ALLAN FRASER
& associates

Consulting Analytical Chemists and Geochemists

COMPARISON OF MARGIN OF ERROR IN SUB-SAMPLE MASS

Allan Fraser

April 2020

Application Note: 31

The margin of error (*E*) in sampling and any subsequent sub-sampling can be calculated as:

$$E = z_c \sqrt{\frac{\hat{P}(1-\hat{P})}{n}} \qquad [1]$$

Where, z_c is the critical value for a 95% level of confidence, $\hat{P}$ is the ratio of the mass of sub-sample and the bulk sample mass and n is the bulk sample mass. E is reported as a % by multiplication by 100.

Example:

A 1500 g sample is split into 10 approximately equal 150 g sub-samples using a 10-way rotary splitter. What is the margin of error in a 150 g sub-sample from this splitting event? A separate mass of 5000 g is split using the same rotary splitter into 10 approximately 500 g equal sub-samples. What is the percentage increase in reliability of the larger sample, i.e., in going from using a 150 g to a 500 g sub-sample?

The margin of error (*E*) at a 95% level of confidence for a 150 g sub-sample split out from a 1500 g bulk sample is calculated using equation [1]:

$$E = 1.96\sqrt{\frac{\frac{150}{1500}\left(1-\frac{150}{1500}\right)}{1500}}$$

$$E = 1.96\sqrt{0.00066}$$

$$E = 0.050$$

$$E = 5\%$$

Therefore, the margin of error in taking a 150 g sub-sample from a 1500 g bulk sample is 5%. For a 500 g sample from a 5000 g bulk sample the margin of error is 3%:

$$E = 1.96\sqrt{\frac{\frac{500}{5000}\left(1-\frac{500}{5000}\right)}{5000}}$$

$$E = 1.96\sqrt{0.00018}$$

$$E = 0.027$$

$$E = 3\%$$

The percentage increase in reliability of a 500 g sub-sample over a 150 g sub-sample from 5000 g and 1500 g, respectively is:

$$\frac{5\% - 3\%}{3\%}\ x\ 100$$

$$67\%\ or\ {\sim}70\%$$

How to cite this document:

Fraser A.W. (2020). Comparison of Margin of Error in Sample Mass. Application note 31. 3 pages. www.allanfraserandassociates.co.za