

With these spreadsheets a collection of CO₂ data is collected and then analyzed. Through this analysis, an air exchange rate as well as a ventilation rate was calculated and used to determine the health quality of the CO₂ concentrations in the air of a specific room.

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ENGR 115
2p.m.
10/20/2016

Input Parameters

Measured Coutdoor (ppm)	420
Assumed Coutdoor (ppm)	400
Correction Factor (ppm)	-20
Volume of Room (ft3)	1485
Room Capacity (ppl)	10

Analysis

Measurement	Date & Time	Hobo CO2 Concentration
1	10/20/2016 14:45	869.4
2	10/20/2016 14:46	638
3	10/20/2016 14:47	456.7
4	10/20/2016 14:48	372.4
5	10/20/2016 14:49	363.9
6	10/20/2016 14:50	465.8
7	10/20/2016 14:51	368.1
8	10/20/2016 14:52	542.1
9	10/20/2016 14:53	870
10	10/20/2016 14:54	663
11	10/20/2016 14:55	697.2
12	10/20/2016 14:56	722.8
13	10/20/2016 14:57	763.7
14	10/20/2016 14:58	882.8
15	10/20/2016 14:59	981.1
16	10/20/2016 15:00	1023.2
17	10/20/2016 15:01	1077.5
18	10/20/2016 15:02	1087.9
19	10/20/2016 15:03	1142.2
20	10/20/2016 15:04	1247.9
21	10/20/2016 15:05	1260.1
22	10/20/2016 15:06	1286.3
23	10/20/2016 15:07	1316.2
24	10/20/2016 15:08	1398
25	10/20/2016 15:09	1482.3
26	10/20/2016 15:10	1448.1
27	10/20/2016 15:11	1416.4
28	10/20/2016 15:12	1403.5
29	10/20/2016 15:13	1400.5
30	10/20/2016 15:14	1403.5
31	10/20/2016 15:15	1404.2
32	10/20/2016 15:16	1406.6
33	10/20/2016 15:17	1417.6

34	10/20/2016 15:18	1407.8
35	10/20/2016 15:19	1417.6
36	10/20/2016 15:20	1416.4
37	10/20/2016 15:21	1418.8
38	10/20/2016 15:22	1406.6
39	10/20/2016 15:23	1408.4
40	10/20/2016 15:24	1406.6
41	10/20/2016 15:25	1400.5
42	10/20/2016 15:26	1391.3
43	10/20/2016 15:27	1390.7
44	10/20/2016 15:28	1380.3
45	10/20/2016 15:29	1377.3
46	10/20/2016 15:30	1386.4
47	10/20/2016 15:31	1386.4
48	10/20/2016 15:32	1370.6
49	10/20/2016 15:33	1372.4
50	10/20/2016 15:34	1380.3
51	10/20/2016 15:35	1392.6
52	10/20/2016 15:36	1393.8
53	10/20/2016 15:37	1387.7
54	10/20/2016 15:38	1384
55	10/20/2016 15:39	1381.6
56	10/20/2016 15:40	1382.2
57	10/20/2016 15:41	1365.7
58	10/20/2016 15:42	1368.7
59	10/20/2016 15:43	1177.7
60	10/20/2016 15:44	1067.8
61	10/20/2016 15:45	778.4
62	10/20/2016 15:46	750.3
63	10/20/2016 15:47	736.9
64	10/20/2016 15:48	801
65	10/20/2016 15:49	783.9
66	10/20/2016 15:50	1000
67	10/20/2016 15:51	460.3
68	10/20/2016 15:52	426.1
69	10/20/2016 15:53	430.4
70	10/20/2016 15:54	423.7
71	10/20/2016 15:55	415.8
72	10/20/2016 15:56	399.3
73	10/20/2016 15:57	398.7
74	10/20/2016 15:58	440.2
75	10/20/2016 15:59	428
76	10/20/2016 16:00	1127
77	10/20/2016 16:01	582.4
78	10/20/2016 16:02	550.1
79	10/20/2016 16:03	508.5
80	10/20/2016 16:04	514.7

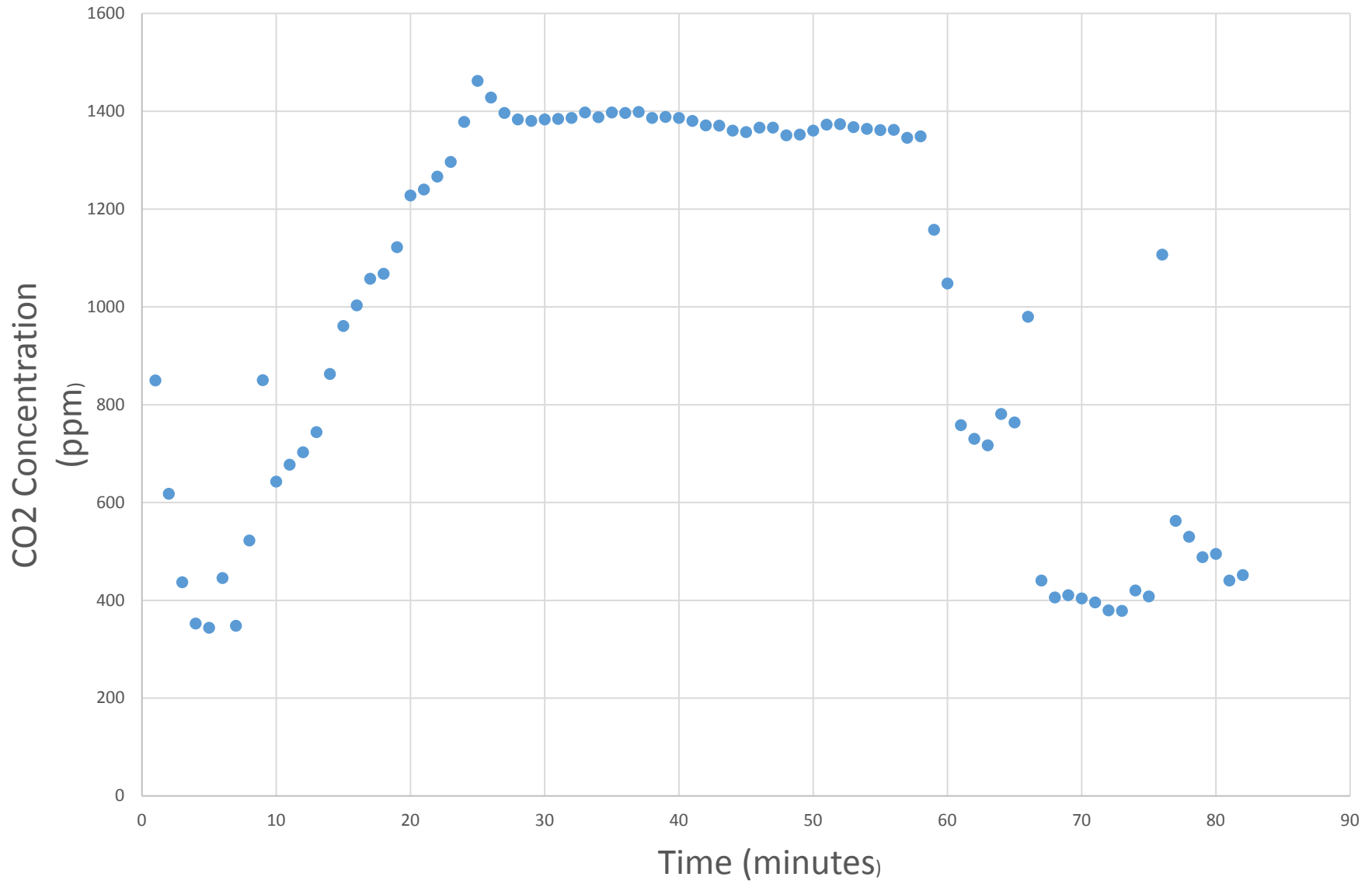
81	10/20/2016 16:05	460.3
82	10/20/2016 16:06	471.9

Actual CO2 Concentration [ppm]
849.4
618
436.7
352.4
343.9
445.8
348.1
522.1
850
643
677.2
702.8
743.7
862.8
961.1
1003.2
1057.5
1067.9
1122.2
1227.9
1240.1
1266.3
1296.2
1378
1462.3
1428.1
1396.4
1383.5
1380.5
1383.5
1384.2
1386.6
1397.6

1387.8
1397.6
1396.4
1398.8
1386.6
1388.4
1386.6
1380.5
1371.3
1370.7
1360.3
1357.3
1366.4
1366.4
1350.6
1352.4
1360.3
1372.6
1373.8
1367.7
1364
1361.6
1362.2
1345.7
1348.7
1157.7
1047.8
758.4
730.3
716.9
781
763.9
980
440.3
406.1
410.4
403.7
395.8
379.3
378.7
420.2
408
1107
562.4
530.1
488.5
494.7

440.3
451.9

CO2 Concentration vs Time



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Input Parameters

Measured Coutdoor (ppm)	420
Assumed Coutdoor (ppm)	400
Correction Factor (ppm)	-20
Volume of Room (ft3)	1485
Room Capacity (ppl)	5

Calculations

Air Exchange Rate (1/hr)	0.25
Time to remove non-reactive chemical (hr)	12.01
Ventilation Rate (ft3/min/person)	1.24

Analysis

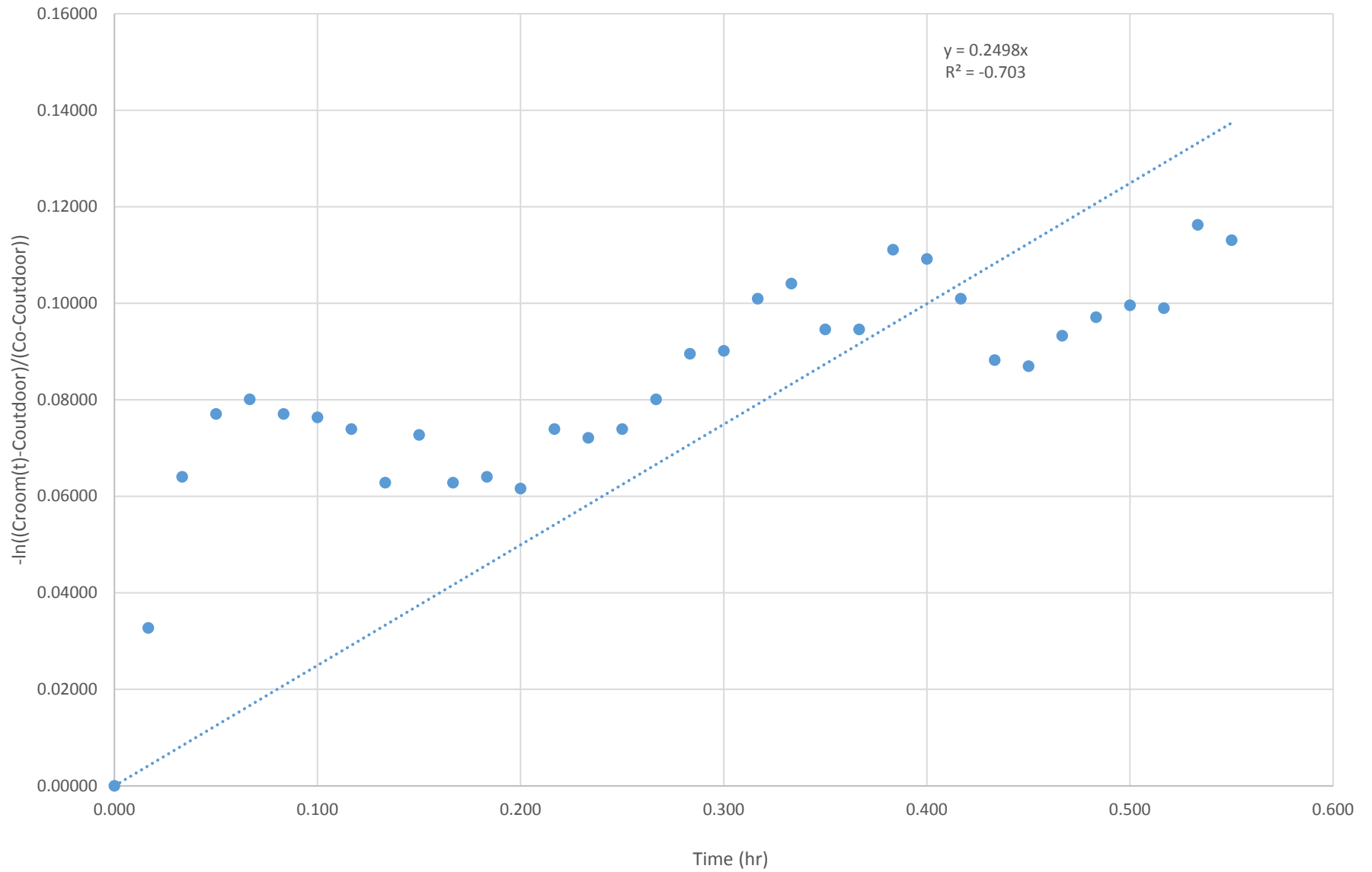
Measurement	Date & Time	Hobo CO2 Concentr
0	10/20/2016 15:09	1482
1	10/20/2016 15:10	1448
2	10/20/2016 15:11	1416
3	10/20/2016 15:12	1404
4	10/20/2016 15:13	1401
5	10/20/2016 15:14	1404
6	10/20/2016 15:15	1404
7	10/20/2016 15:16	1407
8	10/20/2016 15:17	1418
9	10/20/2016 15:18	1408
10	10/20/2016 15:19	1418
11	10/20/2016 15:20	1416
12	10/20/2016 15:21	1419
13	10/20/2016 15:22	1407
14	10/20/2016 15:23	1408
15	10/20/2016 15:24	1407
16	10/20/2016 15:25	1401
17	10/20/2016 15:26	1391
18	10/20/2016 15:27	1391
19	10/20/2016 15:28	1380
20	10/20/2016 15:29	1377
21	10/20/2016 15:30	1386
22	10/20/2016 15:31	1386
23	10/20/2016 15:32	1371
24	10/20/2016 15:33	1372
25	10/20/2016 15:34	1380

26	10/20/2016 15:35	1393
27	10/20/2016 15:36	1394
28	10/20/2016 15:37	1388
29	10/20/2016 15:38	1384
30	10/20/2016 15:39	1382
31	10/20/2016 15:40	1382
32	10/20/2016 15:41	1366
33	10/20/2016 15:42	1369

Actual CO2 Concentration [ppm]	Time(hr)	$-\ln((C_{room}(t)-C_{outdoor})/(C_o-C_{outdoor}))$
1462	0.000	0.00000
1428	0.017	0.03272
1396	0.033	0.06404
1384	0.050	0.07707
1381	0.067	0.08013
1384	0.083	0.07707
1384	0.100	0.07636
1387	0.117	0.07393
1398	0.133	0.06284
1388	0.150	0.07271
1398	0.167	0.06284
1396	0.183	0.06404
1399	0.200	0.06164
1387	0.217	0.07393
1388	0.233	0.07210
1387	0.250	0.07393
1381	0.267	0.08013
1371	0.283	0.08956
1371	0.300	0.09017
1360	0.317	0.10095
1357	0.333	0.10407
1366	0.350	0.09461
1366	0.367	0.09461
1351	0.383	0.11110
1352	0.400	0.10921
1360	0.417	0.10095

1373	0.433	0.08822
1374	0.450	0.08699
1368	0.467	0.09327
1364	0.483	0.09710
1362	0.500	0.09959
1362	0.517	0.09897
1346	0.533	0.11627
1349	0.550	0.11310

Air Exchange Rate for Sunset Study Room



What is the air exchange rate (λ) of the room you tested? Be sure to include the units for the air exchange rate in your answer.

In general it takes $3/\lambda$ hours to remove a non-reactive chemical from indoor air. Based on this time, what recommendations would you make to the occupants of the room?

Compare your ventilation rate for a typical number of occupants to the ASHRAE recommended ventilation rate. Based on this comparison, are the occupants wasting energy heating and cooling the air or are the occupants being too cheap and not supplying enough air? Justify your answer.

Given the ASHRAE standard ventilation standard, what is the maximum number of people you would recommend having in this room at one time? Use your model to determine this number.

The air exchange rate of the room I tested was .25 (1/hr).

Using our air exchange rate, it would take approximately 12 hours to remove a non-reactive chemical from the indoor air. With this in mind, I think it would be appropriate to recommend that the occupants of the room refrain from spending long amount of time in the room, as well as ensuring that the door to the room is always open.

The ASHRAE recommended ventilation rate is 15 (ft³/min/person) while my ventilation rate comes out to 1.24 (ft³/min/person). Based on this comparison, I believe that the occupants are definitely being too cheap and not supplying enough air to the room. The recommended ventilation rate of the ASHRAE is more than 12 times the ventilation rate inside this tested room, so I therefore believe that there needs to be an increase in air flow. Because my ventilation rate is so much dramatically lower than the ASHRAE standard, I would recommend the maximum number of people to be in this room at one time to be preferably 0, but no more than 1 person at a time.