

EVE 290
Introduction to Environmental Engineering

Homework #6

1. A lagoon is to be designed to accommodate an input flow of $0.10 \text{ m}^3/\text{s}$ of non-conservative pollutant with concentration 30.0 mg/L and reaction rate 0.20 day^{-1} . The effluent from the lagoon must have a pollutant concentration of less than 10.0 mg/L . Assuming complete mixing, how large must the lagoon be? (**Ans: $86,400 \text{ m}^3$**)

2. A college bar with volume 500 m^3 has 50 smokers in it, each smoking two cigarettes per hour. An individual cigarette emits, among other things, about 1.4 mg of formaldehyde (HCHO). Formaldehyde converts to carbon dioxide with a reaction rate coefficient of $k = 0.40 \text{ hr}^{-1}$. Fresh air enters the bar at the rate of $1000 \text{ m}^3/\text{hr}$, and stale air leaves at the same rate. Assuming complete mixing, estimate the steady-state concentration of formaldehyde in the air. (**Ans: 0.117 mg/m^3**).

3. Suppose the air in the bar from problem (2) is clean when it opens at 5 pm. If formaldehyde ($k = 0.40 \text{ hr}^{-1}$) is emitted from cigarette smoke at the constant rate of 140 mg/hr starting at 5 pm, what would the concentration be at 6 pm? (**Ans: 0.106 mg/m^3**)