



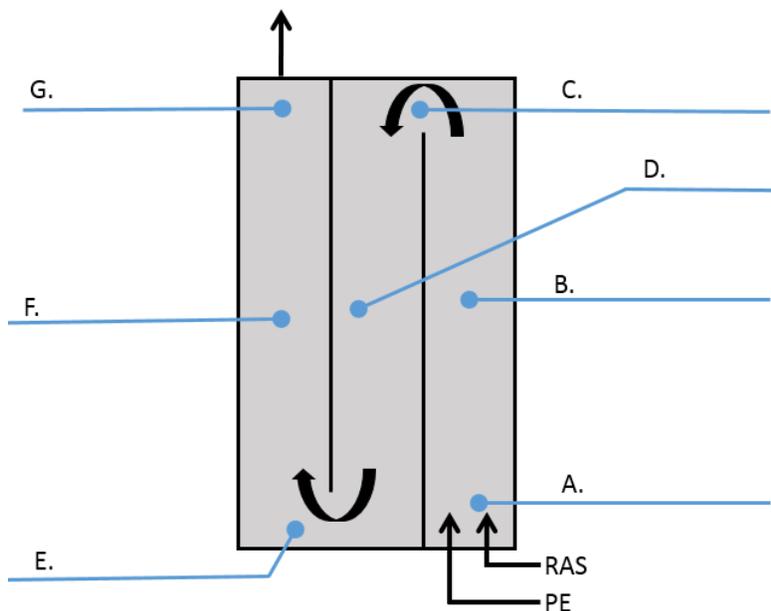
SESSION 4

HOMWORK & WORKBOOK

HOMEWORK: OUR – FINDING ENDOGENOUS RESPIRATION

Part 1: What is your OUR? Go out to your aeration basin and take at least one OUR test. Capture about 7 reads (0 – 60) 10 seconds apart. Be prepared to report your findings to the cohort!

Part 2: An example problem. A 3-pass aeration basin is shown below. On the following page are the results of 7 OUR tests performed on the basin.



1. Using MEASUR, determine the OUR for each of the 7 tests.
2. Where does endogenous respiration begin?
3. Where does this basin need the most air? The least?
4. What are some possible approaches to optimizing the air in this basin?
5. **EXTRA CREDIT: Do the same on your aeration basin!**

Location: A. Beginning Pass 1 (after PE and RAS)	
Time (seconds)	DO (mg/L)
0	7.45
10	7.02
20	6.59
30	6.18
40	5.72
50	5.29
60	4.88
OUR:	
Location: B. Mid-tank Pass 1	
Time (seconds)	DO (mg/L)
0	7.44
10	7.12
20	6.81
30	6.48
40	6.16
50	5.84
60	5.52
OUR:	
Location: C. End Pass 1 beginning Pass 2	
Time (seconds)	DO (mg/L)
0	7.48
10	7.21
20	6.93
30	6.68
40	6.40
50	6.14
60	5.89
OUR:	

Location: D. Mid-tank Pass 2	
Time (seconds)	DO (mg/L)
0	7.47
10	7.31
20	7.15
30	7.00
40	6.85
50	6.69
60	6.52
OUR:	
Location: E. End Pass 2 beginning Pass 3	
Time (seconds)	DO (mg/L)
0	7.17
10	7.02
20	6.86
30	6.70
40	6.57
50	6.43
60	6.27
OUR:	
Location: F. Mid-tank Pass 3	
Time (seconds)	DO (mg/L)
0	7.37
10	7.32
20	7.28
30	7.24
40	7.20
50	7.15
60	7.10
OUR:	
Location: G. End Pass 3, aeration basin effluent	
Time (seconds)	DO (mg/L)
0	7.42
10	7.39
20	7.33
30	7.30
40	7.25
50	7.22
60	7.18
OUR:	

EXERCISE – AERATION PRESSURE

Purpose: To develop knowledge, comfort and proficiency with the relationship between energy and aeration air discharge pressure.

3 IMPACT OF BLOWER PRESSURE ON ENERGY

Disch. pressure	Reduction in pressure of ___ psig				
	-0.2	-0.4	-0.6	-0.8	-1.0
12	1.3%	2.7%	4.0%	5.4%	6.7%
11	1.5%	2.9%	4.4%	5.9%	7.4%
10	1.6%	3.3%	4.9%	6.6%	8.3%
9	1.8%	3.7%	5.5%	7.4%	9.3%
8	2.1%	4.2%	6.3%	8.4%	10.6%
7	2.4%	4.8%	7.3%	9.7%	12.2%

**Assumes 70% blower eff & 92% motor/drive eff*

ACTIVITY QUESTIONS

a. How much energy is saved if this 50 hp blower's discharge pressure is reduced from 7 psig to 6 psig?	kWh/year	
b. What if it's a 150 hp blower, and the pressure is lowered from 10 psig to 9.6 psig. What percentage of energy is saved?	%	
c. If a 75 hp blower is turned down from 9 psig to 8 psig, how much money is saved (if energy costs 6¢ per kWh)?	\$ /year	
d. If a 40 hp blower is turned down from 8 psig to 7 psig, how much energy is saved, and what percentage does that represent?	kWh/year	%

EXERCISE – DO RESIDUAL

Purpose: To develop knowledge, comfort and proficiency with the relationship between energy and residual dissolved oxygen (DO).

Materials needed: Laptop

Oxygen is required by the organisms that carry out secondary treatment in the aeration basin. Installed DO meters read how much “residual” or leftover oxygen is present. While many plants control blower operation automatically to maintain 2 mg/L DO or lower, we also see that many aeration basins carry excess DO “just in case” a large load comes in unexpectedly. This extra DO has an energy cost. The cheat sheet table shows how much energy savings (as a percentage) is available if residual DO is reduced to 2 mg/L, at various mixed liquor temperatures.

The cheat sheet allows you to explore different scenarios and determine the approximate actual savings associated with these scenarios.

2 IMPACT OF DO LEVELS ON ENERGY

Saturated DO

DO in basin = driving force for oxygen transfer
Driving force UP means Energy goes DOWN

DO rule of thumb

0.5 mg/l reduction creates ~ 6% energy savings

DO calibration & cleaning

A probe that reads 10% low (e.g. 2.0 when actual is 2.2) is costing you 2.4% at the blower.

DO level increases

As mixed liquor temp increases, the impact of elevated DO levels increases.

IMPACT OF AVERAGE DO LEVEL ON BLOWER ENERGY						
Mixed liquor temp		DO sat mg/l	Energy savings potential if DO reduced from __ to 2.0 mg/l			
°C	°F		2.5	3	4	5
0	32	14.6	4.0%	7.9%	15.9%	23.8%
2	36	13.8	4.2%	8.5%	16.9%	25.4%
5	41	12.8	4.6%	9.3%	18.5%	27.8%
10	50	11.3	5.4%	10.8%	21.5%	32.3%
15	59	10.1	6.2%	12.3%	24.7%	37.0%
20	68	9.1	7.0%	14.1%	28.2%	42.3%
25	77	8.2	8.1%	16.1%	32.3%	48.4%

NOTE Higher impact as elevation increases

Instructions: Use the table and cheat sheet above to answer the questions below.

EXERCISE – DO RESIDUAL CONTINUED**Questions****IN SESSION QUESTIONS**

- a. What percentage of energy could be saved if an aeration basin holding 25°C mixed liquor lowered its DO residual from 3 mg/L to 2 mg/L? _____%
- b.
- c. If a plant is running 200 hp of blowers, and it has 59 °F mixed liquor, how many kWh/y of energy might it save by lowering its DO from 3 mg/L to 2 mg/L? _____kWh/year
- d. In b) how much cost is saved (at \$0.06/kWh)?
\$ _____/year
- e. How much total money can be saved if a plant running 100 hp of blowers in 20 °C mixed liquor reduces their DO residual from 5 mg/L to 2 mg/L? _____kWh/year

HOMEWORK

- f. Your plant runs (on average) what total horsepower of blower? _____ hp
What is the approximate temperature of your plant's mixed liquor? _____ °F
What is the DO residual setpoint at your plant? _____ mg/L
- g. How much total money is saved if your plant reduces DO residual to 1 mg/L? (Hint: you may have to use an estimate savings to get to 1 mg/l.) \$ _____/year