A new probability model is developed for quantitative mineral resource assessments — the probability model is used to generate probabilistic estimates of ore and resource tonnages in an assessment area. The probability model accounts for uncertainty due to incomplete information about the assessment area. The model uses a probability mass function to represent the number of undiscovered deposits and a joint probability density function to represent the ore and resource tonnages in those deposits. The joint probability density function, which is generated from published ore tonnages and resource grades, is formulated in two different ways. One way accounts for potential relations between the ore tonnages and the resource grades; the other way assumes that the ore tonnages and resource grades are probabilistically independent of one another. The equations associated with the probability model are solved numerically using Monte Carlo simulation.

Simple equations relate the input to the probability model and the probabilistic estimates: The mean total ore (resource) tonnage for the assessment area is the product of the mean number of undiscovered deposits and the mean ore (resource) tonnage in a single deposit. The variance in the total ore (resource) tonnage for the assessment area is a weighted sum of two variances: the variance of the number of undiscovered deposits and the variance of the ore (resource) tonnage in a single deposit. In addition to providing intuition about the behavior of the probability model, these equations are used to check the numerical solutions, which are calculated with Monte Carlo simulation.