Mine Closure 2023 - Behrooz Abbasi, Jeff Parshley, Andy Fourie & Mark Tibbett (eds)

doi:10.36487/ACG_repo/2315_083

In defence of NPV

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Abstract

At previous mine closure conferences, there have been many criticisms of the use of NPV (net present value) in the use of mine closure cost estimates. Many of these criticisms have argued that NPV should not be used at all. It is considered that the discussion is really about the use of discounting. Whilst acknowledging that NPV can be mis-used and mis-understood, they are not reasons to discourage its use – do not throw out the baby with the bath water!

This paper outlines the use of discounting for the different types of mine closure cost estimates, specifically:

- *Life of asset/mine – the actual closure cost budget at end of mine life*
- *Financial liability - financial balance sheet provisions and Asset Retirement Obligations (AROs)*
- *Sudden closure - the current closure liability*
- *Regulator - Regulatory closure bonds or financial assurances.*

The adoption of discounted cost estimates, using NPV discount rates, is an acknowledged and accepted accounting process for the development of balance sheet provisions and AROs. The balance sheet provision (or ARO) estimate should not, however be confused with the actual closure cost budget or any regulatory closure bond. All of these cost estimates have different purposes and typically use different calculation methods, albeit using a common data set.

It is argued that NPV can and should be used in each of these closure cost estimates, but in different ways. This paper discusses the reasons for using NPV discounting, its potential mis-use and its benefits, noting that it is an essential element for estimating the costs for long term and in perpetuity site management.

Keywords: *net present value, discounting, closure cost estimate, financial assurance, in perpetuity.*

1 Introduction

The author has attended many previous mine closure conferences where there have been criticisms of the use of 'NPV' (net present value) in the use of mine closure cost estimates. It is the author's view as a practitioner (and not as an accountant), that the criticisms of NPV in the context of mine closure cost estimates are really about the use of discounting. Some of the criticisms have essentially argued that discounting should not be used at all. Whilst acknowledging that discounting can be mis-used, that is not a reason to discourage its use, but recognition of possible mis-use should be a trigger to ensure that it should be applied appropriately. Generalised statements that recommend against the use of 'NPV' or 'discounting' without qualifying where it should not be used, devalue a powerful tool in closure cost estimating that can be utilised to gain broad stakeholder understanding and agreement on managing long term closure liabilities.

This paper provides some background on the types of mine closure cost estimates and the use of NPV discounting. It discusses where discounting can be mis-used or mis-read, various attributes of discounting and how it can be a powerful technique to model long term and 'in perpetuity' closure costs.

2 What is NPV discounting?

NPV discounting needs to be considered in the context of its purpose and the difference between the present value and the net present value of money, which has been described as:

> *"…Present value tells you what you'd need in today's dollars to earn a specific amount in the future…"* whereas *"…Net present value is used to determine how profitable a project or investment may be…" Beers (2022)*

Both values use a discount rate, however the quantum of the adopted discount rate should be different when determining each. For closure cost liabilities we want to know what money needs to be set aside and invested 'today' (the present value) to cover those future liabilities. As an example, if there is an obligation to spend $1,000 in 20 years' time, then $686 needs to be invested today at a 2% real interest rate to cover the future $1,000 obligation, provided that the interest is re-invested each year (i.e. compounded). That is, the existing discounted liability of the $1,000 obligation in 20 years is $686 (at 2% real discount rate).

There are, however, two key issues:

- The money must be set aside and invested, with the investment returns compounded (i.e. re-invested)
- The influence of the discount rate that is adopted to calculate the present value.

The influence of the discount rate is particularly important. Determining the NPV of a project using discounted cash flow analysis is a common procedure for evaluating the viability of a new project. Typically a higher discount rate is adopted as a conservative approach to meeting investment hurdles – a positive NPV indicates that the project will exceed the investment returns desired by the company.

When assessing closure liabilities, a lower discount rate should be used to reflect conservative returns (and accounting for inflation) that might be achieved for the invested money that is required to cover the future closure costs. It is a mistake to use the same discount rate for both assessing the NPV of a project and to determine the present value of closure liabilities.

A recent interim policy directive in British Columbia demonstrates the use of different discount rates for the two purposes of valuing an asset versus valuing a closure liability. The Ministry of Energy, Mines and Low Carbon Innovation has defined a discount rate of 8% to be used where mineral resources are proposed as security for part of the reclamation bond security. Lower discount rates, however, of between 1.5% and 4.0% are defined by EMLI (2022) for long term cost liabilities when determining the reclamation liability cost estimate.

The quantum of the discount rate and the duration of discounting are further discussed in Sections 4 and 6 of this paper.

3 Types of closure cost estimates

To better understand the contextual use of NPV discounting it is important to first discuss the different types of closure cost estimates. Closure cost estimates are used for different purposes:

- Budgeting for those sites about to enter closure execution
- Balance sheet provisioning (such as Asset Retirement Obligations)
- Regulator bonds, financial assurances and closure levies.

Therefore, there is not just a single closure cost as described in Neubauer (2022). The ICMM fact sheet on Financial Concepts for Mine Closure in ICMM (2019a) and Brock et al (2019), describe four types of closure cost estimates:

- Life of asset/mine - LoA (or LoM)
- Financial liability
- Sudden closure
- Regulator (financial assurance).

The role of discounting in these closure cost estimates is different.

The LoA closure cost estimate is essentially the final closure budget and includes:

> *"…costs that the operator expects to incur in the context of the current mine plan at the end of the mine life…" ICMM (2019a)*

Discounted costs for this liability might be included in the discounted cash flow analysis for the life of mine plan. When considering the closure budget, however, it would not be appropriate to discount costs for the active phase of closure, but it is appropriate to include discounted costs for long term land management, site maintenance and monitoring as well as any post relinquishment cost liabilities.

The 'financial liability' cost estimate is the estimate of liabilities as defined by the accounting standard applicable to the organisation making the estimate. Typically, the closure cost estimate is based on the closure liability that exists at the time of reporting (present obligation). In simple terms, this translates to the extent of current disturbance plus any other present constructive obligations related to closure. For companies reporting under the International Financial Reporting Standard and IAS 37, this is described as:

> *"…IAS 37 applies to provisions—liabilities of uncertain timing or amount … IAS 37 requires those liabilities to be measured at the best estimate of the expenditure required to settle the present obligation, with that expenditure being discounted to its present value if the effect of the time value of money is material …The effect is most likely to be material for large long-term provisions—for example, provisions for asset decommissioning and environmental rehabilitation costs…" IFRS Accounting (2022)*

The estimate of the current closure obligation is discounted out to the nominated end of asset life. For each subsequent reporting period, the closure obligation is reviewed for any changes, such as increased disturbance or reduction in disturbance due to progressive rehabilitation. The discount is also 'unwound' each subsequent reporting period, because the period to cessation of operations has reduced. In theory, therefore, the closure provision should match the estimated closure cost at the end of asset life.

For the 'sudden closure' scenario, the closure cost estimate is treated in a similar manner to the LoA closure cost estimate in that the active phase of sudden closure would not be discounted. It is appropriate to include discounted costs for long term land management, site maintenance and monitoring as well as any post relinquishment cost liabilities.

Financial assurances imposed by regulators differ by jurisdiction. The estimate of the amount for the financial assurance is normally carried out using a methodology, or according to guidelines, determined by the regulator, which vary widely across the world. In theory, financial assurances are meant to protect the State (and therefore community) if an operator is unable to meet its closure obligations. Therefore, in theory the estimate should only apply to the current disturbance. In practice, this varies with some regulators requiring the financial assurance to apply to the end of asset closure scenario. As with the LoA closure and sudden closure scenarios, it is not appropriate to discount costs for the active phase of closure, but it is argued that discounting costs for long term land management, site maintenance and monitoring is entirely appropriate. In British Columbia, a recent interim policy document, as described in EMLI (2022) incorporates net present value estimates for the annual costs of the post-closure period. Unfortunately, this is not common for many regulators - indeed any form of discounting is often prohibited. Often an arbitrary percentage increase is required to be applied to the overall cost estimate as a surrogate for the post active closure phase of management, monitoring and maintenance. For example, in the state of Victoria in Australia, a 5% cost is added to the closure cost estimate for 'post closure environmental monitoring requirements' in that state's rehabilitation cost calculator tool (ERR 2023). This is a 'hope and pray' approach that the percentage contingency will be sufficient.

4 What discount rate to use?

The choice of the discount rate is typically determined at the corporate level and reviewed by the financial auditors. Applicable accounting standards (e.g. IFRS or US GAAP) provide guidelines on discounting for financial provisions or asset retirement obligations. The discount rate that has been applied to calculate the balance sheet provisions is often reported in the notes to corporate financial statements. It is not within the scope of this paper, nor within the capabilities of the author, to discuss what are applicable rates for mine closure cost estimates, other than to state that they should err on the side of caution and be based on a risk-

free, real discount rate (that accounts for inflation) rather than a nominal discount rate. The difference between these two rates has been described as:

> "*A nominal interest rate equals the real interest rate plus a projected rate of inflation. A real interest rate reflects the true cost of funds to the borrower and the real yield to the lender or to an investor*." *Nickolas et al (2023)*

Therefore for a mine closure cost estimate, the real discount (or interest) rate should be used to ensure that it reflects the realistic return on money that needs to be invested to account for the future closure costs.

5 Where discounting can be mis-used or be misleading

Many comments at previous mine closure conferences that were critical of 'NPV' were not specific, but resulted in an overall impression that discounting has a poor reputation and really should not be applied for closure cost estimating. Considering the different types of closure costs discussed in the previous section and the variable use and application of discounting, it is perhaps understandable that discounted mine closure costs can lead to confusion and be seen as misleading. Situations where those discounted mine closure costs may mislead, include where:

- Discounting has been applied to the cost estimate for the active phase of closure, for example for sudden closure or for the LoA cost estimate (or closure budget)
- An inappropriate (i.e. too high) discount rate has been used
- Various stakeholders, including community, management, regulators and company boards mis-interpret the discounted balance sheet provisions as the LoA cost estimate
- Operational phase decisions do not consider significant closure items because their costs, and therefore their importance, have been discounted for the balance sheet provisions
- Stakeholders are under the impression that the closure cost provision has actually been set aside for investment, rather than being represented as a negative contributor to a company's value as reported in the balance sheet.

These examples are genuine concerns but are due to the mis-application of, or lack of understanding about, discounting and especially balance sheet provisions.

ICMM (2019b) states that:

> "…*An NPV (or present value) analysis of costs is likely to suggest that progressive closure is more expensive, as the present value of any expenditure will be lower the further in the future it is placed (assuming no change in scope). However, if progressive closure is looked upon as an investment, a more balanced analysis emerges*…"

Whilst this statement may be valid, it is argued that a business case should be developed for or against implementing progressive rehabilitation. The risk cost of deferring progressive rehabilitation should be calculated and assessed against the 'benefit' of the discounted cost of the deferred rehabilitation. The overall assessment of the benefit / cost of progressively rehabilitating versus deferring then allows a more robust and defensible decision process, rather than simply rejecting the discounted approach.

Misleading use or poor understanding of discounting should not justify rejecting or downplaying it as a powerful tool for mine closure cost estimating. The important point is to understand the basis of costs and how discounting has been used. Generalised statements such as "…*the cost estimate must be accurate and based on current costs, not future costs discounted to the current year*…" in Bocoum et al (2021) may be appropriate when referring to the active phase of mine closure, but fail to acknowledge the applicability of discounting for long term site management.

6 Power of discounting

Apart from the use of discounting for balance sheet provisions and asset retirement obligations, the real power of discounting is to properly represent long term and in perpetuity closure costs beyond the active closure phase as well as for any post relinquishment activities.

6.1 What is involved in long term site management?

The need for land management, monitoring and maintenance recognises that not all closure strategies will initially be successful. The duration of these closure activities will depend on the issues specific to each site. Optimism around short duration monitoring phases is often found to be wanting, as noted in Byrne (2019). As a result, sites are often not able to be relinquished within their expected timeframes with many sites facing the prospect of never achieving relinquishment. The concept of in perpetuity management of closed mine sites had little acceptance in the industry until recent times. The fact is, that this now a reality for many sites around the world, particularly those requiring long term water management as described in Byrne & Hancock (2018).

Long term, as well as in perpetuity, site management costs can involve the following activities and costs:

- Land management - ongoing costs for management of land, rates, permits, taxes
- Monitoring costs - water quality, vegetation, social, land stability, dam surveillance, regulator liaison, reporting
- Maintenance costs - erosion control and repair, vegetation repair, water treatment, access road maintenance, capital upgrades of monitoring and treatment plant and equipment.

The longer the duration of these post 'closure' phases (i.e. beyond the active closure phase and potentially beyond relinquishment), the more significant the costs become in relation to the overall closure budget. These more significant costs present increased funding challenges, particularly if an organisation wishes to divest itself of site management and liabilities. External stakeholders, notably community groups, NGOs and regulators, often find it difficult to comprehend how an in perpetuity cost can even be estimated, let alone financed. Discounting of those long term costs is the only way to model the estimate, gain stakeholder agreement and establish appropriate financing mechanisms.

6.2 Long term risks

In addition to the uncertainties that external stakeholders have regarding estimating costs associated with long term site management, they also have concerns about how risks will be taken into account. These uncertainties relate to the likelihood of risks occurring, the consequence quantum if they do occur, as well as the timing of their occurrence. The methodologies to describe and model the costs of these long term risks have been addressed by others, Bowden et al (2001); Bocking et al (2009); Byrne (2011); Bocking and Fitzgerald (2012).

The methodologies described in Bowden et al incorporate discounting as an integral part of modelling the long term cost of post closure risks. This involves a probabilistic approach to quantifying risk events by estimating the ranges of cost consequences. Any uncertainty around the timing of the risk occurrence is also estimated using a probabilistic methodology. These uncertainties, together with the estimated likelihood of risk occurrence are then modelled using Monte Carlo simulation.

6.3 Financing mechanisms

Various financing mechanisms to fund long term mine closure liabilities have been described in World Bank (2010); Pacheco (2012); and Bocking and Fitzgerald (2012). The latter refers to the estimate of closure funds:

> "*…determined by a net present value to be placed in a special purpose company to manage future post closure liabilities…*".

The use of discounting for longer term costs is acknowledged by the IGF (2021), which notes amongst good practice trends:

> "…*Discounting of costs that occur after closure (such as post-mining monitoring and care and maintenance), to the time of closure (but not to the present)*…".

The influence and power of discounting for long term closure liabilities is demonstrated by the case study of Waihi Gold in New Zealand. The details of the closure and risk costing are described in both Bowden et al (2001) and Australian Government (2016). For this site, a quantitative risk assessment was used to establish a post-closure financial assurance for the Martha mine open cut. A capitalisation bond structure was established comprising four components of base (or known) costs; public liability insurance costs; industrial and special risk insurance costs; and "*gradual risk issue costs*". All costs were discounted to a present value to establish the bond amount which was then reviewed and determined by an Environment Court hearing. Based on that hearing, a capitalisation bond of NZ$6 million was posted. The capitalisation bond still exists with an amount set at NZ$10.4 million (Oceania Gold 2022).

The use of discounting was an important and integral part of establishing the capitalisation bond process for the Waihi Gold project. It demonstrates the power of discounting to appropriately model long term site management costs. Indeed, it is argued that without the use of discounting, it is impossible to arrive at an estimate for such costs that is acceptable to a wide range of stakeholders.

7 For what duration should discounting be applied?

An important aspect of using discounting for long term and in perpetuity site management is the duration for which costs should be modelled. The duration will be determined by two factors:

- The estimated duration of the activity
- The discount rate to be applied.

For cost estimation of very long term and in perpetuity activities the perennial question is often asked - for how long to model the costs, 10 years, 100 years, 1,000 years, 10,000 years? If discounting is not used then there is no answer to this question. In fact, if discounting is not used then unrealistically high cost estimates can be derived, which generates little prospect of reaching agreement by the majority of stakeholders, especially the entity which is required to make the payment. In that circumstance the entity could end up walking away from its obligations leaving the state and community with a considerable legacy liability. It is therefore in all parties' interests to reach agreement on an acceptable approach that minimises future risks and liability.

The example below has been developed to provide some guidance on the duration that should be applied for discounting long term closure costs. This example calculates an obligation to spend $100 per year in perpetuity. For a 2% real discount rate, the discounted liabilities for that obligation are $5,064 and $5,087 for durations of expenditure of 250 years and 300 years respectively, and just $5,095 for a 350 year duration of expenditure (what is suggested as a non-material 0.2% increase). As such, calculating the discounted liability over 350 years effectively evaluates the in perpetuity obligation at that selected discount rate. This example demonstrates that the effect of applying a 2% real discount rate results in minimal total cost increases beyond about 350 years duration and therefore it would serve little purpose to assess ongoing cost items beyond that time.

Figure 1, shows the results of this example for a range of different discount rates, clearly showing that the higher the discount rate that is applied, the shorter time frame for which the in perpetuity costs need to be estimated. It indicates, for example that if a real, risk-free discount rate of 8% were to be adopted then there is no material difference in estimated costs after about 100 years. The key question is, however, whether the initial 'seed' investment can safely and confidently achieve an 8% return to fund the costs for that period. Similarly, a suggested 'cut-off' duration for a 4% discount rate is about 175 years.

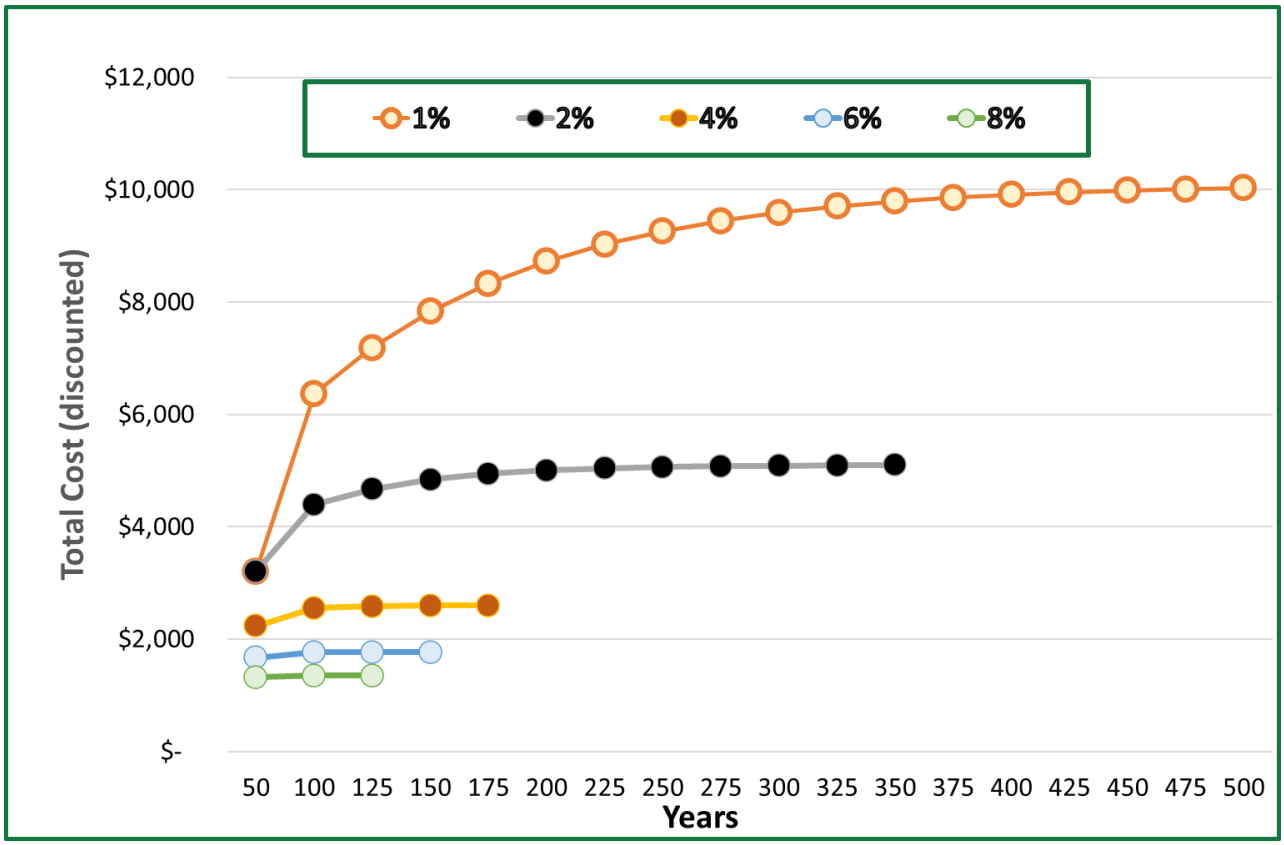

Figure 1 Applicable durations of various discount rates (example $100/year expenditure)

8 Conclusions

The term 'NPV' has received criticism at previous mine closure conferences. It appears that the criticisms actually relate to the use of NPV discounting in mine closure cost estimates. Some of these criticisms may be justified, particularly where discounting is mis-used or poorly understood. These are, however, not reasons to recommend against its use or downplay its value and effectiveness. When the criticisms are left unqualified, they tend to devalue a powerful tool for the estimate of closure costs – a tool that can be utilised to gain broad stakeholder agreement on managing long term closure liabilities.

It is important to understand the different objectives of NPV discounting in the context of the four primary types of closure cost estimate:

- Financial liability
- Life of asset
- Sudden closure
- Regulator financial assurances.

Discounting is required and accepted in balance sheet provisions and asset retirement obligations for the reporting of closure costs as financial liabilities.

For the other three types of closure cost estimates, life of asset, sudden closure and for regulatory financial assurance, discounting should generally not be applied to the costs for the active closure phase. It is, however, a very powerful tool for modelling long term land management, monitoring and maintenance costs beyond the active closure phase. For these long term cost estimates, especially those involving in perpetuity costs, the use of discounting is the only way to model the cost estimate, gain stakeholder agreement and establish applicable financing mechanisms.

Acknowledgement

The author wishes to acknowledge and thank Dr Adrian Bowden of FuturesPlanner, who provided valuable insight into his extensive experience of probabilistic costing methodologies; his use of NPV discounting on many closure and liability assessment projects; his experience with the Waihi Gold project; and for reviewing drafts of this paper.

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