

CHLORINE BUILDUP IN VENTILATED ROOM

PROBLEM:

A release from a broken supply line from a one ton container of chlorine into a ventilated room is considered. This creates a buildup of chlorine in the room. The concentration of chlorine in the room is to be determined for the situation where the one ton container is within a TGO Total Containment Vessel when the break occurs in the vacuum supply line from the TGO Vessel. This is compared to the concentration of chlorine in the room that will result from a break in the supply line from the one ton container when it is not in a TGO Vessel. Release conditions are taken as those of the Federal worst case release scenario with the exception that the active mitigation system of the TGO Vessel is permitted to function.

DISCUSSION:

The two cases to be considered are:

- The one ton container within the TGO Total Containment Vessel that is located in the room
- The one ton container located in the room without the TGO Vessel

The chlorine release from the TGO Vessel is limited by the amount of chlorine that would pass from the TGO Vessel until the chlorine release is detected and the TGO Vessel is automatically valved closed in two (2) seconds. The one ton container can sustain a steady flow of 15 lb/hr. This gives a maximum chlorine release from the TGO Vessel to the room of 0.00833 lb for two seconds.

The chlorine release from the one ton container without the TGO vessel under the worst case conditions is a release of 2,000 lb of chlorine in ten (10) minutes as required by the worst case scenario of the Federal RMP .

In either case, the release is considered with 55% of the release leaving the room as permitted by the worst case scenario. This leaves 45% of the chlorine release left in the room. The time variation of the release is determined by doing mass balances for the chlorine left in the room at one minute increments. It is assumed that there is instantaneous uniform mixing of the chlorine in the room in each one minute interval. The room concentration history is continued until the room has a zero concentration of chlorine.

The chlorine concentration in the room is a function of the volume of the room. Room volume magnitudes are considered from as small as 1,000 cu ft to as large as 1,000,000 cu ft.

RESULTS:

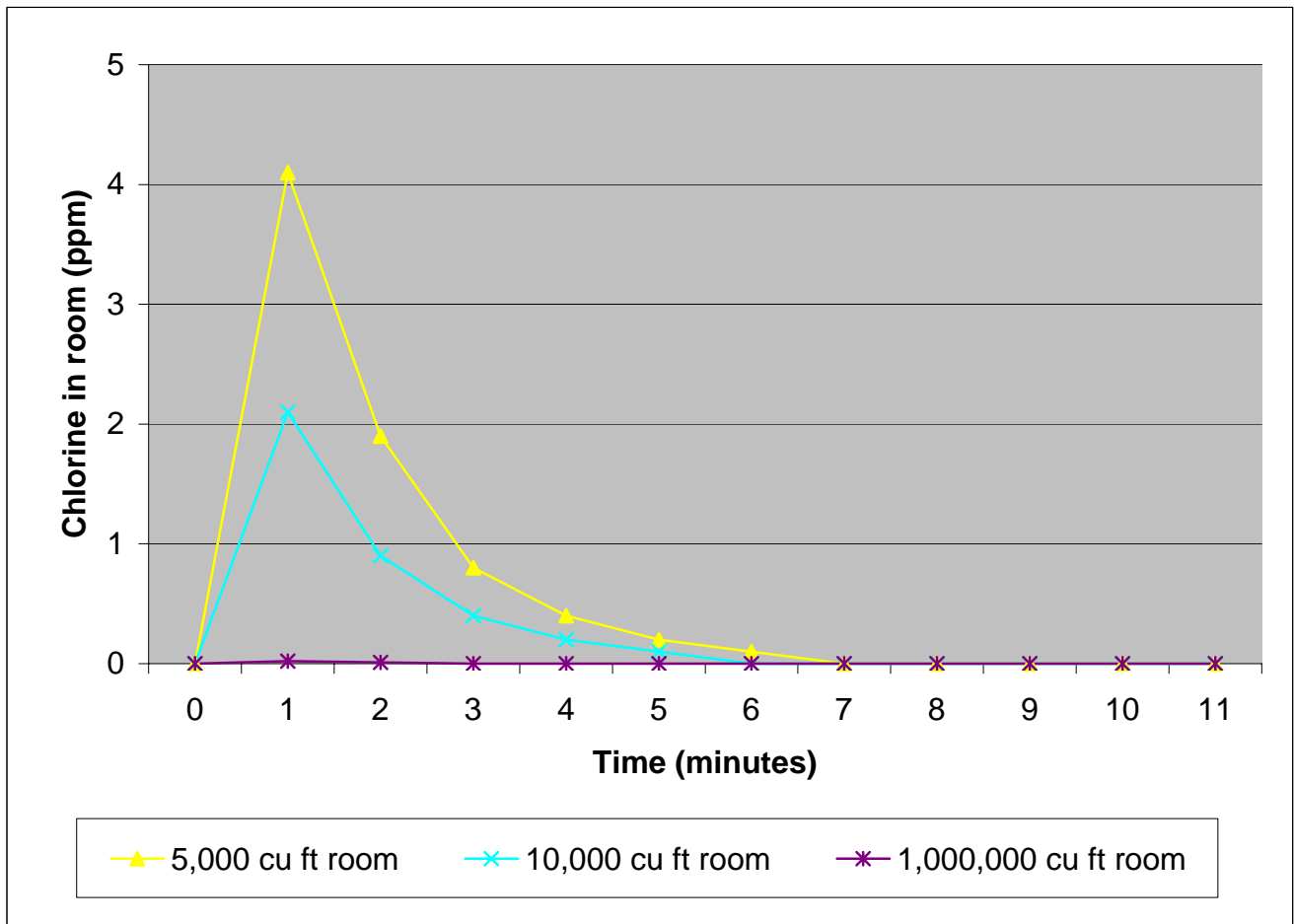
The following conclusions are determined:

- The one ton container, without the TGO Vessel, produces extremely high levels of chlorine concentration that reach up to two million ppm for the 1,000 cu ft room to still two thousand ppm for the 1,000,000 cu ft room. These levels are sustained for up to ten (10) minutes before they begin to decrease.
- The one ton container in the TGO Vessel produces a peak concentration of 20.7 ppm for the 1,000 cu ft room to 0.02 ppm for the 1,000,000 cu ft room. These peak levels decrease rapidly to 1 ppm within less than five minutes from the start of the release.

All of these results are presented in Chart 8 & Chart 9.

CHLORINE BUILDUP IN VENTILATED ROOM WITH TGO VESSEL

TIME (MIN)	Leakage Rate (lb/min)	Amount in Room (lb)	Room Volume 5,000 CU FT	Room Volume 10,000 CU FT	Room Volume 1,000,000 CU FT
0	.00833	0	0	0	0
1	0	0.0037485	4.1	2.1	0.02
2	0	0.00168683	1.9	0.9	0.01
3	0	0.00075907	0.8	0.4	0
4	0	0.00034158	0.4	0.2	0
5	0	0.00015371	0.2	0.1	0
6	0	0.00006917	0.1	0	0
7	0	0.00003113	0	0	0
8	0	0.00001401	0	0	0
9	0	0.000006303	0	0	0
10	0	0.000002836	0	0	0
11	0	0.000001276	0	0	0



CHLORINE BUILDUP IN VENTILATED ROOM WITHOUT TGO VESSEL

TIME (MIN)	Leakage Rate (lb/min)	Amount in Room (lb)	Room Volume 1,000 CU FT	Room Volume 2,000 CU FT	Room Volume 5,000 CU FT	Room Volume 10,000 CU FT	Room Volume 1,000,000 CU FT
0	200	0	0	0	0	0	0
1	200	200	1,100,000	550,000	220,000	110,000	1,104
2	200	290	1,600,000	800,000	320,000	160,000	1,601
3	200	331	1,830,000	910,000	370,000	180,000	1,827
4	200	349	1,930,000	960,000	390,000	190,000	1,926
5	200	357	1,970,000	990,000	390,000	200,000	1,971
6	200	361	1,990,000	1,000,000	400,000	200,000	1,993
7	200	363	2,000,000	1,000,000	400,000	200,000	1,998
8	200	363	2,000,000	1,000,000	400,000	200,000	2,004
9	200	363	2,000,000	1,000,000	400,000	200,000	2,004
10	200	363	2,000,000	1,000,000	400,000	200,000	2,004
11	0	163	900,000	450,000	180,000	90,000	900
12	0	73	400,000	200,000	80,000	40,000	403
13	0	33	180,000	90,000	40,000	20,000	182
14	0	15	80,000	40,000	20,000	10,000	83
15	0	7	40,000	20,000	10,000	0	39
16	0	3	20,000	10,000	0	0	17
17	0	1	10,000	0	0	0	6
18	0	0	0	0	0	0	0

