible, of which 255 will be counted toward the final grade.
Labs- Twelve lab experiments will be performed during the semester, each worth 30 points. Lab reports will be exchanged between students and the instructors using Blackboard.
Exams- Two hourly exams are scheduled, a midterm and final exam.

Final Presentation- Final presentations on surface water characterized during the semester will be performed during the final exam period.

**Successful, timely completion of this course depends on committing yourself early and maintaining your effort.** To this end, this course adheres to the following UAF eLearning Procedures:

**INSTRUCTOR RESPONSE TIME**
The instructors will attempt to respond promptly to student emails during normal business hours, but response times may be up to 24 hours. Assignments graded by instructors (e.g., lab reports, exams, blog posts) will generally be returned within 48 hours after assignment due date but no longer than a week. Grades in Blackboard will be updated weekly.

**HOW TO CHECK YOUR GRADE**
To check your grades for assignments and find comments from your instructor, click on the My Grades link in the sidebar menu in Blackboard. All the assignments and their due dates are listed. If your instructor has left comments, there will be a Comments link. Click on this link to view comments.

- If the score is for a test or quiz, click on the check mark or your score to see results and feedback.
- If the score is for an assignment, the title of the assignment is a link and by clicking this link you'll be taken to your submission, grade and comments.
- If you see a green explanation point, your assignment has not been graded yet.

**EFFORT AND STUDENT INVOLVEMENT***
The categories below demonstrate how the 2 hours of lecture, 3 hours of lab and 4 hours of non-lecture in a face to face course translate into 9 hours of work in an online course, meeting the requirement of 9 hours of work per week for a 3 credit course. This calculation covers the entire course.

1. **INSTRUCTION:** lectures *22%*
2. **INDIVIDUAL RESEARCH:** *lab experiments 33%*
3. **ASSIGNMENTS:** readings, *case studies, quizzes, homework 22%*
4. **COLLABORATION:** *case studies, laboratory project 23%*

*This metric of student effort is used during development to ensure rigor and alignment with the federal guidelines and definitions for credit hour equivalents for online learning and other out-of-classroom work. This portion of the syllabus is for development purposes only and students will see only the sections required by Faculty Senate in their syllabus.

**EXPECTATION OF STUDENT EFFORT**
Students should expect to spend 9 hours per week on this class. Students are expected to complete the weekly assignments by their due dates.
If circumstances arise that cause you to need extra time on any assignment(s), e-mail your instructor for guidance. Extensions of due dates may be granted, but your instructor expects to be informed in advance if you are not able to submit your assignment on time. Students are expected to maintain a working backup plan to be implemented in the event of a computer malfunction or an interruption of their normal Internet service during the course.

**ACADEMIC INTEGRITY**
Honor code and Academic integrity- Students are expected to conduct themselves in accordance with the UAF Honor code. The Chemistry Department policy states: *Any student caught cheating will be assigned a course grade of F. The students' academic advisor will be notified of this failing grade and the student will not be allowed to drop the course.*

As described by UAF, scholastic dishonesty constitutes a violation of the university rules and regulations and is punishable according to the procedures outlined by UAF. Scholastic dishonesty includes, but is not limited to, cheating on an exam, plagiarism, and collusion. Cheating includes providing answers to or taking answers from another student. Plagiarism includes use of another author's words or arguments without attribution. Collusion includes unauthorized collaboration with another person in preparing written work for fulfillment of any course requirement. Scholastic dishonesty is punishable by removal from the course and a grade of "F." For more information go to Student Code of Conduct. (http://uaf.edu/usa/student-resources/conduct)

**SUPPORT SERVICES**

**UAF eLearning Student Services** helps students with registration and course schedules, provides information about lessons and student records, assists with the examination process, and answers general questions. Our Academic Advisor can help students communicate with instructors, locate helpful resources, and maximize their distance learning experience. Contact the UAF eLearning Student Services staff at 907. 479.3444 or toll free 1.800.277.8060 or contact staff directly – for directory listing see: http://elearning.uaf.edu/contact

**UAF Help Desk**

Go to http://www.alaska.edu/oit/ to see about current network outages and news.
Reach the Help Desk at:

- e-mail at helpdesk@alaska.edu
- fax: 907.450.8312
- phone: 450.8300 (in the Fairbanks area) or 1.800.478.8226 (outside of Fairbanks)

**DISABILITIES SERVICES** - The **UAF Office of Disability Services** operates in conjunction with UAF eLearning. Disability Services, a part of UAF's Center for Health and Counseling, provides academic accommodations to enrolled students who are identified as being eligible for these services.

If you believe you are eligible, please visit their web site (http://www.uaf.edu/disability/) or contact a student affairs staff person at your local campus. You can also contact Disability Services on the Fairbanks campus by phone, 907.474.5655, or by e-mail (uaf-disabilityservices@alaska.edu).

**VETERAN SUPPORT SERVICES** - Walter Crary (wecrary@alaska.edu)is the Veterans Service Officer at the Veterans Resource Center (111 Eielson Building, 474-2475). Fairbanks Vet Center 456-4238. VA Community Based Outpatient Clinic at Ft. Wainwright is 361-6370.

## Tentative Lecture and Lab Schedule

### Week 1 – Introduction
Reading: Environmental Science, Ch 1-2
*Case study: The Obligation to Endure, an excerpt from Silent Spring by Rachel Carson*
**Lab 1: Safety and Scientific Method**
- Safety map and contract
- Data interpretation and testable observations
- Neutralization of acids and bases

### Week 2 – Air Quality
Reading: Environmental Science, Ch 3, 25
*Case study: Bear Trouble*
**Lab 2: Modeling Air Quality and Introduction to pH**
- HYSPLIT modeling of air plumes
- PHET simulation- pH scale basics
- pH of household items

### Week 3: Introduction to Water Quality
Reading: Environmental Science, Ch 17
*Case study: Tricolsan in water treatment – from research to regulation in Minnesota*
**Lab 3: Water Quality and Contamination**
- Effects of water contamination
- Water treatment
- Practice with environmental probe measurements

### Week 4: Water Quality and Treatment
Reading: Environmental Science, Ch 18
*Case study: PCBs in salmon causing accumulation in spawning lake sediments*
**Lab 4: Sampling Surface Water**
- Selecting a sample site
- Sampling natural waters
- Sample preservation
- Distance students: Prepare and ship samples to UAF for additional analysis.
- On campus students: Jigsaw of analytical techniques.

### Week 5 – Water Quality of Groundwater
Reading: Environmental Science, Ch 7
*Case study: Sulfolane*
**Lab 5: Surface Water Analysis**
- Surface water characterization
- Virtual stream lab
- Site descriptions (distance) and analytical jigsaw screencasts (on-campus) due.

### Week 6- Marine Water Quality
Reading: Environmental Science, Ch 15, 16
*Case study: Effects of ocean acidification on corals*
**Lab 6: Marine Water Quality and Ocean Acidification**
- Effect of atmospheric $CO_2$ on ocean pH
- Shell stability upon ocean acidification

### Week 7 – Contaminant Transport and Transformation

Reading: Environmental Monitoring and Characterization, Ch 16 *Available on blackboard*
***Exam 1***

**Lab 7: Contaminant Partitioning**

- Contaminant partitioning in the environment

**Week 8– Weathering and Soil Formation**

Reading: Environmental Science, Ch 19, 23
*Case study- How permanent is permafrost?*

**Lab 8: Weathering and Soil Formation**

- Rocks into soil
- Exploring Alaskan soils

**Week 9 – Metals and Inorganic Contaminants**

Reading: Environmental Science, Ch 24
*Case study – Pebble mine: Tension between mineral recovery, fishing, and community health*

**Lab 9: Soil Quality and Contamination**

- Soil contamination
- Treating acid mine drainage

**Week 10 – Environmental Microbiology I**

Reading: Environmental Science, Ch 6
*Case study: Coliforms in Antarctica*

**Lab 10: Microbiology of Soils**

- Virtual microscope
- Virtual pond dip

**Week 11 – Environmental Microbiology II**

Reading: Environmental Monitoring and Characterization, Ch 14 *Available on blackboard*
*Case study – Oil Biodegradation and Bioremediation: A Tale of the Two Worst Spills in US History*

**Lab 11: Biodiversity and Biomagnification**

- Yeast responses to pollution
- Biomagnification

**Week 12 – Ecological Interactions and Bioaccumulation**

Reading: Environmental Science, Ch 9
*Case study: Bioaccumulation in the Arctic*

**Lab 12: no lab, Thanksgiving**

**Week 13 –Forest Fires & Ecological Succession**

Reading: Environmental Science, Ch 26
*Case study: Primary succession following deglaciation at Glacier Bay, Alaska*

**Lab 13: Sharing project data.** Peer research project presentations, peer evaluations

**Week 14 - Climate Change in the Arctic**

Reading: Environmental Science, Ch 28
*Case study: What does the data tell us about climate change?*

**Lab 14: Energy Sources and Climate Change**

- Energy sources and alternative energy
- Climate change

**Week 15 – Peer Research Presentations, Story GIS Project**

## Tentative Course Schedule

| Wk. | Date | Topic | Reading | Case Study | Laboratory |
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| 0 | Sept 4 | Introduction to the course | | | No lab |
| 1 | Sept 7<br>Sept 11 | Labor Day<br>Intro. to Environmental Chemistry | Env. Sci. 1-2 | The Obligation to Endure | 1: Safety and Scientific Method |
| 2 | Sept 14<br>Sept 18 | Air Quality | Env. Sci. 3, 25 | Bear Trouble | 2: Modeling Air Quality and Introduction to pH |
| 3 | Sept 21<br>Sept 25 | Introduction to Water Quality | Env. Sci. 17 | Regulating Triclosan | 3: Water Quality and Contamination |
| 4 | Sept 28<br>Oct 2 | Water Quality and Treatment | Env. Sci. 18 | PCB Transport in the Arctic | 4: Sampling Surface Water |
| 5 | Oct 5<br>Oct 9 | Water Quality of Groundwater | Env. Sci. 7 | Sulfolane | 5: Surface Water Analysis |
| 6 | Oct 12<br>Oct 16 | Marine Water Quality | Env. Sci. 15-16 | Ocean Acidification | 6: Marine Water and Ocean Acidification |
| 7 | Oct 19<br>Oct 23 | Contaminant Transformations<br>**EXAM 1** | *Env. Mon. 16 | none | 7: Contaminant Partitioning |
| 8 | Oct 26<br>Oct 30 | Weathering and Soil Formation | Env. Sci. 19, 23 | Permanent Permafrost | 9: Weathering and Soil Formation |
| 9 | Nov 2<br>Nov 6 | Metals and Inorganic Contaminants | Env. Sci. 24 | Pebble Mine | 10: Soil Quality and Contamination |
| 10 | Nov 9<br>Nov 13 | Environmental Microbiology I | Env. Sci. 6 | Coliforms in Antarctica | 8: Microbial World |
| 11 | Nov 16<br>Nov 20 | Environmental Microbiology II | *Env. Mon. 14 | Biodegradation of Oil | 11: Biodiversity and Biomagnification |
| 12 | Nov 23<br>Nov 27 | Ecological Interactions & Bioacc.<br>Thanksgiving | Env. Sci. 9 | Bioaccumulation in the Arctic | No lab |
| 13 | Nov 30<br>Dec 4 | Forrest Fires and Ecological Succession | Env. Sci. 26 | Glacier Bay Succession | Group work on presentations |
| 14 | Dec 7<br>Dec 11 | Climate Change in the Arctic | Env. Sci. 28 | Data on Climate Change | 14: Energy Sources and Climate Change |
| 15 | Dec 14<br>Dec 18 | **EXAM 2**<br>3:15-5:15 pm Final Exam- Student Presentations | | | |