Smarter drilling can improve confidence in mineral resource classification

Ongoing drilling costs can be minimised

A question our clients ask often is, "how much drilling do we have to do before we can reasonably expect a defined Indicated Resource?"

In order to define worthwhile targets, companies invest considerable resources on the initial exploration drilling program – but you can spend your drilling budget wisely using early indicators to enhance additional drilling campaigns and minimise ongoing costs.

Early, wide-spaced drilling results delineate exploration targets and can lead to an Inferred Mineral Resource. This drilling data contains hidden information that can and should be used to inform and optimise additional drilling and sampling activities.

In addition to the critical role of modeling geological continuity, it's also wise to use all grade information in the early stages to improve confidence intervals on expected mean grades in low and high grade areas. Conditional simulation modeling of grade continuity at different drillhole spacing – and so at different costs – will greatly assist in deciding the appropriate infill drillhole spacing needed to update resource classification from 'Inferred' to 'Indicated' Resource.

The solution

Proven statistical simulation methods have been used since the 1950's to study and quantify risk (uncertainty) in many scientific fields including the medical, manufacturing, aerospace, environmental, agricultural and financial industries. In mining, quantifying confidence on tonnages and grades is notoriously difficult unless a large amount of information is available. While true resource risk can be known with some precision at the grade control drilling and production reconciliation stage, this risk should be assessed at the earliest possible stage.

For example, we applied the conditional simulation method using turning bands to a Western Australian uranium deposit to assess the drillhole spacing required for updating Inferred Resources to Indicated Resources. Using different scenarios, drillhole spacing data was generated and validated on the entire deposit to assess the 80% central confidence interval on the global mean grade. Early indicators were that the exploration drilling was effective for defining the global mean grade at an acceptable risk. Just as importantly, the scenarios could also be used to demonstrate variability of this risk in low and high grade areas.
One specific scenario was then selected to represent a ‘true’ case and sampled at a number of different infill drillhole spacings. Using the newly obtained infill drilling datasets, new models for the spatial continuity were estimated and validated with respect to the original spatial model.

The new models were used to generate a large number (200 in total) of conditional simulation scenarios for each of the different infill drillhole patterns. The resulting confidence intervals on the mean grades in localised low and high grade areas was then assessed for smaller mining panels related to the planned in-situ recovery mining method. As a result, one infill drilling scenario was selected as the most appropriate as it provided an effective balance between local grade risk and drilling costs.

**How we help**

Coffey uses a number of commercial geostatistical software packages that can be used to carry out drillhole spacing (grade) optimisation studies. We have also developed in-house software to do this for very large block models, and we’ve researched the applicability of the method on a number of deposits, for example uranium, gold and nickel.

With the proviso that geological continuity is also included in a final assessment to determine whether the selected drillhole spacing will be practical, the use of conditional simulation of exploration data to assess infill drilling scenarios has proven to be a powerful ‘financial decision tool’.

If you have any questions about how this might help you with your project, please feel free to contact Louis Voortman on +61 8 9269 6200 or via email at aloysius.voortman@coffey.com.