Sampling based on modern sampling theory

Alex Stewart International employs more than 1,200 people in over 45 countries and operates 17 laboratories, write *Mr. Graham Stewart and Mr. Kozo Matsumoto, Alex Stewart International Corporation*. Alex Stewart International provides its customers with independent verification of the quantity and quality of bulk commodity shipments, as well as geochemical analysis of mining samples for exploration projects. Core business services are for large international commodity trading companies within the agriculture, metals and mineral and oils and petroleum industries.

As a service company, one of Alex Stewart International's core business areas is the supervision of weighing and sampling of base-metal concentrates, where we consider it most important to rely on modern sampling theory, not on rule-of-thumb.

Total sampling variance is defined as:

- Primary variance of primary increments divided by the number of primary increments;
- + sample preparation variance + analytical variance divided by the number of replicate analyses.

In order to design any sampling scheme, first it is important to decide the target value of the total sampling variance.

Then a decision must be made on: primary variance of primary increments; sample preparation variance; and analysis variance.

Here, in fact in modern theory, there are two schools of thought;

- P. Gy's theory using the concept of variogram; and
- traditional theory stemmed from some of JIS standards.

Traditional sampling theory is based on the assumptions that each sampling point is statistically independent of all others and that analysis results at each point are subject to a normal standard distribution.

If this is not deemed to be the case, then it is better to follow Gy's theory.

Following Gy's theory, the required number of sample increments for each lot tends to be much less than the one established by traditional theory. However, at Alex Stewart International, it is believed that the truth lies is between both theories and that considerable experience in actual shipments is vital.

Also, in actual shipments, correct determination of moisture content of any bulk cargo is extremely important. This point would seem self-evident, but in reality, contrary to expectation, it is rarely carried out at the loading point. Alex Stewart has considerable experience in this throughout the world.

Lastly, it should be emphasized that normally taking many samples will not resolve any sampling issues. Too many samples can create other serious difficulties in sample reduction. This issue will also have to be resolved based on theory and experience.