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Technical Leadership in Mining & Energy

Application of Modifying Factors to Determine Mineral Reserves

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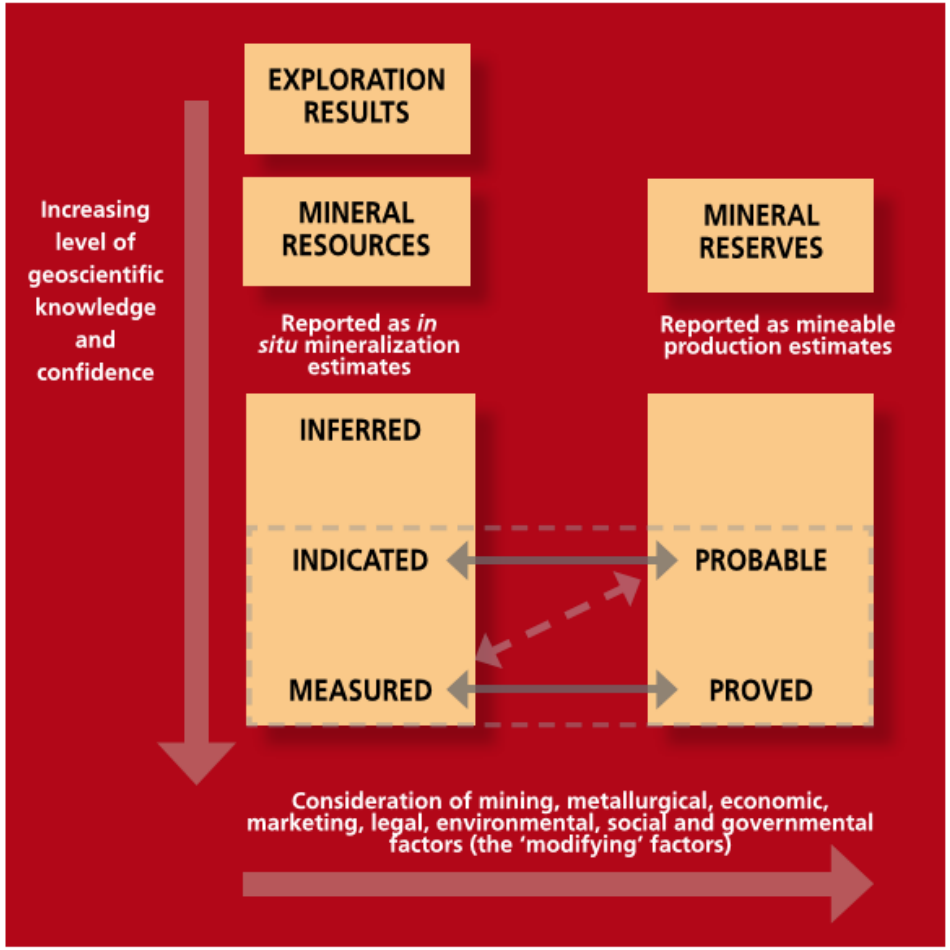
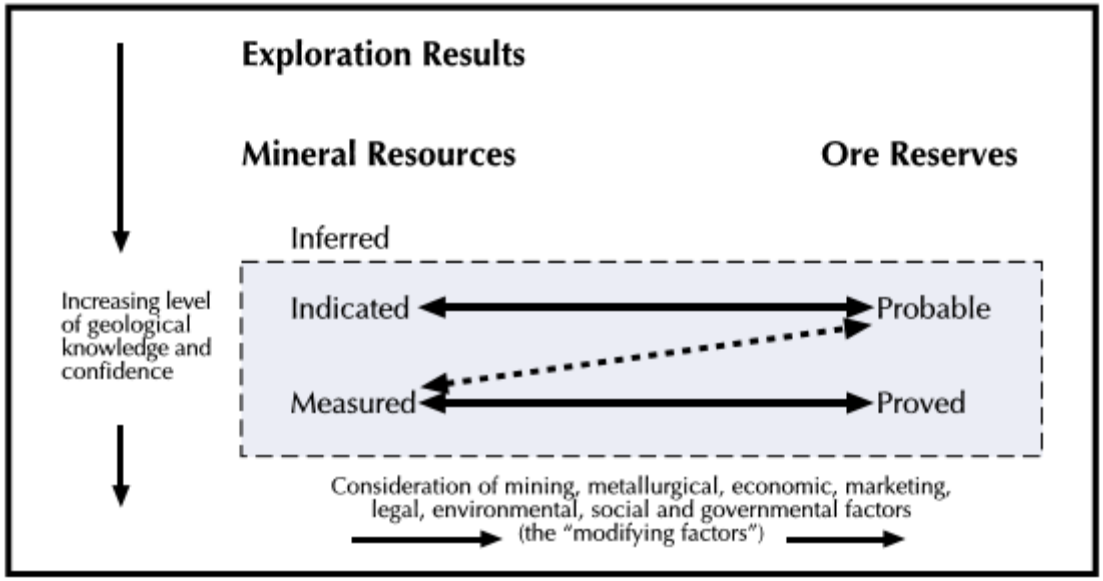
12 May 2016

Application of Modifying Factors to Determine Mineral Reserves



SAMREC Code

Application of Modifying Factors to Determine Mineral Reserves



JORC Code

Application of Modifying Factors to Determine Mineral Reserves

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CRIRSCO states that …

The mining industry is a vital contributor to national and global economies. It is a truly international business that depends on the trust and confidence of investors and other stakeholders for its financial and operational well-being. Unlike many other industries, it is based on depleting mineral assets, the knowledge of which is imperfect prior to the commencement of extraction. It is therefore essential that the industry communicates the risks associated with investment effectively and transparently in order to earn the level of trust necessary to underpin its activities.

Application of Modifying Factors to Determine Mineral Reserves

What is Mining?

Mining, by its nature, is defined as the economic extraction of mineralised materials from the earth.

Examples

Copper

Lead

Zinc

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Other examples …

Uranium

Iron

Gold

Diamonds

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Mineral Reserves

A Mineral Reserve is the economically mineable material derived from a Mineral Resource. Appropriate minimum economic assessments must have been completed including consideration of modifying factors.

- Includes diluting and contaminating materials
- Allows for losses expected to occur during mining
- Modifying factors used must be disclosed

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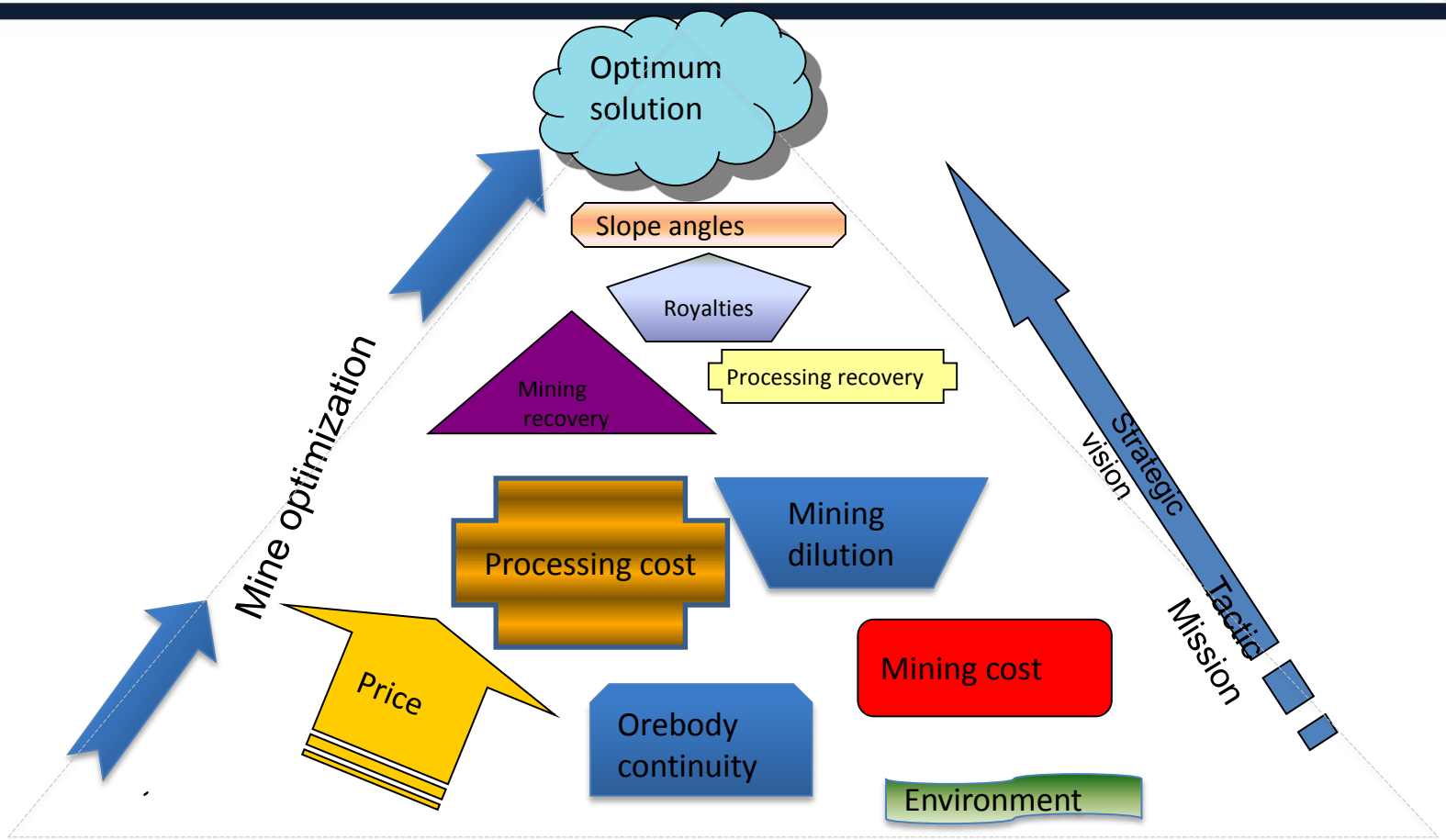

Application of Modifying Factors to Determine Mineral Reserves

Modifying factors

Modifying factors, according to the SAMREC code, are defined to include the following:

- Mining *(geotech, water, mining cost, mining recovery, dilution)*
- Metallurgical *(process cost and recovery)*
- Economic *(pricing, cost, revenue)*
- Marketing *(demand, customers)*
- Legal *(licensing, tenure, etc)*
- Environmental *(EIs, EMPs)*
- Social *(stakeholders, impact on communities, relocations)*
- Governmental *(political, government policy, etc)*

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Mining factors

Mining factors are those that will have a direct impact on the amount of and quality of material that can be extracted from the ground. These include:

Geotechnical / rock engineering- Wall and rock stability, pit slope angles and provision of safe mining environment. Usually depends on type of host rock.

Hydrology and hydrogeology –

The impact of the mining project on the existing surface water has to be assessed as well as the impact of ground water on the project. The presence of water may affect the business case of a project. Eg river near area may restrict pit expansion or even development. Water management plans critical to help control slope stability.

Application of Modifying Factors to Determine Mineral Reserves

Mining Factors …(continued)

Metallurgical and processing-
Conversion of ore to useable metal/ product. Processing cost, recovery applied. Floatation, leaching, etc.

Economic –
The project/mine economic potential must be assessed to justify business profitability. All monetary and some technical parameters applied.

- Product price
- Mining cost
- Recoveries (mining, processing)

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Mining Factors …(continued)

These parameters can be used in various ways to evaluate the economics of the project. One of those ways is the determination of a cut-off grade (COG), which is a factor that is used to select ore that must be processed to a final product.

The COG is very important that the accuracy of its modelling can affect the value of the mining operation accordingly. The Competent Person determining this factor must be able to understand the mineralisation as well as the mining and processing methods employed in the extraction and production of the final product.

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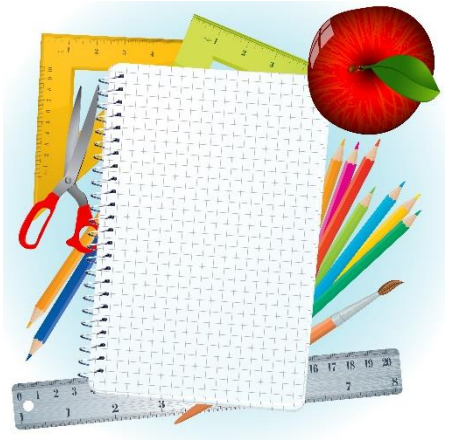
Cut-off grade



It can be defined in a simple basic formula as follows:

$$Cut\text{-}off\ grade = \frac{operating\ costs}{Revenue}$$ (Basic equation)

$$Revenue = Price * recovery$$

Other variables such as mining dilution, rehabilitation costs, stay-in-business cost, and royalty tax can be included depending on the costing model being applied. The royalty tax in particular can have a profound effect on the value because it directly affects the Mineral Reserves. The higher the royalty tax, the less the Reserves

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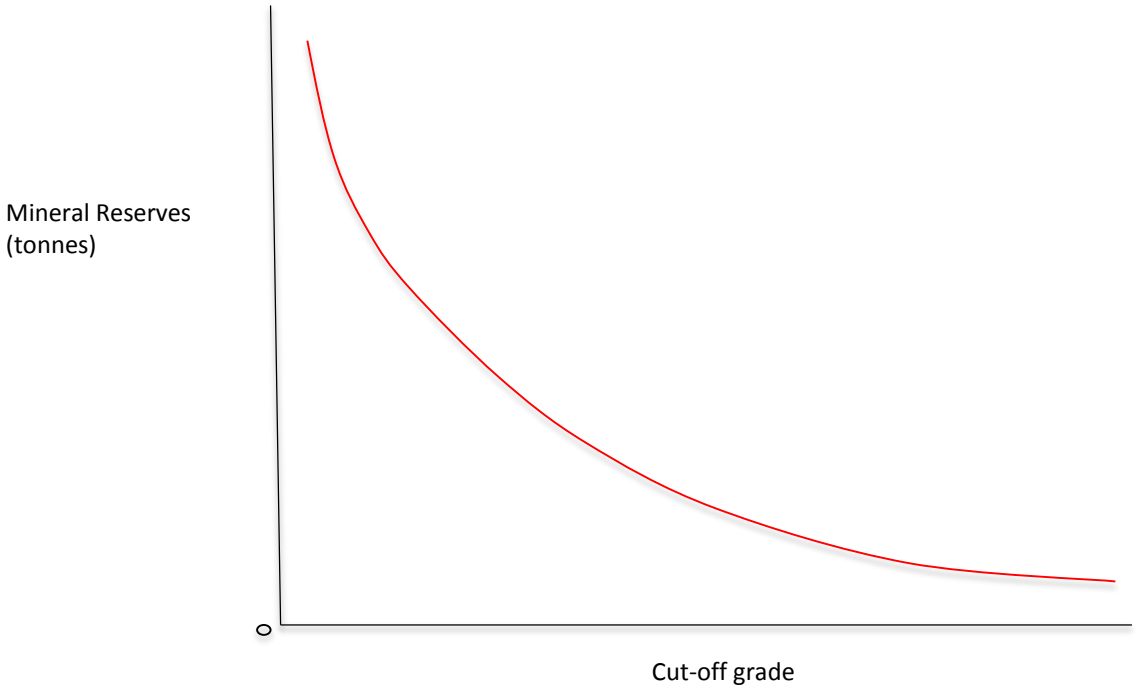
Cut-off grade...*(continued)*



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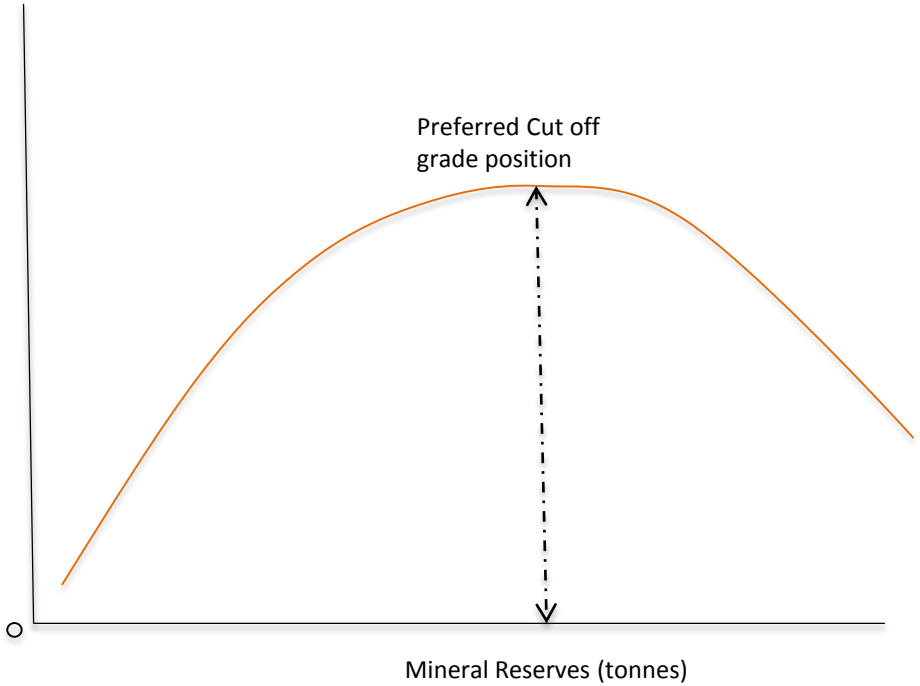
Cut-off grade...*(continued)*

In an optimum mine design, the selected cut-off grade should be one which yields the maximum revenue for the mining operation.



Application of Modifying Factors to Determine Mineral Reserves

Industry Cost Curve

The Competent Person determining the Cut-off grade must carefully apply his knowledge and skills such that the selected value minimises any negative impacts on the revenue.

The impact is usually not limited to a specific mine, but may also extend to the industry by distorting the market production levels and pricing trends when modelled into a global cost curve.

The cost curve is a database of the mining costs and production levels for different mining operations from different parts of the world. It is used by the market to assess global commodity production and pricing levels.

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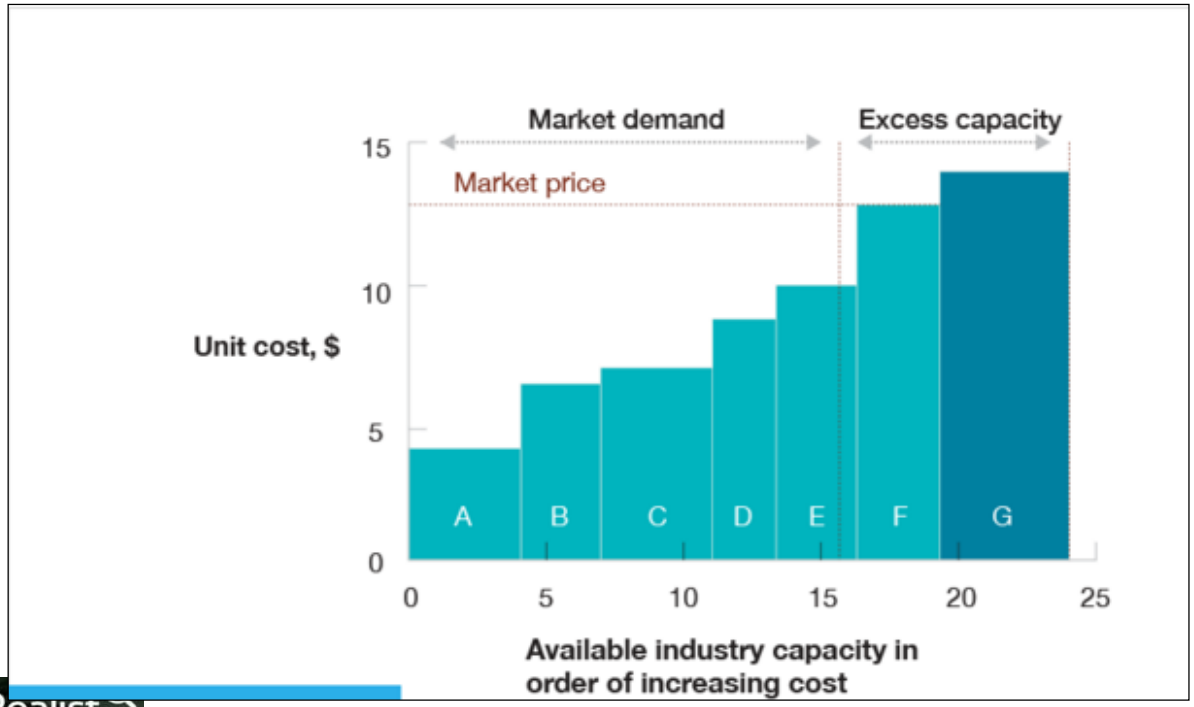
Cost Curve …*(continued)*

It is useful for a mine/ project to rank itself at the end of the evaluation, on the cost curve, to know where its position is in relation to its competitors.



Market Realist

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Cost Curve …*(continued)*

For any mining company, its position on the cost curve is very important, because it is what determines how effectively it will be able to withstand the ups and downs of the commodity cycle.

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Marketing

Unless there is demand and the product from the mine is sold, there is no business case to justify developing a mine.

The Mineral Reserve has to be mined, processed and sold.

Application of Modifying Factors to Determine Mineral Reserves

Surface Infrastructure

- Bulk Earthworks
- Structures
- Earthworks, Drainage.
- Electrical distribution

Application of Modifying Factors to Determine Mineral Reserves

Environmental & social

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- Environmental and social impact assessment
- ECO, audits, due diligence and assurance
- Strategic advice and management planning
- Stakeholder engagement
- Specialist studies – air quality, GHG and climate change, social, economic, ecosystems services, visual
- Resettlement planning and implementation
- Sustainability
- Corporate social responsibility
- Closure planning
- Permitting and licencing

Application of Modifying Factors to Determine Mineral Reserves

Legal and Government

Legal compliance

This is a necessary part of a mining project evaluation process in determining Mineral Reserves. Non-compliance could most definitely mean no mine development.

Government

- Policy (eg taxation regime)
- Politics

Application of Modifying Factors to Determine Mineral Reserves

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– Mining – all commodities
– Geotechnical
– Waste Management
– Environmental and Social
– Surface Water and Groundwater
– Surface Infrastructure and Rail

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