**CENG 340 Environmental Engineering Fall 2013**

**Week 1 Laboratory – Safety, Orientation, and Data Analysis**

**Date: Tuesday, September 3, 2013**

**Topic:  Lab Safety, Orientation, and Data Analysis**

**Report: No report due for this lab, other than reporting of your data to the group during the lab.**

**Objectives for today:**

1. Become oriented to the lab, in particular with respect to safety issues.
2. Collect data from a real, local, environmentally-relevant project, analyze the data using spreadsheet software, calculate parameters of central tendency (average) and variability (standard deviation, confidence interval), and perform hypothesis testing if appropriate.

**Laboratory Safety**

1. Lab safety video.
2. Location of lab safety equipment and information in the Environmental Lab.
3. Bucknell lab safety document.

**Data Analysis and Inference of Conclusions**

You are given some four samples of evaporated frack flow back fluid and four samples of chemically treated frack flow back fluid. You have been asked to determine if a treatment process has made any reduction in the salinity (saltiness) of this gas well wastewater. The data are as follows:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Column A | B | C | D | E |
| Treatment? | Dish # | Initial mass of empty pan, g | Mass after evaporation of water in sample, g | Concentration of salt in original, 5 mL sample, mg/L |
|  |  |  |  |  |
|  |  |  |  |  |
| Treated (T) |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
| Untreated (UT) |  |  |  |  |
|  |  |  |  |  |

Data analysis tasks:

1. Go to Moodle and retrieve the Excel file titled “CENG340\_data\_lab1\_sept3\_2013”
2. Measure the mass of 8 pans [4 treated (T) and 4 untreated (UT)] after evaporation of water and record in column D in table above.
3. Use the data recorded in the Excel file to calculate the mass of salt in each dish.
4. For each row, calculate the concentration of salt in each sample and record in column E above. All samples had a starting volume of 5 milliliters (ml).
5. Enter the data into a spreadsheet program on the laptop.
6. Calculate the average of the data for the untreated samples and for the treated samples.
7. Calculate the standard deviation of the data for both untreated and treated samples.
8. Calculate the 95% confidence interval of the data for both untreated and treated samples.
9. Generate a column plot comparing the treated and untreated data using averages and error bars based on 95% confidence intervals. I recommend you use KaleidaGraph to create high quality figures.
10. With your groups discuss if it makes sense to perform a t-test to determine if the samples are significantly different.
11. If appropriate, perform a t-test to determine if the treated samples are significantly different than the untreated samples.

Questions for your group to discuss and respond in class:

Just looking at the average salt concentration in the treated samples versus the untreated samples, was the treatment effective?

Which data set had higher variability?

Using your results, could you defend to the public that this treatment process reduced the concentration of salt in this wastewater?

Would the treated water be allowed to be received at a wastewater treatment plant? Note that the Pennsylvania Department of Environmental Protection (DEP) now requires a maximum monthly average concentration of 500 mg/L TDS in water discharged to domestic wastewater treatment plants.