COAL MINE CLOSURE STANDARDS

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Chair UNECE GoE on CMM and Just Transition

WORLD BANK GROUP
ENERGY AND EXTRACTIVES GLOBAL PRACTICE
Three Pillars Underpin Successful Transitions

- **Institutional Governance**
  - Policies and legal framework are critical to a just transition and may need adjustments/amendments to provide adequate coverage as mines close and transition proceeds

- **People and Communities**
  - This is the core consideration and actions that impact the coal mining communities must have broad stakeholder input and interaction—something that has not always been central to the process in coal mining regions

- **Repurposing Land and Assets**
  - Critical to redevelopment is providing restored land and ensuring best use that is environmentally sound and most equitable for stakeholders
  - Establishes post mining potential for re-investment and healthy growth
Why it is important to strengthen existing legal and regulatory requirements for coal mine closure?

- In many jurisdictions, existing mine closure regulations were designed to avoid environmental and safety hazards but may not have considered future uses of land.
- Regulations governing environmental consequences of mining, closure, and restoration have changed over the years as experience and understanding has become more global in scope, but not in all jurisdictions.
- Planning for closure should begin as the mine is opened to avoid future problems caused by poor decisions during mine life.
- Mine closure should be engineered to protect aquifers, and control gas emissions and effluents.
- Surety bonds or other financial facilities may be inadequate for closure and restoration—knowing the costs of closure is critical for future planning.
- Processes for irrevocable closure are important to protect against unofficial mining and allow for repurposing.
Three phases of closure—planning and good practices are key to achieving a just and equitable transition

**Pre-closure**
Planning operations should start as early as possible involving mine operator, governing authorities and local stakeholders

- Early and well-informed risk-based choices in the early planning stages of mine closure
- Preparation of a well-considered and comprehensive plan
- Selecting possible options for repurposing mine lands
- Make choices that ensure that the value of the mined land and remaining non-coal resources are utilized to their fullest potential

**Closure**
Reclaiming and restoring mine lands, initiated to reduce/eliminate geotechnical and environmental risks and hazards such as mine water and fugitive gases

- Preservation of remaining assets and natural resources, archived mine plans, maps, and data
- Identifying, monitoring and addressing residual risks during closure enables optimal and sustainable use of former mine lands and assets
- Managing risks and developing mitigation strategies which are based on sound technical approaches
- Engage and involve governing bodies and affected stakeholders

**Regional transition**
Implementing projects with higher value in former mine lands using remaining physical infrastructure and natural resources

- Remediation and future land use with well organized government innervation
- Well informed decisions based on factually addressed legacies and opportunities, employing Land Repurposing Methodology (LRM)
- Strategic impact assessment, pre-licensing, Special purpose entities (SPEs)
The aim of coal mine closure planning

Coal mine closure planning should begin early in the mining life cycle — mining practices employed during mining should be chosen with an eye toward inevitable closure.

Planning should be directed at mitigating the impact of risks and charting a path to a sustainable post-closure future.

Unaddressed risks increases costs of closure, reduces value of remaining natural resources, and increases potential for unintended local and global environmental consequences.

Well planned closure envisages a sustainable future and the highest use of remaining assets and natural resources after the mine closes.

This illustrates the coal mining lifecycle at a gassy coal mine. When the mine closes, the methane in the void and surrounding strata could become a source of fugitive emissions. Sustainable mine closure planning could present options for efficiently capturing, using, or at minimum, destroying this powerful greenhouse gas.
Coal mine closure and a post-closure sustainable future centers on risk-based planning

- Risk management is essential for planning mine closure and future resource utilization to ensure stable land and a safe environment for land repurposing.

- Key actions are:
  - identifying potential and existing hazards
  - assessing the risks to community and future land use options
  - adopting a plan of action to mitigate risks and remediate hazards

- Mitigation of risks and remediation of hazards may be costly, but the value of repurposed land and a healthy future depend on early decisions based on good-practices during the coal mine life cycle.
Sustainable coal mine closures require strong technical procedures

Four overarching principles are paramount when planning and implementing mine closure:

1. Public Safety—protection of the surrounding community
2. Land Stability—prevention of soil erosion and mitigating problems caused by subsidence
3. Mitigation of chemical impacts—safeguarding against surface and subsurface pollutants
4. Environmental reclamation, emissions control, and post-closure land use—revitalizing mined land while controlling methane emissions and mine water excursion

In most jurisdictions, these principles are the foundation for legal and regulatory frameworks that govern mining activities on the surface and subsurface. They may need updating and better enforcement procedures.
Probability-based risk assessment is employed to preserve asset value and protect communities

- The World Bank has adopted an approach to mine closure that is risk-based and centered on good practices
- It is a systematic approach employing a probability-based risk assessment that may be used to predict the likely outcome of taking (or not taking) certain steps to mitigate potential loss of value to land and other natural resources
- The impact of risks to mine-related asset and natural resources should be considered when planning the closure of the mine.
- Planning should start early in the life of the mine and should be reviewed periodically

Matrix mapping the likelihood of a risk occurring versus the range in severity of its potential impact. Mine management performing the assessment will use their professional judgement to determine the likelihood of occurrence and the severity of impact.
• Valuable non-coal natural resources will remain after coal mines are closed

• They may be valued, or pose a threat to the environment—but managing these resources is crucial to repurposing mined land

• The United Nations Framework Classification is a key part of a system that can be employed to manage resources and develop appropriate strategies for their future use

• Understanding the potential use of non-coal resources, such as gas, water and other valuable materials is an important consideration when planning closure and repurposing mined-land in a way that supports the local community and region undergoing transition
Planning for sustainable closure requires identification of risks and mitigants

<table>
<thead>
<tr>
<th>Overarching Principles</th>
<th>Asset or resource at risk</th>
<th>Intrinsic value</th>
<th>Risks and potential negative impacts</th>
<th>Actions that will reduce risks</th>
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</thead>
<tbody>
<tr>
<td>Natural ground, surface features, and landforms</td>
<td>Ecological preservation</td>
<td>Inversible alteration or destruction</td>
<td>Pre-mine planning and judicious placement and management of mine wastes</td>
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<td>Useable land surface</td>
<td>Agriculture and real estate</td>
<td>Contamination of topsoil, destruction of wildlife habitat</td>
<td>Land use planning coordinated with mine planning and periodic monitoring</td>
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<td>Workforce and local community</td>
<td>Human resources and community strength</td>
<td>Social and economic disruptions</td>
<td>Human resource mapping and progressive retraining during mine life. Train, up-skill, re-skill and relocate.</td>
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<td>Neighboring industrial community</td>
<td>Industrial ecosystem centered on natural resources and workforce</td>
<td>Mine closure and relocation of workforce causing economic loss</td>
<td>Careful planning and business community engagement. Development and implementation of long-term strategies and economic support</td>
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<tr>
<td>Surface water resources</td>
<td>Water supply for community and agriculture</td>
<td>Chemical contamination, disruption or depletion of supply</td>
<td>Plan to prevent and avoid unnecessary impact on surface water sources. Monitor, mitigate, and report</td>
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<tr>
<td>Subsurface water resources (groundwater)</td>
<td>Water supply for local community, commercial and industrial uses</td>
<td>Subsidence and strata relaxation, disturb, depletes or destroys groundwater reserves</td>
<td>Diligent mine planning and use of water monitoring wells drilled into key aquifers. Water supply clean-up.</td>
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<td>Mine void storage</td>
<td>Storage of valuable resources, CO₂ or wastes</td>
<td>Filled with disused equipment, fire, collapse, and water flood</td>
<td>Plan and retain in-mine pipes to drain and monitor and control gas and water, or stored gases or wastes.</td>
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<td>Coal-associated hydrocarbons</td>
<td>Low-cost and relatively clean fuel for uses</td>
<td>Leakage, migration, loss, and accidents</td>
<td>Capture, use or abate. If sealed must monitor regularly.</td>
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<td>Subsurface mineral rights</td>
<td>Subsurface mineral, oil and gas rights</td>
<td>Lack of clear ownership will thwart development</td>
<td>Clarify legal rights and streamline transfer of mineral title after mine operations cease</td>
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<tr>
<td>Subsurface water rights</td>
<td>Rights to groundwater for all uses</td>
<td>Rights are valuable and may be contested preventing use</td>
<td>Clarify legal rights and streamline transfer of mineral title after mine operations cease</td>
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<tr>
<td>Subsurface rights to the mine void</td>
<td>Rights required for storage or extraction of gas and water</td>
<td>Unclear laws deter use and may prevent extraction of resources</td>
<td>Clarify legal rights and streamline transfer of mineral title after mine operations cease</td>
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<td>Access to Markets</td>
<td>Access to energy and commodity markets</td>
<td>Complex regulations may block easy access and impede sales</td>
<td>Access to energy markets should be ensured by appropriate legislation and regulation.</td>
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<td>Access to Finance</td>
<td>Funding is needed for commercial projects</td>
<td>Funding and insurance often difficult or impossible to obtain for coal mine projects</td>
<td>Special finance is needed for mine land repurposing, water clean-up, methane capture and use, and mine void utilization.</td>
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- Risks are present in each of the domains within which a coal mine operates: the surface, subsurface and the legal, regulatory and financial.
- Mining professionals should determine the likelihood that the intrinsic value of an asset or natural resource will be diminished if actions are not taken.
- Mine plans should be developed with considerations for inevitable closure.
- Mine closure should be planned using risk assessment to determine the potential diminishment of value for assets and resources that are key to reclamation and repurposing.
Plot of methane production at an abandoned mine complex in Illinois USA
Plot of methane production at an abandoned mine complex in France operated by Francaise de l’Energie
Plot of methane emissions at an active mine in Western Colorado, USA operated by Arch Coal
THANK YOU

FOR MORE INFORMATION PLEASE CONTACT:

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