

Building Release

A release occurring inside a building with subsequent emissions to the outside cannot be simulated by the standard Gaussian dispersion models. CHARM® is capable of performing such a simulation. As an example a grid describing a simple building with four rooms was created. A plan view of the rooms is shown in Figure 1. The tan area around the rooms represents the area immediately outside of the building and included in the simulation.

There is a window to the outside of room 1 on the east and north sides. Room 2 has an opening to the outside on its north side. Room 3 has openings to the outside on its south and west side. Room 4 has two outside openings on the east side and one on the south. There are openings within the building between all adjacent rooms.

The simulation consisted of pressurized vessel in room 1 containing 3 gallons of phosgene. The phosgene liquid partially flashed and also formed a pool. The pool was allowed to flow freely over the room's floor. The wind is assumed to be from the east at 10 mph. It is blowing into the east window in room 1. There is no other ventilation besides the ambient wind.

A series of snapshots of the plume can be seen in Figure 2 through Figure 6. In the figures the movement of the plume from room 1 to room 2 to room 3 and then the outside can be seen. Some phosgene makes it into room 4 as well, but at significantly lower concentrations than the other rooms.

In Figure 7 the plume exiting the building can be seen with the building in place. The same plume, but without the building being drawn, is also visible in Figure 8. The plume in individual rooms can be seen in the figure. Room 1 is in the rear to the left in both figures.

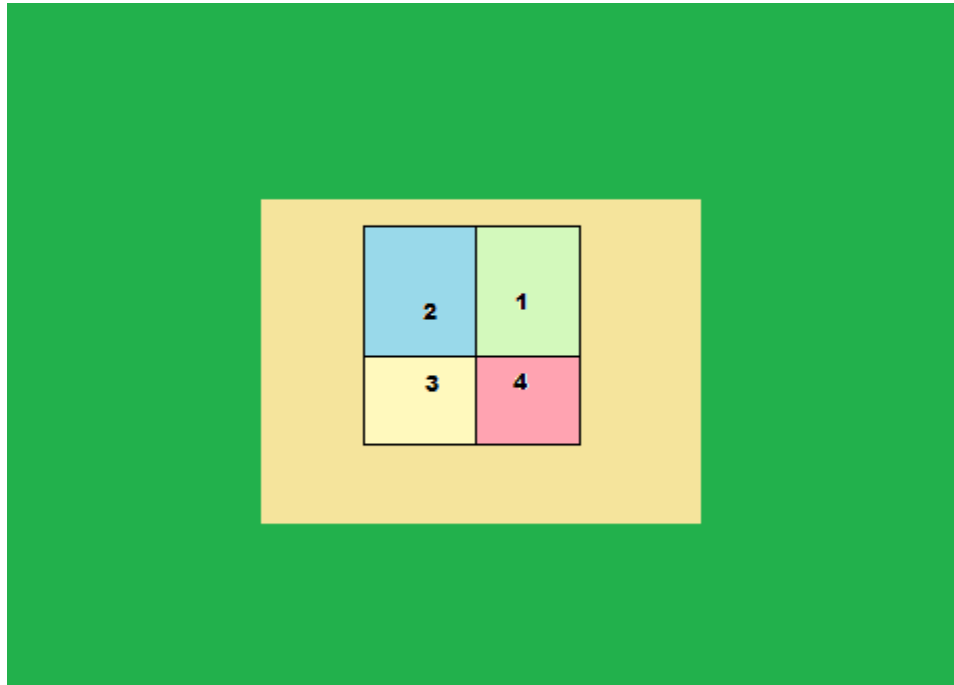
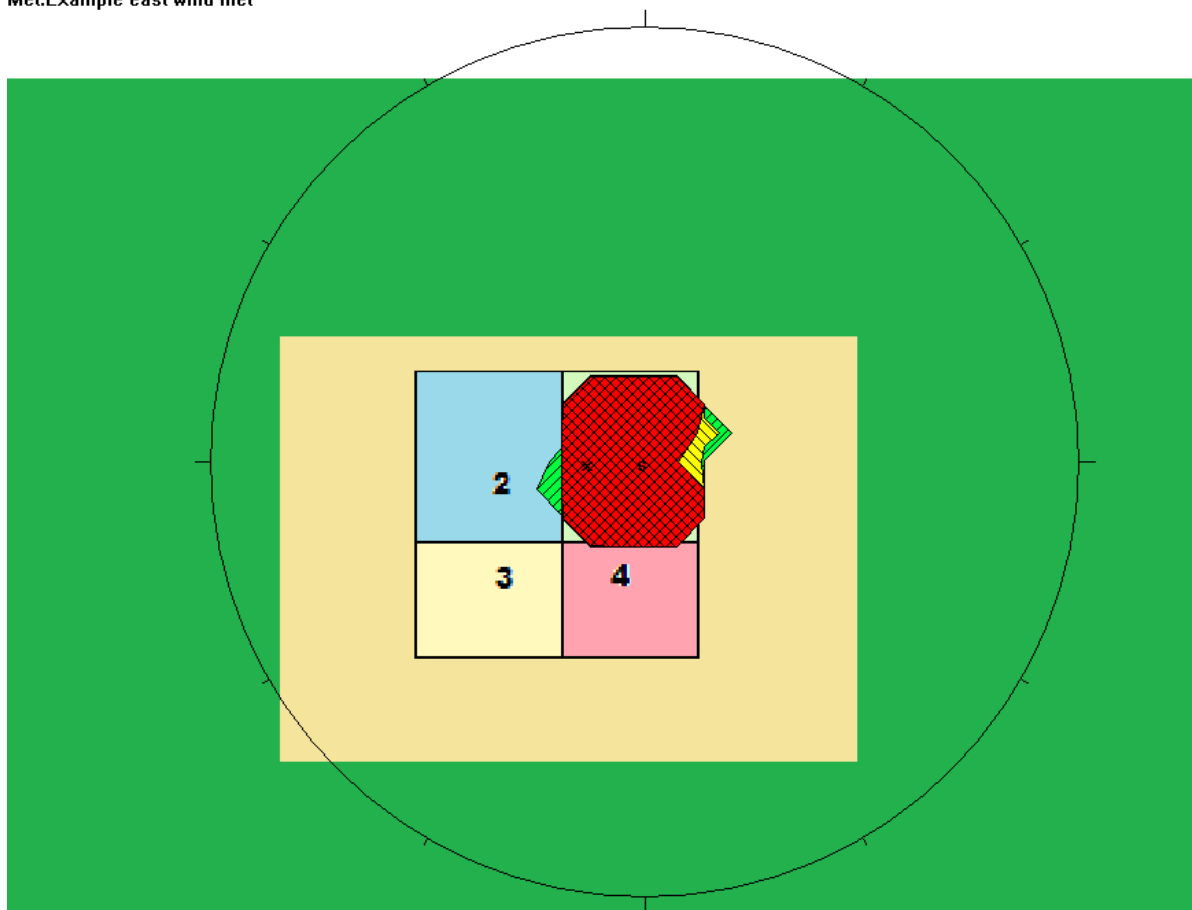


Figure 1 Plan view of simple four room building.

Example release in building
 Species: Phosgene
 Met: Example east wind met



Snapshot Plume
 Time: 00=05
 Height: 0 ft
 Above Ground
 Radius: 50 ft
 Plot Scale 1:238

Max Liq Depth: 0.0025 ft

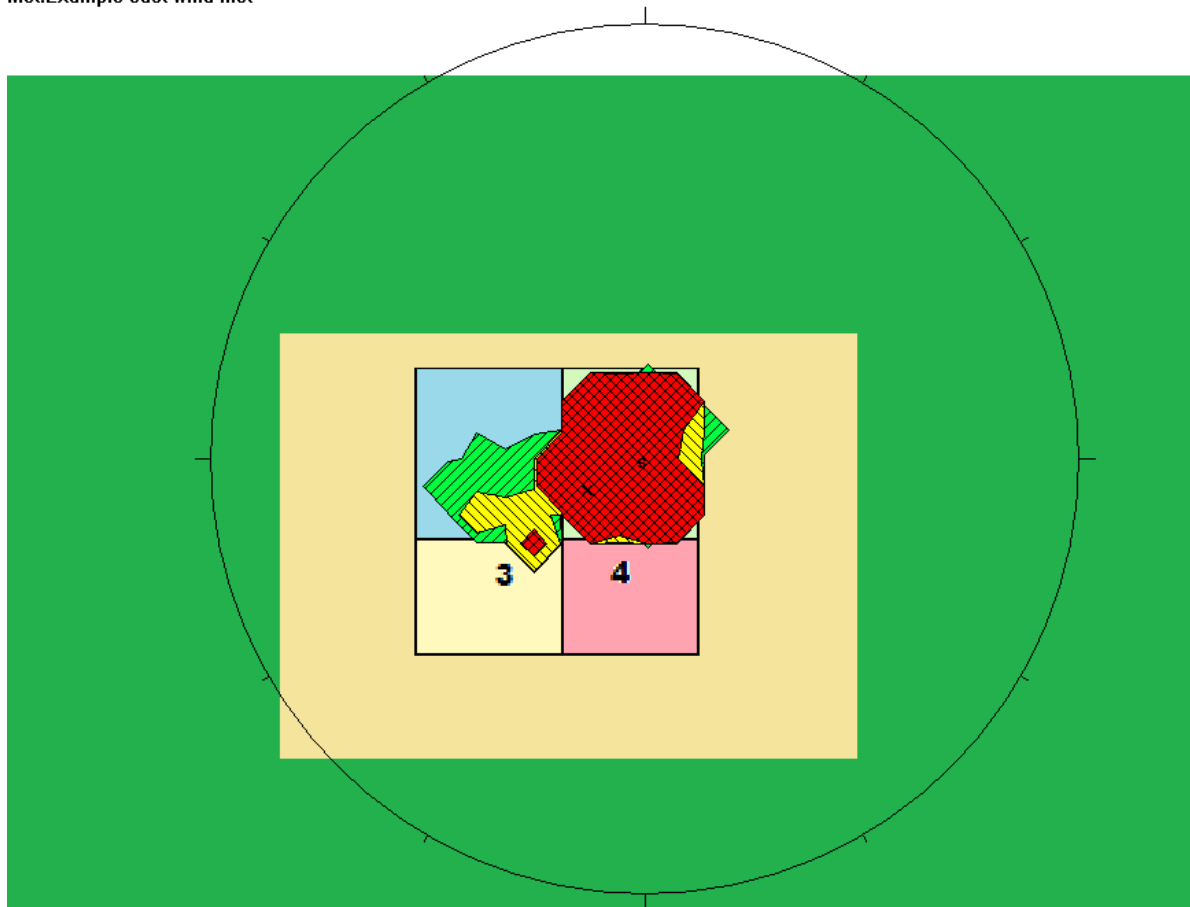
Hatch	Conc(ppm)	Max Dist
	0.1	13 ft
	1	12 ft
	10	12 ft

Hatch	Conc($\mu\text{g}/\text{m}^3$)
	404
	4.04e+003
	4.04e+004

Max Conc
 $\times = 8175$ ppm
 Dist: 6 ft Ang: 271
 Max Conc at hgt 2 ft
 8175 ppm
 Dist: 6 ft Ang: 271

Figure 2 Surface level concentrations at 5 seconds into release.

Example release in building
Species: Phosgene
Met: Example east wind met



Snapshot Plume
Time: 00=10
Height: 0 ft
Above Ground
Radius: 50 ft
Plot Scale 1:238

Max Liq Depth: 0.0048 ft

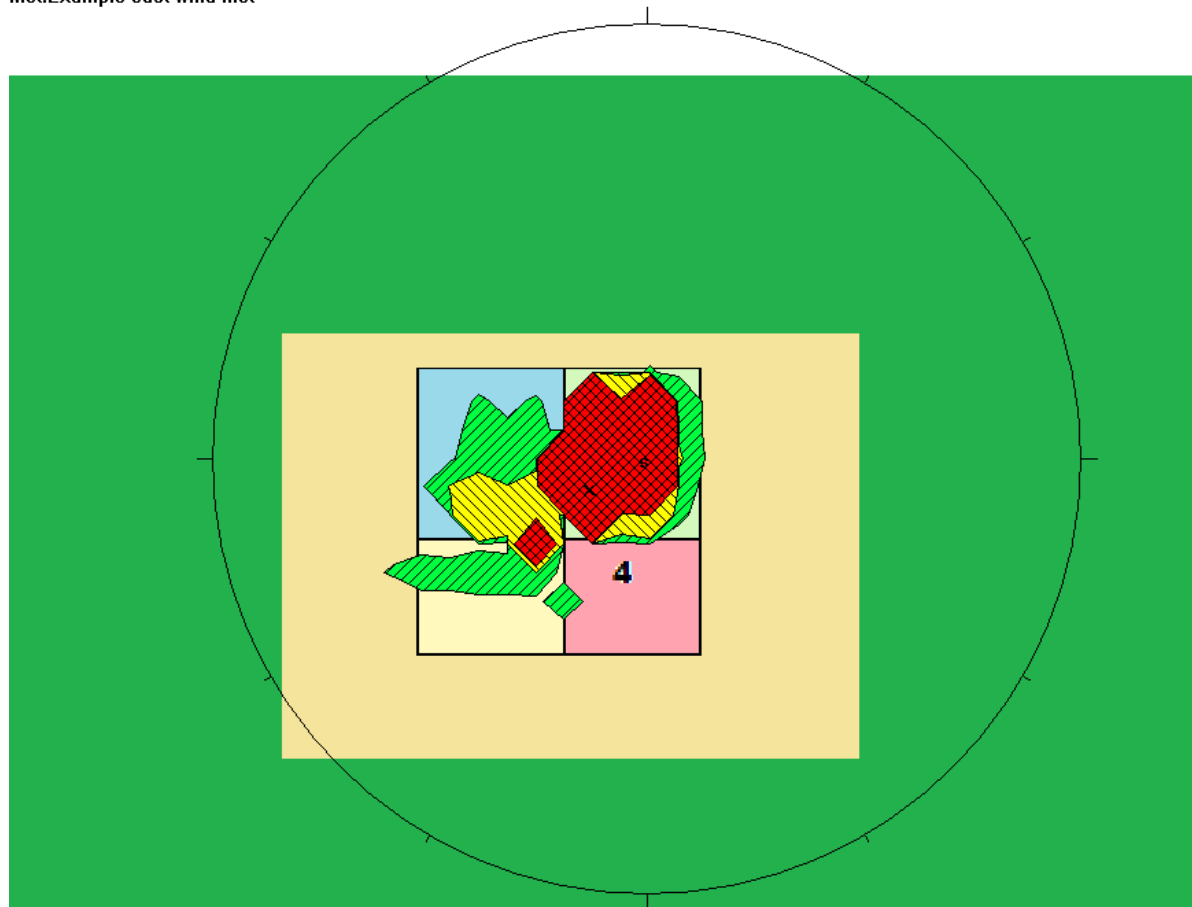
Hatch	Conc(ppm)	Max Dist
Green	0.1	26 ft
Yellow	1	22 ft
Red	10	17 ft

Hatch	Conc($\mu\text{g}/\text{m}^3$)
Green	404
Yellow	4.04e+003
Red	4.04e+004

Max Conc
x = 2.095e+004 ppm
Dist: 7 ft Ang: 244
Max Conc at hgt 2 ft
2.095e+004 ppm
Dist: 7 ft Ang: 244

Figure 3 Surface level concentrations at 10 seconds into release.

Example release in building
Species: Phosgene
Met: Example east wind met



Snapshot Plume
Time: 00=15
Height: 0 ft
Above Ground
Radius: 50 ft
Plot Scale 1:238

Max Liq Depth: 0.0052 ft

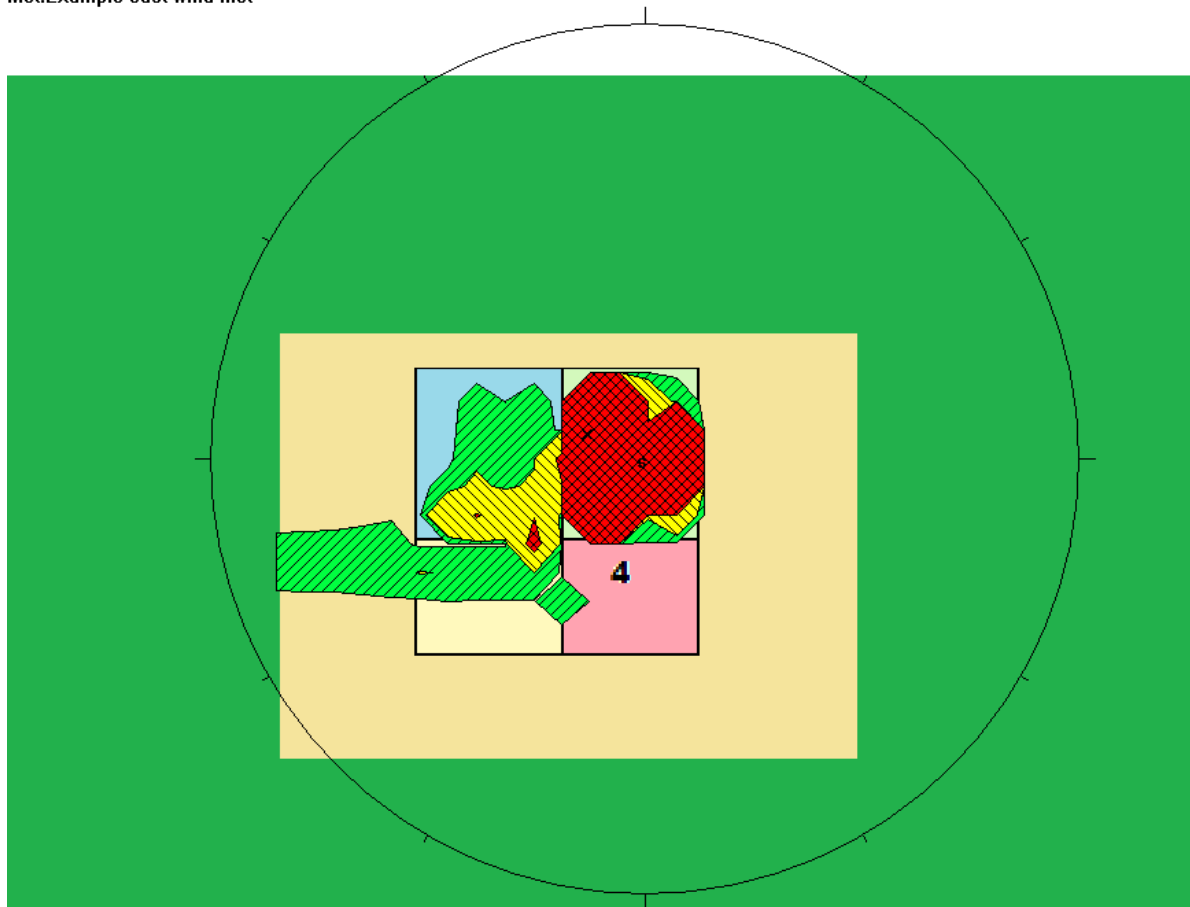
Hatch	Conc(ppm)	Max Dist
Green diagonal lines	0.1	33 ft
Yellow diagonal lines	1	23 ft
Red cross-hatch	10	18 ft

Hatch	Conc($\mu\text{g}/\text{m}^3$)
Green diagonal lines	404
Yellow diagonal lines	4.04e+003
Red cross-hatch	4.04e+004

Max Conc
x = 4.148e+004 ppm
Dist: 7 ft Ang: 244
Max Conc at hgt 2 ft
4.148e+004 ppm
Dist: 7 ft Ang: 244

Figure 4 Surface level concentrations at 15 seconds into release.

Example release in building
 Species: Phosgene
 Met: Example east wind met



Snapshot Plume
 Time: 00=20
 Height: 0 ft
 Above Ground
 Radius: 50 ft
 Plot Scale 1:238

Max Liq Depth: 0.0052 ft

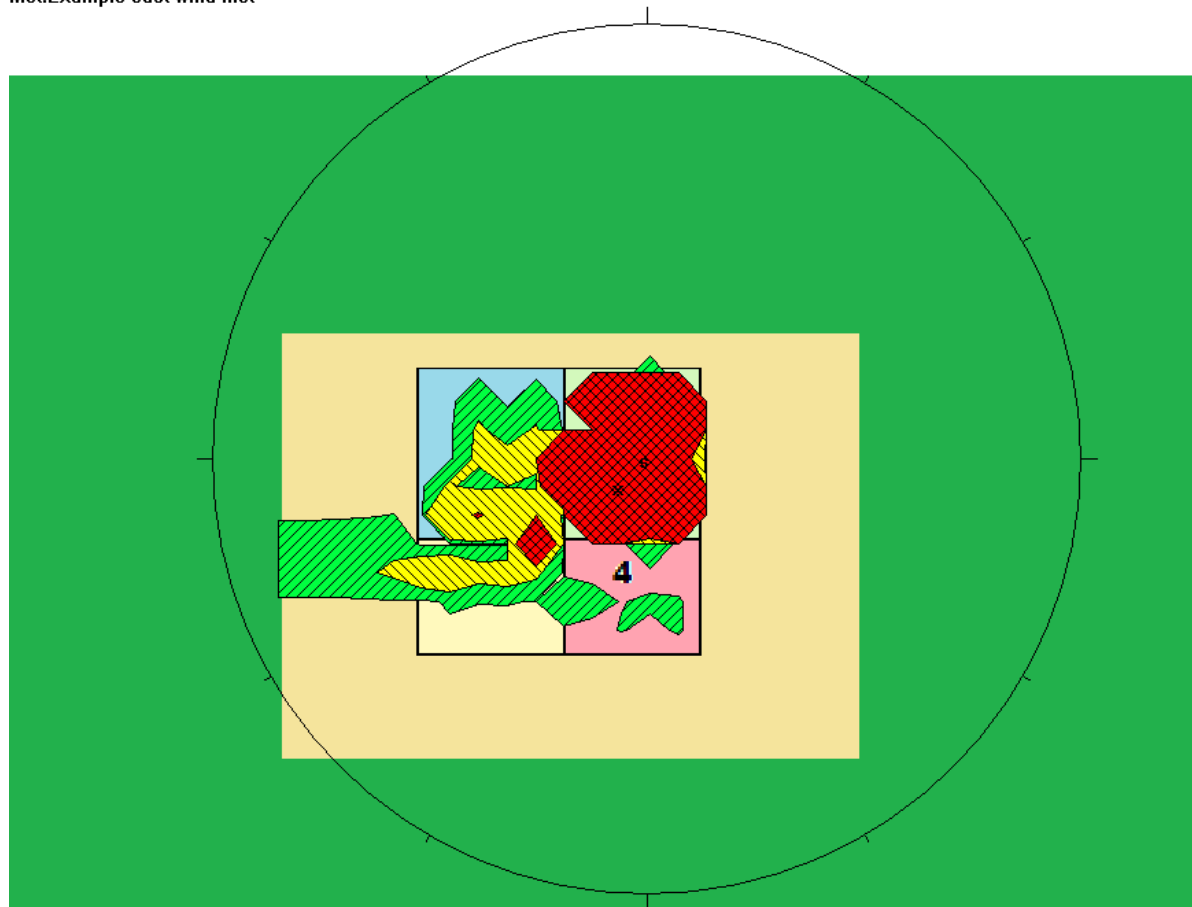
Hatch	Conc(ppm)	Max Dist
	0.1	45 ft
	1	29 ft
	10	21 ft

Hatch	Conc($\mu\text{g}/\text{m}^3$)
	404
	4.04e+003
	4.04e+004

Max Conc
 $x = 4.931\text{e}+004$ ppm
 Dist: 7 ft Ang: 299
 Max Conc at hgt 2 ft
 $4.931\text{e}+004$ ppm
 Dist: 7 ft Ang: 299

Figure 5 Surface level concentrations at 20 seconds into release.

Example release in building
Species: Phosgene
Met: Example east wind met



Snapshot Plume
Time: 00=25
Height: 0 ft
Above Ground
Radius: 50 ft
Plot Scale 1:238

Max Liq Depth: 0.0052 ft

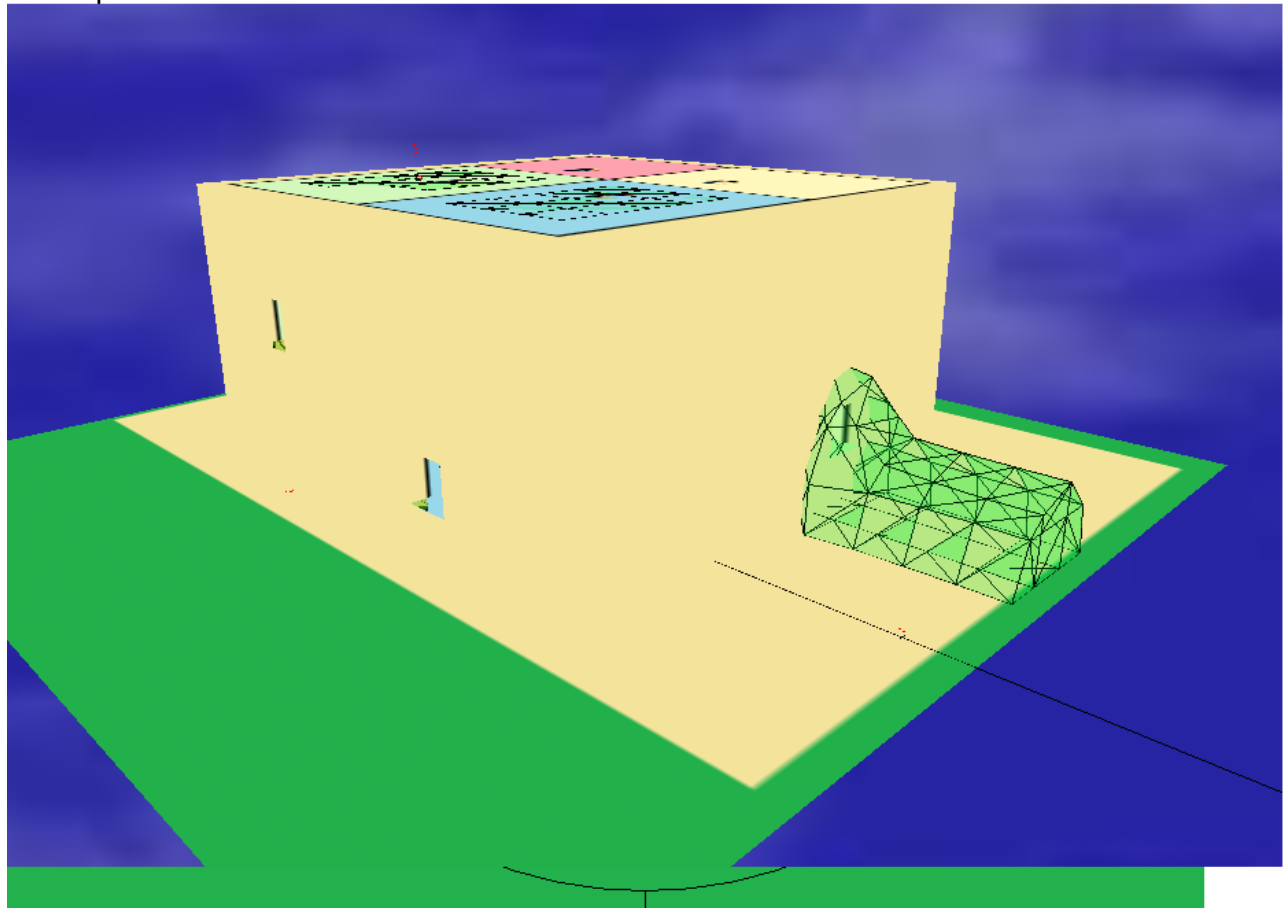
Hatch Conc(ppm)	Max Dist
0.1	45 ft
1	34 ft
10	21 ft

Hatch Conc($\mu\text{g}/\text{m}^3$)
404
$4.04\text{e}+003$
$4.04\text{e}+004$

Max Conc
 $x = 3.177\text{e}+004$ ppm
Dist: 4 ft Ang: 224
Max Conc at hgt 2 ft
 $3.177\text{e}+004$ ppm
Dist: 4 ft Ang: 224

Figure 6 Surface level concentrations at 25 seconds into release.

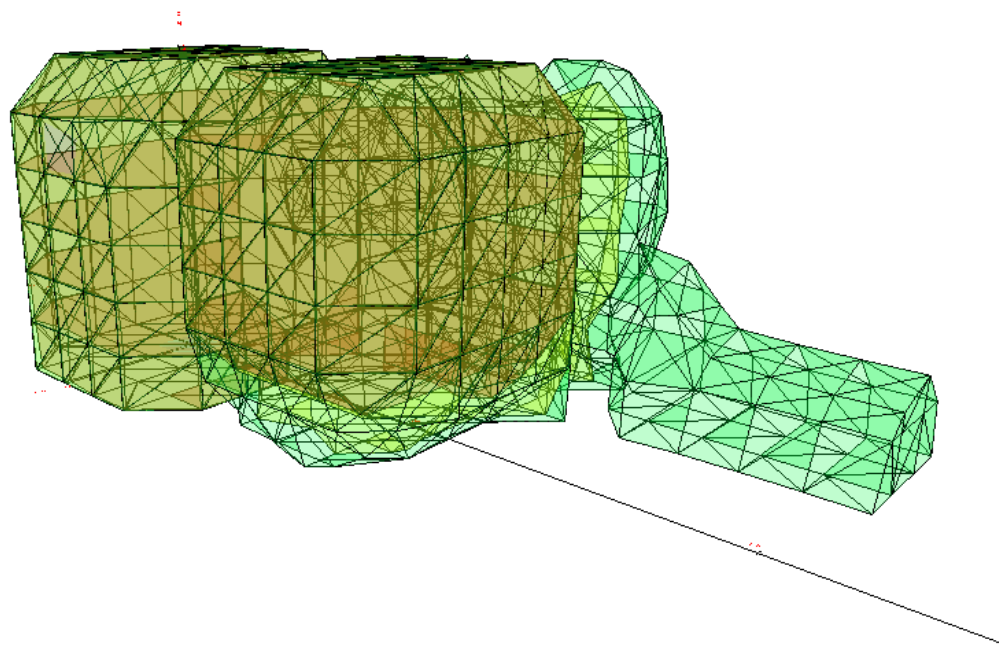
Example release in building
Species: Phosgene
Met: Example east wind met



3D Display
Snapshot Plume
Time: 00=30
Max Liq Depth: 0.0052 ft
Con (ppm): 0.1
Con (ppm): 1
Con (ppm): 10
Con ($\mu\text{g}/\text{m}^3$): 404
Con ($\mu\text{g}/\text{m}^3$): 4.04e+003
Con ($\mu\text{g}/\text{m}^3$): 4.04e+004
Observer Location
X[E-W]: -63 ft
Y[N-S]: 42 ft
Z[Alt]: 27 ft
Az : 135.8
El : -19.32
Observer Motion
Speed : 0.0 mph
Az : 135.8
El : -19.32
Observed Location
X[E-W]: -28 ft
Y[N-S]: 6 ft
Z[Alt]: 9 ft
X[E-W] Min: -42 ft
X[E-W] Max: 7 ft
Y[N-S] Min: -22 ft
Y[N-S] Max: 10 ft
Z[Alt] Min: 0 ft
Z[Alt] Max: 20 ft

Figure 7 3D display of plume exiting building.

Example release in building
Species: Phosgene
Met: Example east wind met



3D Display
Snapshot Plume
Time: 00=30

Max Liq Depth: 0.0052 ft

Con (ppm): 0.1
Con (ppm): 1
Con (ppm): 10
Con ($\mu\text{g}/\text{m}^3$): 404
Con ($\mu\text{g}/\text{m}^3$): 4.04e+003
Con ($\mu\text{g}/\text{m}^3$): 4.04e+004

Observer Location

X[E-W]: -55 ft
Y[N-S]: 41 ft
Z[Alt]: 24 ft
Az : 136.5
El : -17.17

Observer Motion

Speed : 0.0 mph
Az : 136.5
El : -17.17

Observed Location

X[E-W]: -28 ft
Y[N-S]: 12 ft
Z[Alt]: 11 ft
X[E-W] Min: -42 ft
X[E-W] Max: 7 ft
Y[N-S] Min: -22 ft
Y[N-S] Max: 10 ft
Z[Alt] Min: 0 ft
Z[Alt] Max: 20 ft

Figure 8 3D display of plume exiting building (concentration only).