Lab #2 – Sampling and Splitting

Name: ________________________________ Grade: ____________ <u>Feedback</u>:

Group Name: ___________________________

Pledge: "On my honor as a Virginia Tech student, I have neither given nor received unauthorized assistance on this assignment." Initial_____

By participating in this class, all students agree to abide by the Virginia Tech Wellness principles:

https://ready.vt.edu/well.html

If you answer yes to any questions in the Hokie Health survey (questions can be posted in the syllabus), you must not attend class in person. Notify me by email and contact Schiffert Health Center for testing and quarantine protocol.

Introduction

Mineral processing operations must be constantly monitored to ensure that optimal levels of separation performance are maintained and plant profitability is maximized. The monitoring requires the collection of samples from process streams and the reduction of these samples down to a manageable but representative weight. In industrial operations, samples are often collected on a daily basis for measuring particle size distribution, assay, moisture, etc. A good sample requires that all particles have an equal chance of being included in the sample (i.e., the sample is accurate) and samples taken in multiple are identical (i.e., the sample is precise). These two requirements can only be met when proper sampling and splitting procedures are followed by plant personnel.

The purpose of this laboratory exercise is to conceptually demonstrate the important factors that influence the sampling process. In the laboratory, you will (i) collect a representative sample of a real ore, (ii) reduce the sample into smaller representative lots using two different splitting techniques, and (iii) evaluate whether the sampled lots appear to be representative based on weight comparisons.

<u>Helpful Equations</u>

Sample Loss	$\% \; Sample \; Loss = 100 \left(\frac{Head \; Wt - Sample \; Wt}{Head \; Wt} \right)$
Mean Weight	$\bar{x} = \frac{\sum_{i=1}^{n} x_i}{n}$
Standard Deviation	$s = \sqrt{\frac{\sum_{i=1}^{n} ¿(x_i - \bar{x})^2}{n-1}} ¿$
Maximum Error (%)	$e_{max} = 100 \frac{\lvert x_m - \bar{x} \rvert}{\bar{x}}$

x_i = individual value, x_m = value furthest from the mean, n = number of samples

Procedure

Dry Material Sampling

Your laboratory instructor will provide you with a pile of crushed ore. You will collect a representative sample from the pile and then use two different splitting techniques (i.e., coning & quartering and Jones riffler) to reduce the amount of your sample. For each splitting technique, you will compare the weights of your splits to determine the effectiveness of each technique.

1. Don all appropriate safety and personal protective equipment.

2. Estimate what portion of a two-gallon bucket you would need to fill to collect ~ 4 kg of sample (3.785 liters/gal; 1000 cm^3/liter; powder has ~30% void space; silica density = 2.65 g/cm^3).

3. Obtain two 2-gallon buckets and weigh them.

4. Using a sampling scoop, attempt to collect a representative sample from the pile for each bucket. (Hint: Think about how your samples should be collected in order to make them as representative of the total ore and as equivalent in weight as possible.)

5. Weigh the buckets containing your samples and determine the weight of each sample by subtracting the bucket weight from the total weight (bucket plus sample). Consider how close your estimate was.

6. Create a cone from your first bucket sample (A), flatten it and divide it into quarters. Combine opposite corners into two subsamples. Repeat this procedure for each subsample to create a total of four samples from your original 4-kg sample. Weigh each sample and record the weights.

7. Split your second bucket sample (B) into two parts using the Jones Riffler. Split each part again to produce a total of four samples. Weigh each sample and record the weights.

8. Choose one of the final sub-samples to retain for a future laboratory exericse. Place the sample in a plastic bag, and record your group name, date, expiration date, sample identifier, and any other pertinent information.

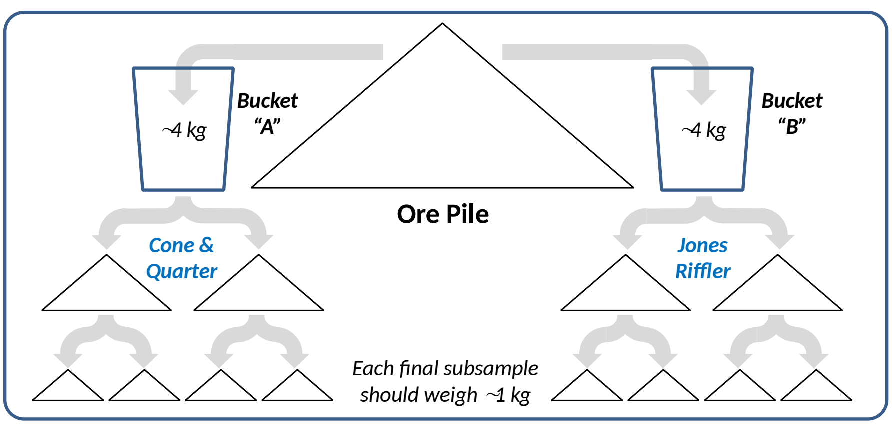

Figure 1. Laboratory procedure for sampling and splitting.

Data Records & Calculations

1. What portion of a two-gallon bucket do you need to fill to collect ~ 4 kg of sample (3.785 liters/gal; 1000 cm^3/liter; powder has ~30% void space; silica density = 2.65 g/cm^3)?

Data Table

Value	Sample A (C&Q)	Sample B (JR)
Fraction of Bucket to Fill (%)		
Bucket Weight (kg)		
Sample Weight (kg)		
Split 1 Weight (kg)		
Split 2 Weight (kg)		
Split 3 Weight (kg)		
Split 4 Weight (kg)		
Mean Weight (kg)		
Standard Deviation (kg)		
Maximum Error (%)		
Sample Loss During Splitting (%)		

Discussion Questions

1. Why is sampling an important task in mineral processing facilities?

2. How should the required sample weight change with increasing particle topsize? Please explain.

3. How should the required sample weight change with increasing heterogeneity? Please explain.

4. What do the statistical parameters you obtained in the experimental sampling exercise suggest about the two splitting methods? Which method was superior and why? Did you observe any bias?

5. Did you lose any sample during the splitting exercises? If so, do you believe that the amount of the lost was significant to your calculated values? How might this impact your findings?

6. What procedures would you recommend in order to provide a laboratory with a representative 1 gm sample of this ore for determining copper content?

Conclusions

1. What was the objective of this laboratory exercise?

2. What were your major findings?

3. What important fundamental concepts did you learn from the exercise?