

Introduction to Applied Environmental Geochemistry and Geochemical Modeling

**April 30 to May 4, 2007
University of Alberta
Edmonton, AB, Canada**

Presented by
Dr. Robert Donahue, P.Eng.
Applied Environmental Geochemistry Research Facility University of Alberta

Dr. John Mahoney,
MWH Americas, Inc. Denver, CO

Dr. Terry Fonstad, P.Eng
Department of Agriculture and Bio-resource Engineering
University of Saskatchewan

Course Description

An understanding of geochemical principles is essential to the cost effective management of groundwater and waste management problems. The course will provide the geo-science practitioner with the tools to characterize groundwater systems and predict their response to contaminants loading or remediation efforts. The material is presented through examples of basic mineral-water-atmospheric gas interactions and through case studies of contaminated sites, mine waste management, CO₂ sequestration and intensive livestock operations. The course material is delivered through lectures and hands on geochemical modeling designed to reinforce geochemical concepts and provide analytical tools for the working professional.

Who should attend

The course is designed for the practicing geo-science professional engineer, geologist, soil scientist, and hydrogeologist.

What you will learn

- Ground water characterization
- Mobility of inorganic contaminants
- Redox chemistry of carbon, nitrogen, iron and sulphur compounds
- Geochemistry of monitored natural attenuation
- Geochemistry for CO₂ sequestration
- Geochemistry of livestock waste management
- Modeling exercises on groundwater and mine waste water mixing
- Modeling exercises on mine waste management

What you get

- 36 hrs of lectures and hands on applied geochemical modeling
- Course notes binder, CD with problem solutions and 2 text books
- Breakfast, lunch and coffee for 5 days
- Daily post class social

Course Fees

Course is limited to 30 participants

Early registration \$1900 (Prior to March 30 2007)

Late registration \$2400 (After March 30 2007)

Registration Ends April 6 2007

Course Outline and Lecture and Problem Session Schedule

Monday May 1 Robert Donahue

7:30	Breakfast and Coffee
8:00 AM	Registration and Distribution of Course Materials
8:30 AM	Introductions and Course Objectives
9:00 AM	Lecture 1 Thermochemical principles Enthalpy, Entropy, Gibbs Free Energy, Law of Mass Action.
10:00	Coffee and a Stretch
10:20	Lecture 2 Aqueous complexes, Activity Coefficients and Speciation
12:00 PM	Lunch
1:00PM	Lecture 3 Acids Bases and Carbonate Geochemistry
2:15	Problem Session 1 Introduction to Speciation Modeling using PHREEQC Solution, Solution_spread, selected_output,
3:00 PM	Refreshments and a Stretch
3:20 PM	Problem Session 1 continued Thermodynamics. Uranium Tailings (calcium arsenate minerals) complexation speciation
5:00 PM	Finished for the Day

5:30 PM Social Gathering and Buffet Dinner at the Faculty Club

Tuesday May 2 Robert Donahue

8:00 AM	Breakfast and Coffee
8:30 AM	Lecture 4 Oxidation and Reduction Theory Pe, Eh vs. pH Stability Diagrams, PHREEQC redox calculation
10:00	Coffee and a Stretch
10:20	Problem Session 2 Geochemical Reactions in PHREEQC Solution Charge Balance Calculations, Mineral and Gas Phase Equilibrium, Mineral Dissolution and Precipitation.
12:00 PM	Lunch
1:00PM	Lecture 5 Iron, Sulphur and Nitrogen Geochemistry
3:00 PM	Refreshments and a Stretch
3:20 PM	Problem Session 3 Geochemical Reactions in PHREEQC continued -Redox Definition and speciation
5:00 PM	Finished for the Day

5:30 Trip to Old Stathcona for Cocktails and Appetizers -

Wednesday May 3 Terry Fonstad (Sorption and Ion exchange),
John Mahoney (Surface complexation)

8:00 AM	Breakfast and Coffee
8:30 AM	Lecture 6 (Terry) Sorption and Ion Exchange reactions
10:00	Coffee and a Stretch
10:20	Problem Session 4 (Terry) PHREEQC Sorption, Ion Exchange
12:00 PM	Lunch
1:15PM	Lecture 7 (John) Surface Complexation
3:00 PM	Refreshments and a Stretch
3:20 PM	Problem Session 5 (John) PHREEQC Surface Complexation
5:00 PM	Finished for the Day

Free Evening for Students

Thursday May 4 John Mahoney, Math talk
Robert Donahue Problem Session
Terry, Reactive Transport Analysis

8:00 AM	Breakfast and Coffee
8:30 AM	Lecture 8 (John) Mathematics of Geochemical Analysis and Modeling
9:30	Problem session 6 (Robert) Geochemical Mixing Problems
10:00	Coffee and a Stretch
10:20	Problem session 6 (Robert) Continued Sequential Reactions, Reaction Path modeling, and Inverse Modeling Copper Mine water mixing, Uranium Waste Rock Seepage Analysis, Organic Carbon reactions CO ₂ sequestration and flyash overburden inverse modeling
12:00 PM	Lunch
1:15PM	Lecture 9 (Terry) Reactive Transport analysis
3:00 PM	Refreshments and a Stretch
3:20 PM	Problem Session 8 (Terry) Reactive Transport Modeling Advection and dispersion with mineral solubility Column Hog Effluent Model with ion exchange
5:00 PM	Finished for the Day

Free Evening

Friday May 5 Robert Donahue and John Mahoney

8:00 AM	Breakfast and Coffee
8:30 AM	Lecture 10 Mine tailings, Pit Lakes and Acid Rock Drainage
10:00	Coffee and a Stretch Presentation of Certificates and Awards
10:20	Problem Session Mine tailings, Pit Lakes and ARD Problems
12:00 PM	Lunch
1:15PM	Lecture 11(John, Robert, Terry) Overview of geochemical modeling and common error in modeling, and group discussion
2:30 PM	Course Evaluation
3:00 PM	Finished for the Day and Course Completion

Instructor Biographies

[Dr. Robert Donahue, P.Eng.](#)

Dr. Donahue specializes in applied geochemistry and has over 15 years of consulting experience in geo-environmental engineering. He has conducted geochemical field investigations at active uranium mine in-pit and above ground tailings facilities and has conducted geotechnical and geochemical assessments of oils sands, copper mine and phospho-gypsum tailings. His work includes the investigation and remediation of petrochemical and mine waste contaminated sites.

Dr. Donahue is the course coordinator and can be reached at (780) 492-5112 and by email at rdonahue@ualberta.ca

Dr. John Mahoney

Dr. Mahoney, Principal Geochemist at MWH Americas, Inc., has nearly 30 years of experience as a consultant/researcher in the environmental, mining, and nuclear waste fields. He specializes in using various geochemical models to assess the fate of chemicals in aqueous systems. He has previously been the lead instructor for geochemical modeling classes at ICARD 2000 in Denver, and at a course at McGill University in 2002. Dr. Mahoney has also taught focused seminars on the geochemistry of mine waste and geochemical modeling for a mining company in Indonesia. In addition to his expertise in geochemical modeling, Dr. Mahoney also has experience in mine pit lake chemistry, environmental analytical chemistry, data validation and laboratory quality assurance.

Dr. Terry Fonstad, P.Eng.

Dr. Fonstad's expertise is in geo-environmental engineering. His research and consulting interests are in waste management and utilization, surface water and ground water protection and development, intensive livestock facility planning and development. He has been involved in extensive industrial consultations on site investigations for the establishment of intensive livestock operations, development of guidelines for intensive livestock facilities, and development of guidelines for the design and construction of earthen manure storages.

Registration Contact

Sally Petaske

Civil & Environmental Engineering
University of Alberta

Phone (780) 492-2176

Fax (780) 492-8198

Email sally.petaske@ualberta.ca

Local Accommodations

[On campus accommodations](#)

The University of Alberta offers guest accommodations in some of the student residences. Whether you are a guest or a student, at a U of A residence you are entering an environment built completely around your needs. We offer convenient locations, competitive prices, and friendly and efficient service with a variety of accommodation options. Some common services offered include coin-operated laundry facilities, free local calling, and fully furnished, self-contained units. On a year round basis we offer the following types of guest accommodation: Conference Centre Guest Rooms – Hotel style rooms for short term stays with queen or double beds, private washrooms, cable TV, phone, high speed internet access, daily housekeeping service and more...

<http://www.uofaweb.ualberta.ca/residences/>

Local Hotel

[Campus Towers, Edmonton](#)

11145-87 Avenue

Edmonton, Alberta

Canada T6G 0Y1

Phone: 780.439.6060 Email: reservations@campustower.com

Fax: 780.433.4410 Toll Free Reservations 1.888.962.2522