

Plot Title: Library 312

#	Date Time, GMT-07:00	CO2, ppm (LGR S Host Connected (Stopped (LGR S/I End Of File (LGR
1	4/1/2016 11:41:00	654.5
2	4/1/2016 11:42:00	682.5
3	4/1/2016 11:43:00	636.1
4	4/1/2016 11:44:00	406
5	4/1/2016 11:45:00	402.9
6	4/1/2016 11:46:00	409.6
7	4/1/2016 11:47:00	382.2
8	4/1/2016 11:48:00	385.8
9	4/1/2016 11:49:00	378.5
10	4/1/2016 11:50:00	386.4
11	4/1/2016 11:51:00	449.9
12	4/1/2016 11:52:00	544.6
13	4/1/2016 11:53:00	562.3
14	4/1/2016 11:54:00	550.7
15	4/1/2016 11:55:00	557.4
16	4/1/2016 11:56:00	573.3
17	4/1/2016 11:57:00	617.8
18	4/1/2016 11:58:00	623.3
19	4/1/2016 11:59:00	640.4
20	4/1/2016 12:00:00	641
21	4/1/2016 12:01:00	642.9
22	4/1/2016 12:02:00	659.3
23	4/1/2016 12:03:00	670.9
24	4/1/2016 12:04:00	683.8
25	4/1/2016 12:05:00	700.9
26	4/1/2016 12:06:00	710.6
27	4/1/2016 12:07:00	679.5
28	4/1/2016 12:08:00	704.5
29	4/1/2016 12:09:00	703.3
30	4/1/2016 12:10:00	711.2
31	4/1/2016 12:11:00	734.4
32	4/1/2016 12:12:00	744.2
33	4/1/2016 12:13:00	733.8
34	4/1/2016 12:14:00	728.3
35	4/1/2016 12:15:00	766.8
36	4/1/2016 12:16:00	768
37	4/1/2016 12:17:00	774.7
38	4/1/2016 12:18:00	735.7
39	4/1/2016 12:19:00	736.9
40	4/1/2016 12:20:00	772.9
41	4/1/2016 12:21:00	735.7
42	4/1/2016 12:22:00	727.7
43	4/1/2016 12:23:00	747.3
44	4/1/2016 12:24:00	721.6
45	4/1/2016 12:25:00	703.3

46	4/1/2016 12:26:00	701.5
47	4/1/2016 12:27:00	706.3
48	4/1/2016 12:28:00	701.5
49	4/1/2016 12:29:00	694.7
50	4/1/2016 12:30:00	658.7
51	4/1/2016 12:31:00	667.9
52	4/1/2016 12:32:00	660
53	4/1/2016 12:33:00	641
54	4/1/2016 12:34:00	632.5
55	4/1/2016 12:35:00	619.7
56	4/1/2016 12:36:00	623.3
57	4/1/2016 12:37:00	638.6
58	4/1/2016 12:38:00	628.8
59	4/1/2016 12:39:00	605.6
60	4/1/2016 12:40:00	606.8
61	4/1/2016 12:41:00	580
62	4/1/2016 12:42:00	586.1
63	4/1/2016 12:43:00	586.1
64	4/1/2016 12:44:00	576.9
65	4/1/2016 12:45:00	580
66	4/1/2016 12:46:00	576.3
67	4/1/2016 12:47:00	569.6
68	4/1/2016 12:48:00	568.4
69	4/1/2016 12:49:00	553.7
70	4/1/2016 12:50:00	562.3
71	4/1/2016 12:51:00	555.6
72	4/1/2016 12:52:00	561.7
73	4/1/2016 12:53:00	551.3
74	4/1/2016 12:54:00	541.5
75	4/1/2016 12:55:00	553.7
76	4/1/2016 12:56:00	553.1
77	4/1/2016 12:57:00	543.3
78	4/1/2016 12:58:00	529.3
79	4/1/2016 12:59:00	584.2
80	4/1/2016 13:00:00	559.8
81	4/1/2016 13:01:00	428
82	4/1/2016 13:02:00	404.8
83	4/1/2016 13:03:00	434.1
84	4/1/2016 13:04:00	366.9
85	4/1/2016 13:05:00	389.5
86	4/1/2016 13:05:00	
87	4/1/2016 13:06:00	

S/N: 9789942)

Megan Moore
 ENGR 115
 11:00am-1:50pm
 1-Apr-16

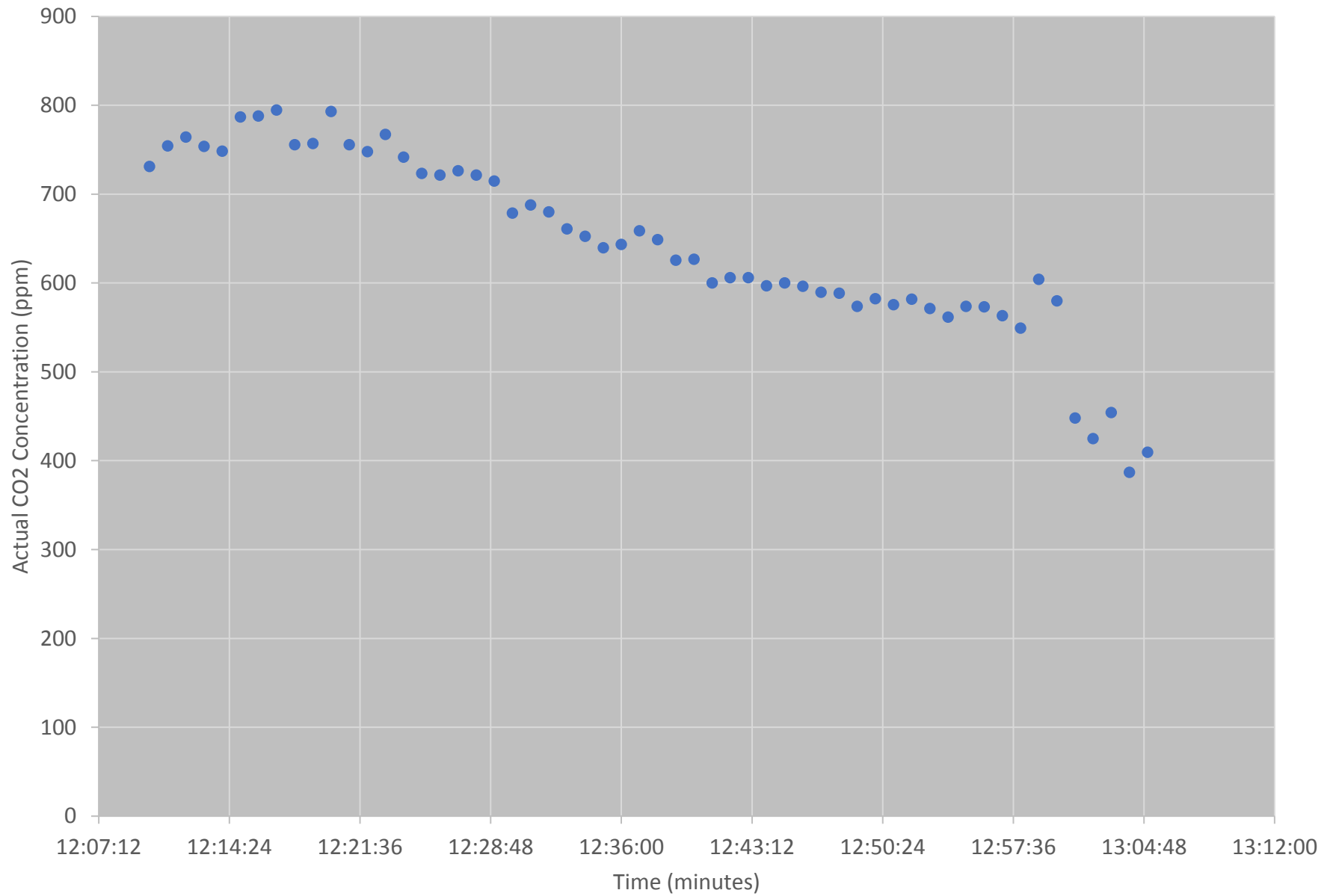
Input Parameters	
Measured Outdoor (ppm)	420
Assumed Outdoor (ppm)	400
Correction Factor (ppm)	-20

Analysis			
Measurment	Date and Time	Actual CO2 Concentration (ppm)	Hobo CO2 Concentration (ppm)
30	4/1/2016 12:10:00	731.2	711.2
31	4/1/2016 12:11:00	754.4	734.4
32	4/1/2016 12:12:00	764.2	744.2
33	4/1/2016 12:13:00	753.8	733.8
34	4/1/2016 12:14:00	748.3	728.3
35	4/1/2016 12:15:00	786.8	766.8
36	4/1/2016 12:16:00	788	768
37	4/1/2016 12:17:00	794.7	774.7
38	4/1/2016 12:18:00	755.7	735.7
39	4/1/2016 12:19:00	756.9	736.9
40	4/1/2016 12:20:00	792.9	772.9
41	4/1/2016 12:21:00	755.7	735.7
42	4/1/2016 12:22:00	747.7	727.7
43	4/1/2016 12:23:00	767.3	747.3
44	4/1/2016 12:24:00	741.6	721.6
45	4/1/2016 12:25:00	723.3	703.3
46	4/1/2016 12:26:00	721.5	701.5
47	4/1/2016 12:27:00	726.3	706.3
48	4/1/2016 12:28:00	721.5	701.5
49	4/1/2016 12:29:00	714.7	694.7
50	4/1/2016 12:30:00	678.7	658.7
51	4/1/2016 12:31:00	687.9	667.9
52	4/1/2016 12:32:00	680	660
53	4/1/2016 12:33:00	661	641
54	4/1/2016 12:34:00	652.5	632.5
55	4/1/2016 12:35:00	639.7	619.7
56	4/1/2016 12:36:00	643.3	623.3
57	4/1/2016 12:37:00	658.6	638.6
58	4/1/2016 12:38:00	648.8	628.8
59	4/1/2016 12:39:00	625.6	605.6
60	4/1/2016 12:40:00	626.8	606.8
61	4/1/2016 12:41:00	600	580

62	4/1/2016 12:42:00	606.1	586.1
63	4/1/2016 12:43:00	606.1	586.1
64	4/1/2016 12:44:00	596.9	576.9
65	4/1/2016 12:45:00	600	580
66	4/1/2016 12:46:00	596.3	576.3
67	4/1/2016 12:47:00	589.6	569.6
68	4/1/2016 12:48:00	588.4	568.4
69	4/1/2016 12:49:00	573.7	553.7
70	4/1/2016 12:50:00	582.3	562.3
71	4/1/2016 12:51:00	575.6	555.6
72	4/1/2016 12:52:00	581.7	561.7
73	4/1/2016 12:53:00	571.3	551.3
74	4/1/2016 12:54:00	561.5	541.5
75	4/1/2016 12:55:00	573.7	553.7
76	4/1/2016 12:56:00	573.1	553.1
77	4/1/2016 12:57:00	563.3	543.3
78	4/1/2016 12:58:00	549.3	529.3
79	4/1/2016 12:59:00	604.2	584.2
80	4/1/2016 13:00:00	579.8	559.8
81	4/1/2016 13:01:00	448	428
82	4/1/2016 13:02:00	424.8	404.8
83	4/1/2016 13:03:00	454.1	434.1
84	4/1/2016 13:04:00	386.9	366.9
85	4/1/2016 13:05:00	409.5	389.5

Logged

Concentration of CO2 vs. Time in Library 312



Megan Moore
 ENGR 115
 11:00am-1:50pm
 1-Apr-16

Input Parameters	
Measured Outdoor (ppm)	420
Assumed Outdoor (ppm)	400
Correction Factor (ppm)	-20
Room Volume (ft ³)	2194.5
Room Capacity (people)	4

Calculations:	
Air Exchange Rate (1/hr)	1.4247
Time to remove non-reactive chemical (hr)	2.11
Ventilation Rate (ft ³ /min/person)	13.03

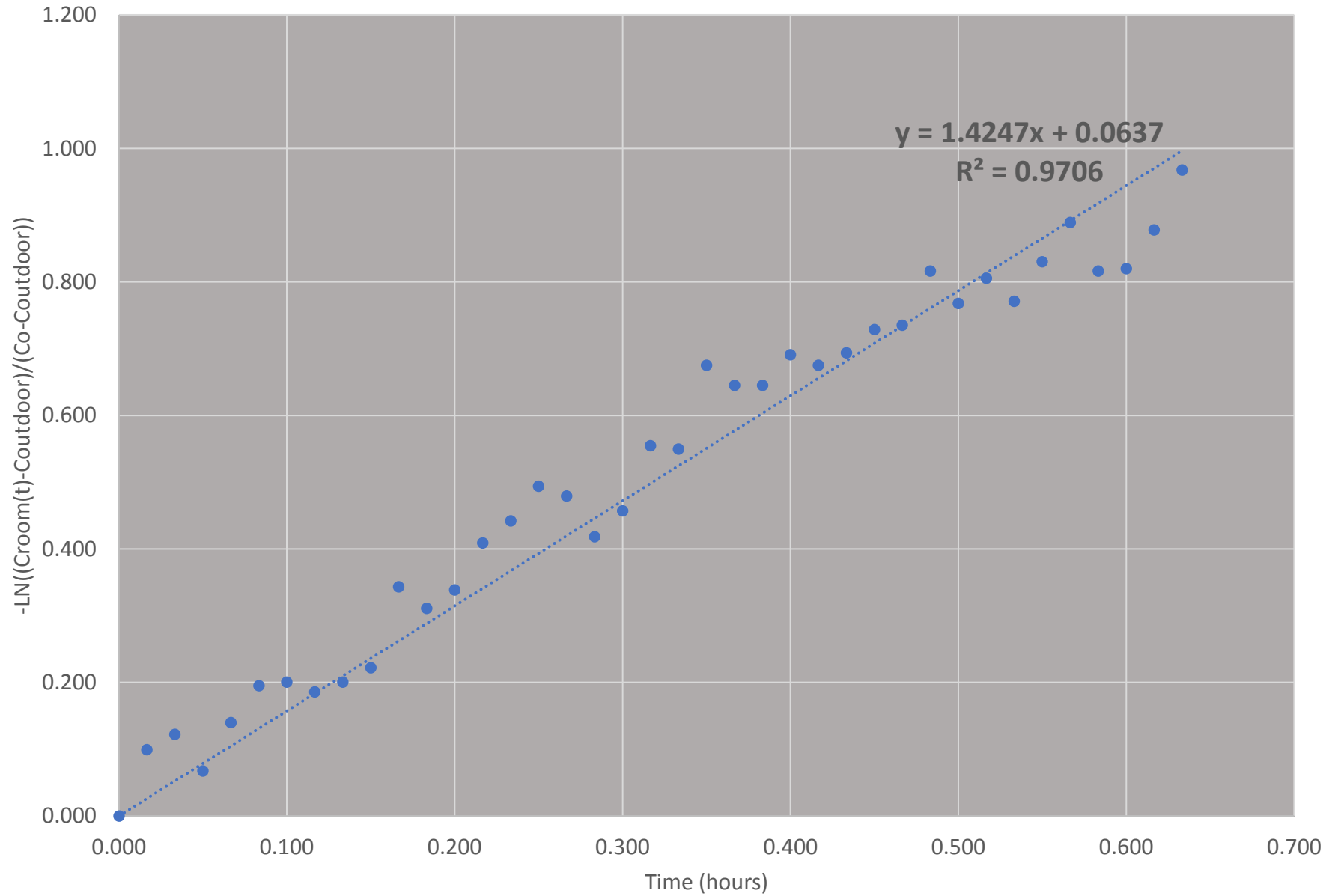
Analysis			
Measurment	Date and Time	Actual CO2 Concentration (ppm)	Hobo CO2 Concentration (ppm)
0	4/1/2016 12:20:00	792.9	772.9
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3	4/1/2016 12:23:00	767.3	747.3
4	4/1/2016 12:24:00	741.6	721.6
5	4/1/2016 12:25:00	723.3	703.3
6	4/1/2016 12:26:00	721.5	701.5
7	4/1/2016 12:27:00	726.3	706.3
8	4/1/2016 12:28:00	721.5	701.5
9	4/1/2016 12:29:00	714.7	694.7
10	4/1/2016 12:30:00	678.7	658.7
11	4/1/2016 12:31:00	687.9	667.9
12	4/1/2016 12:32:00	680	660
13	4/1/2016 12:33:00	661	641
14	4/1/2016 12:34:00	652.5	632.5
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17	4/1/2016 12:37:00	658.6	638.6
18	4/1/2016 12:38:00	648.8	628.8
19	4/1/2016 12:39:00	625.6	605.6
20	4/1/2016 12:40:00	626.8	606.8
21	4/1/2016 12:41:00	600	580
22	4/1/2016 12:42:00	606.1	586.1
23	4/1/2016 12:43:00	606.1	586.1
24	4/1/2016 12:44:00	596.9	576.9
25	4/1/2016 12:45:00	600	580
26	4/1/2016 12:46:00	596.3	576.3
27	4/1/2016 12:47:00	589.6	569.6

28	4/1/2016 12:48:00	588.4	568.4
29	4/1/2016 12:49:00	573.7	553.7
30	4/1/2016 12:50:00	582.3	562.3
31	4/1/2016 12:51:00	575.6	555.6
32	4/1/2016 12:52:00	581.7	561.7
33	4/1/2016 12:53:00	571.3	551.3
34	4/1/2016 12:54:00	561.5	541.5
35	4/1/2016 12:55:00	573.7	553.7
36	4/1/2016 12:56:00	573.1	553.1
37	4/1/2016 12:57:00	563.3	543.3
38	4/1/2016 12:58:00	549.3	529.3

Experimant Time (hr)	$\tau = -\text{LN}((\text{Croom}(t) - \text{Coutdoor}) / (\text{Co} - \text{Coutdoor}))$
0.000	0.00000
0.017	0.09947
0.033	0.12222
0.050	0.06738
0.067	0.13991
0.083	0.19497
0.100	0.20056
0.117	0.18574
0.133	0.20056
0.150	0.22194
0.167	0.34342
0.183	0.31094
0.200	0.33877
0.217	0.40903
0.233	0.44214
0.250	0.49417
0.267	0.47926
0.283	0.41827
0.300	0.45691
0.317	0.55479
0.333	0.54949
0.350	0.67524
0.367	0.64519
0.383	0.64519
0.400	0.69086
0.417	0.67524
0.433	0.69391
0.450	0.72864

0.467	0.73499
0.483	0.81623
0.500	0.76790
0.517	0.80535
0.533	0.77120
0.550	0.83014
0.567	0.88905
0.583	0.81623
0.600	0.81969
0.617	0.87797
0.633	0.96760

Determining the Air Exchange Rate for Library Room 312



1.) 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.

The air exchange rate of library room 312 is 1.4247 per hour.

2.) 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?

It takes 2.11 hours for the CO₂ to completely leave Library room 312. If the occupants don't want to be affected by high levels of CO₂, they should wait 2.11 hours before going back into the room. After 2.11 hours, the CO₂ level should be minimal.

3.) 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.

Our ventilation rate is 8.68 ft³/min/person, ASHRAE's recommended ventilation rate is 15 ft³/min/person. Our ventilation rate is 6.32 ft³/min/person lower than the ASHRAE recommended ventilation rate. The occupants are being too cheap and not supplying enough air. If more occupants are in the room, the ventilation rate decreases. To meet the standard, the ventilation rate should increase if there is an increase in occupancy. If less occupants are in the room, the ventilation rate increases. This is wasting energy because less people require a lower ventilation rate because they aren't producing as much CO₂ as more people in a room will. The higher the amount of people in the room, the higher the ventilation rate needs to be in order to meet the ASHRAE standard. The lower the amount of people in the room, the lower the ventilation rate should be to not waste energy.

4.) 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.

I would recommend having between 3 and 4 people in this room at one time. Having between 3 and 4 people gives us a ventilation rate between 17.37 ft³/min/person and 13.03 ft³/min/person.