Problem 1. Pasquill-Gifford

A power plant has an emission stack that is 11 meters tall and a diameter of 2.5 meters. During operation it emits an estimated 7g/s of Sulfur Dioxide, emitting gas at a temperature of 100 degrees Celsius at a stack velocity of 0.3 m/s.

There is a school exactly 1.4 km downwind of the tower. The school has two stories, one at ground level and the other at a height of 8 m. On a very sunny day with wind speeds of 2 m/s what concentrations will the school be exposed to? State any assumptions you have made.

Problem 2. Puff Model

A factory, rather then operating a continuous stack, intermittently releases radon into the atmosphere. Each time it releases about 20 kg in a single short puff. The release happens from a tower that is 12m high. A housing subdivision is located 750m downwind of the factory and average wind speeds are about 3 m/s. Before conducting the calculation do you think the subdivision is exposed to higher concentrations on days where the atmosphere is stable or unstable - explain?

Now, calculate what the peak ground level concentrations that the subdivision will be exposed to will be on atmospherically stable and unstable days.

Problem 3. Indoor Air

A room has a floor plan that is 5×5 meters and 4 meters high. You know from a local survey that likely contaminants range from passive tracers to particles of density $2000 kgm^{-3}$ of size 0.1, 1, 10 and 100 microns.

Local guidelines stipulate that you must ventilate the space at a rate of 3 air changes per hour (i.e. the flow rate of your ventilation system is such that you flush the room 3 times per hour).

You are comparing two ventilation systems: (i) a traditional mixing system and (ii) a two layer displacement ventilation where you design the interface height, separating cool and warm, to sit at a height of 2 m.

If the contamination is coming from the ventilation system compare the concentrations between the two systems, including the concentrations inhabitants will be exposed to as well as total average concentrations.

If the contamination is coming from an internal source compare the concentrations between the two systems, including the concentrations inhabitants will be exposed to as well as total average concentrations.

You may assume a contaminant concentration of $1 gm^{-3}$ in your calculations.