

Best practices in mine closure and rehabilitation

Top 10 Closure Principles and Key Policy Elements

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IGF

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Presentation Overview

- Presentation of the IGF
 - What is mine closure and why is it important?
 - Top 10 principles of mine closure for governments (and industry)
 - Closure case study examples throughout
-



A landscape photograph showing a dirt road in the foreground, two workers in high-visibility vests and hard hats on the right, and rolling green hills in the background under a blue sky with light clouds. A dark blue semi-transparent banner is overlaid on the left side of the image, containing white text.

IGF: The Intergovernmental Forum on Mining, Minerals, Metals and Sustainable Development



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INTERGOVERNMENTAL FORUM
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Global Forum
80 MEMBER
COUNTRIES



DEDICATED TO IMPROVING
MINING GOVERNANCE TO HELP
ACHIEVE THE UN SDG.

A VOLUNTARY INITIATIVE
CREATED THROUGH
THE UN IN 2005



How do we help governments?

IN-COUNTRY
ASSESSMENTS



CAPACITY
BUILDING



TECHNICAL
ASSISTANCE



GUIDANCE FOR
GOVERNMENTS



CONFERENCES



85 Member countries



AMERICAS

- | | |
|--------------------|--------------------------|
| Argentina | Republic of Panama |
| Bolivia | Ecuador |
| Brazil | El Salvador |
| Canada | Guatemala |
| Chile | Guyana |
| Colombia | Honduras |
| Costa Rica | Jamaica |
| Dominican Republic | Mexico |
| | Peru |
| | Suriname |
| | United States of America |
| | Uruguay |

AFRICA

- | | | | |
|--------------|---------------|--------------|--------------|
| Botswana | Gabon | Mauritania | South Africa |
| Burkina Faso | Ghana | Morocco | South Sudan |
| Burundi | Guinea | Mozambique | Sudan |
| Cameroon | Guinea Bissau | Namibia | Tanzania |
| Chad | Kenya | Niger | Togo |
| Comoros | Lesotho | Nigeria | Uganda |
| Congo | Liberia | Rwanda | Zambia |
| Egypt | Madagascar | Senegal | Zimbabwe |
| Eswatini | Malawi | Sierra Leone | |
| Ethiopia | Mali | Somalia | |

EURASIA

- | | | |
|-------------|-------------|--------------------|
| Afghanistan | Ireland | Russian Federation |
| Armenia | Kazakhstan | Saudi Arabia |
| Bhutan | Kyrgyzstan | Sweden |
| Cambodia | Laos | Thailand |
| France | Mongolia | Timor-Leste |
| Georgia | Myanmar | United Kingdom |
| Germany | Netherlands | |
| India | Philippines | |
| Iran | Romania | |

OCEANIA

- Fiji
- Papua New Guinea

Mine Closure and Rehabilitation





What is Mine Closure?

Mine closure is the process of planning for, and implementing the closure of, a mining operation in consultation with stakeholders and regulators that results in a productive post-mining land use that is environmentally sound and supports community goals.

There is a lot implied by this statement:

- ▶ It is the responsibility of the mine operator
- ▶ It is undertaken in consultation with government and stakeholders
- ▶ It starts at the ESIA stage and finishes with relinquishment
- ▶ It must be supported by a comprehensive plan, cost estimate and financial assurance



Why is Mine Closure Important?

Mines have a finite life and will eventually close. For mining to be truly sustainable, mines must provide for the needs of people today and then close in a way that does not compromise the environment or social framework of future generations.

- ▶ Many mines are expected to close in the coming years – government and industry need to be ready to close these mines successfully.
- ▶ The need for metals and minerals to support modern technology and a transition to a low-carbon society means that a significant number of new mines will open in the coming decades.
- ▶ Planning for closure of these mines must start now with the right regulations and processes so industry together with governments and stakeholders can plan for mine closure before new operations begin.

10 Principles for a Responsible Mine Closure

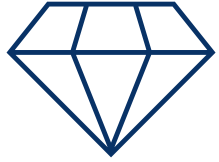




Principles of mine closure

Planning	Environmental Stability	Community engagement and transition	Cost Estimating and Financial Assurance
<ol style="list-style-type: none">1. Use leading practices.2. Start early, be part of ESIA and continue throughout the mine life.3. Outline the vision, objectives, closure criteria and risk assessment.4. productive post-mining land use(s).	<ol style="list-style-type: none">5. Physical and Chemical Stability6. Progressive rehabilitation and biodiversity	<ol style="list-style-type: none">7. inclusive engagement and consultation with communities and stakeholder throughout the mine life.8. support economic and social stability and result in productive land-uses after closure.	<ol style="list-style-type: none">9. Comprehensive closure cost estimates10. financial assurance to cover the full estimated closure costs and sufficient to cover any outstanding residual risk and long-term treatment and management costs at the time of relinquishment.

Mine Closure Planning



1. Closure is the obligation of industry using leading practices



2. Planning must start early, be part of ESIA and continue throughout the mine life



3. Closure must be supported by a plan that outlines the vision, objectives, closure criteria and risk assessment



4. Closure should result in productive post-mining land use(s)





Mine Closure Planning

1. Mine closure is the **obligation of mine operators** to plan, fund and complete according to local regulations and international standards and **leading practices**.
- Obligation of the mine operator is a given
 - Mine closure is a complex multidisciplinary topic that requires a wide range of expertise and regulatory frameworks.
 - Leading international standards, regulatory frameworks and guidance documents should be used or required to supplement local regulations and standards. Examples include:
 - Guidance for Mine Closure Plans – e.g. Northwest Territories Canada
 - Global Review: Financial Assurance for Governments - IGF
 - Integrated Mine Closure 2nd Edition - ICMM

Mine Closure Planning



2. Mine closure **planning must start early** as part of mine design and environmental and social impact assessment and **continue throughout the mine life.**

- Planning should start during advanced exploration and be incorporated into mine design – **planning for closure**
- Build community involvement early and form closure committees that will continue during mine operations
- Mine closure plans should be reviewed and updated every 3-5 years – more often as closure approaches. A final closure plan should be ready 2 years before planned mine closure.

Mine Closure Planning



3. Mine closure plans should outline the **closure vision, objectives, activities and completion criteria** and be supported by a risk assessment.

Vision → Objectives → Activities → Criteria

- Closure Vision
 - High-level vision for what closure will achieve and foundational principles for closure
 - May be defined by government such as the requirement for physical and chemical stability
- Closure Objectives – By mine component or domain
 - Concrete, site-specific statements of what closure activities or measures aim to achieve. E.g. Convert the open pit into a water reservoir or rehabilitate the waste rock pile.
 - Objectives should be defined for each component of the mine such as pits, piles, tailing, etc.



Vision → Objectives → Activities → Criteria

- Closure Activities

- The actions taken to achieve the closure objectives.
- E.g. To achieve the objective of rehabilitating the waste rock pile will require, regrading to stable slopes, development of drainage pathways, covering with overburden and soil, and revegetation.

- Closure or Completion Criteria

- Specific actions, measurements or requirements that define when the closure objectives have been met.
- E.g. The objective of rehabilitating the waste rock pile will be achieved once at least 70% of the pile is covered with maturing vegetation with a mix of at least a dozen different species and that no erosional channels have developed for three successive wet seasons.

Mine Closure Planning



4. Mine closure must provide for a **productive post-mining land-use**.

- ▶ *Many closure practitioners argue that selecting post-closure land use is the single most important decision in developing a closure plan, as all closure and reclamation activities will be defined based on the next use of the land (APEC Checklist, 2018).*

Think broadly about end land-use. There are many opportunities for the use a disturbed site.

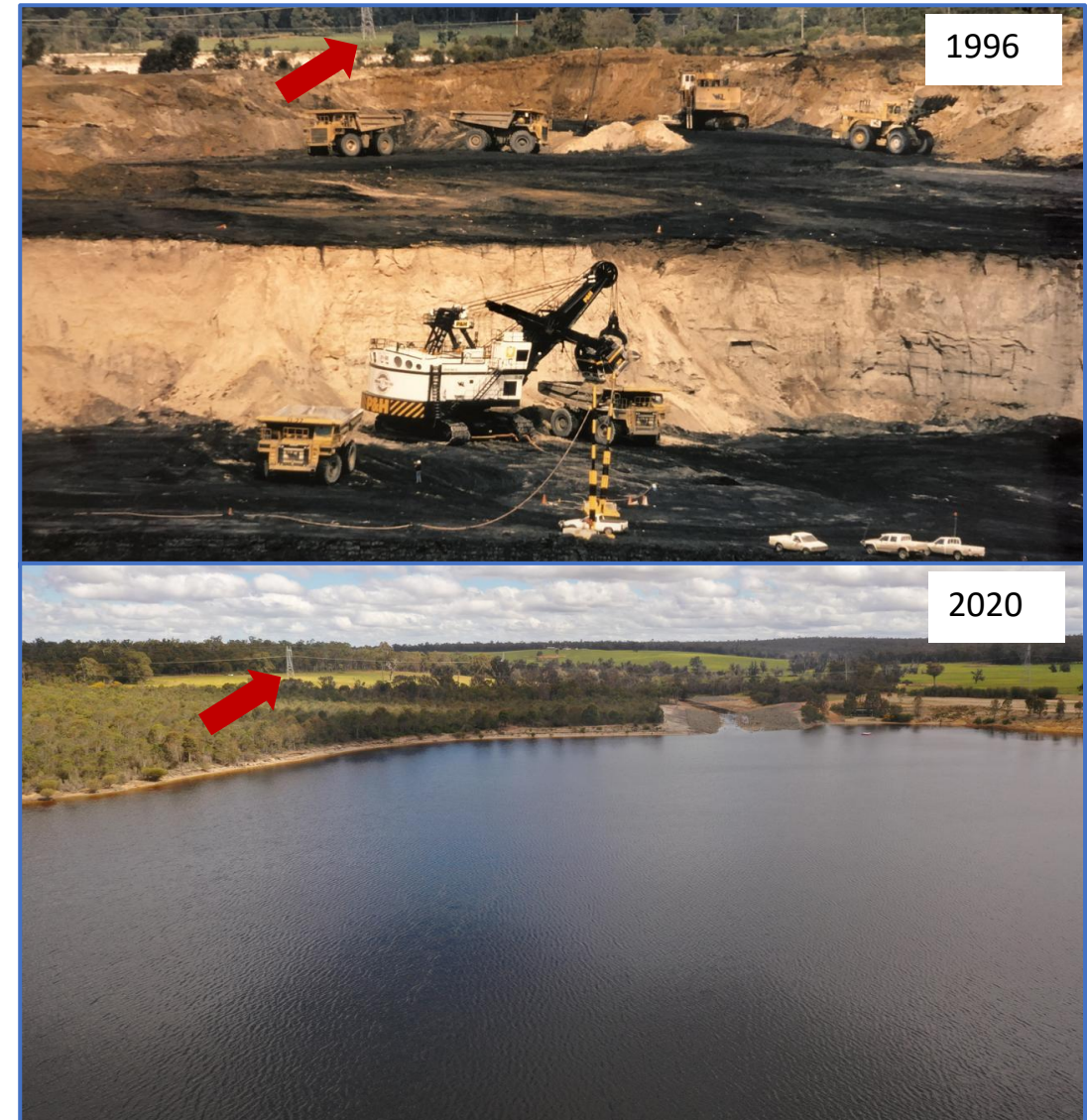
- **Tourism** – repurposing of mining areas for tourism (watersports in pit lake, nature park)
- **Nature conservation** – creation of biosphere reserve, protected area, nature trails
- **Clean energy** – mining land repurposed as solar panel or wind farms
- **Forestry, Agriculture or Aquaculture** – mining land repurposed for woodlots, crops, grazing land or a pit lake used for fish farming.
- **Water reservoir and hydroelectric dams** – Pit lakes repurposed as water reservoirs
- **For use of legally registered small-scale miners**



Post-Mining Landuse

Lake Kepwari Australia

Lake Kepwari is the site of a former open pit coal mine that has been restored to a recreational lake for watersports, camping and fishing and relinquished in 2020. It is expect to receive over 37,000 visitors annually and has allowed for economic diversification of the region.





Post-Mining Landuse

Lake Kepwari Australia



Environmental Stability



5. Closure results in a post-mining landscape that is physically and chemically stability



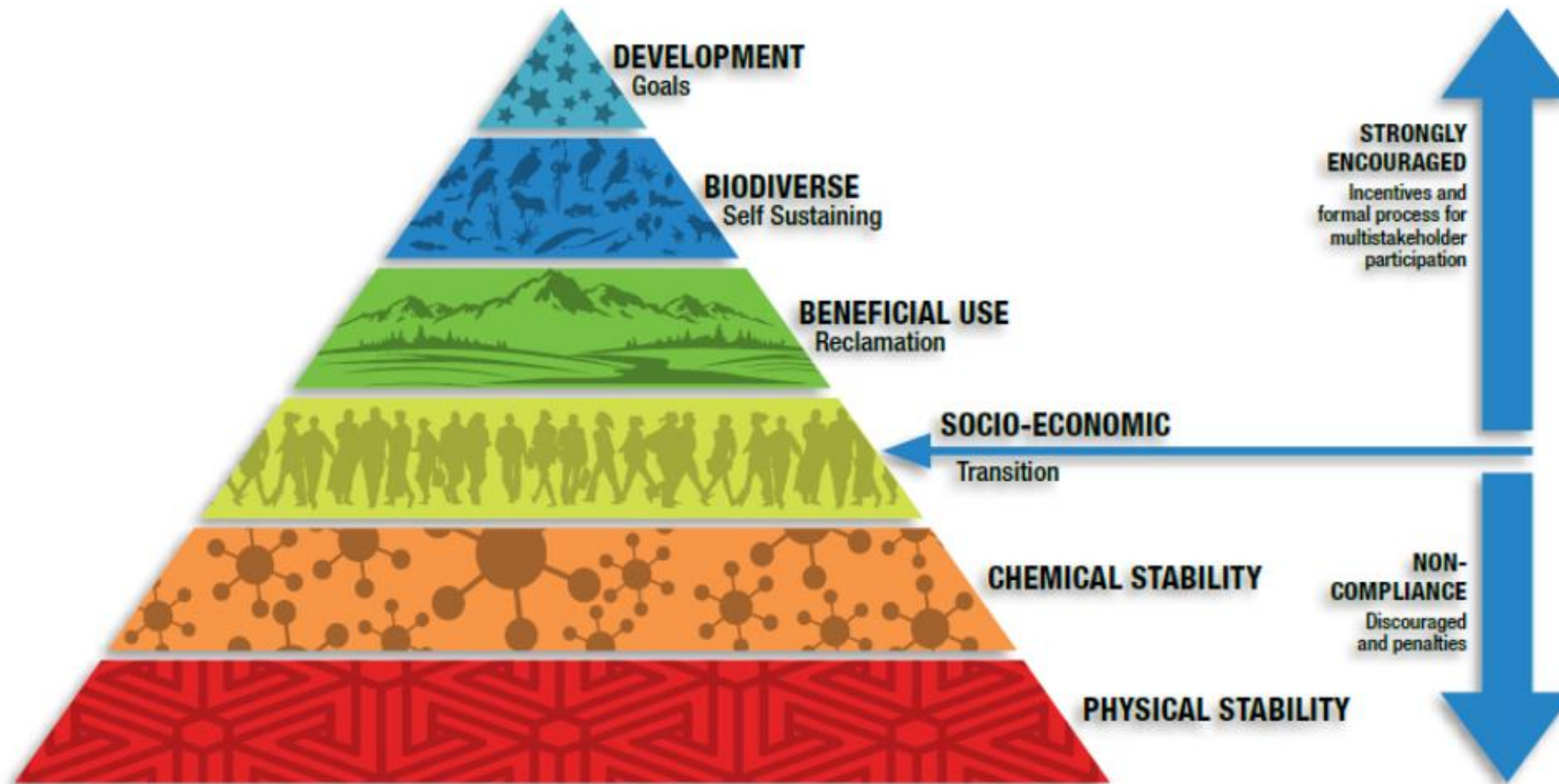
6. Closure plans and policies should support progressive reclamation and biodiversity



Environmental Stability



5. Mine closure must ensure an environmentally sound post-mining landscape that is **physically and chemically stable** in the long term



Environmental Stability



6. Mine closure plans should include **progressive reclamation**, and reclamation research. **Biodiversity** should be maintained or enhanced, if appropriate for the defined end-land use.
- Components of the mine site that are no longer needed by the operation should be reclaimed or rehabilitated as soon as practicable.
 - Progressive reclamation and reclamation research trials play an important role in evaluating the optimum reclamation methods for a given site, test and demonstrate the effectiveness of closure activities, validate completion criteria, and build trust with communities and the regulators
 - Most jurisdictions encourage or require progressive reclamation and allow for a reduction in financial assurance once parts of a site are reclaimed. This provide a financial incentive for mine operators to implement progressive reclamation.



Progressive Reclamation

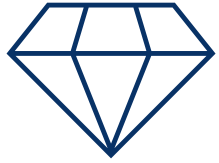
Akyem Mine, Ghana

Reclamation test site
on waste rock disposal
facility at the Akyem
Mine, Ghana.



Photo by Rob Stevens

Community Engagement and Transition



7. Closure planning must include inclusive engagement and consultation with communities and stakeholder throughout the mine life



8. Post-mining transition should support economic and social stability and result in productive land-uses after closure



Community Engagement and Transition



7. Mine closure plans and the post-mining transition must be developed in **consultation with stakeholders and communities** throughout the mine life.

It is important that communities and stakeholders are fully involved in closure planning, implementation and monitoring. Communities and government that will inherit the legacy of the mine (positive or negative) must have a say.

Considerations for social closure:

- Closure committees – one or more committees of stakeholders and regulators that are formed early and continue to final closure
- Inclusive engagement with women, men, youth and different individuals and groups in society – not just with male leaders
- Monitoring – include closure committee or community members

Community Engagement and transition

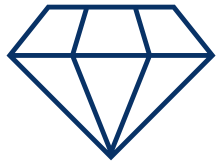


8. Mine closure must support **economic and social stability** after the mine has closed and where possible, **provide economic and social opportunities** through post-mining land uses.

- Social transition – the transition to a post mining economy and the success of that economy after closure should form part of closure planning
- Support the advancement of regional and national development goals
- Consider the impacts and opportunities on:
 - Mine suppliers,
 - Infrastructure,
 - Community economic transition and business resilience,
 - Employee transition and their families,
 - Impact to women and others in the community that may not work directly for the mine



Closure Cost Estimating and Financial Assurance



9. Closure plans must be supported by a current comprehensive **closure cost estimates**



10. Government should hold **financial assurance** to cover the full estimated closure cost during operation.



Cost Estimating and Financial Assurance



9. Mine closure plans should be supported by a comprehensive estimate of closure costs that are revised and refined with each closure plan.

- **Closure cost estimates** are the calculations used to determine the cost of implementing the closure plan – the cost of all the closure activities defined in the plan.
 - An estimation of all the direct and indirect costs of closure
 - Costs are gradually refined and improved as closure plans and engineering designs are defined. Level of accuracy increases with time.
 - Based on a third-party completing the closure
 - Used to estimate financial assurance

Cost Estimating and Financial Assurance

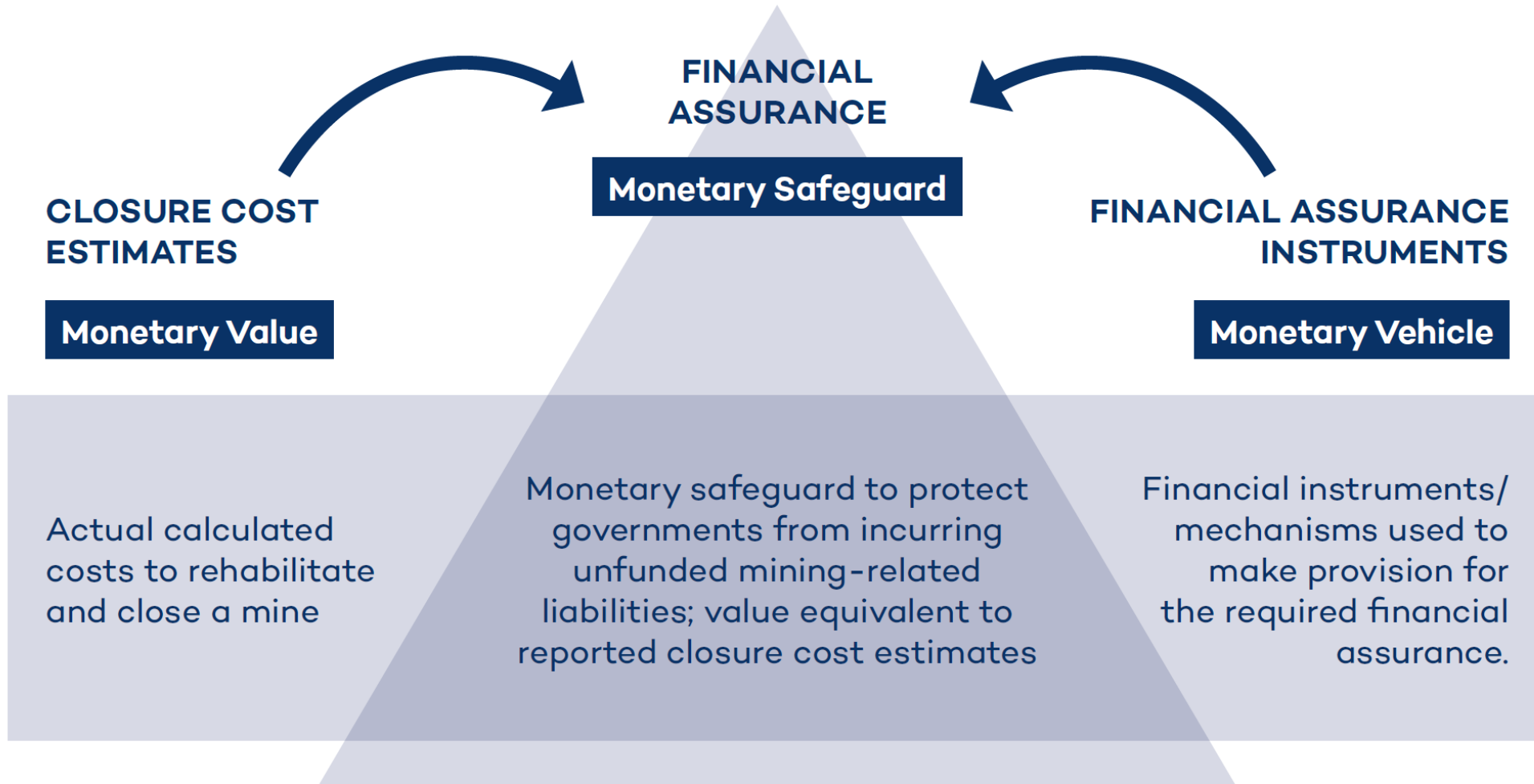


10. Governments should hold **financial assurance** sufficient to cover the full estimated closure cost of a mine during operation

Financial assurance is the monetary provision required to safeguard government from being liable for closure costs if the mine operator fails to fulfill its closure obligations.

- **Financial assurance instruments** are the monetary tools or mechanisms used for the mine operator to provide financial assurance to governments, such as cash, letter of credit or insurance.

Cost Estimating → FA → FA Instrument





Mine Closure Planning

IGF Closure Guidance

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IGF CASE STUDY

Inclusive Closure
and Post-Mining
Transition at the
Golden Pride Mine,
Tanzania

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**Integrating Gender
Equality and Mine Closure**

Actions for governments

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**Relinquishment of
Closed Mine Sites:**

Policy steps for governments

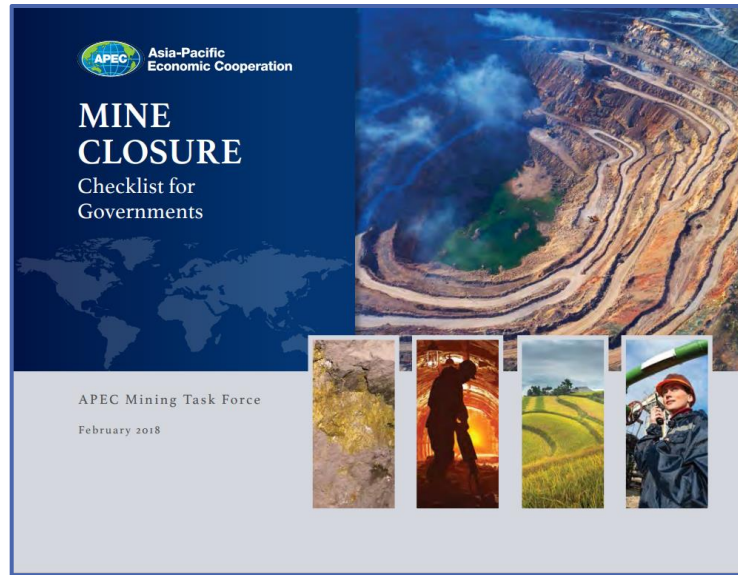
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Mine Closure Planning

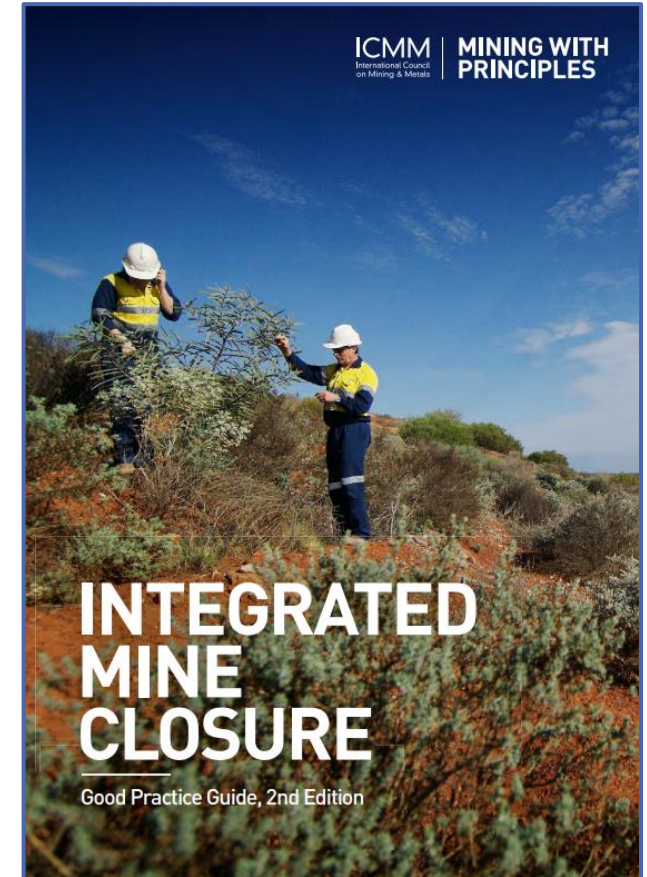
International Closure Guidance



APEC, 2018



World Bank, 2021



ICMM, 2019

- APEC and World Bank Guidance document are directed at government.
- ICMM guidance is directed at industry, but still relevant to governments

THANK YOU

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'Sun Mine' Tailings Site – Sullivan Mine, BC



- Power Generation: 1,048 MW (4,032 cells)
- Investment: \$ 5.3 M
- Teck Resource provided the land and \$2M in start up funding to the community and eventually purchased the site to meet its commitment to addressing climate change.
- Average earnings: \$ 244,000 per year - Earnings in 25 years: \$ 1.5 M

Yanacocha Mine Water Reservoir



San Jose reservoir,
Yanacocha Mine
Peru: former open pit
has been lined and
now provides year-
round water for 5,000
users



<http://ourvoice.newmont.com/2016/02/10/yanacocha-welcomes-regional-government-officials/>