CEEG 340 - PS4
Problem 1

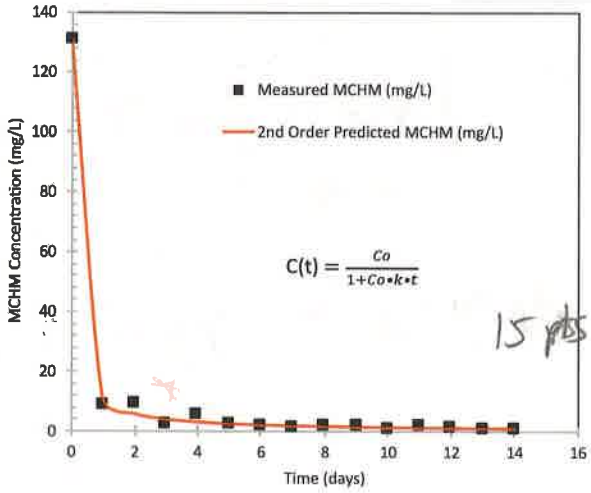
Input Values	
Calculated Values	
Constants	

30 pts

Part (a)

k (L/mg-day)	0.083
Co (mg/L)	131

Time (days)	MCHM (mg/L)	2nd Order Predicted MCHM (mg/L)	Residuals Squared
0	131	131.0	0.00
1	8.9	11.0	4.33
2	9.3	5.7	12.74
3	2.2	3.9	2.81
4	5.3	2.9	5.62
5	2.4	2.4	0.00
6	2	2.0	0.00
7	1.5	1.7	0.04
8	1.8	1.5	0.10
9	2	1.3	0.46
10	0.6	1.2	0.35
11	1.8	1.1	0.52
12	1	1.0	0.00
13	0.5	0.9	0.17
14	0.8	0.9	0.00
	Sum of Squares		27.15



15 pts

Part (b) The biodegradation rate of MCHM is a second order (determined by visual inspection), and has a second order rate coefficient, k, of 0.089 L/(mg-day). 10/15

Part (c) Based on the CDC's recommendation of not using water with more than 1 ppm_m of MCHM, it will be safe to drink after **12 days**. 5pts

(2) (20, 15)

(a) DALYS = YLL + YLD

$= (80-55) + 0.37 \times 30 + 0.54 \times 2$

(10, 15)

DALYS = 37 YEARS

(b) DALYS = YLL + YLD

$= 0^{*} + 0.54 \times 4 + 0.13 * (65-22)$

$= 8$

DALYS = 8 YEARS

* YLL = 0, B.C. DEATH NOT DUE TO DISORDER

(−2 PTS IF YLL ≠ 0)

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11.9 This problem allows you to think about how exposure impacts the concentration of air pollutants you are exposed to. (a) Maintain a diary for one full day and record all the locations you visit. Include the times of entry and exit for each location. Also record any interesting air quality information for each location. Calculate the percentage of time spent in each type of location. Summarize the data in a table. (b) In which location did you spend the most amount of time? The least? (c) Calculate the 24-hr time integrated average *exposure concentration* (units of $\mu g/m^3$) to airborne particles based on your recorded activity patterns, using the average airborne PM_{10} concentration for different locations provided below.

20 pts

Location	**Average Airborne PM_{10} Concentration ($\mu g/m^3$)**
Home	90
Office-Factory	40
Bar-Restaurant	200
Other Indoor	20
In a Vehicle	45
Outdoors	35

(a) (b) Students should be developing this type of table from the data entered into their dairy for their 24 hour period. Their raw data from the diary can be attached to the problem solution as an appendix. (c) Students can the use the table below to determine the "time averaged" concentration

10 pts FOR TABLE

Location	**Average Airborne PM_{10} Concentration ($\mu g/m^3$)**	**Time spent in Location (~~mins~~) h**
Home	90	X
Office-Factory	40	Y
Bar-Restaurant	200	Z
Other Indoor	20	W
In a Vehicle	45	0
Outdoors	35	0

Solutions Manual prepared by: Colleen Naughton, Ziad Katirji, Heather E. Wright Wendel, and James Mihelcic
Environmental Engineering: Fundamentals, Sustainability, Design, 2nd Edition
James R. Mihelcic and Julie Beth Zimmerman, John Wiley & Sons, New York, 2014.

5 pts WT AVE $= \frac{1}{24}(X \times 90 + Y \times 40 + Z \times 200 + W \times 20)$ $\mu g/m^3$

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(d) Now add a 35 $\mu g/m^3$ "proximity effect" to one of your locations above that we will assume is from exposure to cigarette smoking at that location. How does this change your 24-hr time integrated average *exposure concentration* (units of $\mu g/m^3$) to airborne particles?

Solution: 5 pts

Students' answers should vary.

CEEG 340 PS2

15pts

11.13 A travel demand management action is planned that will add parking spaces to an existing park-and-ride facility that is served by transit. The plan will add 120 parking spaces. Assume the new spaces will have a 95 percent estimated utilization rate and these individuals will use the available light rail and bus service. Also assume that the average commute that will be eliminated is 42 miles roundtrip (distance from lot to destination and return), and there are 250 operating days per year. (a) What is the annual reduction in vehicle miles traveled from implementation of the park and transit ride facility? (b) if the emission factor for reactive hydrocarbons is 0.23 grams/mile driven and for NO_x is 0.40 grams per mile driven, what is the estimated reduction in air emissions for both of these air pollutants over the year?

Solution:

a. $120\ spaces \times 0.95\ utilization \times 42 \frac{miles}{roundtrip} \times 250 \frac{days}{year} = \mathbf{1.20 \times 10^6 \frac{miles}{yr}}$ 5

b.

$1.20 \times 10^6 \frac{miles}{yr} \times 0.23 \frac{grams\ hydrocarbon}{year} = \mathbf{275{,}000\ grams\ hydrocarbon\ reduced/yr}$ 5

$1.20 \times 10^6 \frac{miles}{yr} \times 0.40 \frac{grams\ NO_x}{mile\ driven} = \mathbf{479{,}000\ grams\ NO_x\ reduced/yr}$ 5

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15 pts

11.28 Investigate sources of hazardous air pollutants emitted near your community. Go to Scorecard (www.scorecard.org) to gather data about air pollutant emissions. The Scorecard site makes the Toxics Release Inventory easily searchable; by entering your zip code, you can find a list of major air polluters in your area. (a) For your area, identify the top three five polluters and their total emissions. (b) Plot total environmental release for data from the top emitting company over the years of available data. (c) Describe the overall trend of emissions over time.

Solution:

Students answers may vary based on the location they choose but here an example for Detroit, MI (as of November, 2013):

a. The top five polluters and their emissions in Detroit, MI are shown in the table below:

5 pts

Rank	Facility	Emissions (lb)
1	GM NAVO Pontiac Assembly Center	1582541
2	GM MCG Orion Assembly Center	430284
3	Ford Wixom Assembly Plant	254816
4	LDM TECHS. New Hudson	100066
5	Precision Coatings, Inc.	70600

b. The plot for the total environmental release data for BM NAVO Pontiac Assembly Center is shown in the figure on the next page.

5 pts

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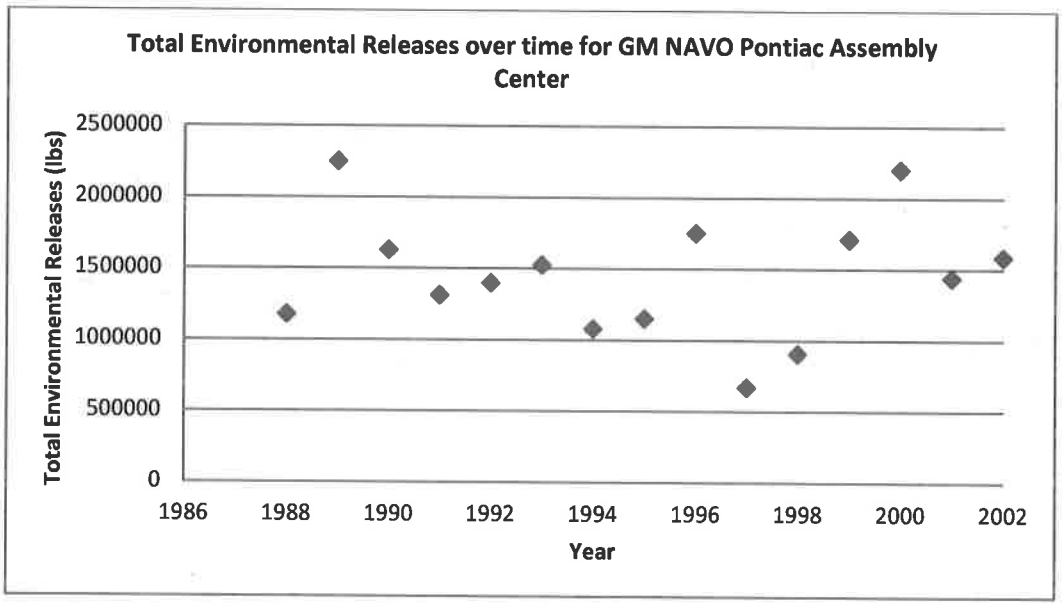

5 pts

c. It appears there was a general decrease of emissions from 1989 through 1998 (with lowest total environmental releases in 1997 and 1998) but followed by a sharp increase in 1999 and 2000 with another drop in 2001 and 2002.

SOME STUDENTS WILL NOT HAVE DATA FOR MULTIPLE YEARS. GIVE FULL CREDIT, AS LONG AS THEY HAVE DATA FOR ONE YEAR.