

# Contaminant Hydrogeology

## Course Outline:

<i>W</i>	<i>Date</i>	<i>Topic</i>	<i>Reading</i>	<i>HW</i>
1	8/25	Introduction: Course Overview; types and sources of contamination.	Fetter Chapter 1. Bahr (1992)	
<b>Part I: Physical Processes</b>				
	8/27	Review of Darcy's Law. Mathematical symbols. Fick's laws.	Squillace et al. (2002) Fetter 2.1 - 2.3	
	8/30	Advection and dispersion.	Freeze: Prologue and Chapter 1 Fetter 2.4 - 2.6	# 1 out
2	9/1	Concentration profiles and breakthrough curves. Determination of velocity.	Domenico and Schwartz, p. 231-233. Mackay et al. (1986)	
	9/3	More about velocity determination.	Plummer et al. (1993)	
	9/7	<b>Monday/Tuesday Switch Day</b> Forms of A-D equation. Diffusion vs. Dispersion. Peclet numbers.	Fetter 2.7	# 1 in # 2 out
3	9/8	Boundary conditions. Solutions of the A-D equation.	Fetter 2.8	
	9/10	The pore volume concept. Dimensionless form of the A-D equation. Sauty's findings.	Fetter 2.9	
	9/13	Lab determinations of dispersivity. The scale effect.	Fetter 2.10, 2.11 and 2.14	#2 in # 3 out
4	9/15	Macrodispersivity and the scale effect: deterministic explanation.	Molz et al. (1983)	
	9/17	Macrodispersivity and the scale effect: stochastic explanation. Geostatistics.	Fetter 2.12 Domenico and Schwartz, p. 228-231	
	9/20	The Borden and Cape Cod sites: explanations of macrodispersivity.	Domenico and Schwartz, p. 234-236 (see third reading). Garabedian et al. (1991).	#3 in # 4 out
5	9/22	Cape Cod and MADE sites. Macrodispersivity and the scale effect.	Boggs et al. (1992).	
	9/24	Geologically-based models of heterogeneity.	Koltermann and Gorelick (1996) Webb and Anderson (1996)	
	9/27	The two-region model	Fetter 4.9. Bajracharya and Barry (1997)	# 4 in #5 out
6	9/29	Fractured media transport. Multifluid contaminant problems.	Fetter 2.16. Fetter 4.1-4.6, 4.11 and 4.12, 5.1 and 5.2 (review).	
	10/1	More on multifluid contaminant problems.	Fetter 5.3 - 5.9	
7	10/4	<b>Exam 1 during lab time, 10/5. Covers through 9/29.</b> More on multifluid contaminant problems. Wilson's micromodel experiments.		#5 in

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<b>Part II: Chemical Processes</b>				
7	10/6	Structure and properties of organic compounds.	Fetter 7.1 to 7.5	
	10/8	More on organic compounds. Chemical processes affecting transport: overview.	Fetter 3.1 and 3.2	
	10/11	First order decay. First-order decay and its affect on transport. 2nd and 0-order decay.	Fetter 3.8	#6 out
8	10/13	Biodegradation and subsurface microbiology.	Fetter 7.6 and 7.7 Thomas and Ward (1992)	
	10/15	<i>NO CLASS — Midterm Break</i>		
	10/18	More biodegradation: Monod kinetics.	Fetter 3.9	#6 in #7 out
9	10/20	Heterogeneous reactions. Sorption processes. Sorption isotherms and retardation	Fetter 3.3 and 3.4	
	10/22	Freundlich and Langmuir isotherms	Fetter 3.4	
	10/25	Sorption of organics.	Fetter 3.6	#7 in #8 out
10	10/27	Nonequilibrium sorption and its effect on transport.	Fetter 3.5 Bahr (1989)	
	10/29	Environmental contamination. Risk assessment.	Freeze Chapter 3	
	11/1	Waste management and society.	Freeze Chapter 4	#9 and 10 out
11	11/3	Overview of site investigations and introduction to site evaluation exercise.	Brownlee (1985). Mercer and Spalding (1991)	
	11/5	Drilling, sampling and geologic interpretation	Fetter 8.3 and 8.4	
	11/8	Inorganic contaminants. Complexation reactions. (GSA)	Fetter 3.7, 6.1-6.6	#8 in
12	11/10	Precipitation-dissolution reactions and their effect on transport. (GSA)	Fetter 6.7-6.10	
	11/12	Tenad approach. Summary of reactions	Fetter 3.7.4	
<b>Part III: Site Investigation and Remediation</b>				
	11/15	<b>Exam 2 during lab time. Covers through 11/12.</b> Transport of colloids and microorganisms	Fetter 4.3 and 3.10. Bitton and Harvey (1992)	
13	11/17	More on colloidal transport and its affect on other contaminants	McCarthy and Zachara (1989) Reading on bioterrorism	
	11/19	Monitoring-well construction. Purging and water sampling	Fetter 8.1, 8.2, 8.5 - 8.14.	
	11/22	Plume interpretation. Plumes as manifestation of a process	Domenico and Schwartz, pp. 352 - 360. Broholm et al. (1999)	
14	11/24	<i>Thanksgiving</i>		
	11/26	<i>Thanksgiving</i>		

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	11/29	Overview of corrective actions.	Fetter, 9.1 and 9.2. Bredehoeft (1992). Hockman (1992)	
15	12/1	Physical containment methods. Hydraulic containment and removal (pump-and-treat).	Devinny et al. (1990). Fetter, 9.3 and 9.4.	
	12/3	Immiscible phase recovery	Fetter 9.5-9.7	
	12/6	In situ bioremediation	Fetter 9.8-9.11	
16	12/8	In-situ reactive barriers		
	12/10	Discussion of Final Projects.		#9 & 10 in

**Final Exam: Tuesday, Dec. 14, 5:30 p.m..**