**Air Resources Management**

**Assignment 2**

(Please hand only printed material, written concisely, Times New Roman 12 or Calibri 10-11)

1. Assume that Haifa bay area (HBA) is 5 km wide (*W*) x 7 km long (*L*) and that on a certain morning the inversion is at 150 m a.g.l (*H*). Wind blows at 2 m/s (*u*) in the direction normal to the “width” of the study area. Every day, the concentration of benzene (*c*) at 6 am in the study area is zero. It can be also assumed that the “background” concentrations of benzene upwind of HBA is zero, too. The emission rate (*E*) of benzene in the study area is 1000 tones/year (based on a VOC survey like the one you discussed in assignment #1), and it can be assumed to be uniformly distributed across the surface (ground) of the study area.
2. Sketch a scheme of the problem assuming a simple box model (SISO)
3. Write the mass balance equation for the control volume
4. Calculate the concentration of benzene as a function of time (from 6 am until next day 6 am) for emissions that occur

(1) throughout the whole day, and

(2) only in the rush hours (2 hours in the morning, 7-9 am and 2 hours in the afternoon 5-7 pm).

(Integrate your calculated concentration over the whole day to make sure you do not violate any of the above assumptions!)

1. Plot your results. (1 h temporal resolution)
2. What is the “time constant” of the concentration changes? (h)
3. Based on (d), which emission pattern fits the descriptions and assumptions of the problem.

2. What should be the maximum allowed emission of benzene in HBA such that the daily ambient air quality standard (3.9 g/m3) is not violated?

3. Repeat Q1 but now assume that airborne benzene participates in a first order reaction that consumes it. The reaction rate is 105 min^-1.

a. What is the effect of benzene atmospheric reaction on its ambient concentrations?