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Annual Student Report – Summer 2018

Andy Shen, Undergraduate Student
AET-2: Process Modeling and Analysis

Mentors: Jeffrey Hyde, Robert Parker
August 14, 2018

UNCLASSIFIED

Introduction

- **Los Alamos High School** - Class of 2017
- **University of California, Los Angeles** - Class of 2021
  - B.S. Applied Mathematics
  - Minor: Statistics

Agenda

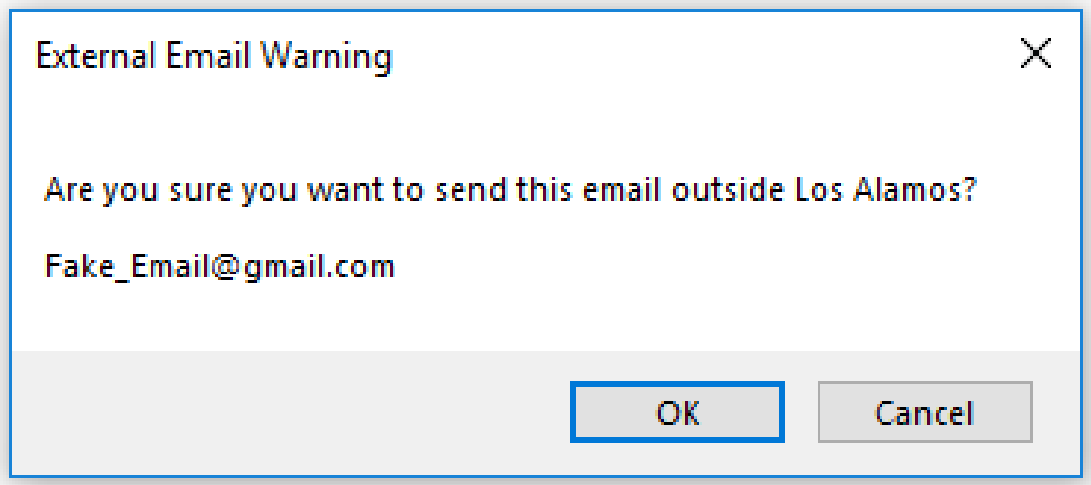
- Outlook Email Checker Add-In Project
- Storage Glovebox Removal Project for PF-4
- Waste Water Model Project

AET-2
PROCESS MODELING & ANALYSIS

Microsoft Outlook External Email Checker

Outlook Add-In

- To identify whether an email or meeting request is outside of the LANL network or not
- If the email address does not end in “lanl.gov”, a warning pop-up box is displayed

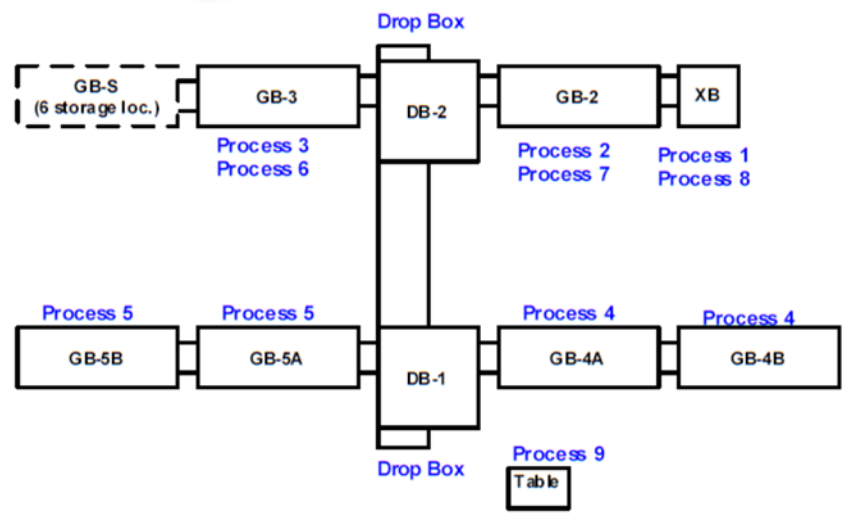


PF-4 Storage Glovebox Removal Project

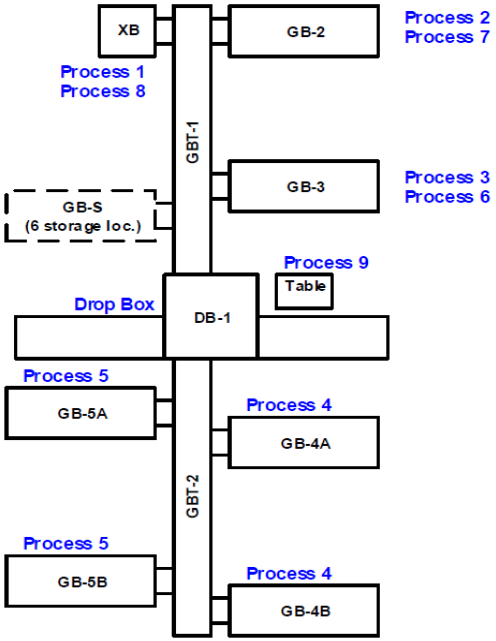
Background Information

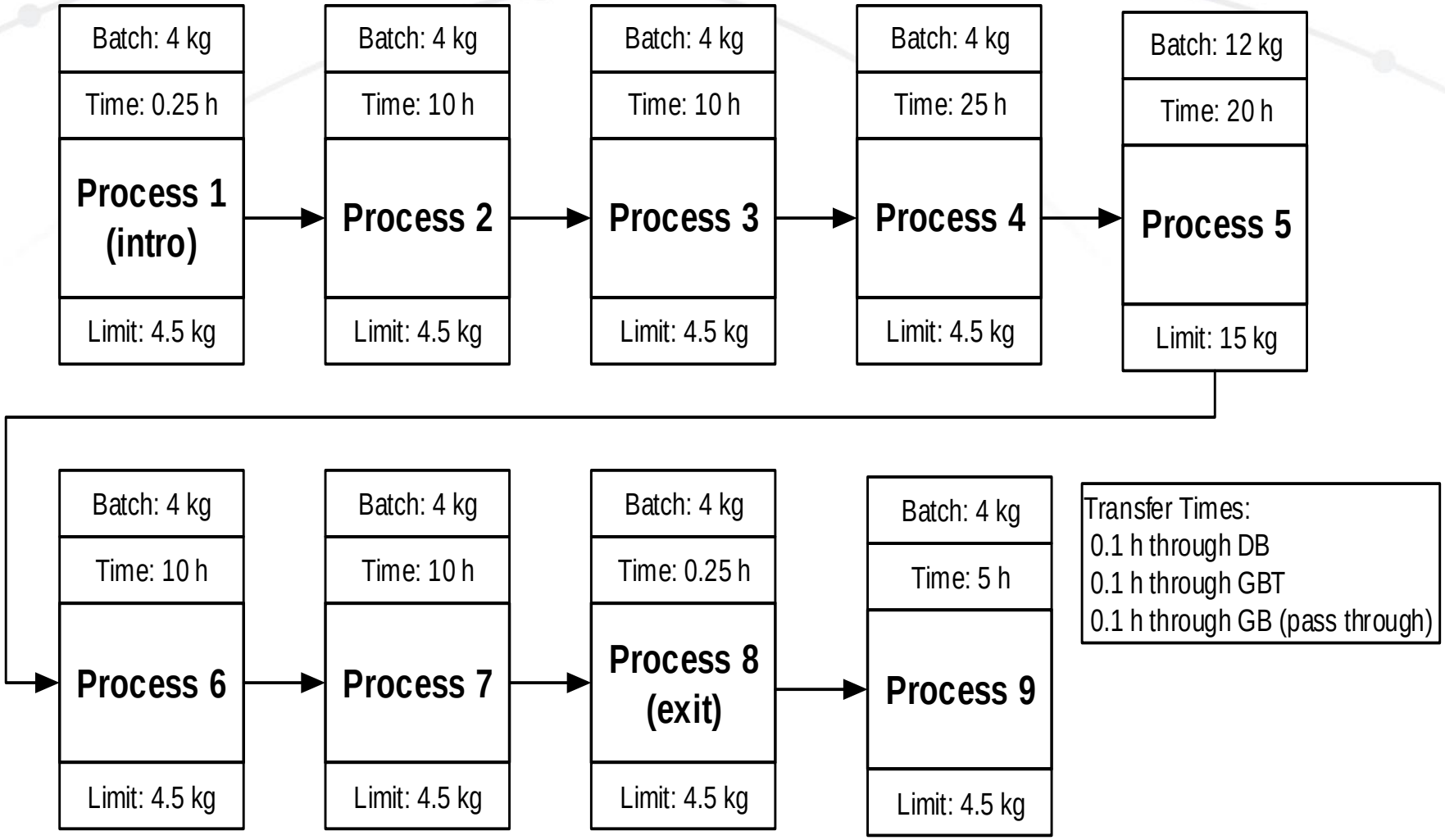
- PF-4 has two configurations for gloveboxes
  - Parallel
  - Serial
- Items travel from glovebox to glovebox
- Pass-Through
  - Multiple items passing through at once
- No Pass-Through
  - One item at a time
- Modeled with ExtendSim

Serial Configuration



Parallel Configuration

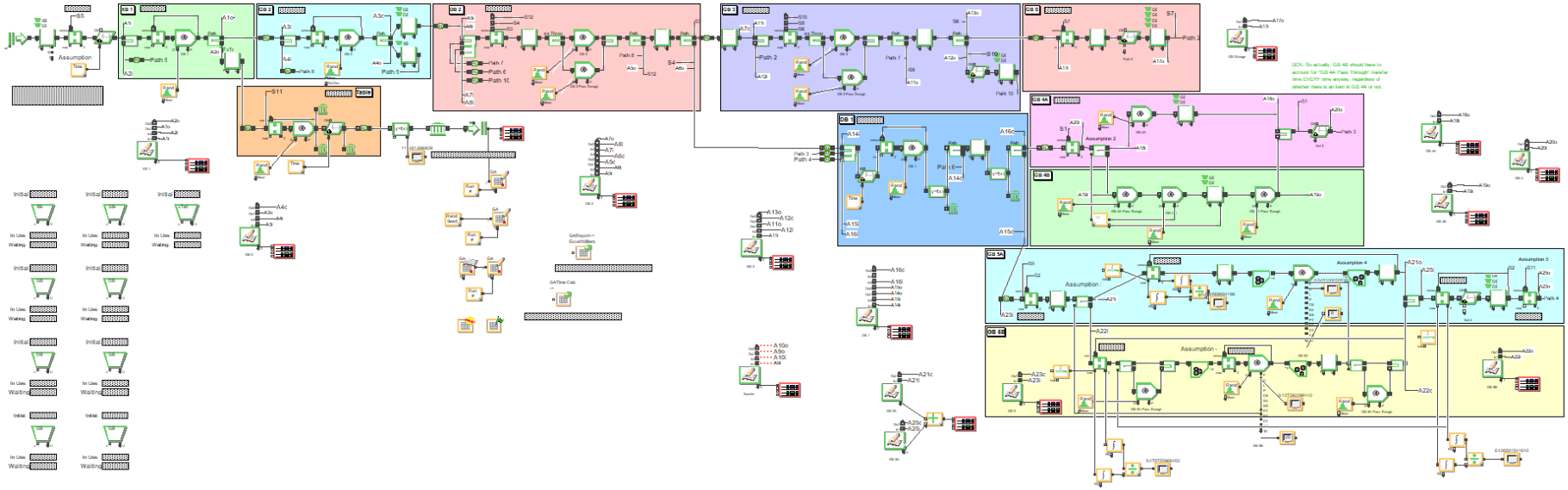



Batch: 4 kg
Time: 0.25 h
Process 1 (intro)
Limit: 4.5 kg
Batch: 4 kg
Time: 10 h
Process 2
Limit: 4.5 kg
Batch: 4 kg
Time: 10 h
Process 3
Limit: 4.5 kg
Batch: 4 kg
Time: 25 h
Process 4
Limit: 4.5 kg
Batch: 12 kg
Time: 20 h
Process 5
Limit: 15 kg
Batch: 4 kg
Time: 10 h
Process 6
Limit: 4.5 kg
Batch: 4 kg
Time: 10 h
Process 7
Limit: 4.5 kg
Batch: 4 kg
Time: 0.25 h
Process 8 (exit)
Limit: 4.5 kg
Batch: 4 kg
Time: 5 h
Process 9
Limit: 4.5 kg
Transfer Times:
0.1 h through DB
0.1 h through GBT
0.1 h through GB (pass through)

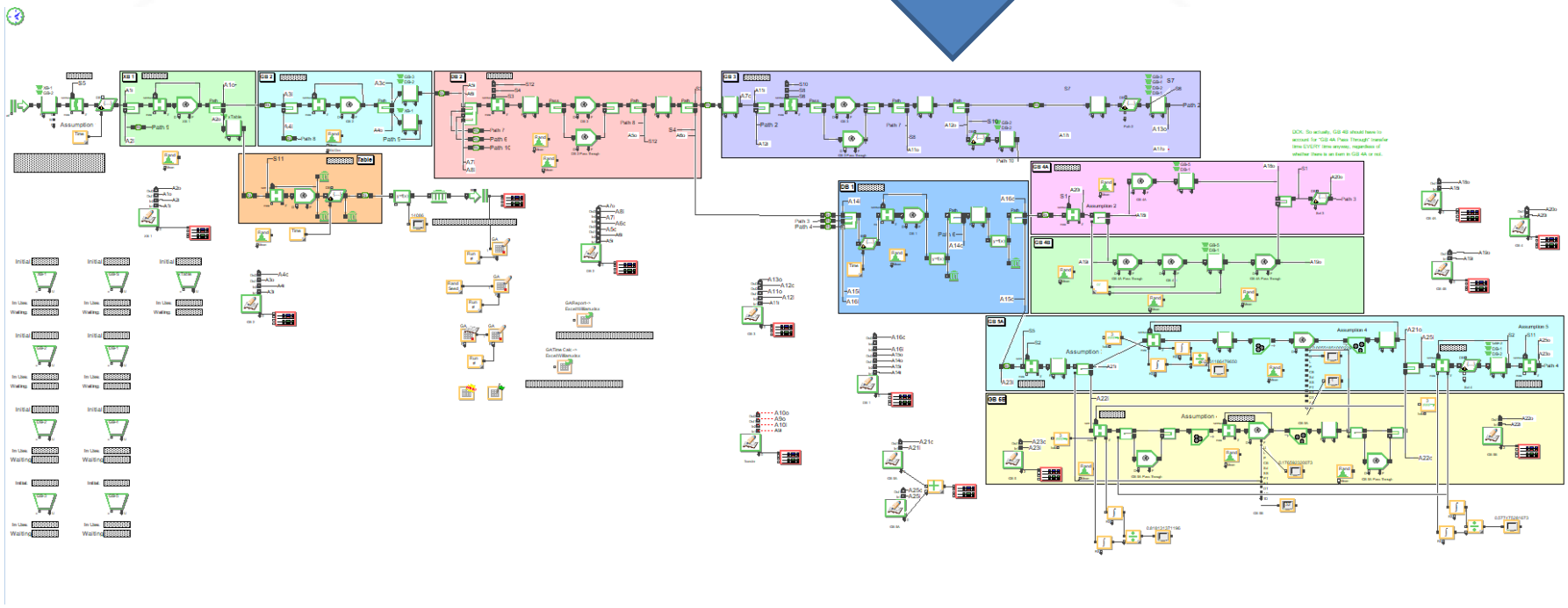
Storage Glovebox (GB-S)

- Storage unit for items to queue during process
- Maximum capacity of six items
- What happens when it is removed from the model?

Model Pre-Removal (SPT)



Model Post-Removal



Results and Discussion

- Generally, process time is unaffected after removing GB-S
- Storage Glovebox unnecessary
  - Has little to no effect on process time
  - Financial/programmatic effects

Specification	Model	Processing Time (hr.)
With GB-S	Serial Pass Through	2,200
	Serial No Pass Through	5,800
	Parallel Pass Through	2,200
	Parallel No Pass Through	2,200
Without GB-S (Shen, A.A.)	Serial Pass Through	2,300
	Serial No Pass Through	5,100
	Parallel Pass Through	3,100*
	Parallel No Pass Through	N/A

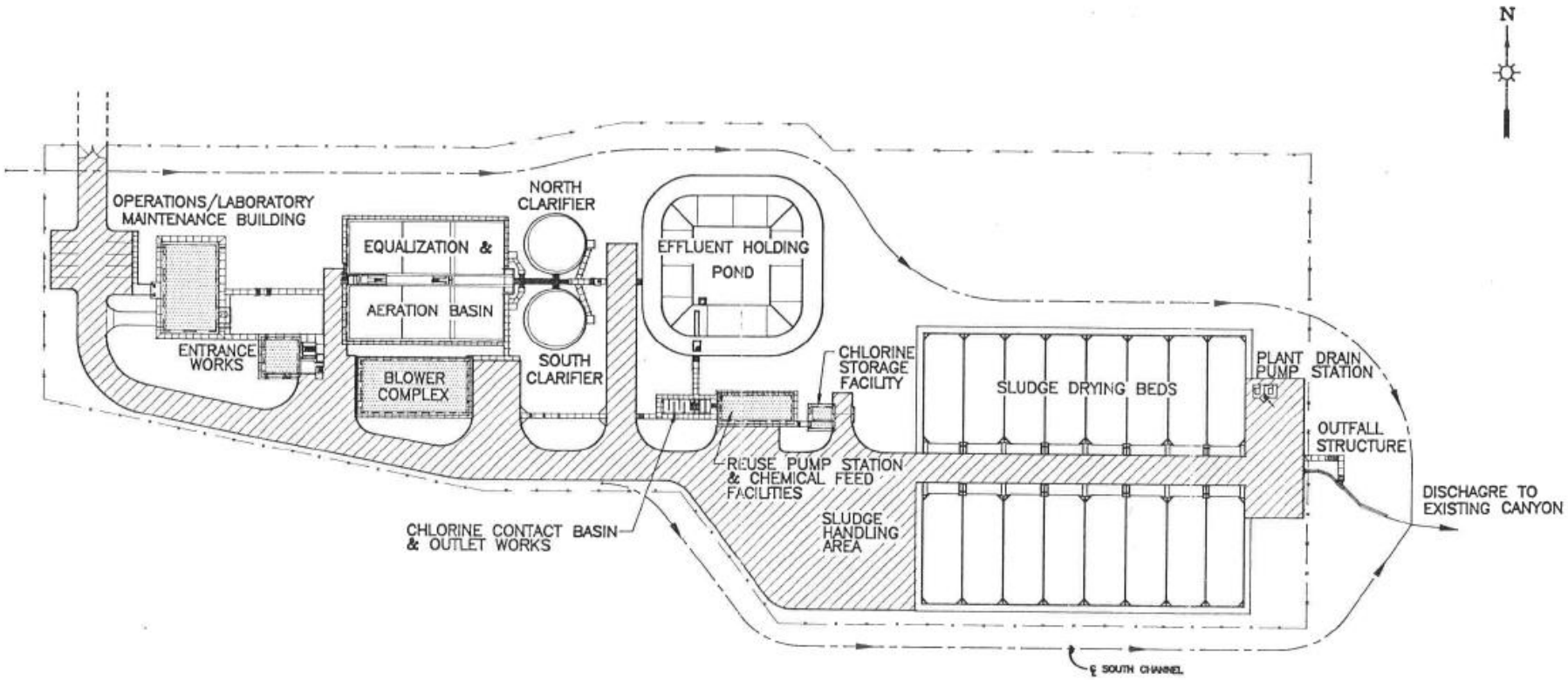
Waste Water Model Project (Ongoing)

Background – see written diagram

Overall Purpose

- Assess availability of reuse water for SCC
- Examine methods to effectively and properly manage these water supply resources
- Specific Task
  - Model water output rates from SWWS
  - Analyze with respect to season and year and look for statistical significance
  - Characterize variability among water output rates

Sanitary Waste Water System (SWWS)



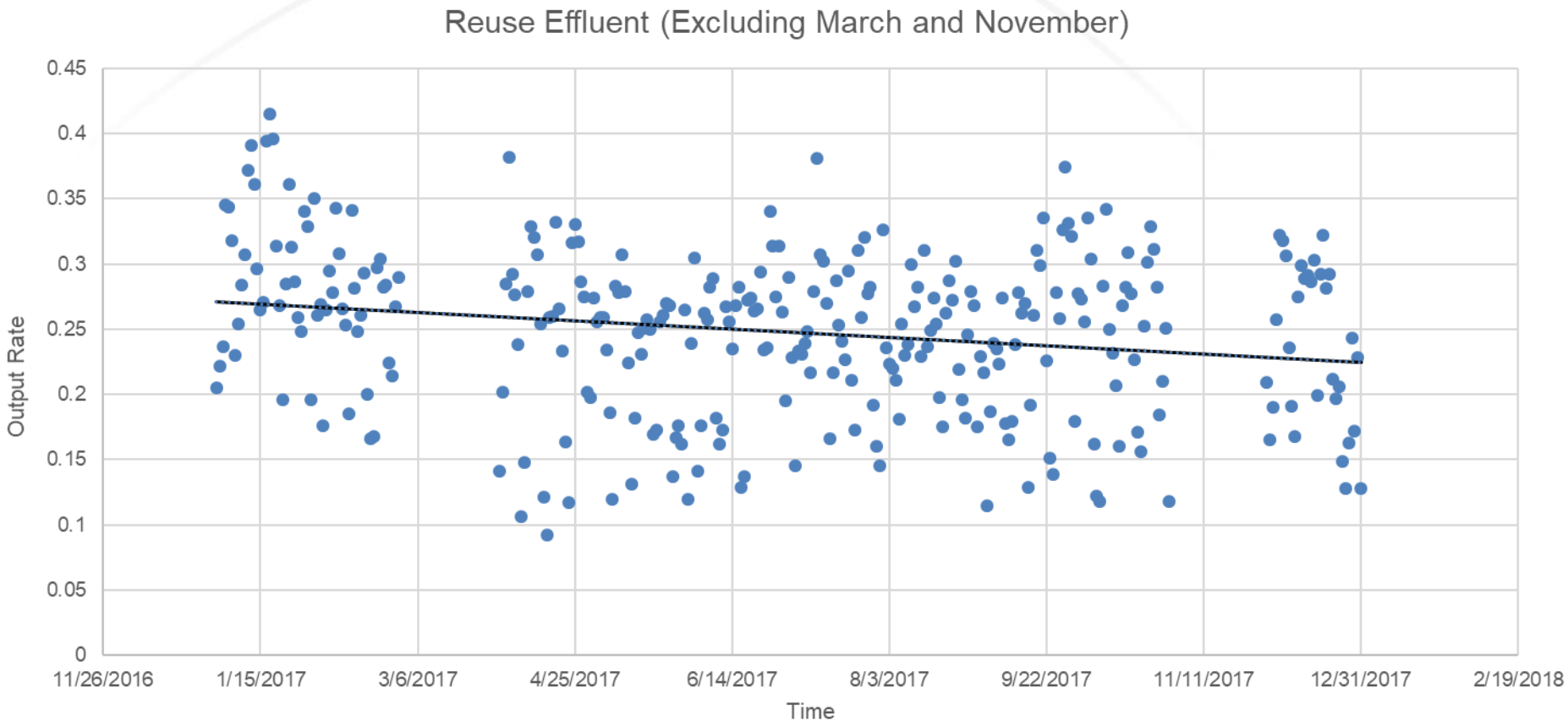
Sanitary Effluent Reclamation Facility (SERF)

Strategic Computing Complex (SCC)

Strategic Computing Complex (SCC)

Calculations

- T-test of two means
  - Looking for statistical significance
  - Microsoft Excel
- Populations
  - Seasons (2008-2017)
  - Years (2008-2017)


Reuse Effluent (Excluding March and November)
Output Rate
0.45
0.4
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
11/26/2016
1/15/2017
3/6/2017
4/25/2017
6/14/2017
8/3/2017
9/22/2017
11/11/2017
12/31/2017
2/19/2018
Time

Hypotheses and Significance

- Null Hypothesis
  - H_0: $\mu_1 - \mu_2 = 0$
  - Season and/or year **does not** have an effect on output rate
- Alternative Hypothesis
  - H_A: $\mu_1 - \mu_2 \neq 0$
  - Season and/or year **does** have an effect on output rate
- Significance Level
  - $\alpha = 0.05$
    - 5% chance of Type I Error – Data shows a difference when there is not

Distribution of Samples – Seasonal

- Spring: March, April
  - 2017: May, April
- Summer: June, July
  - 2008: May, August
- Fall: September, October
  - 2015: September, November
- Winter: December, January

Results - Seasonal

- Winter vs. Summer and Spring vs. Fall (non-consecutive)
  - $p < 0.05$
  - Reject H_0 (difference exists among the two seasons)
- Spring vs. Summer, Summer vs. Fall (consecutive)
  - $p < 0.05$
  - Reject H_0 (difference exists among the two seasons)
- Fall vs. Winter, Winter vs. Spring (consecutive)
  - $p > 0.05$
  - Fail to reject H_0 (no difference among the two seasons)

Is there a Seasonal Difference?

Season	Spring	Summer	Fall	Winter
Spring	x	YES	YES	NO
Summer	x	x	YES	YES
Fall	x	x	x	NO
Winter	x	x	x	x

Comparing Winter vs Summer

- Average output for winter is greater than summer
- Possible Factors
  - Precipitation
  - Evaporation

Results	*Winter*	*Summer*
Mean	0.266814216	0.243459902
Variance	0.003940847	0.003037544
Observations	619	611
Hypothesized Mean Difference	0	
Degrees of Freedom	1212	
t Stat	6.935866707	
P(T<=t) one-tail	3.27665E-12	
t Critical one-tail	1.64611183	
P(T<=t) two-tail	6.5533E-12	
t Critical two-tail	1.961923227	

Results - Yearly

- Comparing 2009-2016
- Most years indicate a statistically significant difference in output rate ($p < 0.05$)
- Few Exceptions
  - 2009 vs. 2014
  - 2010 vs. 2013

Conclusions

- Generally, there exists a statistically significant difference among water output rates between both season and year
- Possible factors
  - Dryness or Wetness of season
    - Net precipitation/evaporation
  - Differences in seasonal/yearly temperatures

Acknowledgements

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  - Jerrad Auxier, Jeffrey Hyde, Bill Kubic, Robert Parker
- Students
  - Joel Johnson, Devin Kimball, William Peck

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