Release from One Building Impacting another Building's Ventilation Inlet

A case that comes up often during a building's design phase is if a release occurs from the new building could it affect the clean air inlet of an adjacent building or vice versa. A model that can be used in the very near-field and account for multiple buildings is required to perform the analysis. The CHARM® Software is such a model.

An example case was run with CHARM to demonstrate such a case. In the simulation it is assumed that Hydrogen Sulfide is being emitted from a stack. The objective is to see if the emission could lead to odor impacts (~ 10 ppb, 0.010 ppm) at the ventilation inlet at the top of an adjacent building and about 50 feet downwind. The calculation grid is presented in Figure 1. The H_2S is assumed to be emitted at 0.1 lbs/hr and at a concentration of 200 ppmv. The meteorology assumed a wind speed of 5 mph, direction toward the ventilation inlet, and stability class of E. Meteorological conditions are constant.

Steady-state conditions are reached in the simulation within 30 seconds. A graph of the concentration history at the ventilation inlet is given in Figure 2. This history indicates the H_2S concentration at the ventilation inlet gets to about 99 ppb (0.099 ppm). This is about 10 times above the odor limit.

Another possible view is a 3D display of the plume and buildings. Such a view is in Figure 3. This 3D view shows the plume concentrations of 0.1 ppm (100 ppb) (in green) and 1 ppm (in yellow). The 1 ppm area is present only near the source. In the figure the plume is coming toward the observer. The source is in the background. The bulk of the plume is at heights below the ventilation inlet. The leeward sides of the tower with the ventilation impact on top of the impacted building are generally unaffected.

CHARM can also handle releases inside buildings that then escape to the outside and outside air concentrations entering a building. In fact, it is possible to have a release occur inside a building, make it to the free atmosphere, transport to another building, and then be entrained into the building.

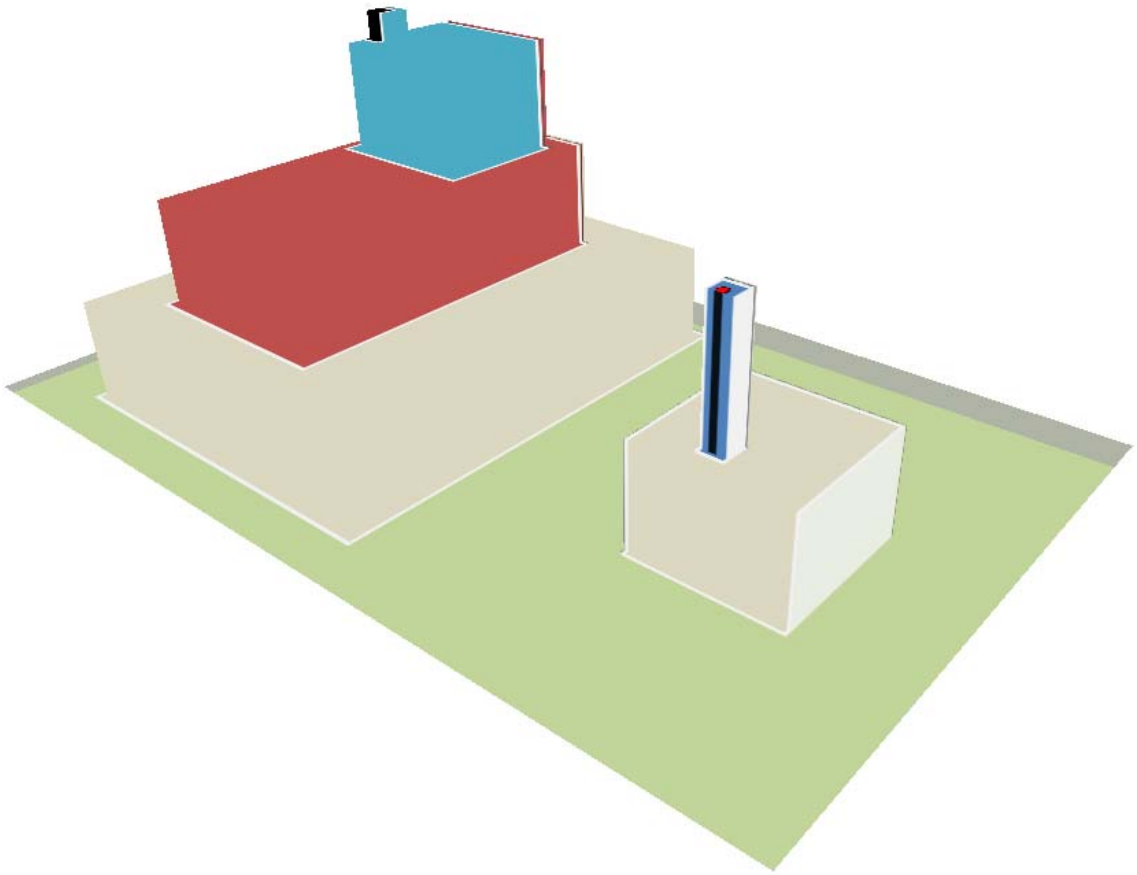


Figure 1 Calculation grid. Source is from stack on smaller building.

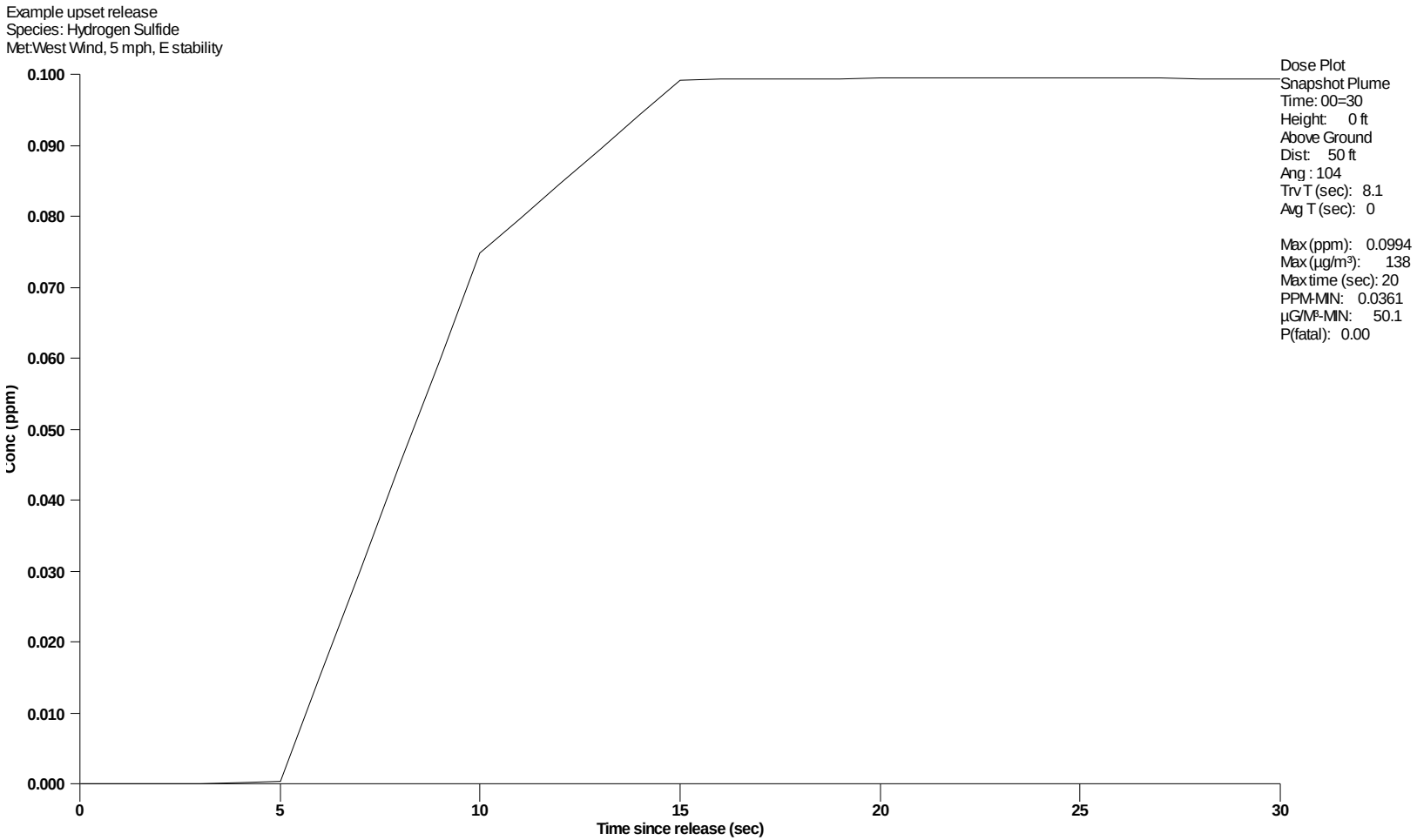
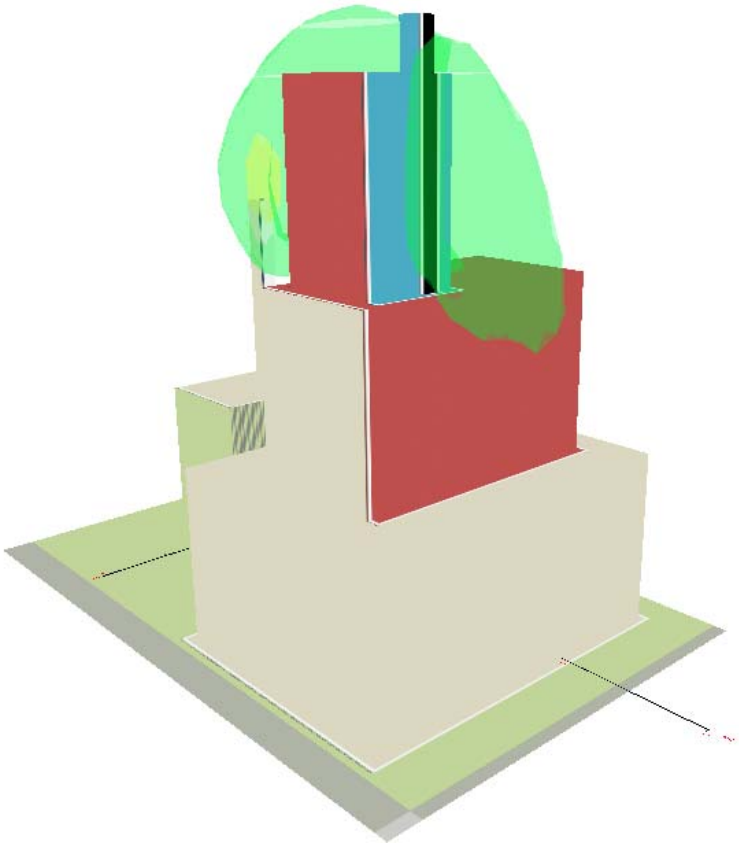


Figure 2. Concentration history at ventilation inlet.

Example upset release
Species: Hydrogen Sulfide
Met:West Wind, 5 mph, E stability



3D Display
Snapshot Plume
Time: 00=30
Con (ppm): 0.1
Con (ppm): 1
Con (µg/m³): 139
Con (µg/m³): 1.39e+003
Observer Location
X(E-W): 131 ft
Y(N-S): -89 ft
Z(Alt): 66 ft
Az : -46.67
El : -16.85
Observer Motion
Speed : 0.0 mph
Az : -46.67
El : -16.85
Observed Location
X(E-W): 49 ft
Y(N-S): -12 ft
Z(Alt): 32 ft
X(E-W) Min: -2 ft
X(E-W) Max: 68 ft
Y(N-S) Min: -23 ft
Y(N-S) Max: 4 ft
Z(Alt) Min: 18 ft
Z(Alt) Max: 33 ft

Figure 3. 3D display of plume impacting a building.