

MINE CLOSURE - THE 21ST CENTURY APPROACH

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1. INTRODUCTION

Mining is an economic activity that has been occurring for hundreds, and in some cases thousands of years, and mine closure is an aspect of mining where historic practices and evolving community expectations do not meet. Some closed mine sites do not meet the standards now expected by the community, governments and best industry practices. It is a topic whose relevance has emerged in the past decades due first to increasing awareness of public health and safety issues and, more recently to increased awareness of environmental contamination and environmental preservation.

Unlike other industrial operations where buildings are frequently torn down after their economic life is past and so are not reminders of past practices which would not be acceptable today, mine closure problems from the past are visible today. Mine closure is also an area of operations where institutional and legal frameworks have evolved significantly over the past decades in response to changing public, government and industry expectations. Mine closure is an area where blame for problems is easy. As well, it is an issue that brings industry practices, government policy and regulations with respect to environmental protection and community expectations together. Standards have and will continue to evolve, but this doesn't mean ever changing yardsticks.

What is mine closure? Essentially the objective is to leave a mine site in a condition which is safe and stable, limiting further environmental impact so that the mining tenements can be relinquished for alternative land use. Mine reclamation refers to the restoration of land affected by mining for further economic use. Mine closure and mine reclamation are not after-thoughts. They need to be planned from the beginning of an operation.

2. OVERVIEW OF INTERNATIONAL CONSIDERATIONS RELATED TO MINE CLOSURE

Mine closure has become a topic of broader discussion in the past 20-25 years during which time the institutional and legal frameworks that govern the practice of mine reclamation have evolved in response to changing expectations.

In 1987, the Brundtland Commission resulted *inter alia* in the well-known definition of sustainable development namely that meets the needs of the present without compromising the ability of future generations to meet their own needs. The Brundtland report provided material for environmental groups, pressure from which has resulted in a more vocal public demanding that governments create stronger legislation to compel the mining industry to be more environmentally sensitive.

In June 1991, an International Round Table Conference on Mining and Environment was organized in Berlin. Although mine closure was not broadly discussed, the *Berlin Guidelines* provided an initial outline of "necessary environmental guidelines and strategies on mining with emphasis on developing countries". In many

countries, environmental impact assessments, now required by law, are the vehicle under which companies are required to produce a closure plan in significant detail.

In 1992, United Nations Conference on Environment and Development (also known as the Rio Conference), produced Agenda 21, the programme for environmental management for the 21st Century. It emphasized the need for adoption of environmental guidelines for natural resources development. Since 1992, UNEP and other international agencies have been asked to provide environmental guidelines for the mineral sector. In 1997, DESA and UNEP compiled *Environmental Guidelines for Mining Operations* and these discussed approaches to implementation, monitoring, enforcement and participation.

In 1994 an International Conference on Development, Environment and Mining was co-sponsored by the World Bank, UNEP and the International Council for Metals and the Environment (ICME). The purpose was to share ideas, perspectives, information and solutions with respect to the challenges surrounding sustainable mineral development. Key conclusions, *inter alia*, were that:

Environmental regulations do not act as a disincentive to investment provided that the regulations are realistic, transparent and stable.

The objective of rehabilitation of mine sites should be to restore them to a self-sustaining ecosystem that is as close as practical to its original state prior to mining activity. There is a need for mechanisms that ensure the availability of funds to finance rehabilitation.

Principles of environmental management are being adopted by industry and these are seen as a vital part of efforts towards continuous improvement. The management systems being adopted depend on regulations and on corporate cultures. These systems are part of the industry's efforts to demonstrate that mining is compatible with environmental protection.

In 1998, UNEP produced *Case Studies on Tailings Management* in partnership with the ICME. UNEP also developed a training manual on *Mine Rehabilitation for Environment and Health Protection: A Training Manual* with the World Health Organization to introduce mine personnel to new skills as information and training are at the heart of any new approach.

3. ENVIRONMENTAL LIABILITY AND SITE REHABILITATION

Every phase of the mining sequence involves some degree of ground disturbance. The objective of site rehabilitation is protection of public health and safety and the return of the site and its surroundings to economic use and/or a sustainable ecosystem. In many dry countries, we can see the tracks and scars of exploration covering many square kilometres of land that will never be mined. Techniques can now be used to reduce the extent of disturbance, but some rehabilitation will always be needed.

During mining operations, much ground is exposed to the elements. Closure usually involves sealing underground mines and rehabilitating, regrading, stabilizing and revegetating open pit operations.

New operations try to minimise land disturbance, plan for soil and waste storage, undertake progressive revegetation and land management. In fact, experience has demonstrated that a well managed mine that follows strict environmental stewardship principles throughout its operations will be easier and less costly to reclaim. A key issue is where, when and how to dispose of mine spoil, tailings and other mine waste so that these operations are both safe and have a minimal environmental impact now and in the future.

Following closure, the site needs to be restored to some predetermined plan. Today, the more progressive mining companies start planning for closure before the first operations commence so that the costly need to re-handle material, reshape landforms and restore degraded environments at the last moment is minimised.

At many sites however, the damage has already been done, in which case rehabilitation in a post-project sense is required. These situations are invariably expensive, often with no clear view of where the funds will come from. Post-project rehabilitation needs to be intensely practical and cost-effective. In many cases the objective will be to make a site physically and chemically secure rather than planning for a productive after-use. Time may be one of the tools relied upon to do over many years what technology and intensive care could otherwise achieve in a few months at more active sites.

One issue, however, is that in many cases there are no final standards to which a site must be returned to and every mine and mine environment is unique. Increasingly, consultations need to occur between the company, the community and its stakeholders and the government as to what the final site plan should look like. Ultimate relinquishment of the mine site by the company is impossible unless closure standards are established.

The issue of legal and financial responsibility is at the heart of many rehabilitation projects. For new projects, legislation may set performance targets in terms of environmental impacts and long-term land-use, perhaps enforced through financial bonds or securities that guarantee the public purse against defaulting companies. The rehabilitation procedures may already be evaluated at the EIA stage and stipulated as obligations in the project permit.

Many companies now see their relationships with the public as being at least as important as regulatory compliance. Public acquiescence of mining as a future activity is strongly influenced by its vision of ecological performance at today's sites. The rehabilitation of sites which leaves a public asset in terms of farmland, recreation reserves or nature habitat has become an increasingly common policy of mining companies. Site rehabilitation in these cases goes beyond the mere physical stabilisation of slopes and pits and providing a vegetation cover at the least cost.

Health and safety has long been regarded as a workplace issue, with objectives being limited to physical safety and protection from exposure to toxics. While these are still important, additional concerns include public safety from structures during and after operation, the fate of hazardous materials and wastes which may have been buried at the site, and about public security of the land after closure.

Beyond the confines of the mine, mining wastes, if not properly contained, can potentially affect public health in both nearby communities and surrounding

ecosystems. Mine wastes may include cyanide compounds, heavy metals, radionuclides and asbestos (though never all in one waste stream). These can become solubilised or carried as suspended particles in waters leaching from the waste sites. This leachate, together with drainage from the mine, is often highly acidic or saline, and may also carry a high sediment load. The common incidents of contamination, which could ultimately affect public health or well-being, are pollution of drinking water supplies, aquatic ecosystems including fishing grounds, agricultural soils and urban areas.

As environmental and safety issues continue to evolve, all aspects of mine management must be reviewed from time to time to see if they are still relevant. Old practices may no longer be acceptable, as in the use of certain chemicals or in the standards of disposal. New techniques become available in slope stabilisation, in revegetation and in monitoring. It is necessary for supervisors and managers to remain up-to-date with the latest techniques in order to constantly improve environmental performance. For this, a constant link with environmental and technical research and development as well as with the changing environmental priorities of governments is an absolute necessity for all managers.

4. THE LEGACY OF INAPPROPRIATE/INSUFFICIENT MINE CLOSURE – ABANDONED MINES

One of the major outstanding environmental problems is that of abandoned mine sites, a legacy of centuries old practices, of inadequate, insufficient or non-existent mine closure. The potential costs of rehabilitation, the lack of clearly assigned (or assumed) responsibility, the absence of criteria and standards of rehabilitation as well as other factors have delayed action by all parties - industry, governments and communities. Yet, land degradation from old mine operations is well known in almost all countries.

While many have seen these derelict sites, and there are many references in the literature, there have been few systematic surveys to quantify how many sites need attention. There has been even less work on trying to quantify the nature of associated problems so as to prioritize remediation efforts.

UNEP has begun to compile information associated with the few national or regional inventories that exist although these are mostly in developed countries. These surveys are still ad-hoc and based on internal data collection in only some agencies (eg. abandoned sites on national park lands).

This is an important environmental issue on which we hope to make progress over the next year. In the meantime, if Workshops such as this one on mine closure can contribute to the development and implementation of good closure plans and technologies, the number of future abandoned or orphaned mines will surely diminish over time.

5. MINE REHABILITATION FOR ENVIRONMENT AND HEALTH PROTECTION - TRAINING

Building capacity to implement new policies in government and industry has been a major activity for UNEP. The work includes making information available to a wide range of professions, preparing trainers manuals, stimulating the upgrading of training curricula in institutions, and holding training workshops. In 1998, UNEP produced a training manual on *Mine Rehabilitation for Environment and Health*

Protection. The manual is designed as an applied, hands-on guide to address the rehabilitation of disturbed land, particularly as it applies to mining lands. It is a practical, factual method whereby rehabilitation techniques can be applied.

When the decision has been made to decommission and close down a mine, the site rehabilitation plan should be brought to its final stages. In many countries and for many companies, rehabilitation is an on-going process as part of their operations. Unless an alternate use has been agreed upon with the nearby community, all physical facilities such as buildings, conveyor belts, silos and chimney stacks should be removed and all logistics features such as roads and power lines should be appropriately rehabilitated. Also, closure monitoring needs to be established and continued into the next stage, namely the post-closure period.

Post closure is the period following the shut-down and rehabilitation of the mine. If all environmental impacts have been appropriately and acceptably addressed, there may be a situation where the owner can “walk away” from the site. Monitoring however, will be required over a specific period of time to ensure that all the remedial work that has been carried out is stable and secure and functioning. Given that mining companies have little interest in their closed mine sites, there may come a time when this post-closure monitoring becomes the responsibility of a third party with funding from some type of insurance bond.

Under other active care conditions, a site may have to undergo perpetual maintenance. This would be in addition to the post closure monitoring. Even under passive care conditions, continual or periodical inspections and monitoring should take place.

6. FINANCIAL ISSUES

As with all mining operations, there are real and significant financial considerations with respect to mine closure and site rehabilitation, especially given that closure and rehabilitation occur at a time when the operation is no longer financially profitable. This is one major reason why governments are increasingly requiring companies to provide guarantees for mine closure, sometimes referred to as reclamation funds prior to a mine opening. It is important that these funds be established in accordance with both best accounting practices and in accordance with the tax provisions in the mine's jurisdiction (in some jurisdictions, these funds are required by law).

There are a range of financial surety instruments ranging from irrevocable letters of credit, performance bonds, trust or reclamation funds, insurance policies or other guarantees. It is important that these funds become auditable items on a company's books so as to be reported on. It is recommended that these funds be established under law and receive monies from the earliest days of operations. Company closure plans should be updated regularly so as to be prepared in the event of the need for a mine to be put under care and maintenance or in the event of premature closure. Governments have a role in setting the policy and tax frameworks for these financial instruments.

7. SOCIAL ISSUES

Although often neglected, the social effects of mine closure are often as adverse as the environmental and economic effects. In many countries in recent years, mine closures have exceeded new mine openings resulting in a significant number of workers being displaced. This situation is expected to continue in many countries including South Africa, Canada and China over the next decade. With hundreds of thousands of workers displaced, consideration needs to be given to issues of income, skills training, worker mobility (although many workers do not want to move), physical, and mental well-being and alternative patterns of work. Mine closures represent a significant social and cultural upheaval as well as having financial implications for the country.

While there are no easy answers to these challenges, many companies are starting to discuss mine closure impacts with the community in advance of mine construction and operation. This is the case for the new copper zinc mine of Cia Minera Antamina (CMA) in Peru. Antamina, a consortium of Rio Algom, Noranda, Tech and Mitsubishi Corp has discussed with the community elders what they would like to see left in their community after the mine operators remove their equipment. Even now, certain mine facilities are being designed and built with community after use in mind.

8. INSTITUTIONAL AND LEGAL ISSUES

While current policy and legislative frameworks vary widely around the world, it is increasingly important that countries formulate clear, stable and predictable policies for industry to follow. These policies can evolve but should not fluctuate nor be unequally applied. It is equally important to recognize that each mine is unique, that some flexibility will be required as the mine operates and that artisanal, hardrock and coal mines and aggregate operations are different.

9. FUTURE ISSUES

While it is clear that current best practices and regulations in many countries require mine closure plans, the challenge remains as to how to ensure that some companies don't cut corners in an effort to remain competitive. Further, what is the best way to ensure that small and medium sized companies, of which there are many more, also commit themselves to environmental stewardship and best practices. Globally, government environmental policies vary greatly and, it is important to recognize the contribution mining makes to national economies.

Abandoned mines present more legal and financial challenges than technical ones. The threat of future liability imposed on third parties that attempt to clean-up sites is a deterrent to progress. Under the laws of several countries, liability for toxic pollutants is retroactive with no statute of limitations meaning that present owners are responsible for the property in perpetuity even if they were not involved in the original mine. Work is underway in some countries to address this problem through "good Samaritan" clauses or other similar mechanisms.

There are several outstanding financial policy issues including: how can mine closure and reclamation funds be integrated into artisanal, small and medium sized operations? How can financial surety options be realistic, flexible and sufficient to

address mine rehabilitation yet not so burdensome as to push companies into bankruptcy or deter them from commencing operations? What are the options to meet the financial burden of reclaiming abandoned mine sites, many from more than one hundred years ago?

The social challenges are also very real. Just as environmental impact assessments became the tool for measuring a mine's environmental impact, social impact assessments may become the tool to address social impacts. Perhaps these two mechanisms may become juxtaposed into socio-environmental impact assessments which *de facto* occurred recently in Canada with the proposed Voisey's Bay project.

10. CONCLUSIONS

It is possible that mining in the 21st century could become a model of an economically viable, environmentally sensitive, socially responsible industrial sector producing sustainable and decentralized benefits to foster other activities and increased capacities in the communities which will endure long after a particular mining operation closes.

In order for this to occur, a true partnership needs to emerge in association with each individual mining operation. Industry is challenged to assume greater environmental stewardship and communicate with nearby communities in all aspects of their operations. As the mining industry is often judged by its weakest member, good companies are urged to pressure those which give the industry a bad name to improve their environmental and social performance. National governments need to articulate clear policies and rules for environmental impact assessments including mine closure and site rehabilitation.

And what is UNEP's role? We are working with mining schools trying to ensure that the broad range of environmental issues are incorporated into the different subject curricula. We are currently improving access to environmental information primarily through the environment portion of the joint UNCTAD-UNEP website (www.natural-resources.org/environment). We are partnering with the Coalition for Environmentally Responsible Economics (CERES) in the Global Reporting Initiative which represents

The first global framework for corporate sustainability reporting encompassing environmental, social and economic issues – the *triple bottom line*. Should we consider insisting that companies must always report on closure planning and actual closure in their environmental report?

UNEP's mission is to provide leadership and encourage partnerships with the private sector and help decision makers in government and local authorities and industry develop and adopt policies and practices that are cleaner and safer, make efficient use of natural resources, incorporate environmental costs and reduce pollution and risks for humans and the environment. We try to stimulate policy debates like this one on mine closure as this is a critical environmental and social component of mining operations and remains a challenge for us all.

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