CIVE 3331 - ENVIRONMENTAL ENGINEERING
Spring 2003

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Purpose: Exercises related to Lecture # 16. These exercises develop skills in selected environmental groundwater quality problems. Critical thinking is exercised in determination of analogies between lecture examples and the problems in this exercise set. Direct relationships to various accreditation objectives are highlighted in **Bold** type in the following sections. The exercises start on the next page.

Relevant ABET EC 2000 Criteria: Criterion 3 Program Outcomes and Assessment

(3-a) an ability to **apply knowledge of** mathematics**, science,** and engineering.
(3-e) an ability to identify, formulate, and solve engineering problems.
(3-k) **an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.**

Relevant CEE Educational Objectives:

(3) Emphasize problem-identification, problem-formulation and **communication skills**, **problem-solving techniques** and the **many facets of engineering design** throughout the curriculum.

(5) **Prepare every student to develop the skills for critical thinking and lifelong learning.**

Relevant CEE Program Outcomes:

ii. **Students should acquire the ability to solve practical civil engineering problems by applying the knowledge of mathematics, science**, **engineering, modern techniques**, **skills and practical tools they gained in their courses.**

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Exercise_016-1

Consider the use of a tracer gas to determine the air exchange in a room. By injecting a stable gas into the room and monitoring its concentration with time, we can estimate I(air exchanges per hour). The governing equation is

$C=C_o * exp(-It)$

If one takes the natural logarithm if the equation then $lnC = lnC_o - It$.

A plot of log concentration versus time should have slope of negative *I*.

Suppose you gather the following data, determine the infiltration rate *I*.

Time (min)	Concentration (ppm)
0	10.0
30	8.0
60	6.0
90	5.0
120	3.3

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Exercise_016-2

A single-story home with infiltration rate of 0.5 ach (air exchanges per hour) has 200m^2 of floor space and a total volume of 500m^3. (A very low ceiling!) If 0.6 pCi/m^2-s of radon is emitted from soil and enters the house, estimate the steady-state concentration of radon in the house.

Exercise_016-3

A convective kerosene heater is tested in a well mixed 27m3 chamber having an air exchange rate of 0.39 ach. After one hour of operation, the NO concentration reached 4.7 ppm. Treating NO as a conservative pollutant,

a) Estimate the NO source strength of the heater.
b) Estimate NO concentration that would be expected in the lab one hour after the heater is shut down.
c) If this heater were used in the home of problem 016-2, what steady state NO concentration would you expect? (Assume continuous use).