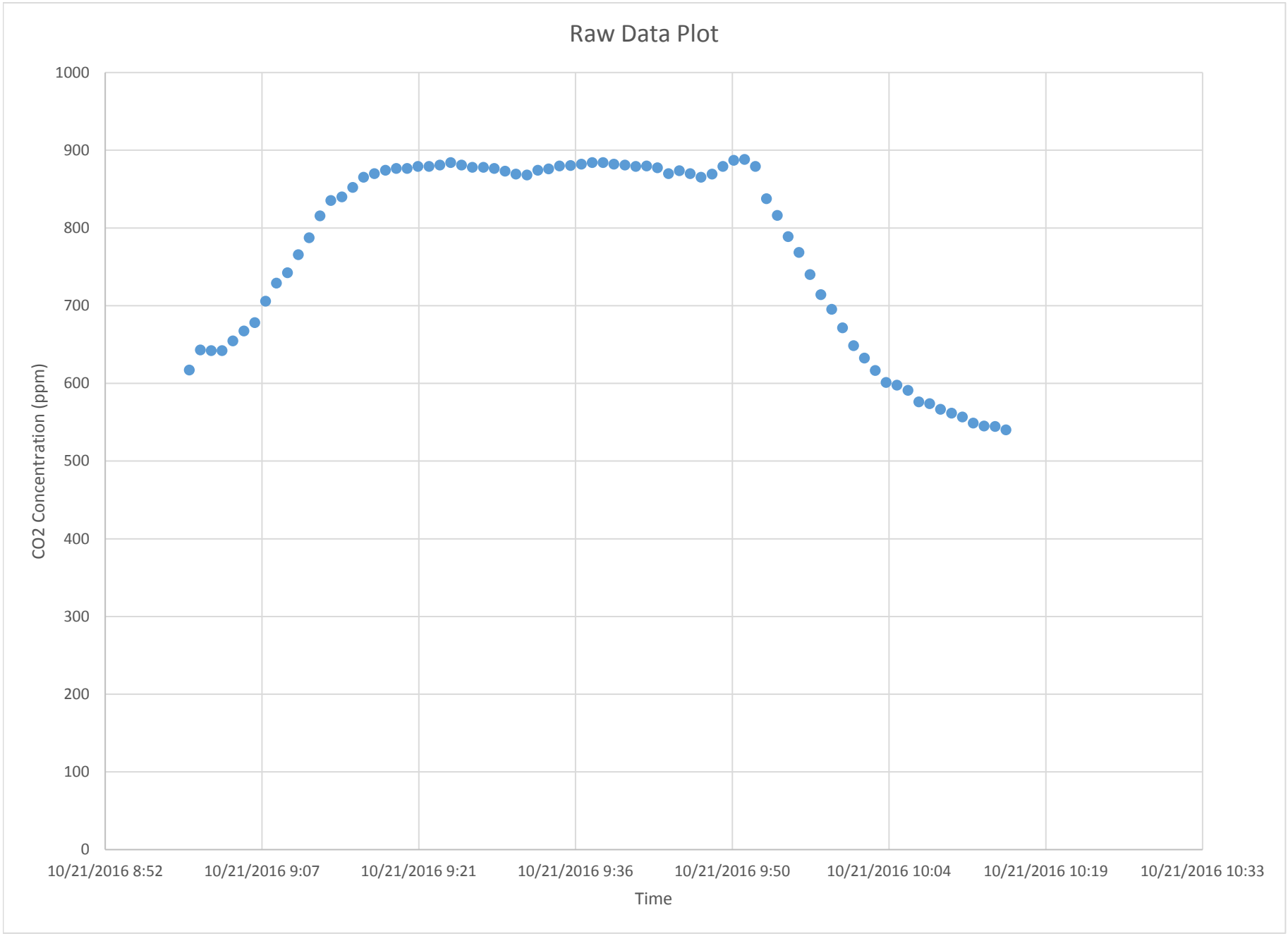
Technical Analysis Example: Mike Malone

Created: October 21, 2016
Class: Engineering 115,
Intro to Environmental Resources Engineering

Professors: M. Lang, E. Cashman

The purpose of this lab was to track the decrease in CO^2 as a conservative gas in order to monitor ventilation rates and air exhange rates of a specific room.


Raw Data Plot
1000
900
800
700
600
500
400
300
200
100
0
CO2 Concentration (ppm)
10/21/2016 8:52
10/21/2016 9:07
10/21/2016 9:21
10/21/2016 9:36
10/21/2016 9:50
10/21/2016 10:04
10/21/2016 10:19
10/21/2016 10:33
Time

Mike Malone
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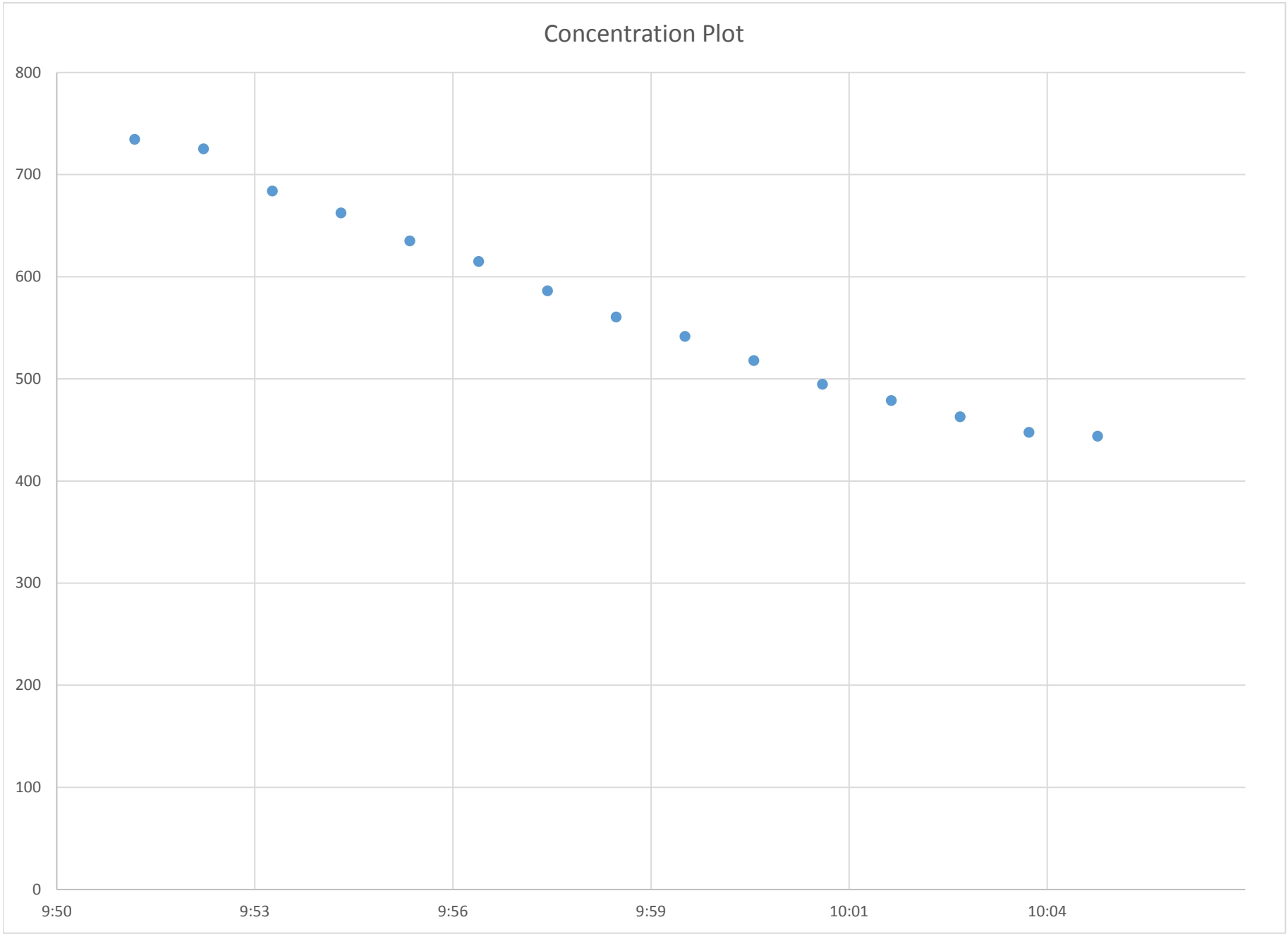
F 8-1:50AM
October 21,2016

Input Parameters:

Measured Outdoor [ppm]=	553.7
Assumed Outdoor [ppm]=	400
Correction Factor [ppm]=	-153.7

Analysis:

Measurement	Date and Time	HOBO CO2 Concentration	Actual CO2 Concentration
1	9:51	888.3	734.6
2	9:52	879.1	725.4
3	9:53	837.6	683.9
4	9:54	816.2	662.5
5	9:55	788.8	635.1
6	9:56	768.6	614.9
7	9:57	739.9	586.2
8	9:58	714.3	560.6
9	9:59	695.4	541.7
10	10:00	671.6	517.9
11	10:01	648.4	494.7
12	10:02	632.5	478.8
13	10:03	616.6	462.9
14	10:04	601.3	447.6
15	10:05	597.7	444


Concentration Plot
800
700
600
500
400
300
200
100
0
9:50
9:53
9:56
9:59
10:01
10:04

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Input Parameters:

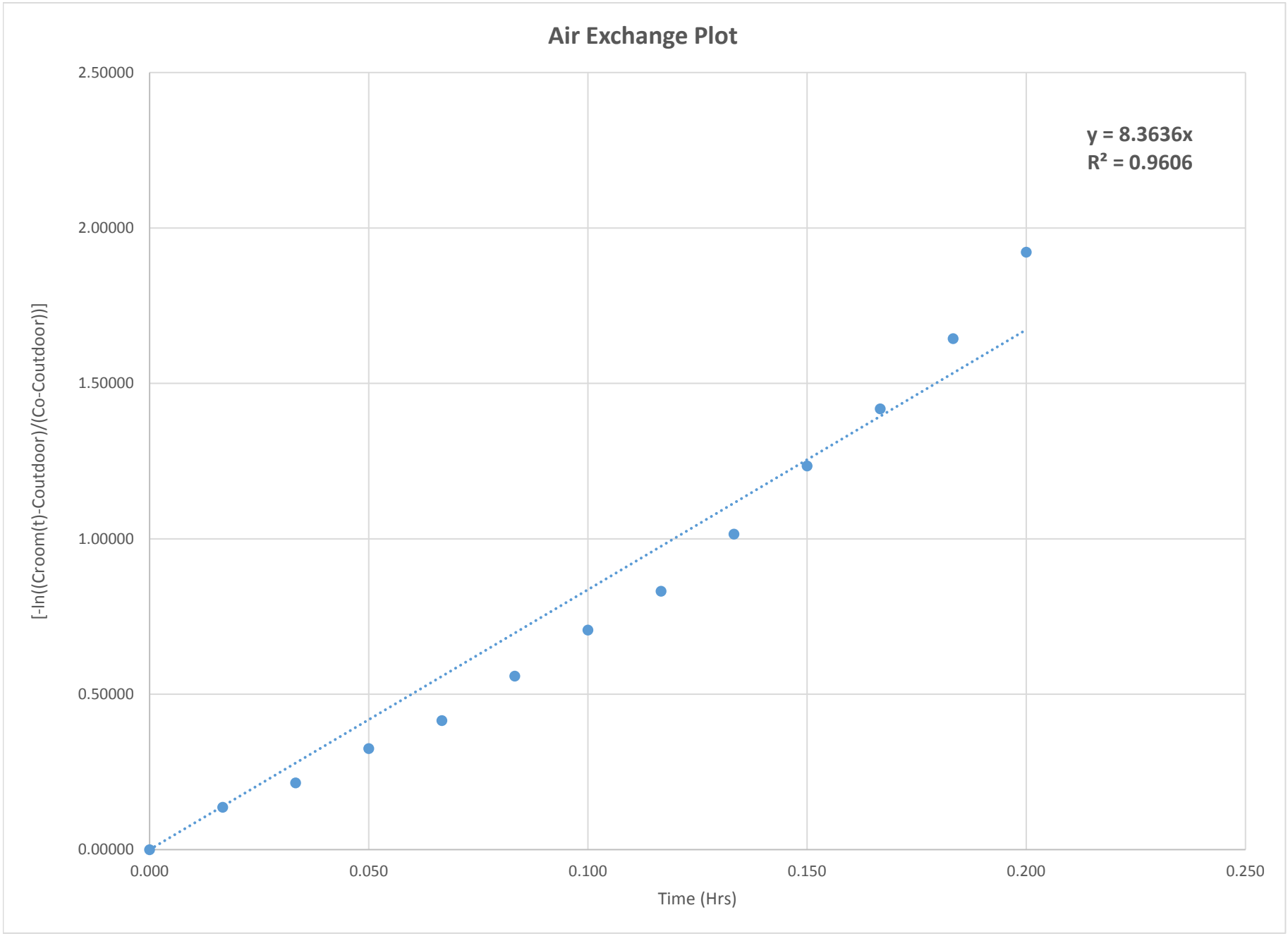
Measured Outdoor [ppm]=	553.7
Assumed Outdoor [ppm]=	400
Correction Factor [ppm]=	-153.7
Room Volume (ft^3)	1080
Room Capacity (people)	8

Analysis:

Measurement	Date and Time	HOBO CO2 Concentration	Actual CO2 Concentration	Experiment Time [hr]	[-ln((Croom(t)-Coutdoor)/(Co-Coutdoor))]
0	10/21/2016 9:52	879.1	725.4	0.000	0.00000
1	10/21/2016 9:53	837.6	683.9	0.017	0.13643
2	10/21/2016 9:54	816.2	662.5	0.033	0.21480
3	10/21/2016 9:55	788.8	635.1	0.050	0.32504
4	10/21/2016 9:56	768.6	614.9	0.067	0.41488
5	10/21/2016 9:57	739.9	586.2	0.083	0.55823
6	10/21/2016 9:58	714.3	560.6	0.100	0.70614
7	10/21/2016 9:59	695.4	541.7	0.117	0.83134
8	10/21/2016 10:00	671.6	517.9	0.133	1.01522
9	10/21/2016 10:01	648.4	494.7	0.150	1.23434
10	10/21/2016 10:02	632.5	478.8	0.167	1.41814
11	10/21/2016 10:03	616.6	462.9	0.183	1.64351
12	10/21/2016 10:04	601.3	447.6	0.200	1.92222

Calculations:

Air Exchange Rate [1/hr]	8.3636
Time to remove non-reactive chemical [hrs]	0.358697
Ventilation Rate [ft3/min/person]	18.8181


Air Exchange Plot
y = 8.3636x
R² = 0.9606
[-ln((Croom(t)-Coutdoor)/(Co-Coutdoor))]
2.50000
2.00000
1.50000
1.00000
0.50000
0.00000
0.000
0.050
0.100
0.150
0.200
0.250
Time (Hrs)

Questions

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 (λ) is approximately 8.36 per hour.

2. In general it takes 3/λ 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?

Our room only takes about a third of an hr to remove pollutants so with the capacity of only 5 people this room has good ventilation. If some non-reactive chemical was released, the room should be fine to enter after 22minutes or a half of an hour to be safe.

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 room was small, so 5 was assumed to be a typical number of occupants. ASHRAE recommended a ventilation rate of 20cfm per person, our room has a good ventilation rate of 30cfm (https://www.trane.com/commercial/uploads/pdf/520/iss-apg001-en.pdf). They might be wasting money ventilating, but in the room we used, they had valuable musical instruments so it might be worth it in this case.

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.

Adjusting the capacity, no more than 7 people should be in the room to meet the ASHRAE standard of 20cfm per person. At a capacity of 7, our 21.5cfm. At a capacity of 8,18.8 cfm not meeting the standard.