ECONOMIC CONSEQUENCES
OF THE IN SITU NUGGET EFFECT

Theory, Predictability, and Strategies for many ores including Gold, Iron ore, Lateritic Nickel, Diamonds, Cement, Copper cathodes, and impurities such as Arsenic and Molybdenum in ores.

A ONE-DAY SHORT COURSE BY FRANCIS F. PITARD

The in-situ nugget effect is well recognised in gold ores. A similar situation also occurs in many other ores, such as alumina and silica in iron ores, cobalt in lateritic nickel, etc.

Nugget effects in deposits require the use of bulk samples in order to be representative. However, the cost and turn around time is significant. Francis Pitard analyses the problems, and makes some recommendations.

Course Content:

- Historical views and nature of the Nugget Effect
- Definitions and notations
- In situ Constitution Heterogeneity leading to the In Situ Nugget Effect
- The difference between Nugget Effect and In Situ Nugget Effect
- Estimation of the Variance of the Nugget Effect
- Components of the variographic random variance
- A theoretical approach to quantify the In Situ Nugget Effect
- Gy's Sampling Theory to the rescue
- Estimation of the mineral of interest maximum particle size
- Estimation of the mineral of interest clustering effect: The key to a true vision of hidden difficulties for feasibility studies
- The Low Background mineral of interest content
- A valuable influx from C.O. Ingamells's views on how to sample a mountain
- Methods for estimation of the Low-background constituent of interest content
- The concept of Most Probable estimated mineral content
- When the Most Probable estimated mineral content divorces the expected average content
- Interactions between the In Situ Nugget Effect and economical ore cutoff grades
- Relationship between mining resources recovery success, selected ore grade cutoffs, and the In Situ Nugget Effect: Ignoring this relationship can lead to false economics and financial disaster.
- Effect of the In Situ Nugget Effect on the estimated average ore grade
- Effect of the In Situ Nugget Effect on the estimated ore reserves
- Solutions from sampling diagrams
- Case study #1: Arsenic impurity
- Case study #2: Molybdenum by-product
- Case study #3: Coarse gold and clustering of fine gold
- Case study #4: Cobalt content of a Nickel Laterite deposit
- Case Study #5: Alumina and silica in iron ore
- Case study #6: Impurities in cathodes
- Case study #7: Silica in cement
- Case study #8: impurities in alumina
- The special case of sampling diamonds in Kimberlite pipes
- *(Note: case studies will be considered according to participant interests.)*
- Economic consequences of a large In Situ Nugget Effect

- Conclusions
- Recommendations
- Open discussion

Francis Pitard is a consulting expert in sampling, statistical process control, and Total Quality Management. He is President of Francis Pitard Sampling Consultants and provides consulting and teaching services in many countries. He had six years of experience with the French Atomic Energy Commission and fifteen years with Amax Extractive R&D before starting his own consultancy.

For more than 20 years FPSC has provided professional sampling consultation services and educational programs to many of the world's leading companies engaged in such diverse activities as base metals, precious metals, coal mining, steel and aluminium smelting, petroleum exploration and production, chemical manufacturing, environmental monitoring and power generation, etc.

His courses in the USA are presented by the Colorado School of Mines, and he presented short courses for many years for the Australian Mineral Foundation. His clients include many major Australian mining companies, and major mining companies in North and South America and South Africa.

FPSC is a recognized international expert in all aspects of Total Quality Management, Sampling, Statistical Process Control, and the practical application of statistical methods for problem solving.