AusIMM Courses

GUIDE TO CUT-OFF ANALYSIS IN MINING

This resource is based on material from the [Business Optimisation, Performance and Improvement Short Course]

Guide to Cut-off Analysis in Mining

Cut-off grade is a **fundamental concept** applicable **across the mining industry** which influences everything from in-situ Mineral Resources and Ore Reserves, through to the financial returns and ESG impacts of mining.

Consequently, understanding cutoff grade is **crucial for making informed decisions** about resource extraction, production levels, profitability, and strategy. Despite the major implications, most mines use **simple break-even analysis** to guide cut-off grade decisions.

What is Break-even Analysis?

Break-even analysis identifies the point at which revenue equals costs, resulting in neither profit nor loss.

> *"To put it simply, break-even is the grade at which revenue obtained is just equal to the cost of producing that revenue,"* says Andrew Hall.

Andrew Hall, Chief Executive Officer, AMC Consultants and facilitator of the AusIMM Business Optimisation, Performance, and Improvement Short Course.

In mining, ‘break-even’ is often used to determine the cut-off grade.

Break-even vs Cutoff Grade

"A break-even calculation is just one way of deriving a number you can use as a cut-off," says Andrew. With 30 years' experience in feasibility studies, due diligence, project evaluation, business transformation and strategy optimisation.

Break-even simply represents the grade where revenue matches costs, while **cut-off** distinguishes ore from waste. **Break-even and cut-off are not synonymous.**

Break-even grade… a flawed approach

A quick review of **the simple break-even formula** shown below identifies a number of significant shortcomings including which costs to include, and that all the components can be highly variable and depend on either the material being mined or the prevailing economic environment.

$$\text{BREAK-EVEN GRADE} = \frac{\text{COST}}{\text{PRODUCT PRICE} \times \text{RECOVERY}}$$

A practical example of some of the flaws in a break-even approach is playing out in the mining industry right now. Prices for most metals have softened and costs have increased significantly due to inflation.

This has resulted in many mines, that **use break-evens, increasing their cut-off grade**. But as the cut-off grade is increased, more effort is required to mine each ore tonne, which further increases costs leading to the need to further increase the Break-even grade. Fortunately there is a solution!

Beyond Break-even

Andrew warns that part of the issue is there are **no specific goals to break-even calculations** and there is **no consideration of the impact cut-off** has on the average ore grade, consequently using a break-even almost guarantees that value will not be maximised.

In 1950, Mortimer published a paper outlining cut-off grade definitions based on profitability goals. Lane, in his original paper in the 1960's, and his book "the Economic Definition of Ore" first published in the 1980's, advanced cut-off grade modelling to three-dimensions by also considering capacities of the various parts of the production system.

In the Short Course, Andrew explains **the evolution of cut-off grade theory** from Mortimer's definition and Lane's methodology, through to the most **recent advances and practical application.**

Cut-off analysis is a vital tool for mining professionals to optimise mine performance and make strategic decisions to enhance economic viability and sustainability.

Gain a deeper understanding of how cut-off can be used for optimising mine performance, and the various contexts in which it can be applied, with the Business Optimisation, Performance, and Improvement Short Course.

SHORT COURSE

Business Optimisation, Performance and Improvement

Maximise the value of your mining project and **de-risk your operation** by gaining cut-off grade expertise, strategy optimisation and project evaluation basics.

Gain **actionable insights** into developing an **optimised strategy** for a mining project and the performance measures that can be put in place to align the operations with strategic intent so the business goals are achieved – with guidance on balancing the trade-offs between **the long-term business goals** and **short-term production targets.**

Learn practical knowledge that you can apply immediately to enhance your project's outcomes:

- Project evaluation basics
- Strategy optimisation
- Cut-off grade theory and practice
- Key performance measures and reporting
- Recent developments in new technologies and innovations
- How to conduct benchmarking and implement continuous improvements

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