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This report was prepared on behalf of the Environment and Security (EnvSec) Initiative. The Environment Security (ENVSEC) initiative is led by three organizations – the United Nations Environment Programme (UNEP), the United Nations Development Programme (UNDP), and the Organization for Security and Co-operation in Europe (OSCE) with the North Atlantic Treaty Organization (NATO) as an associate partner.

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The North Atlantic Treaty Organization embodies the transatlantic link that binds Europe and North America in a unique defence and security alliance. In response to recent changes in the overall security environment, NATO took on new fundamental tasks. These include addressing both instability caused by regional and ethnic conflicts within Europe and threats emanating from beyond the Euro-Atlantic area. NATO's 'Security Through Science' programme brings scientists together to work on new security issues of concern to NATO, Partner and Mediterranean Dialogue countries.

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MINING FOR CLOSURE

POLICIES AND GUIDELINES FOR SUSTAINABLE MINING PRACTICE AND CLOSURE OF MINES

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PREFACE

In the debate on what role the environment plays in causing or resolving conflict, the partnership of international organizations working on the "Environment and Security" initiative takes a pragmatic position. We focus on participatory assessments and targeted follow-up activities in conflict-prone areas and believe that we can help communicate to achieve environmentally sound development and peace on the ground.

Conducting assessments of transboundary environmental risks in Central Asia, the Caucasus and South Eastern Europe we have concluded that mining both in terms of legacies and future planning needs special attention. Environmental protection, human health risks, competition for land have increasingly to be taken into consideration in mining regulation and practice. Positive trends are visible: project planning and conduct of mine operations to facilitate environmentally and socially acceptable closure have evolved significantly in recent years.

In this context, we are happy to present the ENVSEC publication: *"Mining for Closure – Policies and guidelines for sustainable mining practice and closure of mines"*. It is intended as a checklist and guidebook on "best practices" related to mining, useful for an audience far beyond the mining industry, including government, NGOs, international organizations and the general public.

"Mining for Closure" was first presented to a broader group of experts and politicians in a sub-regional Ministerial Conference, in Cluj Napoca, Romania in May 2005. The participants welcomed and endorsed the report as "a guide and checklist for reducing and mitigating the environmental, health and security risks from mining practices" in the 'Cluj Declaration' issued at the conference.

We see in *"Mining for Closure"* something like a recipie for stimulating debate and public accountability of mining legacies and operations. Through applying the basic principles and guidelines, not only mining will become environmentally and socially more sustainable, it may also result in more democracy, increased wellbeing and security of those directly and indirectly affected.

Frits Schlingemann	Director and Regional Representative, UNEP Regional Office for Europe
Ben Slay	Director, UNDP Bratislava Regional Office
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EXECUTIVE SUMMARY

This document aims to present a basis for action within South Eastern Europe (SEE) and within the Tisza River Basin (TRB) towards the development of corporate practice, regulatory frameworks, governance guidelines and/or financial and insurance markets suitable for the support of a modern mining industry. In particular, this document wishes to present a number of options and ideas that can be applied to address the funding and execution of mine closure and mine rehabilitation while still achieving conditions suitable for new and ongoing mining activities. Further, the document provides details of many important information sources and is intended to constitute a reference source.

The draft document was launched at the *Sub-regional Conference on "Reducing Environment and Security Risks from Mining in South Eastern Europe and the Tisza River Basin (TRB)"* conducted in Cluj-Napoca, Romania, 11-14 May 2005.

The sub-regional conference drew high-level participation of Mr. Klaus Toepfer, UNEP Executive Director, Mrs. Sulfina Barbu, Minister of Environment and Water Management of Romania, and Mr. Miklos Persanyi, Minister of Environment and Water of Hungary. It was attended by representatives from a range of countries and jurisdictions including: Albania, Bosnia and Herzegovina, Bulgaria, Croatia, The former Yugoslav Republic of Macedonia, Romania, Serbia and Montenegro and Kosovo (territory under UN administration), Romania, the Slovak Republic, and Hungary.

The objective of the Conference was to draw up an action programme to reduce environment and security risks from mining in the region, including further assessment and pilot projects at high-risk sites, and endorse guidelines for sustainable mining practice and closure of mines. The event concluded with the signing of Declaration of the High-Level Panel of the Sub-regional Conference included as Appendix A to this report.

RATIONALE FOR THE MINING FOR CLOSURE REPORT

In 1999, a representative of the European Bank for Reconstruction and Development (Nazari) wrote the following:

> *The mining sector is a very important contributor to local and national economies, including in central and eastern Europe (CEE) and the former Soviet Union (FSU). However, in parts of CEE and the FSU, the mining sector has often been characterised by inappropriate planning, operational and post-operational practices, including a lack of an adequate regulatory framework and inadequate implementation of mine rehabilitation and closure activities. In some of the regions associated with significant mining activities, this has resulted and continues to result in significant adverse environmental and health and safety impacts and related liabilities. As a result, donors and international organisations and agencies are frequently requested to provide financial assistance to alleviate the most heavily impacted areas.*
>
> *A programme to develop a policy and regulatory framework for financial provisioning related to mine rehabilitation and closure should be initiated. This programme would be able to assist participating countries in developing the required policy and regulatory framework to further promote and implement long term environmentally sound and sustainable development in the mining sector. The programme would also contribute to reducing the uncertainties associated with post-operational practices, and potentially related adverse environmental impacts and costs. It would also facilitate the introduction of a standardised approach to this issue, establishing a 'level playing field with fixed goal posts' for regulators, investors, mining companies, and operators ...*

Despite efforts, the progress of work to meet such calls has not been rapid. There remains much to be done. Indeed, it is perceived by, *inter alia*, the ENVSEC Initiative partners (OSCE, UNDP, UNEP, in association with NATO) that the efforts by international bodies to address this issue and provide guidance to national and international institutions in their role as stakeholders in mining activities remain insufficient. This important deficiency in international action has serious implications for the SEE/TRB region.

GENERAL BACKGROUND

Increasing expectations for environmental protection, desires for reduced human health risks, competition for land, and the increasing value of the natural environment as recreational space have led to marked improvements in regulatory requirements and mining practice in a number of countries. Many miners have introduced management policies, practices and technologies that markedly reduce the environmental harm caused by mining (Environment Australia, 2002b; Gammon, 2002; Miller, 2005). When viewed in combination with growing desires to preserve land areas as a repository for valuable biological assets, for natural environmental services, and for aesthetic appeal, these developments appear likely continue to drive continued improvement in mining practice.

As a part of this positive trend, mine planning, mine closure practices and the conduct of mine operations to facilitate environmentally and socially acceptable closure have also evolved significantly in recent years. While in the past communities often saw that the only choice available was whether a deposit should be mined or not, it has been clearly shown that the manner in which a mine is planned can have major positive influences on the magnitude and duration of impacts over the life of the development and following its closure (Environmental Protection Agency, 1995a, p.2).

In this context, the title *Mining for Closure* chosen for this document is *not* intended to indicate that existing mining activities should be bought to closure, and future mining activities curtailed significantly. To the contrary, the mining sector is a very important contributor to local and national economies and it must be recognised that in the past, authorities did generally not require the "closing" of mines in the manner described throughout this report. Further, the extractive industries will continue to underpin the economies of many countries in the future. As such, ongoing and new developments to process and mine the mineral resources of "mining nations" will be vital for many of them to pursue sustainable development. In recognition of this importance, this document is intended to help facilitate mining policy development, capacity development and institutional development so that they can yield a sustainable mix of social, economic, and environmental outcomes from mining. The key focus of this document is upon countries in SEE/TRB, however much of the material and ideas presented here are intended to be generic.

OBJECTIVES OF THE REPORT

The ENVSEC Initiative seeks to facilitate a process whereby key public decision-makers in South Eastern and Eastern Europe, Central Asia and Caucasus are able to motivate action to advance and protect peace and the environment. This should occur via the collaborative articulation and adoption of policies, practices and guidelines for sustainable mining practices, *Mining for Closure*, and closure of mines in order to support the reduction of environment and security risks in SEE/TRB.

This document has the aim: to support the articulation and adoption of policies, practices and guidelines for sustainable mining practices, *Mining for Closure* and closure of mines for the reduction environment and security risks in SEE/TRB.

Towards that aim, the document has the following objectives:

objective I – to present principles, ideas and guidelines for mining policy development, capacity development and institutional development that can yield a sustainable mix of social, economic, and environmental outcomes in the SEE/TRB region with key foci being:

- operation of existing and new mining operations in order to ensure and facilitate cost-effective closure that fulfils acceptable sustainability requirements;
- re-mining or otherwise valorising abandoned or orphaned sites in order to make safe and/or remediate and close them (including finding other uses/economic value from sites);
- closure, making safe and/or remediation of abandoned or orphaned sites;

objective II – to support the ongoing assessment of transboundary environmental and human safety risks posed by sub-standard mining operations – both active and abandoned; implementation of risk reduction measures through demonstration at selected sites, evaluation and testing of possible policy changes and transboundary cooperation mechanisms.

WHAT IS MINING FOR CLOSURE?

The items included above are packaged here as a concept labelled *Mining for Closure*. In essence, the general ethos of *Mining for Closure* is captured by integrated mine planning where a mine closure plan should be an integral part of a project life cycle and be designed to ensure that:[1]

- Future public health and safety are not compromised[2];
- Environmental and resources are not subject to physical and chemical deterioration;[3]
- The after-use of the site is beneficial and sustainable in the long term;
- Any adverse socio-economic impacts are minimized; and
- All socio-economic benefits are maximized.

In addition, there is a great interest in the legacies of the past – and how to deal with them. These are discussed below.

CHALLENGES IDENTIFIED IN PREVIOUS UNEP STUDIES

Mining legacies are clearly identified as a key environmental issue within SEE/TRB. A desk assessment of security risks posed by mining, and particularly those associated with pollution from residual mining wastes *Reducing Environment & Security Risks from Mining in South Eastern Europe* (Peck, 2004) and the *UNEP Rapid Environmental Assessment of the Tisza River Basin* (Burnod-Requia, 2004), showed clearly that there are a large number of mineral resource related sites that are of high hazard in the SEE/TRB area. Further, evidence was found that many have significant risks associated with them that threaten the environment, public health and safety, and/or regional socio-political stability in SEE/TRB countries.

Moreover, it was found that mining and minerals processing operations can affect (and are affecting) the surrounding environment and communities via:

- airborne transport of pollutants such as dust, smelter emissions, gases, vapours;

1. After Sassoon (2000).
2. Generally as posed by safety hazards such as unstable tailings impoundments, toxic waters, unsafe buildings, equipment, open holes, and so forth. However, it must be recognised that few (if any) items in the built or natural environment are "hazard free". Thus, it is reasonable to expect that assume that in all countries there should be transparent debate and agreement on the level of acceptable risk pertinent environmental, social and economic aspects of mines and mining facilities post-closure.
3. The terms applied here, as drawn from Sassoon (2000), van Zyl, Sassoon, Fleury & Kyeyune (2002a) are generic but are intended to bear with them the intent and limitations presented in the source documents.

mass movement of "solid" wastes (generally tailings containing heavy metals and toxic compounds);
- mass movement of liquid, or semi-liquid wastes (again, generally tailings containing heavy metals and toxic compounds);
- waterborne transport of wastes as suspended solids and as dissolved materials.

Such physical risks occur in many jurisdictions around the globe, but the mining countries of this part of Europe share a geographical location and historical pathway that combines with their geological resources in a unique manner. Some of the parameters shared by most or all countries in the region are that:

- the mining sector is a very important contributor to local and national economies and that ongoing and new mining activities will be required to underpin the economies in the future;
- the countries are (relatively) rich in mineral resources and have a long – or very long – history of mineral resource extraction activities;
- there already exists a serious history of mining accidents, due in part to the widespread neglect of environmental safety and human security issues combined with sub-standard extraction and waste management activities, particularly in the post 1945 era;
- transboundary pollution risks associated with mining and mineral processing activities and the legacies of such past activities are many and marked;[4]
- nation states have been subject to marked changes in economic and political circumstances, conflict, and socio-economic hardship during the 1990s that have exacerbated the problems associated with some sites;
- accession to the European Union is imminent or foreseeable and compliance with a range of EU environmental and safety regulations is required for that process to proceed;
- legislative frameworks addressing mining and minerals processing activities, extractive industry legacies as well as accountability (and jurisdictional remit) for the environmental aspects of these activities are still in a state of development or flux;
- capacity within institutions supporting the extractive industries as well as those guiding transboundary risk management and/or disaster response are currently insufficient to deal with the task at hand;
- in economies in transition, national fiscal reserves available for the financing of site reclamation work, and/or social welfare "nets" for the support of communities affected by the environmental impacts of the extractive industries, or the closure of mining operations, may be minimal or non-existent.

This confluence of conditions suggests some urgency in the matter – particularly in issues surrounding abandoned and orphaned sites (legacies). In addition, there seems to be a clear and unequivocal *interest* from within the subject states in the promotion of flexible solutions to find other economic uses or value in abandoned or orphaned mine sites as well as in removing their hazard vectors.

Against this background, it is held that it is necessary to support the ongoing assessment of transboundary environmental and human safety risks posed by sub-standard mining operations – both active and abandoned; implementation of risk reduction measures through demonstration at selected sites, evaluation and testing of possible policy changes and transboundary cooperation mechanisms.

AN AGENDA FOR THE MINING FOR CLOSURE REPORT

At the outset it is reiterated that a fundamental point of departure is the view that ongoing mining activities are vital to sustainable development and environmental protection in the SEE/TRB in general. This is a view shared in varying degrees by development agencies such as the World Bank Group (Onorato, Fox, & Strongman, 1997; Strongman, 2000) and federations of environmental groups such as the European Environmental Bureau (2000).

Further, the report addresses key need areas supporting the "next steps forward" at both local (national) scale and in a transboundary and regional perspective that were presented within the Desk-assessment study for the Environment and Security Initiative Project generated in 2004 (Peck,

4. Countries are the producers or receivers of chronic and (potentially) acute pollution from their neighbours that can include: airborne transport of pollutants such as dust, smelter emissions, gases, vapours; mass movement of "solid" wastes (generally tailings containing heavy metals and toxic compounds); mass movement of liquid, or semi-liquid wastes (again, generally tailings containing heavy metals and toxic compounds); waterborne transport of wastes as suspended solids and as dissolved materials.

2004) and some of the key items within the Rapid Assessment report (Burnod-Requia, 2004). It provides information and guidance for regional decision makers on how they can move policy instruments (measures) forward in the areas enfolding the extractive industries. Central to achieving this is understanding of how many of the problems came to pass.

A range of reasons for mine abandonment are presented in literature surrounding the industry (Environmental Protection Agency, 1995b; Mulligan, 1996; Nazari, 1999; Sengupta, 1993; Smith & Underwood, 2000; van Zyl *et al.*, 2002a; WOM Geological Associates, 2000). The mining related elements that create the legacy of abandoned and orphaned mines are held to include:

- the general absence of mine reclamation policies and regulations until the latter part of the twentieth century;
- ineffective enforcement of mine reclamation policies and regulations if, and where in existence;
- the absence of financial security mechanisms to ensure funds for parties such as government to conduct remediation in the event a mining company going bankrupt and being unable to cover the costs of rehabilitation;
- inadequate financial security to address remediation if, and where such funds were set aside;
- unforeseen economic events that caused early cessation of activity or left companies bankrupt, such as a sudden drop in metal prices, insurmountable difficulties with mining/milling, and/or infrastructure problems;
- past technical practices undertaken such as the sinking of numerous exploration shafts and mineral deposit test pits that were never back-filled prior to the introduction of drilling equipment for mineral deposit evaluation;
- national security issues such as the supply cut-off for strategic metals in times of conflict leading to rapid mining activity with scant consideration of closure requirements or operational longevity;
- loss of mine data including records of underground workings and surface openings due to natural disaster, regulatory flux, unscheduled cessation of activities, political disruption and conflict;
- political unrest, conflict and political instability leading to unscheduled cessation of activities of a number of mines; and
- small scale mining conducted by artisanal or illegal miners, also including the uncontrolled occupation of mine sites.

Since mine abandonment is usually sudden and unplanned, governments are often left responsible for mine closure and rehabilitation. However, it is clear that most of the points outlined above can be planned for, or are preventable in some way. Indeed there are growing expectations around the world that this always be done. Prevention of future mining legacies can be achieved through the *Mining for Closure* activities and principles summarised within this document. Prevention is feasible and desirable via sound governance.

ACTIVITIES WITHIN MINING FOR CLOSURE

In essence, Mining for Closure approaches encompass:

- the definition of a vision of the end result for mining land that sets out concrete objectives for implementation;
- ensuring that the mine closure plan is an integral part of a project life cycle;
- the preparation of a mine closure plan early in the process of mine development and in consultation with the regulating authority and local communities;
- the explicit inclusion of environmental, social and economic aspects in the planning for mining operations;
- allowances for review and evolution that stretch from the pre-mine planning phase, through construction, mining, and mine closure to post-mine stewardship.

As more specific items, such processes should incorporate:

- the concerns/participation of other stakeholders in the reclamation objectives;
- plans for action if ownership reverts to the state despite all efforts to ensure otherwise;
- the preservation of mine management and geological records;
- early delineation of project creditors' claims on the site;
- legal considerations for ownership, both now and in the past;.
- maintenance of control over tenure if leases expire and another party wants to obtain rights to the surface/subsurface;

- adequate capacity among regulatory personnel;
- ongoing research and testing of remediation strategies and technologies and integration of results in *Mining for Closure* review processes;
- surveillance of the views and desires for the involvement of local communities (in particular where such parties wish to ensure the quality of information that they are receiving – demanding a role in site monitoring and access to information to ensure accountability of operator and governments are examples);
- the maintenance of communication between private and public bodies to improve closure policy and regulations;
- ongoing searches for financing measures for clean-up; disaster response; spills management and so forth, particularly for orphaned sites.

It is necessary to underline that it is the role of government (as the representative of stakeholders in the nation state) to ensure that the expectations of stakeholders are met. Further, it must be noted that stakeholder expectations are inherently fluid – and indeed that such expectations can be influenced, and perhaps should be where they do not best reflect the interests of all.

THE GOVERNMENTAL CASE FOR MINING FOR CLOSURE

While there are other advantages defining the governmental case for pursuit of *Mining for Closure*, it suffices to summarise them within the following broad categories:

- the prevention of harmful environmental and social impacts;
- lower risk of non-compliances;
- greater acceptance/less resistance from key stakeholders (in particular local communities and land owners);
- lower financial burdens to the national purse for mine closure and rehabilitation, and
- lower risks for significant liabilities post-closure.

In the context of developing and restructuring economies, these points are perhaps even more telling than for wealthier nations. It is clear however, that where governments do *not* have sufficient fiscal resources to deal with legacies, then even more innovativeness and flexibility will be required in order to protect the public and the environment from the risks posed by mining legacies.

THE BUSINESS CASE FOR MINING FOR CLOSURE

It is also important – and fortunate – that it also makes good business sense to adopt best environmental practice in mining, and to *mine for closure*. Importantly for mining organizations, these benefits evidence themselves both during mining operations and at the end of mine life and as such, they constitute far more than just cost savings that can be achieved during the execution of a task forced upon them.

Benefits (principally after Environment Australia, 2002a) include *inter alia*:

- continual reduction of liabilities via optimization of rehabilitation works undertaken during the productive phase of mining operations rather than deferral of costs to the end of the project;
- provision of a basis for estimating rehabilitation costs prior to final closure so that sufficient financial and material resources can be set aside;
- ongoing testing, assessment and feedback regarding the effectiveness of rehabilitation designs and/or processes in a site specific fashion during the active mine life;
- increased efficiency in execution of work (e.g. in reduction of double-handling for waste materials and topsoil);
- possibilities to optimise mine planning for efficient resource extraction *and* return of ecosystem to a functional form;
- reduced areas of land disturbance through use of smaller waste landforms and mining paths, and in some circumstances progressive backfilling;
- identification of areas of high risk as priorities for ongoing research and/or remediation;
- the direct involvement of operations personnel in achieving mine rehabilitation outcomes;
- the involvement of key stakeholders (especially local communities) in setting priorities for mine rehabilitation;
- reduction of ongoing responsibilities for the site and facilitation of timely relinquishment of tenements and bond recovery;
- reductions in impacts on local communities in terms of environmental, social and economic impacts of mine operations;
- reduction of exposure to contingent liabilities related to public safety and environmental hazards and risks;
- lower risk of regulatory non-compliances,

- greater acceptance/less resistance from key stakeholders (in particular local communities and land owners),
- improved access to land resources from governments;
- improved access to capital from reputable lending institutions;
- the potential for reduced cost of capital and liability insurance;
- continual feedback upon the manner in which community expectations are being achieved.

It is in the best interest of business for such activities to take place at the right phase of mine life in order to minimise such expenditures. As mine decommissioning usually occurs at a point in the life of an operation where the economic recovery of minerals has ceased, and cash flows are minimal or non-existent, then this is not the time to be undertaking the bulk of rehabilitation operations. Again, it is stressed that the overall mine decommissioning process should be integrated with the overall mine operation planning process. Further, if decommissioning and closure are not undertaken in a planned and effective manner, chances are that the results will also be sub-optimal.

THE WAY FORWARD

This document was created in order to present principles, ideas and guidelines for mining policy development, capacity development and institutional development that can yield a sustainable mix of social, economic, and environmental outcomes in the SEE/TRB region. It has been generated in recognition of a fundamental divide between the interests of mining companies who typically wish to develop mines, achieve a good return for shareholders, then leave when production is finished and the interests of the communities who desire wealth and income opportunities created in their midst that will last over time.

This said, the document builds the case for the strategic relevance of *Mining for Closure* for both the mining industry and for governments. Key actors on both sides clearly recognise that the very viability of the mining industry is challenged because of high expectations for environmental protection, desires for lower risk to human health, competing land use demands, and the increasing value of the natural environment as recreational space. The survival of the mining industry *and* sustainable development of countries in SEE/TRB both require a vibrant extractive industry that society accepts.

Throughout this text, a raft of principles, ideas and guidelines are provided. These address the mining policy development, capacity development and institutional development that need to be addressed in order to ensure the operation of existing and new mining operations in order for cost-effective closure fulfilling acceptable sustainability requirements can be achieved. Further, a wide range of ideas for exploration is presented regarding the re-mining or otherwise valorising of abandoned or orphaned sites in order to make safe and/or remediate and close them.

In its content, the document establishes that the way forward must include *fostering of institutional frameworks* that support abandoned or orphaned site management and a shift to sustainable mining and minerals processing practice and that this will require immediate and ongoing *capacity building for (public sector) institutional actors* as well as significant *capacity building among industrial actors*. Pursuant to that, the new skills and knowledge among institutional actors must be directed at key tasks of hazard and *risk-related uncertainty reduction* via focused information collection and by *risk reduction works* at abandoned or orphaned sites. Further, new skills and knowledge applied within sound institutional frameworks within all actors must be applied for *risk reduction at operational sites* and the *development of new resources and re-mining activities* that are aligned with sustainable development. All these must include *dialogue with key stakeholders* such as national and international NGOs, affected citizens, and so forth.

This work outlines trends in the expectations of society and the international community, the general content, and the degree of international uptake of best environmental mining in a range of jurisdictions. As such, the principles presented should serve to guide National agencies responsible for mineral exploitation, and National agencies responsible for environmental quality in their work building of the foundations for good mining policy and administration. Further, such stakeholders can use this document to help inform their own expectations for practice and to stimulate innovation and creation of solutions tailored to their own circumstance. Innovation will be very important as evidence was found throughout this study that a number of the practices and/or the scale of investments required elsewhere may not be affordable here, nor may they be the most applicable.

A CODIFICATION OF PRINCIPLES

A number of principles can be used to guide the management of existing and new mining operations in SEE/TRB so that acceptable sustainability requirements and cost effective closure can be achieved. These principles can be used to support work with abandoned and orphaned mining sites in order to make them safe and/or remediate, and close them. It should be noted that the items listed below should be seen as congruent and synergistic and not exclusive (e.g. such as strict *and* flexible rather than strict *versus* flexible).

In order to *Mine for Closure,* jurisdictions, policies and work approaches should be:

Consistent – Mine closure requirements and procedures should be consistent with those in place in other territories of the region. This is particularly important where two countries share trans-boundary risks.

Centralised – Governments should strive for an independent mine closure law that establishes a single agency for implementation.

Strict – Legislation should apply the polluter pays principle strictly and should ensure that the owner or operator of a mining operation is responsible for execution and completion of successful reclamation.

Financially assured – Legislation should provide that (particularly for new operations and operations with considerable lifespan remaining) financial assurance is provided to ensure successful reclamation.

Long-term financed – Where conditions requiring long-term care exist, the funding of long-term care and management should be included in assurance. However, government legislation should explicitly provide that at a certain moment the company can be relieved of future liabilities for the site.

Temporally bounded – Where long-term care is involved, the operator should be responsible to provide it until relieved of liability, but amenable temporal bounds of such liability should be included in agreements. This requires that care be long-term financed.

Low hazard and viable – Viable, rather than only self-sustaining ecosystems, that are compatible with a healthy environment and with human activities and are low hazard should be left post-mining. Measures to address and prevent ongoing pollution from the site should be in place.

Considered and flexible – The target condition of a mining site should be carefully considered in the light of long-term environmental stability but not in the absence of social and economic uses that can contribute to making it safe. All encompassing requirements to return a site to its original condition or to a condition permitting a maximum range of land uses may be inappropriate. Jurisdictions should be flexible in devising solutions that match site-specific needs in terms of the types of mining operation, climate, topography, the sensitivity of the surrounding environment, and social requirements, and which deliver outcomes consistent with sustainable development principles and objectives

Synergistic – Synergies between actors, particularly actors with the capacity to provide rehabilitation service at lowest cost, should be pursued. This may be achieved by providing incentives for the current industrial actors to provide expertise, equipment, supplies and personnel to support government funding in addressing legacies.

Elastic – Innovative, flexible and forgiving frameworks for indemnification against potential liabilities should be sought, particularly in situations where this may provide the necessary incentives for multi-stakeholder participation in reclamation/rehabilitation works.

Reasonable – There must be recognition that insistence on protection against extremely unlikely events will impose excessive costs and as a consequence, investment incentives may be significantly reduced. Reasonable approaches must be applied when jurisdictions seek assurance against the possibility of loss or damage to the environment.

Creative – In situations where the mine is only marginally profitable or is approaching the end of its life, a creative approach to the design of the instrument may be called for.

Incentive based and tax balanced – the tax or royalty regime of the country should recognise that financial assurance imposes some costs on the operator. This should be balanced to ensure that sustainable development objectives are assured.

Sustainability-oriented – Conditions imposed for closure will need to transcend environmental quality criteria alone to include other important factors employment and social outcomes, as well as long-term resource stewardship.

Innovative – Jurisdictions should innovatively seek alternative economic yield from sites such as the valorization of wastes; alternative land utilization; infrastructure re-use; operational underwriting by tax yield; redevelopment and so forth.

Service oriented – Mining for Closure solutions must identify how essential community services such as medical care, schools, and so forth can be continued after mine closure.

Inclusive – Mining for Closure demands an inclusive stakeholder approach. This inclusiveness must stretch beyond consideration of stakeholders within national boundaries such as communities and also include both regional nation states and international actors.

STEPS TO BE TAKEN

Within the immediately coming years there is considerable urgency to achieve development within institutional frameworks.

Establish detailed and consistent mine closure requirements and procedures across the region according to the principles outlined in this document and of relevant European and international legislation.

Encourage the development of an independent mine closure law that establishes a single agency for implementation in each country. Ensure that these laws are consistent with other such laws within the same regulatory framework and developed by the other countries in the region, and that requirements are not duplicated.

Embark on a capacity-building programme to enhance the ability of national agencies and mines inspectorates to deal with the legacy of mining sites in the region, and to ensure that new mining projects are based on sound environmental and security principles. Such works should focus upon building agency capacity in:

- environmental impact and risk assessment, and screening of new mining projects;
- incorporation of public security measures and emergency preparedness into mining permits and licences;
- dealing with non-active mines, including abandoned sites, and
- management of transboundary risk.

Similarly, within the immediately coming years there is some urgency to establish activities and sanctioned bodies – or strengthen and expand them where they exist – to progress risk reduction in general.

Participate in multi-lateral work for the establishment of officially sanctioned bodies or working groups with the responsibility of scoping programmes for hotspot site remediation and seeking international funding for execution of priority works.

Establish officially sanctioned bodies or working groups for the assessment and management of transboundary risk. Such bodies will likely need to include representatives from generating territories and receiving territories, and as required include international experts and international bodies involved in transboundary environmental and regional security issues. Within this, opportunities should be explored to expand the remit of existing functional entities to reduce bureaucracy, build on existing capacity, and maximise efficient use of limited resources.

Extend &/or establish transboundary notification and disaster response systems linked to the parties mentioned above.

Extend &/or establish monitoring programmes, and/or early warning systems for the assessment of ongoing chronic pollution, and for the detection of pollution events.

Similarly, within the immediately coming years there is some urgency to establish the following activities to progress rehabilitation or risk amelioration at abandoned and orphaned mine sites. These next steps can be read in the context of flagship pilot remediation projects for learning.

Inventorise & prioritise amongst abandoned and orphaned sites in order to ensure the best use of public and private funds. It is unavoidable that this will require the building of detail inventories of mining activities and mine related sites in National jurisdictions complete with salient content such as complete details of current ownership and

activity status for identified sites; assessment of the legal status of abandoned/orphaned mines; geographical detail such as relationship to watershed boundaries; basic engineering and infrastructural parameters and so forth.

Explore the potential of partnerships (including trans-national partnerships) for remediation of orphan and abandoned mining sites that focus on the creation of future economic and social values in the context of a healthy environment and involve both the public and private sectors.

Test & experiment with different forms of partnership and innovative, flexible and forgiving frameworks for indemnification against potential liabilities in the first "case study site" rehabilitation projects.

Understanding the process of risk reduction requires pilot projects, a focus upon data collection and capacity building needs, and learning. As stated in the SEE Desk Assessment:

> *"Pursuant to activities of the type listed above, it is considered that pilot projects in risk reduction that target specific sites in a number of countries have the potential to provide significant tangible benefit. While work towards the amelioration of risks at individual sites is likely to yield environmental, social, developmental and regional security benefit, the prime benefit of any pilot activity should sought in the area of learning for future work. For example, the desk study indicates that better understanding in many areas is required. Examples of such areas are:*
>
> - *the challenges facing transboundary working groups (inter alia: cross border movement, geographical jurisdiction, sharing and compatibility of data, accountability, funding of activities, and so forth and so on);*
> - *the manner in which gaps in legislative frameworks affect management of sites;*
> - *how lack of institutional capacity limit progress with the management of transboundary risks;*
> - *how general resource deficiencies (finance, equipment, technical capacity and so forth) place restraints on execution of works;*
> - *pathways for stakeholder consultation that function best;*
> - *models for industry/community cooperation that function best;*
> - *technical knowledge gaps that prove most critical for success;*
> - *models for financing risk amelioration;*
>
> *The scoping of any pilot projects within the region should take place pursuant to activities focused upon data collection and capacity building needs. Proposals to undertake such projects, and the determination of the specific objectives of any such projects can only take place if the desire to undertake such is expressed by representatives of the affected countries".*

TABLE OF CONTENTS

1. ENVIRONMENT, SECURITY AND MINING FOR CLOSURE

This document aims to present a basis for action within South Eastern Europe (SEE) and within the Tisza River Basin (TRB) towards the development of corporate practice, regulatory frameworks, governance guidelines and/or financial and insurance markets suitable for the support of a modern mining industry. In particular, this document wishes to present a number of options and ideas that can be applied to address the funding and execution of mine closure and mine rehabilitation while still achieving conditions suitable for new and ongoing mining activities.

It is perceived by the Environment and Security (ENVSEC) Initiative partners that the efforts by international bodies to address this issue and provide guidance to national and international institutions in their role as stakeholders in mining activities remain insufficient. This important deficiency in international action has serious implications for the SEE/TRB region.

As part of this process the draft document was launched at the *Sub-regional Conference on "Reducing Environment and Security Risks from Mining in South Eastern Europe and the Tisza River Basin (TRB)"* conducted in Cluj-Napoca, Romania, 11-14 May 2005.

The sub-regional conference drew high-level participation of Mr. Klaus Toepfer, UNEP Executive Director, Mrs. Sulfina Barbu, Minister of Environment and Water Management of Romania, and Mr. Miklos Persanyi, Minister of Environment and Water of Hungary. It was attended by representatives from a range of countries and jurisdictions including: Albania, Bosnia and Herzegovina, Bulgaria, The former Yugoslav Republic of Macedonia, Romania, Serbia and Montenegro and Kosovo (territory under UN administration), Romania, the Slovak Republic, and Hungary.

The objective of the Conference was to draw up an action programme to reduce environment and security risks from mining in the region, including further assessment and pilot projects at high-risk sites, and endorse guidelines for sustainable mining and closure of mines. The event concluded with the signing of Declaration of the High-Level Panel of the Sub-regional Conference included as Appendix A to this report.

The declaration welcomes the Environment and Security Desk Assessment Study *"Reducing Environment and Security Risks from Mining in South Eastern Europe"* (Peck, 2004) and the UNEP report *"Environmental Assessment of the Tisza River Basin"* (Burnod-Requia, 2004) as a basis for priority setting and action planning towards reducing and mitigating the environmental, health and security risks from mining in South Eastern Europe and the Tisza River Basin. Further, it welcomes and endorses this document – the Environment and Security report *"Mining for Closure: policies, practices and guidelines for sustainable mining and closure of mines in South Eastern Europe and the Tisza River Basin"* – as a guide and checklist for reducing and mitigating the environmental, health and security risks from mining practices.

This document has the following form: Section 1 of this document seeks to outline the challenge and the need for this work; Section 2 is then used to establish the rationale for best environmental practice in mining – or *Mining for Closure* as it will be termed here; Section 3 the outlines the important stakeholders in mining and a manner of assessing their relative salience; Section 4 provides a discussion of the mechanics of mine closure and abandonment; Section 5 then presents a summary framework or principles for mining in SEE/TRB and delineates the next steps forward.

1.1 INTRODUCTION

Increasing expectations for environmental protection, desires for reduced human health risks, competition for land, and the increasing value of the natural environment as recreational space have led to marked improvements in regulatory requirements and mining practice in a number of countries. Many miners have introduced management policies, practices and technologies that markedly reduce the environmental harm caused by mining (Environment Australia, 2002b; Gammon, 2002;

Miller, 2005). When viewed in combination with growing desires to preserve land areas as a repository for valuable biological assets, for natural environmental services and for aesthetic appeal, these developments appear likely continue to drive continued improvement in mining practice.

As a part of this positive trend, mine planning, mine closure practices and the conduct of mine operations to facilitate environmentally and socially acceptable closure have also evolved significantly in recent years. While in the past communities often saw that the only choice available was whether a deposit should be mined or not, it has been clearly shown that the manner in which a mine is planned can have major positive influences on the magnitude and duration of impacts over the life of the development and following its closure (Environmental Protection Agency, 1995a, p. 2). In this context, the title *Mining for Closure*[5] chosen for this document is *not* intended to indicate that existing mining activities should be ceased, and future mining activities curtailed significantly. To the contrary, the mining sector is a very important contributor to local and national economies (Nazari, 1999). Further, the extractive industries will continue to underpin the economies of many countries in the future. As such, ongoing and new developments to process and mine the mineral resources of "mining nations" will be vital for many of them to pursue sustainable development. In recognition of this importance, this document is intended to help facilitate mining policy development, capacity development and institutional development so that they can yield a sustainable mix of social, economic, and environmental outcomes from mining. The key focus of this document is upon countries in SEE/TRB, however much of the material and ideas presented here are intended to be generic.

However, while many positive developments have taken place, it cannot be ignored that the major motivating factors behind improvement of existing and new mining activities are the extensive and problematical legacies of abandoned mines and their associated environmental and social problems (Balkau, 2005a, 2005b; U.S. Department of Interior, 1998).[6] Countless thousands of these mining legacies exist around the world and while marked improvements can be noted in the management of ongoing and planned mining developments, the "making good" of past mining sins has been far less impressive. Relatively few of these orphaned or abandoned mines have been restored. The mining sector constitutes a very important contributor to local and national economies in Central and Eastern Europe (CEE) and SEE/TRB. However, in parts of these regions, the mining sector has often been characterised by inappropriate planning, operational and post-operational practices. Moreover, such activities have taken place within inadequate regulatory frameworks. Inadequate implementation of mine rehabilitation and closure activities has been one outcome of note (Nazari, 1999).[7] In the focus region for this document, this has resulted in and continues to cause – significant adverse environmental, health and safety, social and economic impacts and related liabilities (Burnod-Requia, 2004; ICPDR/Zinke Environment Consulting, 2000; Nazari, 1999; Peck, 2004).

In addition to these problems, the contribution that mining can deliver to such Economies in Transition (EiT) is also compromised for other reasons. In 1999, the European Bank for Reconstruction and Development (Nazari) reported that in many EiTs where there are significant mining activities, the lack of implementation of mine closure activities has resulted and continues to result in significant adverse environmental and health and safety impacts. Such failure was normally as a result of financial constraints. It should be noted that the finan-

5. According to Gilles Tremblay, Program Manager, Special Projects with Natural Resources Canada (personal communication: Natural Resources Canada, 2005, 2 August), "Mining for Closure" as presented in this document is very similar to the concept of "Design for Closure" and/or "Operate for Closure" utilised elsewhere. He indicates that the term "Design for Closure" was actively promoted by John Gadsby, a consultant from British Columbia, Canada and he used that in a foreword to a volume on Acid Drainage published in 1990 (Gadsby, Malick, & Day, 1990). According to Tremblay, Canadian actors used such terminology extensively during the 1990s and it was mostly focused on reducing the environmental liabilities at the time of closure. Further, he reports that as part of the Seven Questions to Sustainability Task of the North American MMSD (Mining Metals and Sustainable Development) Regional Process it was realized that to test the contributions of a mining project to Sustainable Development one should change the concept to "Design and Operate for Post-Closure". The mine then becomes a bridge between the pre-mining and post-mining physical and human environment (for green field projects) and served as a powerful way of looking at the contributions of mining to SD.

6. It must be stressed; that the "closure" (or lack thereof) as conducted by the parties that were active at the majority of abandoned and orphaned mines discussed within this document met the environmental requirements imposed (or not imposed) on them at the time of mining and minerals processing activity. While we find that there have been major improvements in the more industrialized countries – such was accepted practice at that time.

7. Then Principal Environmental Specialist, European Bank for Reconstruction & Development (EBRD)

cial, environmental and social liabilities associated with such sites also pose a barrier to development in such jurisdictions. In contrast to countries that have already implemented 'good international mining practices', and despite significant progress since that time, these EiTs have yet to develop sufficiently sophisticated corporate governance, regulatory frameworks, or financial and insurance markets to adequately address mine closure rules or funding.

Among other things, Nazari (1999) indicates that this leads to:

1. delays in developing projects and investments in this sector,
2. potentially inequitable distribution and externalization of closure costs,
3. costly and time consuming tailor-made solutions on a case-by-case basis, and
4. differentiating, and possibly creating the impression of 'penalising' investors seeking financing or political risk insurance through International Financial Institutions.

Addressing the last point, it should be noted that international financial institutions typically require consideration of closure related issues. As a result, investors seeking finance from such sources may be disadvantaged in their endeavours when compared to those potential miners accessing alternative capital markets with more limited requirements relating to closure funding.

The development of corporate governance, regulatory frameworks, financial and insurance markets to address the funding of mine closure is further complicated by involvement of some "junior investors", who unlike many major mining companies, have only limited resources to back up the mining company's obligations, and have significantly lesser sensitivity to other factors driving responsible behaviour such as reputational risks. Such actors are more prevalent in EiTs than in more developed mining nations.

Despite the relevance of these issues and the pressing nature of the challenges, the nature of discussions surrounding the advancement of mining in the region is presently somewhat compromised. As such, it is expected that a key outcome of this document should be a more open and informed debate surrounding the need for mining and the ability of mining to serve as a valuable economic driver for development while still maintaining or even improving the environment.

Bor smelter – Serbia
Photograph by EnvSec

1.1.1 KEY TERMS UTILISED WITHIN THIS DOCUMENT

A number of terms are associated with mine decommissioning or closure depending on particular circumstances. Due to this variation in differing texts and jurisdictions – and due to the coining of a new phrase within this document (*Mining for Closure*), a number of key terms are clarified here.

Within this document, "closure" means more than the act or the moment of ceasing operations at a mine site. Rather, it implies a whole of mine life process that typically culminates in tenement relinquishment. As such, closure is interpreted here to be complete at the end of decommissioning and rehabilitation.[8] However, and as will be explained in this document, this does *not* necessarily imply the return of a site to the state in which it existed prior to mining, nor should it preclude that such activities are carried out while mining is ongoing. To the contrary, ongoing rehabilitation of active mining sites – while mining operations are underway – is considered vital.

The term *"Mining for Closure"*, is intended to be both inclusive and flexible. It is intended to imply that mining operations can take place in such a way that "rehabilitation" has been substantially achieved at the time of closure; that activities to deal with mining legacies on a mining lease may be combined with ongoing or proposed mining operations; that special partnerships to deal with mining legacies can be combined with proposed or ongoing mine activities; that situations can be facilitated where non-miners can form partnerships to rehabilitate or valorise mining legacies, and so forth. Further, it is intended that this term evolve as its content becomes more apparent in the field.

To support these ideas, the following definitions provided for the purpose of this report are largely based on those presented in texts such as the Strategic Framework for Mine Closure (ANZMEC MCA, 2000) and a recent Canadian report (Cal Data Ltd., 2005)[9]. The reader is referred to the definitions overleaf and Figure 1 1, which describes mine site status as used within this document.

- **Active mine site** – a site where mineral exploration, mining or processing is ongoing with relevant and proper regulatory approvals in place.
- **Closing mine site** – a mining operation where cessation of operations is anticipated within less than 2 to 5 years.
- **Idle or Inactive mine site** – all mineral sites where minerals exploration, mining or processing has ceased. Thus all mine sites not considered active.
- **Closed mine site** – (generally) a former active mining site where mineral exploration, mining or processing has concluded and all current appropriate regulatory obligations have been satisfied. However, (specifically) within this document, the definition of a closed mine site will be extended to encompass best practice considerations of *"Mining for Closure"* as developed throughout the document.[10]
- **Mine Closure** – (generally) a whole of mine life process that typically culminates in tenement relinquishment (generally, after a legally binding sign-off of liability). Closure (generally) is deemed to be complete at the end of decommissioning and rehabilitation and where and all current appropriate regulatory obligations have been satisfied. Within this document, the definition will be extended as indicated above.
- **Neglected mine site** – An idle or inactive site that has *not* been closed and has no clear and *obvious* owner but that *may* still be held under some form of title and where all current appropriate regulatory obligations have *not* been satisfied. This definition can include sites where regulation changes have led to closure parameters being imposed after the site became inactive.
- **Temporary Closure** (An Idle/Inactive mine site under Care and Maintenance) – the phase following temporary cessation of operations when infrastructure remains intact and the site continues to be managed. The site is still held under some form of title and all current appropriate regulatory obligations for closure have *not* been satisfied. When being maintained in some way with a view to future resumption of

8. In some definitions, the term closure does not imply any particular level of site clean-up *after* operations cease and the terms such as "rehabilitation", "restoration" and "reclamation" are used to imply "post-closure" improvement of the site to a desired standard.
9. Albeit with different terminology to both reports and with extended and substantially altered definitions – particularly with regards to the distinction between abandoned and orphaned mine sites and "mine closure".
10. With relevant limitations, arguments will be presented later in this document, that a mine will achieve "closure" when measures have been put in place that are designed so as to ensure that: future public health and safety are not compromised and environmental resources are not subject to abnormal physical and chemical deterioration in the long term. As the intent of this document is informative and general, legal definitions will not be sought.

operations, such sites are frequently referred to as being under care and maintenance.

- **Abandoned mine site** – an area formerly used for mining operations (an idle/inactive site) that is neglected and whose legal owners still exist and can be located.
- **Orphaned mine site** – abandoned mining operations or facilities for which the responsible party no longer exists or cannot be located.
- **Mine Decommissioning** – the process that begins near, or at, the cessation of mineral production. This term is often used interchangeably with Mine Closure but here refers to a transition period and activities between cessation of operations and final closure.[11]
- **Rehabilitation** (Reclamation) – the return of the disturbed land to a stable, productive and/or self-sustaining condition, taking into account beneficial uses of the site and surrounding land.
- **Progressive Rehabilitation** – A process referring to the ongoing rehabilitation of mine sites and mineral related facilities during the operational life of a facility. Progressive rehabilitation may include works such as re-vegetation of areas disturbed during project development and operations, re-vegetation of abandoned or filled mine waste areas including tailings impoundment areas; removal and/or disposal of any obsolete structures and materials as per a final rehabilitation and closure plan; backfilling of approved underground or surface excavations using mill tailings to reduce tailings impoundment areas; methods to reduce or eliminate soil erosion and stabilization of the site which will facilitate re-vegetation and reclamation; placement of waste rock in the underground workings or open pits, or by covering the waste rock with till or topsoil and then re-vegetating in an acceptable manner, and so forth.
- **Mining legacy** – (orphaned mines) abandoned mining operations or facilities for which a responsible party no longer exists or cannot be located. The term mining legacies can often refer to a very much older site, where minerals operations have ceased decades, or even centuries ago. For reasons of its generality in the literature, this term is used loosely in this report.[12]

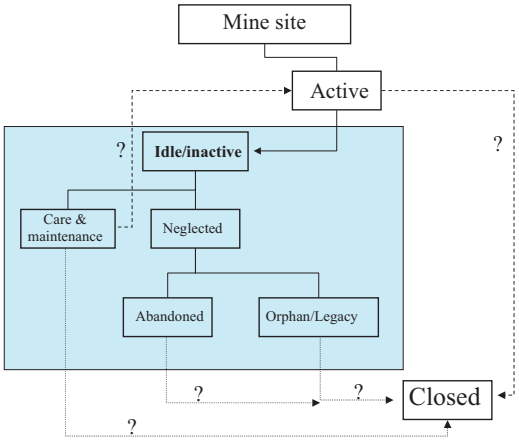


Figure 1.1 **Mineral site status diagram for this document**[13]

Another very important term and concept utilised in this document is *"best practice environmental management in mining"*. In general, the usage of this term (and the shorter term *"best environmental practice mining"*) is intended to capture the management ethos portrayed in a series of more than twenty booklets published by the Australian Government's Department of Environment and Heritage. Each booklet seeks to describe best practice for a particular key aspect of environmental (and indeed, social) management as applied by Australia's

11. The concept of mine closure is an issue by itself. However, an in-depth analysis is not within the scope of this report. For a more complete analysis of the concept of mine closure see Mudder, Terry and Kevin Harvey, Closure Concepts. Mineral Resources forum, UNEP, 1999. "There are many different words used to describe closure including decommissioning, reclamation, rehabilitation, and post-closure. In this paper, decommissioning is referred to as the transitional period between cessation of operations and final closure. Reclamation refers to the physical aspects of earth moving, regarding and revegetation. Rehabilitation is another word for closure used primarily in countries other than the United States. Closure is a term reserved for the point in time at which revegetation has been completed, excess solutions have been eliminated to the extent practical, the maximum degree of passive management has been implemented, and a final surface and/or ground water monitoring programme has been initiated."

12. In many instances throughout the literature, the term "legacy site" is used somewhat interchangeable with "orphan site" and even with "abandoned site". Universally, its usage is also applied in the general sense (such as "legacies of the past" and "legacies of mining"). In the Caldata report cited above, "legacy" has been redefined as an equivalent to "abandoned" for this report. For reasons of the general application of the word "legacy", that definition will be avoided. In essence within this discussion, a legacy site is an orphan site, but the term can *also* encompass a site where regulatory obligations (if they ever existed) for site reclamation were fulfilled at the time of activity cessation (and thus where the tenement has been relinquished and liability – if it ever existed – extinguished) but where whatever reclamation performed was insufficient to render the site "closed" as termed in this document (and as developed throughout this document).

13. Question marks (?) in this diagram indicate that the actual pathway to be followed is unknown, or can be influenced.

leading environmental managers in mining. These booklets have been available electronically and in hard copy and from 1995 to 2000 have been distributed to over sixty countries around the world.

> *An important component of best practice is the ability to be flexible in devising solutions which match site-specific needs in terms of the types of mining operation, climate, topography, the sensitivity of the surrounding environment, and social requirements, which deliver outcomes consistent with sustainable development principles and objectives (Environmental Protection Agency, 1995b).*

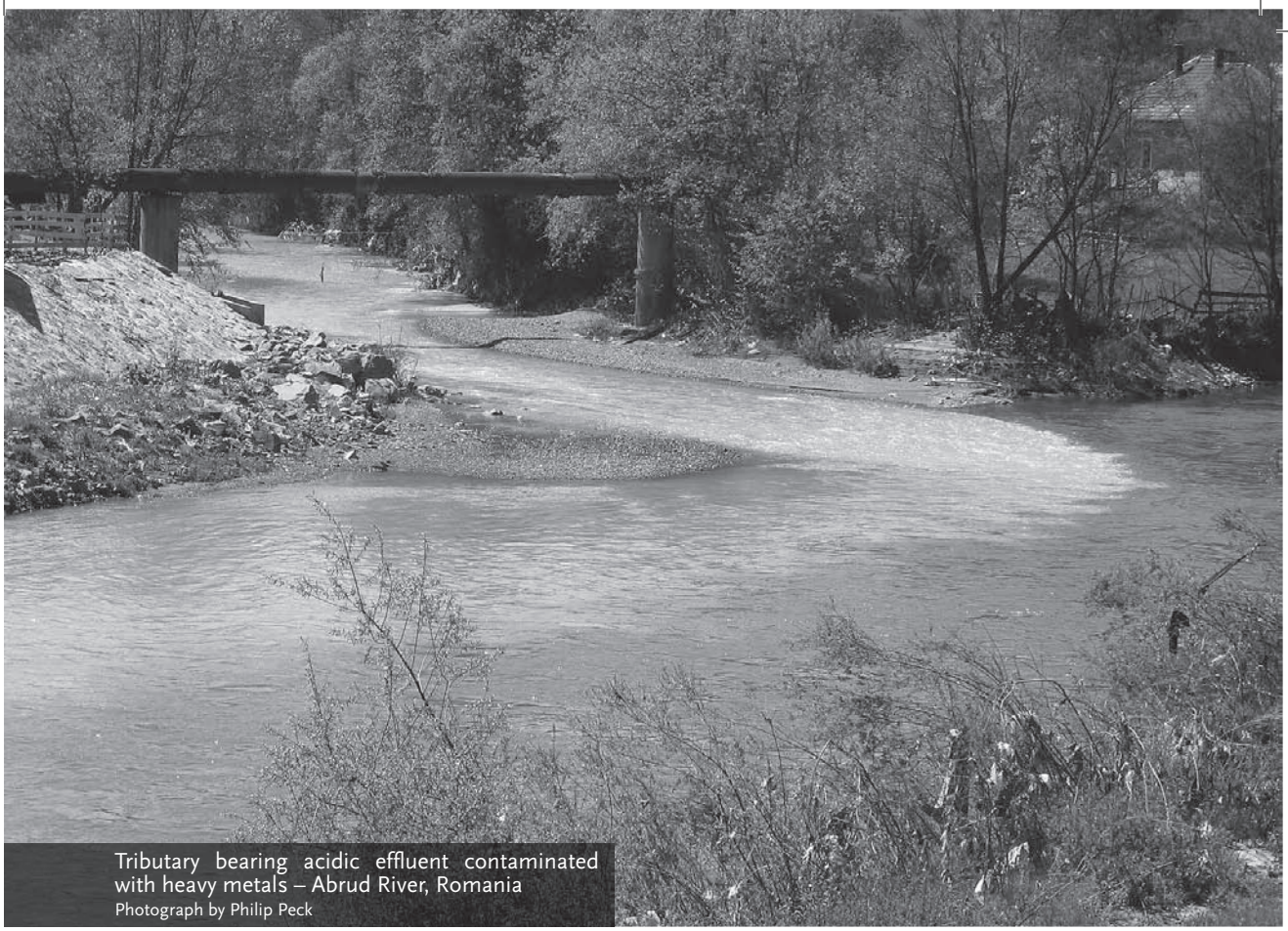
Best practice environmental management in mining focuses on the principles of environment impact assessment and environmental management. The booklets use case studies to demonstrate how these principles can be integrated through all phases of resource development from pre-exploration planning, through construction, operation, closure and post-mining monitoring and maintenance. The resources developed by the Best Practice Environmental Management in Mining programme are available free of charge on the Internet.[14]

Finally in this introduction of important terms, a very limited set of terms describing important physical parameters of mining and environment are provided. These parameters are referred to explicitly and implicitly throughout this entire document. Key reference sources utilised in the generation of this document and/or considered important resources for actors wishing to pursue the topic further are also included here.

- **Acid Drainage** – Also commonly referred to as Acidic Drainage, Acid Mine Drainage (AMD) or Acid Rock Drainage (ARD). Acid drainage arises from the oxidation of sulphide minerals and often occurs when such minerals are exposed to the atmosphere by excavation. Incident rainfall or surface water is acidified when acid-forming compounds dissolve. Effects include acid drainage from waste rock stockpiles and tailings, development of acid conditions in exposed surface materials, increased solubility and or release of metals, and increased salinity or solute loads in waters.
- **Tailings** – Residue from metallurgical processing (process wastes), mainly comprising finely ground rock. When ore bodies are extracted the valuable mineral is surrounded by gangue (uneconomic material) that needs to be separated in a concentrating process. Crushing and grinding methods are used to reduce the mined ore to sand and silt sizes, and then the concentrating process for the valuable minerals can begin. Tailings contain residual target minerals and also often contain process chemical residues.
- **Tailings dams** – Engineered holding and storage areas for process wastes (tailings), also referred to as Tailings Storage Facilities, Process Waste Storage Facilities, Tailings Management Areas (TMAs), Tailings Retention Systems and more. Tailings dams are similar to conventional water dams in that they are designed to be a retaining structure. However, a tailings dam is designed to retain water and solids, whereas a conventional dam retains only water.
- **Surplus Rock or Waste Rock** – Rock that must be extracted to reach economic ore but does not contain significant commercial mineralization. While not as highly mineralized as target ore, such rock can also contain metals and sulphide minerals that contribute to the environmental problems listed above.

Among the many potential or actual environmental impacts related to mining and minerals processing mentioned or discussed in this document, the topic of acidic drainage is of particular importance – particularly because of the considerable liabilities associated with this phenomena. In the SEE/TRB context, acidic drainage is a priority due to its demonstrated potential for trans-boundary pollution in the region (Peck, 2004), the potential ultra-longevity of its impacts, and its widespread prevalence. The general manner in which it is perceived that these terms should be interpreted, how such matters should be approached, and some important supporting information resources are also very briefly

14. They include a series of booklets, a series of checklists designed to provide guidance to regulators and industrial actors and the joint Environment Australia/UNEP Best Practice Environmental Management in Mining Training Kit. The Training Kit is designed to help trainers plan and deliver effective training aimed at improving the environmental performance of minerals operations. The different volumes in the Kit give extensive references to further information, including that which is available from the Sustainable Minerals series e-booklets. Environment Australia developed this training kit in conjunction with the United Nations Environment Programme (UNEP), to move the Sustainable Minerals programme into a new phase. It assists trainers in developing training sessions based on the Sustainable Minerals booklets and provides presentation slides, notes, a selection of case studies and worksheets. UNEP has sought to ensure the kit's international focus, particularly in promoting awareness of Sustainable Minerals techniques in developing countries. See http://www.deh.gov.au/industry/industry-performance/minerals/training-kits/index.html.



Tributary bearing acidic effluent contaminated with heavy metals – Abrud River, Romania
Photograph by Philip Peck

introduced here (as Best Practice Environmental Management was in the preceding text section).

In this instance a huge body of work has been performed internationally. As one prominent example, the Canadian MEND programme and its technical literature outputs are highlighted as a source of prominence.[15] In response to the projected high liabilities facing the Canadian mining industry from acidic drainage from the oxidation of sulphide minerals,[16] the Canadian mining industry, the Canadian federal government and eight provincial governments joined forces in 1989 to form the Mine Environment Neutral Drainage (MEND) programme.[17] Acidic drainage is recognized as the largest environmental liability facing the mining industry and, to a lesser extent, the public through abandoned mines. MEND was implemented to develop and apply new technologies to prevent and control acidic drainage and tremendous progress has been made. The target is for new mines to open without long-term concerns about acidic drainage upon closure. The MEND manual in particular, summarizes the work completed by MEND in a format that provides practitioners in Canadian industry and government – and in other interested jurisdictions – with a manageable single reference document. The document is not a "How to" manual. It is a set of comprehensive working references for the sampling and analyses, prediction, prevention, control, treatment and monitoring of acidic drainage. The document provides information on chemistry, engineering, economics, case studies and scientific data for mine and mill operators, engineering design and environmental staff, consulting engineers, universities and governments.

Explanations and definitions for other terms utilized within the mining and minerals industry that are also utilized within this report or its references, are included at the end of this document.

15. MEND has over 200 technical documents available. Technical reports published under the auspices of MEND are available both in electronic and print formats - see http://www.nrcan.gc.ca/mms/canmet-mtb/mmsl-lmsm/mend/mendpubs-e.htm

16. In 1999, this phenomena was recognized as the largest environmental liability, estimated to be between $2 billion and $5 billion, facing the Canadian mining industry (Tremblay, 1999).

17. See http://www.nrcan.gc.ca/mms/canmet-mtb/mmsl-lmsm/rnet/indart-e.htm and http://www.nrcan.gc.ca/mms/canmet-mtb/mmsl-lmsm/mend/default_e.htm

1.2 ENVSEC AND MINING IN SOUTH EASTERN EUROPE

Environment and Security (ENVSEC) is an Initiative of three organizations – the United Nations Environment Programme (UNEP), the United Nations Development Programme (UNDP), and the Organization for Security and Co-operation in Europe (OSCE). The North Atlantic Treaty Organization (NATO) is an associate partner in the Initiative.

The Initiative is aimed to provide a framework for co-operation on environmental issues across borders and promoting peace and stability through environmental co-operation and sustainable development. The Initiative focused on the three pilot regions: Central Asia, the Caucasus and South Eastern Europe/Tisza River Basin.

The Initiative is structured in three distinct but interlinked pillars, dealing with: vulnerability assessment and monitoring; capacity building and institutional development; and policy development and implementation.

After the launching of the Initiative at the Kiev "Environment for Europe" Ministerial Conference in May 2003, and preparation of the regional report on environment and security priorities in SEE/TRB, the ENVSEC Partners, in consultations with the countries in the region, have developed the following priority fields of action:

- Managing and reducing trans-boundary risks of hazardous activities.
- Management of trans-boundary natural resources.
- Crosscutting issues (awareness, information, education, etc.).

The identified fields of action, including project proposals, were presented at and confirmed by "the ENVSEC Consultations on SEE", held in Skopje, the Former Yugoslav Republic of Macedonia on 23 -24 September 2004. A rapid Environmental Assessment of the Tisza River Basin was presented to the International Commission for the Protection of the Danube River in December 2004. These topics were again confirmed at the *Sub-regional Conference on "Reducing Environment and Security Risks from Mining in South Eastern Europe and the Tisza River Basin (TRB)"* conducted in Cluj-Napoca, Romania, 11-14 May 2005 where the full drafts of both this document, the desk assessment of security risks posed by mining *Reducing Environment & Security Risks from Mining in South Eastern Europe* (Peck, 2004), and the final version of the *UNEP Rapid Environmental Assessment of the Tisza River Basin* (Burnod-Requia, 2004) were also presented.

Within the ENVSEC initiative, South-Eastern Europe covers Albania, Bosnia and Herzegovina, Bulgaria, Croatia, The former Yugoslav Republic of Macedonia, Romania, Serbia and Montenegro and Kosovo (territory under UN administration). The Tisza River Basin includes Romania, Ukraine, Slovak Republic, Hungary, and Serbia and Montenegro. The past decade of war, conflict and transition has left the region with a legacy of inadequate growth, declining living standards and high environmental stress. The region is significantly affected by heavy industrial pollution in urban-industrial areas, intensive agriculture with yet uncalculated health impacts, a lack of water technology and infrastructure, and industrial pollution from the resources and mining sector. Shared resources such as transboundary lakes and rivers as well as biodiversity (e.g. in the Carpathian mountains with a particular focus on the TRB) pose both a challenge and opportunity for cooperation.

There is growing understanding that environmental degradation, inequitable access to critical natural resources and transboundary movement of hazardous materials increase tensions between nation-states and thereby pose a risk to human and even national security. For example transboundary pollution often affects negatively the relations between neighbouring states. Also health risks and involuntary migration due to water scarcity, uncontrolled stocks of obsolete pesticides or other forms of hazardous waste have been identified as threats to stability and peace.

Ongoing disputes and disagreements over the management of natural resources shared by two or more states, can deepen divides and lead to hostilities. However, common problems regarding the use of natural resources can also bring people together in a positive way. Communities and different nations can build confidence with each other through joint efforts to improve the state and management of nature. Environmental co-operation can thereby act as an important means for preventing conflicts and promoting peace between communities.

ENVSEC consultations in Belgrade in 2002 led to a first assessment of environment and security inter-

actions. This was continued with a regional meeting in Skopje in 2004 where priorities were confirmed and further work suggested. This included the assessment of regional cross-border risks from mining and industry, improved management of common river basins (e.g. Tisza, & Sava), and the promotion of nature conservation as a tool to encourage regional cooperation.

Current or planned activities include rehabilitation of most prominent hot-spots (e.g. a feasibility study for closing the Lojane mine in FYR Macedonia) and fostering cooperation in the Tisza and Prespa international basins. Further, and as has been mentioned, a desk assessment of security risks posed by mining, particularly by residual mining wastes and pollution, was performed during 2004.

Among the outstanding environmental, social and economic challenges confronting the mining industry and affected communities – that of abandoned and orphaned mine sites[18] has been particularly slow to be tackled. The potential costs of rehabilitation on a wide scale, the lack of clearly assigned (or assumed) responsibility, the absence of criteria and standards for rehabilitation, as well as other factors, have delayed action by both the industry and by public authorities. Further, (as has been intimated) that the efforts by international bodies to address this issue and provide guidance to national and international institutions in their role as stakeholders in mining activities remain insufficient. This important deficiency in international action has serious implications for the SEE/TRB region.

1.3 WHY IS THIS DOCUMENT REQUIRED?

The ENVSEC Initiative seeks to facilitate a process whereby key public decision-makers in South Eastern and Eastern Europe, Central Asia and Caucasus are able to motivate action to advance and protect peace and the environment. In the context of this ENVSEC project, this should occur via the collaborative articulation and adoption of policies, practices and guidelines for sustainable mining practices, *Mining for Closure*, and closure of mines so as to aid the reduction of environment and security risks in SEE/TRB.

This document has the aim:
to support the articulation and adoption of policies, practices and guidelines for sustainable mining practices, *Mining for Closure* and closure of mines for the reduction environment and security risks in South Eastern Europe.

This document has the objectives:

1. to present principles, ideas and guidelines for mining policy development, capacity development and institutional development that can yield a sustainable mix of social, economic, and environmental outcomes in the SEE/TRB region with key foci being:
   - operation of existing and new mining operations in order to ensure and facilitate cost-effective closure that fulfils acceptable sustainability requirements;
   - re-mining or otherwise valorising abandoned or orphaned sites in order to make safe and/or remediate and close them (including finding other uses/economic value from sites);
   - closure, making safe and/or remediation of abandoned or orphaned sites;
2. to support the ongoing assessment of transboundary environmental and human safety risks posed by sub-standard mining operations – both active and abandoned; implementation of risk reduction measures through demonstration at selected sites, evaluation and testing of possible policy changes and transboundary cooperation mechanisms.

1.4 CHALLENGES IDENTIFIED IN PREVIOUS UNEP STUDIES[19]

As will be demonstrated throughout this document, a large number of mining related studies as produced by a large range of social actors – from Government to community interest groups – have underlined the importance of managing a plethora of environmental, social and developmental challenges related to mining activities. Mining legacies

18. Within this document, abandoned mines are deemed to be those where rehabilitation is incomplete but whose legal owners still exist. Orphaned sites, on the other hand, refer to abandoned mines for which the responsible party no longer exists or cannot be located while idle mining assets refer to abandoned mines that are currently under some form of care and maintenance.

19. At the time of writing, the draft desk-assessment report, titled *Reducing Environment & Security Risks from Mining in South Eastern Europe: Desk-assessment study for the Environment and Security Initiative Project* and *The Rapid Environmental Assessment of the Tisza River Basin* is are available via the Environment and Security initative's web portal at www.envsec.org.

are clearly identified as a key issue within this topic. The ENVSEC initiative has also been active on this front and this short section relates to that work.

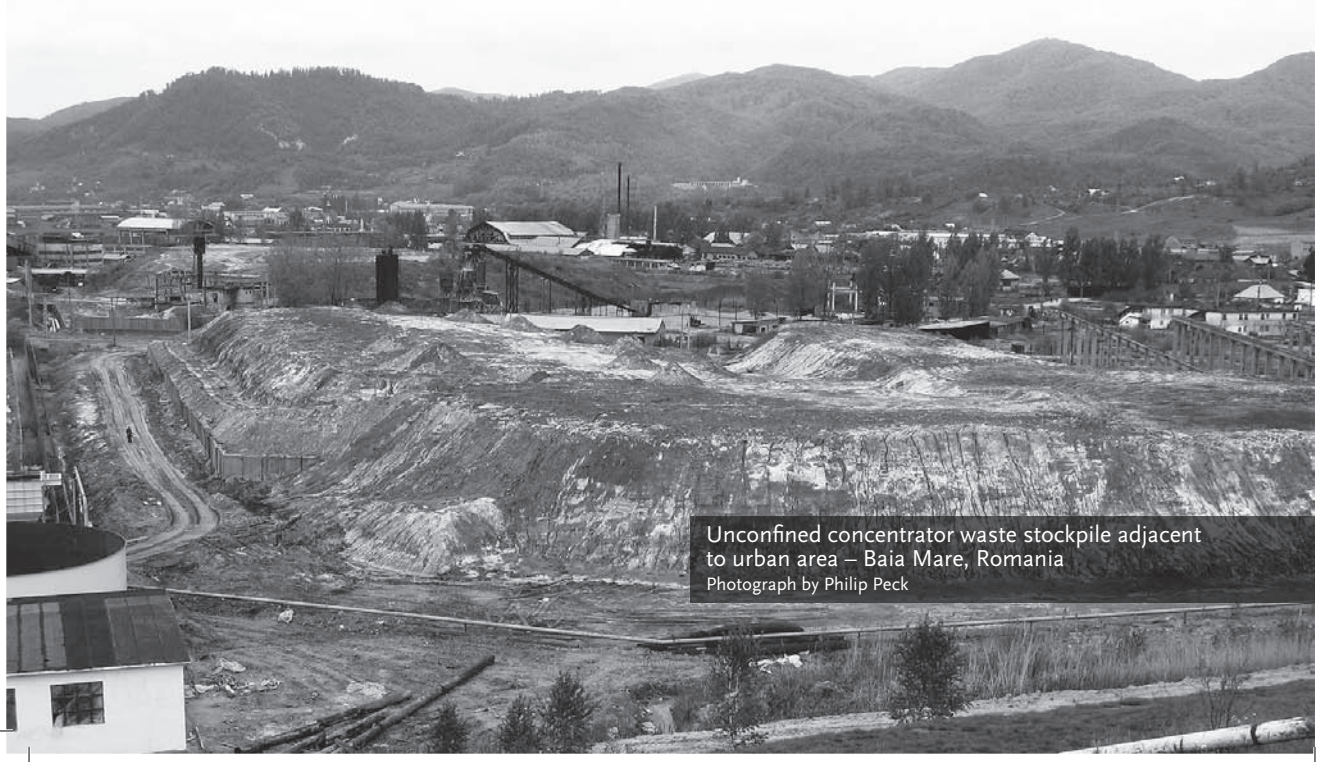
A desk assessment of security risks posed by mining, and particularly those associated with pollution from residual mining wastes *Reducing Environment & Security Risks from Mining in South Eastern Europe* (Peck, 2004) and the *UNEP Rapid Environmental Assessment of the Tisza River Basin* (Burnod-Requia, 2004)[20] both generated during 2004, showed clearly that there are a large number of mineral resource related sites that are of high hazard in the SEE/TRB area. Further, evidence was found that many have significant risks associated with them that threaten the environment, public health and safety, and/or regional socio-political stability in the SEE/TRB countries addressed by the studies.[21] Moreover, it was found that mining and minerals processing operations addressed in the study can affect (and are affecting) the surrounding environment and communities via:

- airborne transport of pollutants such as dust, smelter emissions, gases, vapours;
- mass movement of "solid" wastes (generally tailings containing heavy metals and toxic compounds);
- mass movement of liquid, or semi-liquid wastes (again, generally tailings containing heavy metals and toxic compounds);
- waterborne transport of wastes as suspended solids and as dissolved materials.

Among the sites and operations examined in the study, it was clear that the dominant pathway of exposure – at all levels of interest – is via waterways (fluvial transport) and that the dominant hazards were posed by large tailings impoundments. While airborne toxic emissions from smelters transported in the atmosphere have been a very significant issue in the past, the regional and transboundary importance of airborne emissions appear to have generally reduced in importance.[22]

The overriding importance of fluvial transport mechanisms for tailings wastes in transboundary pollution risks bears several implications with it. To name but a few – very large volumes of materials can be involved with catastrophic damage to downstream land, property and ecosystems associated with the physical impacts of such accidents; biochemical, and eco-toxicological effects of these pollutants can be catastrophic and can extend far beyond the zone physically affected by such materials; the physical and biochemical, and eco-toxicological effects can be very long term.

20. Also building upon an important earlier report from the International Commission for the Protection of the Danube River (ICPDR/Zinke Environment Consulting, 2000).
21. Albania, Bosnia & Herzegovina, Kosovo (Territory under UN interim administration), Macedonia, Serbia and Montenegro.
22. Although sites such as RTB Bor in Serbia and a range of others are still operational, a number of smelter operations have ceased operations, or are closed until such time that acceptable levels of emission can be achieved through upgrading of plant, or have undergone significant emissions control upgrading pursuant to foreign investment.



Unconfined concentrator waste stockpile adjacent to urban area – Baia Mare, Romania
Photograph by Philip Peck

1.5 AN AGENDA FOR THIS DOCUMENT

At the outset it is reiterated that a fundamental point of departure for this document is the view that ongoing mining activities are vital to sustainable development and environmental protection in the SEE/TRB in general. This is a view shared in varying degrees by development agencies such as the World Bank Group (Onorato *et al.*, 1997; Strongman, 2000) and federations of environmental groups such as the European Environmental Bureau (European Environmental Bureau, 2000). As such, a simplistic statement might be that this document seeks to fill an important gap as an apolitical *"back to mining" guide*.

Further, this document will seek to address key need areas to support the "next steps forward" at both local (national) scale and in a transboundary and regional perspective that were presented within the Desk-assessment study for the Environment and Security Initiative Project generated in 2004 (Peck, 2004) and some of the key items within the Rapid Assessment report (Burnod-Requia, 2004). It must seek to provide information and guidance for regional decision makers on how they can move policy instruments (measures) forward in the key influential areas listed in the previous section.

Box 1 **Policy Instruments**

The first group are so-called **regulative or coercive instruments**. Here, a policy goal is achieved through a legislative framework set by government. Such frameworks specify what various actors are allowed to do or not to do. Further, they specify how certain activities should be conducted.

A second group called **economic or utilitarian instruments** intend to have a steering effect towards a planned goal. Through giving incentives (both in financial or non-financial terms) aiming at certain activities it becomes advantageous to adopt certain (desirable) behaviour.

The third group are so-called **informative instruments**. The provision of information through awareness raising campaigns or education aims to combat lacks of information and thus enable people to act in a certain (more rational) manners.

In order to clarify what is meant by policy instruments in this regard, excerpts are supplied in Box 1 after Lindhqvist (2000, p. 41) who divides policy instruments into three different groups.

In addition to the above, prevailing social norms or imperatives also contribute to the achievement of policy related goals. Such norms describe the overall values a society has or the way a society usually acts. Individuals or groups in the society are expected to behave according to the prevailing imperatives (DiMaggio and Powell, 1983:152). Social norms can be described as a condition rather than a policy instrument in this context but it is held that policy interventions can influence norms and vice versa.

Thus, within this document it is sought to aid the development of *inter alia*:

- legal and/or regulatory frameworks for key mining actors (coercive regulatory instruments);
- utilitarian measures designed to provide material incentives for improved performance;
- measures intended to supply or enhance capacity within the mining sector and the regulatory frameworks that enfold it;
- manners in which the norms (accepted and anticipated behaviours) of industrial, regulatory and social actors can be influenced in order to promote improved mining performance.

The brief work agenda presented in this document is principally drawn from the Desk Study (Peck, 2004) and from the Tisza Rapid assessment (Burnod-Requia, 2004). It is intended that this document provide a basis – or direction – for action among regional decision-makers, policy makers, and leading industrial actors in four key areas.

Action area 1: risk reduction at abandoned or orphaned sites – actions among regional actors that can facilitate the reduction of the very significant risks associated with non-operational, abandoned and/or orphaned sites where large quantities of physically and chemically unstable, and/or poorly contained mine wastes are stored. In particular the most significant risks are related to the mass release of tailings wastes to waterways and the ongoing generation of acidic, metals bearing effluents from such sites affecting both surface waters and groundwater.

Action area 2: risk reduction at operational sites – actions that can facilitate the reduction of the very

Tailings contaminated stream after tailings release – Macedonia
Photograph by UNDP, Macedonia

significant risks associated at sites of mining or minerals processing that are operational via capacity building for existing economic actors and industrial activities. A key part of this will be the development of an effective and efficient approach to the funding of closure that enables mine rehabilitation and other environmental, social or economic objectives to be achieved, and also facilitates and encourages industry to comply with the requirements of Government and the community.

Action area 3: development of new resources and re-mining aligned with sustainable development – actions that can stimulate development of institutional capacity, a culture of risk control, and markedly improved operational procedures throughout the region to create a norm of mine planning that encompasses mine closure plans as an integral part of a project life cycle. These shall be designed so as to ensure that: future public health and safety are not compromised; environmental resources are not subject to physical and chemical deterioration; the after-use of the site is beneficial and sustainable in the long term; any adverse socio-economic impacts are minimized; and to ensure that socio-economic benefits are maximized.

Action area 4: fostering of institutional frameworks for abandoned or orphaned site management and sustainable mining and minerals processing practice – further development of legislative frameworks addressing mining and minerals processing legacies; clear accountability (and jurisdictional remit) for the environmental, social and economic aspects of mining and minerals processing activities in the region; and the further development of institutions supporting transboundary risk management and/or disaster response.

As such, and as previously indicated, this document is intended to support "back to mining" initiatives. It will do so via the provision of basic ingredients or principles for the future generation of guidelines for mining within the SEE/TRB region and TRB. The actors that this document addresses and the general manner of intended application are detailed in Section 3. Prior to that material however, the next section will outline why actors such as the international mining community, national mining jurisdictions in leading mining nations, inter-governmental environmental bodies and international development agencies consider *Mining for Closure* and the issue of abandoned or orphaned sites to be so important to sustainable development around the world.

2. THE RATIONALE FOR WORKING TOWARDS "MINING FOR CLOSURE"

As stated in Section 1.3, this document seeks to address three distinct components of the interaction between mining, the environment and society in SEE/TRB. Similar to other mining related initiatives (c.f. ANZMEC MCA, 2000 for instance) it addresses the operation of existing and new mining operations. However, as distinct from such initiatives, *"Mining for Closure"* in this document is intended to encompass the stimulation and the creation of new and innovative frameworks to support the re-mining or otherwise valorising of abandoned or orphaned sites and the closure and making safe of such sites.

This document is intended to build on calls for such frameworks (see for example, Post Mining Alliance, 2005), and existing governmental advances in practice in some jurisdictions (see for example, Gammon, 2002).

Clark *et al.* (2000) summarises the challenge of a process he terms integrated mine closure as follows:

> *Comprehensive mine closure for abandoned mines, presently operating mines, and future mines remains a major challenge for virtually every mining nation in the world. To accommodate the need to close abandoned mines and to ensure that existing and future mines are appropriately closed will require the cooperation of a diverse stakeholder community, new and innovative methods of financing closure and major policy and legislative change in most nations to ensure post-mining sustainable development.*

Mining for closure requires recognition that mining is a temporary use of land, but that the nature of *potential* impacts can be exceedingly long term. Further, such impacts can negatively affect a wide range of stakeholders and economic development in addition to the ecological environment. *Mining for Closure* is a sustainability issue – not just an environmental issue.

As Robertson, Shaw and others (1998; 1998) note, the interest of a mining organization in the land generally terminates with the implementation of a closure plan – a closure plan that is generally focussed upon items such as optimized resource extraction, achievement of regulated environmental objectives and cessation of ongoing liabilities[23] (Laurence, 2003) as quickly as possible and at as low a cost as possible. As such, a mining organization often has, and traditionally has had, a short term planning perspective – a view that is significantly misaligned with the temporal aspects of potential impacts (Strongman, 2000; van Zyl *et al.*, 2002a). The same may even be true of regulatory bodies (Smith & Underwood, 2000).

> *The objectives of present-day mining industries with regard to mine closure are often similar to those of the regulatory authorities. Owners and operators wish to eliminate future liabilities as far as possible to obtain a release from planning and discharge licence conditions or bonds and to give them the freedom to dispose of their sites at the appropriate time (Smith & Underwood, 2000).*

This contrasts markedly with the interests of the succeeding custodian(s) and associated stakeholders. These actors are (or should be) far more focused upon the continued sustainable use of the land (Strongman, 2000). In current frameworks, such custodial interest generally only commences when a closure plan is completed (Robertson, 1998).

In the past, communities often saw that the only choice available was whether a deposit should be mined or not. However, it has been shown that the manner in which a mine is planned can have major influences on the magnitude and duration of impacts over the life of the development and following its closure (Environmental Protection Agency, 1995a, p. 2). This indicates that at first glance the issue of *Mining for Closure* may dominantly be an issue for communities and their guardians to pursue. As a Mining Adviser for the World Bank Group stated some years ago (Strongman, 2000, emphasis added):

> *There is a fundamental divide between the interests of mining companies and the interests of*

23. As such, we are essentially discussing "walk-away" – or legally binding sign-off of liability for the site. However, as Gilles Tremblay, Program Manager, Special Projects with Natural Resources Canada indicates (personal communication: Natural Resources Canada, 2005, 2 August)- for sites with ongoing pollution challenges such as acidic drainage – true "walk-away" conditions may not be achievable.

the communities where mining takes place. Mining companies typically want to develop mines, achieve a good return for shareholders, then leave when production is finished – so that they can develop more mines and continue to produce elsewhere. Communities on the other hand want to see wealth and income opportunities created in their midst that will last over time ...

In line with such interest, the legacy of abandoned mines, their associated environmental, social and economic problems and the future development opportunities for communities has led to an increased emphasis on mine closure planning in recent years (Smith & Underwood, 2000).

However, this is not an issue that has been relegated by mining companies. Nor is it an issue that lacks strategic relevance or attention within the industry. Key actors in the industry clearly recognise that the very viability of the mining industry is challenged because of high expectations for environmental protection, lower risk to human health, competing land use demands, and the value of the natural environment as recreational space, and as the repository of valuable biological assets, natural environmental services and aesthetic appeal (Environment Australia, 2002b).

The Australian mining industry fully accepts the concept and responsibility of minesite rehabilitation and decommissioning (ANZMEC MCA, 2000, p. v).

The importance of such factors affecting the future viability of the mining industry hold in SEE/TRB as they do in countries such as Australia (cited above), and other leading mining nations such as Canada (Gammon, 2002; WOM Geological Associates, 2000), the U.S. and more. Moreover, in the majority of jurisdictions taken as examples in this document, social issues and financial liabilities associated with such sites are being given great attention. Rising opposition to mining and minerals processing from society and increased scrutiny and coordinated opposition from NGOs constitute threats to the industry's "licence to operate". However, in a regional environment and security context, the stress upon certain aspects are somewhat different in SEE/TRB and particularly in multinational watersheds such as the TRB, than they are in these other jurisdictions. In SEE/TRB, prominent aspects affecting factors such as tensions between Nation-states that may result from transboundary pollution and the retardation of social and economic development are central. Here, the loss of mining operations – or the opportunity to mine – may constitute a major loss to the host society in development, environment and economic spheres. In parallel, substandard operations or mine closure may bear with them repercussions at a much higher level than the mining company or the local host community for a minerals operation (Peck, 2004).

Mining practice has evolved to reflect these concerns in a number of countries and regulatory requirements, and some operators have introduced management policies and practices and have adopted technologies that allow mining to occur with minimum environmental harm (Smith & Underwood, 2000). To take Canada as a prominent example, Tremblay (2005) writes that the first government regulations requiring mineral or mine site rehabilitation were enacted in British Columbia in 1969.[24] Since then, the (Canadian) government's approach has been to set broad reclamation objectives, and then negotiate mine-specific requirements through the review of reclamation plans and issuing of permits. The philosophy behind this approach has been that every mine is unique and therefore, reclamation requirements must be tailored to suit the site specifics.[25] Further, to this point and relating to the critical issue of waterborne pollution from mine sites (including acidic and neutral drainage issues). Tremblay (personal communication: Natural Resources Canada, 2005, 2 August) also stresses the understanding of geochemical issues at mine sites is fundamental to the success of reclamation efforts. A better understanding of acidic drainage as a significant environmental issue in the past 20 years has resulted in increased security for many sites in British Columbia and the rest of Canada.

Moreover, and very importantly in the context of this discussion, Miller (2005) reports that a number of jurisdictions have strengthened their legislation in recent years, including Botswana, Canada (the Yukon), Chile, Ghana, India, Peru, South Africa,

24. See Barazzuol & Stewart (2003) for details.

25. Tremblay reports that originally (1969), bonds to secure mine rehabilitation were limited to a maximum of $500 per acre and raised to $1000 per acre in 1975 (1 acre is approximately 0.4 hectares). The legislative limit on the amount of security the province could hold was removed in 1989. Since then, security levels have been increased on many properties to reduce the possibility that public funds may be required to reclaim a mine in case of company default.

Sweden, and the United States and that this trend will undoubtedly continue.[26]

> *Present-day attitudes to environmental protection are increasingly represented in the development of the concept of sustainable development, of "triple bottom line accounting", of cleaner production, of life-cycle assessment to assess potential impacts, of the precautionary principle, and of environmental impact assessment to advise decision-makers and the broader community on the potential negative as well as positive outcomes of a proposed development. All of these are relevant o the mining industry, and extend from the pre-mine planning phase, through construction, mining, and mine closure to post-mine stewardship (Environment Australia, 2002b).*

According to Sassoon (2000), integrated mine planning – a term intended to capture the general ethos of *"Mining for Closure"* means that to achieve this:

> *... a mine closure plan should be an integral part of a project life cycle and be designed to ensure that:*
> - *Future public health and safety are not compromised;*[27]
> - *Environmental resources are not subject to physical and chemical deterioration;*[28]
> - *The after-use of the site is beneficial and sustainable in the long term;*
> - *Any adverse socio-economic impacts are minimised; and*
> - *All socio-economic benefits are maximised.*

and in Australia key minerals industry representative groups[29] hold that:

> *Mine rehabilitation is an ongoing programme designed to restore the physical, chemical and biological quality or potential of air, land and water regimes disturbed by mining to a state acceptable to the regulators and to post-mining land users. The objective of mine closure is to prevent or minimise adverse long-term environmental impacts, and to create a self-sustaining natural ecosystem or alternate land use based on an agreed set of objectives (ANZMEC MCA, 2000, p. v)*[30]

However, it is clear from such instances as the 1985 Stava tailings dam failure in Trento, Italy where 268 people were killed, the tailings dam collapse at Los Frailes in Spain in April 1998 and the Baia Mare cyanide spill in Romania in January 2000,[31] that mining activities still pose risks of significant environmental, social and economic harm. There is a significant need for improvements in the standard of the environmental protection policies, management systems and technologies applied at many mine sites. In many settings, it is the removal of present and significant risk (and danger) that must have an immediate and pressing priority. In seeking to ameliorate or remove such risks however, the broader objectives of longer term sustainability – and *Mining for Closure* – as shall be discussed in this

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26. In this instance, the author is principally referring to legislative requirements for financial assurance for closure and reclamation.

27. Generally as posed by safety hazards such as unstable tailings impoundments, toxic waters, unsafe buildings, equipment, open holes, and so forth. However, it must be recognised that few (if any) items in the built or natural environment are "hazard free". Thus, it is reasonable to expect that assume that in all countries there should be transparent debate and agreement on the level of acceptable risk pertinent environmental, social and economic aspects of mines and mining facilities post-closure. Further, the reader is referred to definitions of risk and hazard provided in the glossary of terms for this document.

28. The terms applied here, as drawn from Environmental Aspects of Mine Closure produced by Sassoon (2000) and Mining for the Future: Appendix B - Mine Closure Working Paper produced by van Zyl, Sassoon, Fleury & Kyeyune (2002a) are generic but are intended to bear with them the intent and limitations presented in the source documents. Clearly the requirements for physical and chemical stability of physical resources and achievement of land use categories are not without bound. The reader is referred to the source documents for such.

29. Australian and New Zealand Minerals and Energy Council (ANZMEC) and the Australian Minerals Industry (represented by the Minerals Council of Australia (MCA).

30. Note however, that the broadness of these positions are not universally shared as the following comment from a South African mining company representative demonstrates: *"From the mining company's point of view, the principal actions and liabilities associated with mine closure at present are: the retrenchment of employees and the cost of associated severance packages as well as in some cases mitigatory funds for the retraining of retrenched employees; the rehabilitation of the areas disturbed by mining and associated activities in line with statutory obligations"* (Reichardt, 2002p, 2B-1).

31. To quote the European Commision (European Commission, 2003): *The collapse of heaps and dams can have a serious impact on the environment and on human health and safety. The collapse of a heap of inert waste from a coal mine at Aberfan in Wales in 1966 was the worst ever such accident in the UK and caused the deaths of 144 people, mainly children. As for tailings dams, at world level these have failed at an average of 1.7 per year over the past 30 years. At Stava, Italy, in 1985, a fluorite tailings dam failed and released 200,000 m³ of inert tailings, killing 268 people and destroying 62 buildings. At Aznalcóllar, Spain, in 1998, an accident in an area close to the Doñana Natural Park in South Andalusia released into the River Guadiamar 2 million m³ of tailings and 4 million m³ of water contaminated by heavy metals. At Baia Mare in Romania in 2000 a tailings pond burst releasing approximately 100,000 m³ of waste water containing up to 120 tonnes of cyanide and heavy metals into the River Lapus; this then travelled downstream into the Rivers Somes and Tisa into Hungary before entering the Danube. In Baia Borsa, also in Romania, 20,000 tonnes of tailings were released into the River Novat, a tributary of the Rivers Viseu and Tisa.*

Tailings dam failure – Los Frailes, Spain
Unknown photographer

document, must still be keep in mind. Moreover, many mines have been operational for long periods of time and as van Zyl et al underline (2002a), while mines in planning stage have maximum freedom to address sustainable development goals during closure and while those that are in the middle of their operating life have significant opportunities to do so, operating mines that are close to the end of their economic life have limited options available.

As such, there appears to be a broad consensus among actors responsible for governance of mining, NGOs with interest in mining, academics studying mining, senior financial institutions financing mining projects, and a body of leading miners, that planning for closure should ideally start during the pre-feasibility stage of a mining project. Further, these actors hold that it is clear that successful mine planning for closure avoids or minimises potentially adverse environmental and social impacts over the life of the mine and into the future by carefully considering the layout and design of the various components of a mine. Similarly there is broad consensus that a thorough understanding of site specifics, not least the geochemistry of materials present on sites (particularly mine wastes) is critical to success. Further, there is agreement that the process of operating and closing mines must integrate community expectations and concerns, governmental requirements, and profitability of the mining project, while also minimising environmental impacts.

Within this document, and within the bounds defined earlier in this section, it is also held that all this needs to be achieved so that *future* public health and safety are not compromised; environmental resources are not subject to (abnormal) physical and chemical deterioration in the *long term*; and that the after-use of the site is beneficial and sustainable in the *long term*.

It should be noted that in many countries, planning for closure or *Mining for Closure*, as we shall call it, is a relatively new concept. Further, rapidly changing economic conditions, particularly in economies in transition such as those in SEE/TRB, have led to mine closures (and/or "mothballing") in the absence of adequate planning (Smith & Underwood, 2000).

The challenge for such countries is added to by the fact that, while the broad consensus outlined above exists, there is not yet "agreement" among *all* actors upon what it is that actually constitutes *mine closure* or *integrated mining approaches*. This is especially true in developing economies and in economies in transition. By working on these challenges together, all stakeholders can seek to address the adverse legacy problems and prevent them in the future. With careful planning, a mine can become an engine for sustainable economic development beyond its own life (Post Mining Alliance, 2005).

2.1 THE OPPORTUNITIES ASSOCIATED WITH BEST ENVIRONMENTAL PRACTICE MINING

An examination of the literature enfolding mining and sustainability indicates that the extractive industries, environment and societies can not only coexist, but can prosper together. Practitioners and stakeholders have delineated a wide set of company internal benefits *and* a wide range of positive environmental and social externalities associated with good mining practice. Traditionally however, good governments have had principle accountability for considering environmental and social externalities while the focus of mining companies has been on internal efficiency concerns.

On a positive note, the benefits for industry that can be achieved through improvement of environmental practice are many. According to the national environmental body in Australia (Environment Australia, 2002b) a leading mining nation, the benefits to a mining organization that are yielded by best environmental practice in mining include:

- improved access to land for mineral exploration,
- greater certainty of outcomes in the project application stage,
- the prevention of harmful environmental and social impacts,
- lower risk of non-compliance,
- greater acceptance/less resistance from key stakeholders (in particular local communities and land owners),
- lower financial burdens in the mine closure and rehabilitation phases, and
- lower risk of significant liabilities post-closure

It is clear that such benefits are of also of great interest to national environmental and mining jurisdictions in SEE/TRB. However, in the context of SEE/TRB, the potential benefits are somewhat broader in scope, not least because the criticality is greater than in countries that have highly developed institutional mechanisms for dealing with such items. As is outlined in detail in the ENVSEC Desk-assessment (Peck, 2004), improved mining practice should also yield benefits in a number of areas that may be accorded less immediate priority in other regions. These include, *inter alia*:

- reduction of significant and at times severe political, social, health and environmental risks – including transboundary risks associated with orphaned, abandoned *and* operational mining sites;
- improvement of internal social stability including a catalytic role in national and regional economic growth;
- ongoing amelioration of existing pollution and prevention of future pollution.[32]

It is clear that differing types of stakeholders in mining will accord these opportunities differing priority. Further, when mine decommissioning planning is incorporated as a part of "best environmental practice mining" as discussed above, then a new subset of benefits is documented. The discussion of such priorities and benefits are addressed later in this document. A number of the items relevant to mine closure are also addressed in more detail in Section 4.

2.2 INVESTMENT IN BEST MINING PRACTICE

While all the arguments presented above should be attractive to governments and to responsible miners, the fact remains that best environmental practice methodologies are not without cost. Further, the point has already been made that rehabilitation of mine legacies – particularly in the absence of ongoing mining activities can be very costly. Thus, a question must be addressed is – Is there reason for mining companies to engage in the discussions of *Mining for Closure*?

In the absence of accountability for environmental quality and the viability of communities in a mining area after the cessation of mining and minerals processing activities, then the answer may be no. This however, is a situation that increasingly lacks relevance as countries seek to build regulatory frameworks that are similar to those of "successful" mining countries.[33] As was discussed at

32. In SEE in general, and in distinct watershed areas such as the TRB, there remain serious challenges with airborne transport of pollutants such as dust, smelter emissions, gases, vapours; (frequent) mass movements of wastes such as tailings containing heavy metals and toxic compounds; waterborne transport of wastes as suspended solids and as dissolved materials. While such challenges exist elsewhere – including advanced mining nations, the gravity of the situation is generally lesser.

33. Refer to Andrews (2002) for a comparison of the relative success of mining countries and their general performance against a range of governance measures.

the start of this section, such frameworks involve miners being made responsible for the restoration of the physical, chemical and biological quality or potential of air, land and water regimes disturbed by mining to a state acceptable to the regulators and to post-mining land users. Further, social considerations can and should be included in such.

Thus, the principal argument applied here, is that while it does cost to be environmentally and socially responsible, such investments to reduce (generally unpriced) environmental damage also reduce private costs to such a degree that the investments are worthwhile. In essence, good mining practice reduces the private costs of miners *as well* as providing the public goods listed above. The gains available to the industry are mainly focused upon increasing efficiency and reducing (potentially) costly risk.

How much then does it cost to *Mine for Closure*? While such numbers will vary from operation to operation – indeed from year to year in operations, it is clear that the numbers, while significant, are modest. In Australia, estimates indicate that:

> *Best practice methodologies make up about 5 per cent of the capital and operating costs for new mining projects. However, these costs can commonly be offset against the many benefits that best practice brings. The cost of cleaning up a major spill for example can exceed the annual budget for good environmental practice at a site by a factor of 10 to 100 or even more. Moreover, best practice energy and water management can routinely yield significant financial savings (Environment Australia, 2002b).*

This however, is for new mining projects. Costs for mature mines are logically somewhat higher but may remain relatively modest. According to the manager for corporate environmental affairs for a major African mining concern, in the case of South African operators of mature mines, total closure liabilities can amount to between 10 – 20% of the total profits of the remaining life of the mines (Reichardt, 2002).[34]

34. Note the slightly different emphasis in these comments. The former addresses *Mining for Closure*, thus includes closure activities and environmental work during the mine lifetime, while the latter only refers to closure activiites.

Backyard clean-up: tailings removal after a tailings impoundment failure – Macedonia
Photograph by UNDP Macedonia

Thus, while the costs of environmental management are generally lower when measures are incorporated at the planning stage instead of retrofitting and redesigning systems later in the life of the mine, and whilst it is not easy to quantify the costs of best environmental practice, such costs appear reasonable. For miners, there are clear indications that the up-front costs of incorporating best environmental practice into a mining operation provide long term gains for projects in terms of regulatory performance and lower potential liabilities (Environment Australia, 2002b).

Further, widespread adoption of best practice environmental management techniques will translate into long term gains for the industry through greater certainty for access to land and project approvals, improved relationships with regulatory authorities, acceptance by the community, and lower levels of risk to the environment.

2.2.1 THE BUSINESS CASE

Until recent decades organisations involved in mining were generally *not* interested in assuming responsibility for the rehabilitation of lands affected by mining activities. Rehabilitation of mine sites imposes costs upon the extractive industries that in the past have generally not been internalised. However, trends towards high (and higher) expectations for environmental protection, reduced risk to human health, and for inclusions of community related considerations, have combined with competing land use demands, increasing value of the natural environment as recreational space, and increased appreciation of functioning ecosystems as the repository of valuable biological assets, providers of natural environmental services and for their aesthetic appeal (Environment Australia, 2002b).

These trends have greatly changed the business case for *best environmental practice in mining* and *Mining for Closure* practices as described in this document. The activities embodied in *best environmental practice mining* and *Mining for Closure* for which the business case is outlined here, are also discussed in more detail in later sections.

In this setting – that of increasing requirements (or absolute requirements) for mine closure – a range of business related benefits of effective mine closure are described (Allen, Maurer, & Fainstein, 2001; ANZMEC MCA, 2000; Environment Australia, 2002a; Robertson & Shaw, 1998; UNEP WHO, 1998; van Zyl *et al.*, 2002a; Van Zyl, 2000; Warhurst & Noronha, 1999; WOM Geological Associates, 2000). Importantly for mining organizations, these benefits evidence themselves both during mining operations and at the end of mine life and as such, they constitute far more than just cost savings that can be achieved during the execution of a task forced upon them.

Benefits (principally after Environment Australia, 2002a) include *inter alia*:

- continual reduction of liabilities via optimization of rehabilitation works undertaken during the productive phase of mining operations rather than deferral of costs to the end of the project;
- provision of a basis for estimating rehabilitation costs prior to final closure so that sufficient financial and material resources can be set aside;
- ongoing testing, assessment and feedback regarding the effectiveness of rehabilitation designs and/or processes in a site specific fashion during the active mine life;
- increased efficiency in execution of work (e.g. in reduction of double-handling for waste materials and topsoil);
- possibilities to optimise mine planning for efficient resource extraction *and* return of ecosystem to a functional form;
- reduced areas of land disturbance through use of smaller waste landforms and mining paths, and in some circumstances progressive backfilling;
- identification of areas of high risk as priorities for ongoing research and/or remediation;
- the direct involvement of operations personnel in achieving mine rehabilitation outcomes;
- the involvement of key stakeholders (especially local communities) in setting priorities for mine rehabilitation;
- reduction of ongoing responsibilities for the site and facilitation of timely relinquishment of tenements and bond recovery;
- reductions in impacts on local communities in terms of environmental, social and economic impacts of mine operations;
- reduction of exposure to contingent liabilities related to public safety and environmental hazards and risks;
- lower risk of regulatory non-compliances;
- greater acceptance/less resistance from key stakeholders (in particular local communities and land owners),

- improved access to land resources from governments;
- improved access to capital from reputable lending institutions;
- the potential for reduced cost of capital and liability insurance;
- continual feedback upon the manner in which community expectations are being achieved.

As is discussed in essentially all informed sources, it is in the best interest of business for such activities to take place at the right phase of mine life in order to minimise such expenditures. As mine decommissioning usually occurs at a point in the life of an operation where the economic recovery of minerals has ceased, and cash flows are minimal or non-existent, then this is not the time to be undertaking the bulk of rehabilitation operations. The overall mine decommissioning process should be integrated with the overall mine operation planning process. Further, if decommissioning and closure are not undertaken in a planned and effective manner, chances are that the results will also be sub-optimal.

2.2.2 THE GOVERNMENTAL CASE

Traditionally, good governments have had a principal accountability for considering environmental and social externalities while the focus of mining companies has been on internal efficiency concerns.

At first glance – and especially for environmentally aware stakeholders – the case for governments pursuing the implementation of *best environmental practice mining* and/or *Mining for Closure*, would appear clear. If miners do not internalise the costs of mine site rehabilitation and other social and/or environmental impacts related to closure, then Governments will have to do so on behalf of society. Such works would have to be paid for from the public purse. Further, for reasons mirroring those outlined in Section 2.2.1, their conduct is likely to be *less* efficient and less effective than if performed by the miner.

However, there are arguments that the imposition of costs on the industry can have detrimental effects, principally as a barrier to investment and development.[35] This said, mining legacies could be deemed to be the result of past and present governance failure that is shared by essentially all mining countries. Herein lies the arguments for governments to pursue *Mining for Closure* – if regulatory frameworks ensuring efficient prevention of mining legacies, and the rehabilitation of existing legacies, are not put in place, then future national tax-payers will have to pay much more for the work and present stakeholders will have to endure the environmental and social nuisances in the meantime.

The following citation from the Assistant Deputy Minister for the Province of Ontario's Ministry of Northern Development and Mines (MNDM) (Gammon, 2002) underlines the position that Governments around the world are faced with as a result of poor governance and industrial environmental practice in the past:[36]

> *In coming to grips with the problem Ontario first felt a need to classify and inventory these site locations. An initial commissioned survey of paper records indicated that there would be on the order of 600 individual features to be dealt with at an estimated total cost of Cdn$500 million. It was further estimated that some 40% of these sites remained in private ownership while 60% had reverted to the Crown and formed a liability for the Ontario taxpayer.*
>
> *The Ontario government has reluctantly recognized that it is not practically possible to apply the "polluter pays" principle in dealing with this legacy. The original operators have long disappeared, the commodities produced have been consumed and the taxes paid have been incorporated in general revenues. The current industry consists of totally different players behaving in accordance with the regulatory framework that the government now has in place. There appears to be no real alternative than to allocate public funds to deal with the worst sites.*

While there are other advantages defining the governmental case for pursuit of *Mining for Closure*, it suffices to summarise them within the following broad categories:

- the prevention of harmful environmental and social impacts,
- lower risk of non-compliances,
- greater acceptance/less resistance from key stakeholders (in particular local communities and land owners),

35. These are discussed in more detail in Section 2.4, refer also to Miller (1998; 2005).

36. Detail references to, and the contents of Canadian work in this area are addressed in Sections 4.2.2, 5.1.2, and 5.1.3.

- lower financial burdens to the national purse for mine closure and rehabilitation, and
- lower risks for significant liabilities post-closure

One additional important point is raised here in the context of developing and restructuring economies. Where governments do *not* have sufficient fiscal resources to deal with legacies, then even more innovativeness and flexibility will be required in order to protect the public and the environment from the risks posed by mining legacies.

2.3 KEY EXTERNAL DRIVERS FOR BEST ENVIRONMENTAL PRACTICE MINING

This section provides details of a number of developments that are acting to drive the uptake of mining practices in line with the concept of *Mining for Closure*. The first topic addressed is Financial Surety (or Financial Assurance). The majority of this discussion is derived or based upon position papers produced by Dr. C. George Miller (1998; 2005) on behalf of the International Council on Mining and Metals (ICMM) and its predecessor, the International Council on Metals and the Environment (ICME).[37] Importantly, financial assurance for mine closure and reclamation is a topic addressed in a number of the drivers listed here.

2.3.1 FINANCIAL ASSURANCE FOR MINE CLOSURE & RECLAMATION

Financial surety instruments can be defined as:

> *guarantees issued by a bonding company, an insurance company, a bank, or another financial institution (the issuer is called the 'surety') which agrees to hold itself liable for the acts or failures of a third party (Miller, 1998)*

At the present time, the most common use of environmental surety instruments are put in place to guarantee environmental performance after closure through the funding of mine site reclamation or rehabilitation. As such, financial assurance or surety is also the amount of money available to a government entity for closure of the mine in the case when the mine owner is not available to perform the work, (such as bankruptcy) during operations or any time thereafter. The financial surety can be provided by a variety of financial instruments or cash deposited in a bank. However, it is important to realise that the governmental policy and local financial markets may determine the type of instrument available for a specific location (Miller, 1998, 2005; van Zyl et al., 2002a; Van Zyl, 2000).

It is clear that financial assurance instruments can be effective in promoting or enforcing environmental protection and while not yet "popular", they are increasingly accepted by industry as perhaps the most effective manner in which to ensure that protection of the environment is achieved and public expectations are met in the mining sphere.[38] To quote Miller (2005, p13) on the topic of Environmental Financial Assurance (EFA):

> *Mining companies accept that the major function of EFA is to protect the government and public in the event a mining company cannot meet its reclamation obligations. While several large companies felt they were capable of fulfilling their environmental obligations without the additional discipline of a financial assurance mechanism, they agreed that a financial assurance instrument does provide more certainty for the protection of the environment. ... All companies accept that government needs to demonstrate to the community that it has received sufficient financial protection from the holder of mineral rights to ensure effective reclamation.*

Miller also provides comprehensive reviews of financial assurance in various regulatory regimes and the common instruments in use in two reports generated six years apart (Miller, 1998, 2005). It

37. Miller has an extensive and distinguished background working with mining and related environmental policy issues. Among other roles he has served as Director of the Centre for Resource Studies at Queen's University, Canada, as Assistant Deputy Minister, Mineral Policy for the Government of Canada, as President of the Mining Association of Canada and as a Director of the Industry Government Relations Group in Ottawa.

38. These views have evolved markedly. Miller (2005) indicates that in his 1998 study (1998), industry showed a marked preference for "soft" assurances such as: financial strength; self-funding of the obligation while retaining control of the funds; a financial test which determines the grade of the company; a corporate guarantee based on that grade; self-funding through financial reserves; parent company guarantees and pledge of assets. By contrast, in the 2004 survey the majority of industry respondents recognized that harder methods such as letters of credit, bank guarantees, deposit of securities, and cash trust funds, may best serve the industry, as they are required to satisfy public expectations. As to which instruments best serve the interests of the government, the 1998 report noted that they would be those that best serve the mutual interests of the government and the company. In the current study, industry respondents suggested that cash deposits, any liquid instrument, and bank guarantees would best serve governments' needs.

is recommended that any reader unfamiliar with financial surety issues and instruments carefully review these documents. Of marked value in examination of these texts is the delineation of industry practice at two distinct points in time, and the clear evolution of both practice and general willingness to engage in the financial surety discussion that is displayed by industrial informants. His work documents a marked change in mining industry attitudes to financial surety that has taken place over the period 1998 to 2005. To extrapolate from these changes, it appears certain that the application of financial surety mechanisms will become both more prevalent and more accepted in coming years.

Readers should be aware however, that these documents were written for and by an industry interest group. As such, it is reasonable to assume that the presentation of the case for financial surety is (inherently) conservative in its representation of performance levels and surety requirements governments can or should demand. When writing for such audiences, the views of the less proactive, and less environmentally advanced among the member actors may often be that which is represented. This stated, it should be noted that ICMM, is a small organization (16 company members as of mid-2005) of companies that see themselves as industry leaders and wish to be perceived as such by other mining stakeholders. They claim, and their reasonably progressive views lend weight to this, that they do not have a "lowest common denominator" approach, but seek to show leadership. The evolution of industry stance, as represented by that group, in the period between the two Miller assessments support this view.

These points aside, the following call from the Government of Ontario underlines a need to treat comments critical of strict financial surety approaches warily in the context of this document:

> *Other jurisdictions have expressed concern that the introduction of provisions similar to those brought in by Ontario would cause premature closure of existing operations and would also deter new investment from coming to the jurisdiction. Ontario is proud that the 2002 Fraser Institute survey of exploration investment decision-makers rated it as the best jurisdiction in the world for such investment. Clearly our tough rehabilitation requirements have not acted as a deterrent (Gammon, 2002, p4)*

According to van Zyl (2000) another important concept is that of *financial accruals* by mining companies for closure. It is common to base accruals on a unit production basis (such as $ per ounce of gold produced). The total amount of the accrual is estimated from the environmental closure cost plus other liabilities specific to a mine such as land holdings, personnel costs associated with the end of operations, and so forth. Financial auditors can perform annual reviews to determine the adequacy of these closure funds.

The following (principally after van Zyl *et al* (2002a) and Miller (1998)) should also be noted regarding financial surety and closure cost accruals:

- Conceptually, financial surety is in place during the total life of the mine and will only be released (in part or in total) after the regulatory agencies have established that rehabilitation has been completed to their satisfaction. However, the financial surety may not be a fixed amount throughout the life of the mine, but may vary as environmental issues develop at a mine, as regulatory changes occur and community expectations change.
- Closure cost accrual takes place over the life of the mine based on a planned mine life, it is not necessarily a linear function as it may vary also over the mine life; and,
- In the US and some other countries, the financial surety is not available to a mining operation for closure work at the end of the mine life. It may be released shortly after the work has been done, but the mining company must be a going concern in order to perform, or contract some entity to perform, the required activities.
- A few mining companies have established sinking funds to pay for the closure of a mine. Money from a sinking fund will be available in cash to pay for closure while an accrual is an accounting allowance that is not liquid. However, it must be noted that while sinking funds may be attractive because they are liquid, in the case of a bankruptcy these become part of the assets of the company and will not be available to pay for closure.

Additional notes on (previously) preferred manners in which to manage closure guarantees and the clear direction of future expectations are included in Box 2.

Table 1 provides a summary of policy guidelines developed by Miller (2005) for the ICMM in 2004. A number of proviso statements, justifications for

Box 2 **Accounting provisions and "good practice"** (Nazari, 1999)

International practice in the absence of regulatory requirements

In the absence of other regulatory requirements, accounting provision is preferred by the mining industry to address mine closure liabilities. This practice is an *accounting transaction* which allows a company to make non-cash provisions for future mine closure costs. However, this does not result in any actual cashflow for the purpose of accumulating closure funds or payment of related expenses. Unless the company has chosen to set aside actual funds for closure, when the project approaches the closure date, closure liabilities are likely to exceed the project's and the company's tangible book values, assuming the typical scenario of a ring-fenced special purpose mining company which is operating one mining project. Any attempts to raise additional funds for closure at this stage by selling the company's assets would be unlikely to raise sufficient funds to meet the closure requirements. A 'one-project-company' may declare bankruptcy at this stage rather than attempting to raise and invest additional funds for the terminal stage of the project with no prospect of a return on such an investment. Declaring bankruptcy would 'externalise' the costs associated with mine closure and result in the financial burden being passed on to the authorities. Government funding may well be inadequate to mitigate potential long term environmental and safety impacts.

'Good mining industry practices' in Australia, Canada, and the USA, for example, are typically guided by industry stewardship, i.e. "self-policing" as a result of good corporate governance, by following company policies and reflecting shareholder, employee, and NGO pressure, relatively recent regulatory frameworks, and sophisticated financial and insurance markets to integrate and address mine closure activities and their financing. In these countries, accounting accruals alone are typically no longer considered adequate to mitigate the risk of non-performance of mine closure activities. Instead, companies are required to secure the funding by providing guarantees for mine closure funds prior to commencing construction and operation, and prior to generating any cashflow from the operation. The available guarantee options include bonding, corporate surety and guarantees, letters of credit, deposits of cash or gold, insurance and other methods. Key considerations during the selection process by both industry and regulators include the costs associated with each option, the credit-worthiness, and the track record of the owner/operator.

the industry position, and deeper explanations have been removed from the original.

In closing, it appears that financial assurance for mine closure and reclamation has progressed rapidly in recent years and will become more and more accepted in coming years. It is absolutely necessary to stress however, that its success is dependent upon the soundness of the governing bodies that put such mechanisms in place.

2.3.2 SEVESO II AND ITS IMPLICATIONS[39]

The Seveso directive[40] was first put in place in 1982 to help prevent and control major accidents involving dangerous substances. The directive was adopted in direct response to, and received its name from the *Seveso accident* in 1976 at a chemical plant manufacturing pesticides and herbicides. Although no immediate fatalities were reported, kilogramme quantities of dioxin(s), a substance lethal to man even in microgramme doses were widely dispersed. More than 600 people had to be evacuated from their homes and as many as 2000 were treated for dioxin poisoning.

In order to broaden the scope of the Directive, and in particular to include the storage of dangerous substances, the Seveso Directive was amended twice, in 1987[41] by and in 1988.[42] It was then replaced in December 1996, by the Seveso II Directive[43] in order to achieve a further widening of its scope and better risk-and-accident management. Important changes

39. This discussion is summarised from http://europa.eu.int/comm/environment/seveso/.

40. *Council Directive 82/501/EEC on the major-accident hazards of certain industrial activities (OJ No L 230 of 5 August 1982)*

41. Directive 87/216/EEC of 19 March 1987 (OJ No L 85 of 28 March 1987)

42. by Directive 88/610/EEC of 24 November 1988 (OJ No L 336 of 7 December 1988)

43. *Council Directive 96/82/EC on the control of major-accident hazards (OJ No L 10 of 14 January 1997)*

Table 1 **Guidelines for framework policies** (summarised from (Miller, 2005))

Owner pays	Legislation should provide that the owner or operator is responsible for execution and completion of successful reclamation activities to an appropriate technical standard. Where long-term care is involved, the operator is responsible to provide it until relieved of liability.
Standard of reclamation	Reclamation should return the site to a safe and stable condition, free of safety hazards (such as unsafe buildings, equipment, open holes, etc.); return the mine site to viable and, wherever practicable, self-sustaining ecosystems that are compatible with a healthy environment and with human activities. There should be measures to address and prevent ongoing pollution from the site. There should not be a blanket requirement to return the site to its original condition or to a condition permitting particular land uses.
Standard of certainty	Closely related to the issue of standard of performance is the degree to which the government seeks assurance against all possibility of loss or damage to the environment. If governments insist on being indemnified against all possible events, excessive costs will be imposed and investment incentive will be drastically reduced. Governments should have a general policy of requiring EFA that is prudent in light of all reasonably foreseeable risks, but they should not insist on protection against extremely unlikely events.
Timing of financial assurance requirement	Any requirement for EFA, or any change in the required standard of reclamation, should be identified as early as possible in discussions between company and government.[44]
Transition arrangements for existing mines	If it is necessary for a government to alter the required standard of reclamation, or to require a financial assurance instrument where none was required previously, the operator should be given a reasonable time to comply with the requirements. In some cases, particularly where the mine is only marginally profitable or is approaching the end of its life, a creative approach to the design of the EFA may be called for.
Taxation	All requirements for EFA impose some costs on the operator. In particular, hard forms of security (such as letter of credit, cash bonds or trust funds) impose two kinds of cost: direct carrying cost and loss of use of the funds for productive investment (or corresponding reduction in borrowing power). It is appropriate that the tax regime of the country recognizes these costs and attempt to minimize their negative effects.
The exit ticket	It is reasonable to demand that Miners accept the costs and liability for environmental protection of the site during operations and for reclaimed the site upon closure. Where conditions such as acid mine drainage exist, it is reasonable that companies also accept the necessity of funding long-term care and management. However, government legislation should provide explicitly that at a certain moment the company can be relieved of future liabilities for the site. In most cases, this relief would be given as soon as site reclamation has been successfully completed. In the case of acid drainage, it would be given as soon as necessary funding arrangements have been established for long-term care.[45]
Alternatives to financial assurance	It is known that the insurance industry is now in a position to offer certain vehicles to supplement or replace existing EFA instruments. At the same time, international standards for environmental quality management, such as the ISO 14000 series, are becoming more widely practised and accepted. This raises the possibility that a practical certification or accreditation system may ensue, giving governments additional confidence in accredited companies.

44. In Ontario for example, a review is normally performed every five years or at the call of the responsible minister in the jurisdiction (personal communication: Natural Resources Canada, 2005, 2 August).

45. However, this remains a topic for debate for sites with ongoing pollution challenges such as acidic drainage and true "walk-away" conditions may not be achievable. One officer of a prominent jurisdiction at least is *"not sure that we will ever see an exit ticket with acidic drainage present on site"* (personal communication: Natural Resources Canada, 2005, 2 August).

and new concepts introduced into the Seveso II Directive included the introduction of new requirements relating to safety management systems, emergency planning and land-use planning and a reinforcement of the provisions on inspections to be carried out by Member States.[46] From 3 February 1999, the obligations of the Directive were mandatory for industry as well as the public authorities of the Member States responsible for the implementation and enforcement of the Directive.

At that time, the focus of the Seveso II Directive was solely upon the *presence of dangerous substances in establishments*. It covered both, *industrial "activities"* as well as the *storage* of dangerous chemicals. The levels of control upon establishments covered by the directive were based upon quantity-related thresholds. There were important areas excluded from the scope of the Seveso II Directive. These included *nuclear safety, the transport of dangerous substances and intermediate temporary storage outside establishments* and *the transport of dangerous substances by pipelines*.

Further, and vital from a mining perspective was that Seveso II did *not* address important activities and hazards posed by activities of the extractive industries concerned with exploration for, and the exploitation of minerals in mines and quarries mining. In fact, for a number of reasons it specifically excluded mine wastes. However, the accident at Baia Mare in Romania in January 2000 changed stakeholder expectations in that regard. The severe pollution of the Danube demonstrated clearly that certain storage and

46. The aim of the Seveso II Directive is two-fold. Firstly, the Directive aims at the *prevention* of major-accident hazards involving dangerous substances. Secondly, as accidents do continue to occur, the Directive aims at the *limitation of the consequences* of such accidents not only for man (*safety and health aspects*) but also for the environment (*environmental aspect*). Both aims should be followed with a view to ensuring high levels of protection throughout the Community in a consistent and effective manner.

Transport of cyanide bearing tailings waste adjacent to river – Gold mining area, Romania
Photograph by Philip Peck

processing activities in mining, especially tailings disposal facilities, including tailing ponds or dams, have potential to produce very serious consequences.

As a result, the Commission highlighted the need for an extension of the scope of Directive 96/82/EC. In its resolution of 5 July 2001 (5) on the Commission Communication on the safe operation of mining activities, the European Parliament passed an extension of the scope of that Directive to cover risks arising from storage and processing activities in mining. In short, a significant range of mining activities are now addressed by Seveso II and the obligations of the Directive are now mandatory for industrial actors and for the public authorities of the Member States responsible for the implementation and enforcement of the Directive. These conditions will also be valid for accession countries and should be of great interest to those countries aspiring to accession.

Links to the full content of Seveso II[47] (Directive 2003/105/EC Of The European Parliament And Of The Council of 16 December 2003 amending Council Directive 96/82/EC on the control of major-accident hazards involving dangerous substances) are included within Appendix B to this document.

2.3.3 THE EU MINING DIRECTIVE AND ITS IMPLICATIONS[48]

As part of its continuing programme of harmonization of regulations, the European Community is developing an extractive industry waste directive. This is known as the European Community Draft Directive on the Management of Waste from the Extractive Industry.[49] The draft directive was given first reading by the European Parliament at the end of March 2004 and the Council reached political agreement on the proposal in October the same year. It seeks to prevent pollution and accidents and directly targets countries such as those in SEE/TRB.

> *The proposed Directive will help prevent serious accidents resulting from the mismanagement of mining waste, like the disaster in Baia Mare in 2000, where the whole of the Danube was polluted with cyanide ... It will also minimise chronic pollution of lakes and rivers by waste facilities that are badly operated and monitored. In short, the proposed Directive will make management of waste from the extractive industries safer. We are currently embarking on a historic enlargement of the EU and must ensure that the best environmental standards are applied across Europe (European Commission, 2003 quoting Environment Commissioner Margot)*

In a press release in mid-2003 (European Commission, 2003) the Commission indicated that the Directive is intended to regulate the management of waste from the mining and quarrying industries. It was held that due to the composition or volumes involved, such waste can constitute a serious threat to the environment and human health if not properly managed. The proposal seeks to introduce EU-wide rules designed to prevent water and soil pollution from long-term storage of waste in tailings ponds, waste heaps, and so forth. The Directive is intended to ensure the stability of these waste storage facilities to minimise possible consequences from accidents. Further, the Directive is intended to work together with the revised Seveso II Directive on the control of major industrial accidents, and a Best Available Techniques document on tailings and waste rock (Commission of the European Community: Directorate-General JRC, 2004).

This initiative falls under the competence of the European Integrated Pollution Prevention and Control Bureau (http://eippcb.jrc.es/), part of the Institute for Prospective Technological Studies (IPTS) in Sevilla of the Joint Research Centre.[50] The Best Available Techniques reference document (BREF) describes the Best Available Techniques of waste management to reduce everyday pollution and to prevent or mitigate accidents in the mining sector

47. Available online at http://europa.eu.int/eur-lex/pri/en/oj/dat/2003/l_345/l_34520031231en00970105.pdf

48. For a summary of this Directive, see http://europa.eu.int/comm/environment/waste/mining/.

49. Proposal for a Directive Of The European Parliament And Of The Council on the management of waste from the extractive industries COM(2003) 319 final 2003/0107 (COD).

50. The IPPC-Directive (96/61/EC) has introduced a framework requiring EU member states to issue operating permits for industrial installations performing activities as described in its Annex 1. These permits must contain conditions that are based on Best Available Techniques (BAT), and aim at achieving a high level of protection of the environment as a whole. Importantly in the context of this document, a key feature of the IPPC-Directive (cf. art. 16) is to stimulate an intensive exchange of information on Best Available Techniques between the European Member States and the industries considered. For Annex 1 activities, the European IPPC-Bureau organises this exchange of information and produces BAT reference documents (BREFs) and Member States are required to take into account when determining permit conditions for so called 'Annex 1'-type installations. The Bureau carries out its work through Technical Working Groups (TWGs) comprising nominated experts from EU Member States, EFTA Countries, industry, and environmental NGOs.

Uncontained mine wastes – Gold mining area, Romania
Photograph by Philip Peck

and is of special relevance to this discussion.[51] In its more than 500 pages, it addresses activities related to tailings and waste-rock management for ores that have the potential for a significant environmental impact. In particular, the work sought out activities that can be considered as examples of "good practice". The intent of the document is to raise awareness of such practices and promote their use across all activities in this sector. It covers waste from all sectors of the extractive industry and specifically focuses on operational issues connected with waste management, prevention of soil and water pollution, and the stability of waste management facilities with a particular focus on tailings ponds.

In the Directive, conditions to be attached to operating permits are detailed. These are intended to ensure that sufficient environmental and safety measures are in place in order for waste management facilities to receive authorization. There will be requirements that waste be classified before disposal and the method of management be chosen to suit to its particular characteristics and ensure the long-term stability of the heaps and ponds used for permanent storage of large amounts of waste. Another key provision is that operators of waste management facilities should draw up closure plans as an integral component of the overall operating plan. Proper monitoring will also be required during both the operational and the after-care phases.

51. The report details of all BREFs are available for download at http://eippcb.jrc.es/pages/FActivities.htm

Further, and again important to discussions listed in Section 2.3.1, the proposal contains an obligation to provide for an appropriate level of financial security to reinforce the "polluter-pays" principle. It will be required that sufficient funds be available to leave waste sites in a satisfactory state after closure. Provisions will be made to cover situations such as those where a company goes into receivership, becomes insolvent or even engages in asset-stripping. Miller (2005, p23), indicates that once the directive is finalized, European countries would be required to amend any existing requirements for mine reclamation and associated financial assurance to agree with its terms. As with most EU environmental initiatives of the commission, the industry position as represented by that author is at this stage wary.

> *For the future development of mines in European countries it is important that the new directive represents the appropriate degree of integration of environment and economy. There is a need to apply the provisions with the appropriate care in order not to jeopardize the survival of companies and thus avoid the environmental and social problems associated with unanticipated closure.*

As has been indicated, the measures in the proposal are to act as a complement to those outlined in the Seveso II Directive 96/82/EEC on the control of major-accident hazards involving dangerous substances. As such, they include the establishment of a major-accident prevention policy and a safety management system. Demands regarding public information are

also included in accordance with the United Nations Convention of 25 June 1998 on Access to Information, Public Participation in Decision-Making and Access to Justice in Environmental Matters (Aarhus Convention) to which the EU is a signatory.

Importantly, all these measures will apply to those waste management facilities that present a high accident risk but will not fall under the provisions of the revised Seveso II Directive.

2.3.4 THE EQUATOR PRINCIPLES[52]

A potentially important development at the supranational level is encompassed within the Equator Principles, an initiative led by the International Finance Corporation and the World Bank. This initiative aims at the very financing mechanisms of the industry. Project financing plays an important role in financing development throughout the world. Further, the financing of projects, particularly in emerging markets, is central to the rise of environmental and social policy issues. In recognition of the fact that financiers have significant opportunities to promote responsible environmental stewardship and socially responsible development (International Finance Corporation, 2003), the Equator Principles seek to ensure that the projects financed by signatories are developed in a manner that are socially responsible and reflect sound environmental management practices. As part of adopting the principles, financiers undertake to carefully review proposals and to refuse loans directly to projects where the borrower will not, or are unable to, comply with the required environmental and social policies and processes (International Finance Corporation, 2003).

A large group of leading banks already support the initiative (33 institutions as of August, 2005). Further, and relevant to earlier discussion of financial surety, the signatory international banks undertake not to finance any project over US$ 50 million unless it meets World Bank and International Finance Corporation environmental policies, standards and guidelines,[53] which include a requirement for closure funding (Miller, 2005 p.6 & p.17). Indeed, the principles include a requirement for fully funding a mine's closure plan by appropriate instruments so that the cost of closure can be covered at any stage in the mine life, including premature and unforeseen cessation of activities.

While the key focus of the principles are upon developing countries, the guidelines may eventually also apply to mines in developed countries (International Finance Corporation, 2003; Miller, 2005). As a potentially negative aspect, Miller (2005) reports the guidelines may act against discretionary leeway currently utilised by many governments, including a number of those in developed countries, when setting the amount and nature of the required financial assurance.[54]

The Equator Principles are included as Appendix C to this document.

2.3.5 GOVERNANCE PRINCIPLES FOR FOREIGN DIRECT INVESTMENT IN HAZARDOUS ACTIVITIES

While not of the scale and visibility of the Equator principles presented above, the Regional Environment Center for Central and Eastern Europe has also worked on a set of principles. Again these seek to ensure that projects – particularly projects in areas such as mining – financed in jurisdictions such as those in SEE, are developed in a manner that are socially responsible and reflect sound environmental management practices.

The REC submitted *Draft Governance Principles on Foreign Direct Investment in Hazardous Activities* on the occasion of the fifth Ministerial Conference "Environment for Europe" in Kiev, Ukraine which took place from the 21 – 23 May 2003.[55] A revised and updated version of these principles was also made available at the Cluj-Napoca confer-

52. See http://www.equator-principles.com/principles.shtml .

53. Since 1998, the World Bank has included in its "Pollution Prevention and Abatement Handbook" (World Bank, 1999) provisions to ensure that any project financed by the Bank or the related IFC (International Finance Corporation) anywhere in the world includes appropriate standards of mine closure and reclamation, including the nature and amount of financial assurance. These requirements are currently stated in general terms. If a country does not have corresponding requirements, then the World Bank/IFC measures govern the project.

54. He indicates that unforeseen side effect of these undertakings could be to frustrate the deliberate policies of governments. If a state demands less than full coverage of potential reclamation liabilities, as a calculated policy designed to attract mining, bank financing may not be available for projects there. As a result, the government's conscious policy may be nullified. The legislation of many jurisdictions gives the responsible minister some discretion in setting the nature and amount of required financial assurance (Miller, 2005, p24).

55. These activities are reported at http://www.rec.org/REC/Introduction/Kiev2003/. The draft document presented is also available at http://www.unece.org/env/documents/2003/kievconference/inf.18.e.pdf

ence where *Mining for Closure* was launched and was also specifically noted in the Declaration of the High-Level Panel of the Sub-regional Conference included as Appendix A to this report.

The governance principles are intended to apply primarily to foreign direct investment (FDI) in industrial, mining and other activities with particular focus upon those with significant social and environmental impacts, especially in countries in transition, under-developed regions and developing countries. These principles have been designed to complement voluntary international codes of conduct, compacts and other instruments. Many of the principles are relevant to the content of this work and the reader is encouraged to examine them.[56] The text for the Governance Principles is included as Appendix D.

2.4 REAL OR PERCEIVED FINANCIAL BARRIERS

In closing this second chapter, it is felt necessary to add context to discussion of financially related barriers to *Mining for Closure* that the have been alluded to, or explicitly stated during the preceding sections.

Having addressed the topic of investment from the firm internal point of view, it is also necessary to provide insights into a number of real or perceived challenges to *Mining for Closure*. The first area is related to the source of mine activity financing. A second area is related to perceptions regarding the potential yields of a development. This second area has three facets, firstly perceptions of the yield (rents) available to a miner, secondly, perceptions regarding distribution of the economic yield available to a host government and thirdly, economic benefits to individuals in positions of power.

An important message here is that responsible governance is central to good environmental and social performance in mining. It has far-reaching implications for the financing of mining, and to the distribution of economic rents from mining activities.

As a first point, the absence of national requirements for adequate mine closure provisions and/or integrated mine closure planning may actually act against more responsible miners. It should be noted that international financial institutions typically require consideration of closure related issues – even where nation states may not. Where such conditions exist, investors seeking finance from such sources may be disadvantaged in their endeavours when compared to those potential miners accessing alternative capital markets with more limited requirements relating to closure funding (Nazari, 1999). There is a higher likelihood that miners seeking finance outside the realm inhabited by reputable financial institutions are also those that have substandard operational practices. In such a scenario, it appears that an absence of adequate frameworks for mine closure may actually serve to "penalise" investors seeking financing or political risk insurance through respectable international financial institutions.

The second area introduced is that of *Mining for Closure* as a potential barrier to investment. In particular, this is indicative of perceptions regarding reduced profits for miners but it also indicates the possibility of pollution haven scenarios being relevant.[57] A possibility here is that national environmental requirements representative of *best environmental practice in mining* may result in potential (and perhaps much needed) miners going elsewhere with their investment resources. While empirical evidence of the validity of this scenario was not found in the review conducted in order to generate this document, there are clearly serious implications for countries eager to attract private sector investment if this is the case.[58] However, this issue should be considered in the light of at least three important points. First, is that mineral resources are immovable. The likelihood that a potential developer can choose between two competing mineral resources based upon "laxity of regulation" appears small. Second is that Government has at hand fiscal frameworks within which they can create attractive packages for prospective mining activity. As Andrews (2002) of the World Bank Group indicates, the taxation, royalty and/or in-

56. The updated and revised governance principles are also available at: http://www.rec.org/REC/Programs/EnvironmentalLaw/PDF/Governance_Principles.pdf

57. Pollution havens have been described and debated by a wide range of authors such as Bommer (1999), Brunnermeier (2004) and Millemet (2004), to name but a few. The concept involves the preferential movement of an industrial activity to nation states or regions where environmental regulations are less stringent, less well developed or where enforcement is weak. There is significant debate whether the hypothesis regarding moves to lax regulation actually holds.

58. Indeed, significant evidence to the contrary was found – See in particular the citation from the Government of Ontario in Section 2.3.1.

vestment subsidy offering for mine developments made by a host government constitutes a key ingredient for such decision making. Thirdly, and closely related to the point made in Section 1 about "junior" miners – lax frameworks may attract just the kind of industrial actors that can be detrimental to the interests of many national stakeholders – that is, miners that do not pursue environmental and social performance seriously.

The third area introduced, requires that the effect upon the rents available to government must be considered. Perceptions may exist that investment in *Mining for Closure* will reduce the economic benefit that can be obtained from a mineral resource. While this might be a feasible scenario in the short term, it appears reasonable to immediately refute this when consideration of the mine-life is taken into account. While it is clear that there are costs involved in the conduct of best environmental and social practice, it is the role of government to ensure an optimum yield from mining in the medium to long-term. The accrual of environmental and social externalities in order to provide short-term internal gain hardly appears to be an optimal approach. Further, and as discussed in Sections 2.1 and 2.2, the ongoing conduct of *Mining for Closure* by miners – while they are mining, represents an efficient, if not the optimal, economic outcome. That is the investment to preventing external costs ex ante is significantly less than the costs associated with making good environmental and/or social damage *ex post*.

The final point addressed here is related to corruption – in particular where individuals or authorities in positions of power or responsibility, seek personal benefit from mining activities and/or seek to oppose the implementation of *Mining for Closure* principles for the reason that the monies available for diversion for personal gain are reduced. In jurisdictions where good governance and the rule of law have not been established, it is feasible that such actors may be able to act in this manner. Indeed, Stephen Stec (personal communication: Regional Environmental Center for Central and Eastern Europe, 2005, 7 July) argues that in certain economies and especially transitional ones, the problem of underpaid and therefore corruptible officials is endemic and has an influence on decision-making related to mining. According to Stec, the large sums of money in mining, combined with authorities in a position to approve or influence mining projects that are not always motivated by the public interest alone, is a serious problem.[59]

Such factors however, should be seen as socio-political aberrations, and not an argument against *Mining for Closure*. The rule of law as evidenced in measures such as the control of corruption, respect for property rights, the elimination of bribery, and the transparent distribution of revenues have been clearly linked to the economic success of mining nations (Andrews, 2002).

59. As such, unclear legal regimes are recognised to add uncertainty with respect to many aspects of *"Mining for Closure"* including in particular financial assurance requirements. Special measures must be taken to ensure that financial assurance on paper is financial assurance in reality – especially where institutions and legal frameworks are less secure.

3. MINING STAKEHOLDERS

This section of the report is intended to provide a brief outline of who mining stakeholders might be, and how differing types of stakeholders can have salience to a mining development or abandoned or orphaned site. Further, it aims to provide some introduction to why multi-stakeholder dialogue (consultation) is considered desirable and to highlight the importance of the capacities held by actor groups. It cannot be ignored that certain levels of capacity are required – both on the side of industry and on the side of other stakeholders such as affected communities – before communication and engagement can even take place (Gibson, 2001).[60]

In order to build institutional frameworks promoting good mining practice it is important to recognise that different groups of social actors each have their own special interaction with mining activities. Moreover, it is not uncommon that under certain circumstances stakeholders from "unexpected positions" can obtain, or seek to obtain, the means to dictate the course that an industrial development might take. This, particularly in situations where they consider that the activities or the environmental or social legacies they generate affect their interests (or lives) negatively.[61] As such, it is important to obtain insights into how actors might obtain such leverage, how situations can be defused and turned to the better, and why communication (or "engagement") should be undertaken with such groups.

In particular communities are a special form of stakeholder. Not least because of distributive justice issues where a considerable literature holds that adjacent communities may bear the greatest costs and receive the least benefits of mining projects (see for example Amundson (2005), Evans, Goodman & Lansbury (2000), Gaventa (1980), Klubnock (1998), Low and Gleeson (1998), Scheyvens & Lagisa (1998) as well as the Oxfam material at http://www.oxfam.org.au/campaigns/mining/publications/index.html as examples). Importantly, and as intimated above, communities may not have the capacity to negotiate effectively at first and investment in capacity building to support communication may be a prerequisite for meaningful dialogue. Further, communities may be interested in more than just the jobs supplied by a mining development, and may also seek to maintain their ways of life, local cultures, and so forth, as well as have a more diversified economic future. In the context of this document, disagreement or conflicts between mining organizations and authorities and communities can spiral out of control – at times such events take place on the national stage, at times they escalate to involve organizations such as transnational NGOs. Such events can cost the mining industry (and even host countries) dearly in terms of time, money and reputation (personal communication: Central European University, 2005, 24 July).

Understanding of stakeholders is particularly important in the context of this document as it is intended to help delineate sound policy goals surrounding mining – and the manner in which policy goal might be achieved via legislative (or other institutional) frameworks. As indicated in the introduction section of this document, such frameworks can help clarify what various actors should be allowed to do or not to do, and how certain activities should be conducted; they can introduce economic or utilitarian instruments seeking a steering effect towards a planned goal; or they can involve the use of informative instruments designed to enable people to adopt alternative behaviour. Further, it was related that the influencing of prevailing social norms or imperatives might also contribute in reaching goals. However, in the context of this document, one of the most important steps may be to initiate the process of talking and listening to stakeholders – particularly communities – granting them legitimacy and actively involving them in planning for closure (and development as appropriate). This said, such actions require properly trained and clearly assigned personnel resources in order to carry out such activities appropriately and to develop trusting relationships with all play-

60. CoDevelopment Canada has taken the position that communities rarely have the negotiating skill to effectively engage mining companies or other proponents. They support capacity building in communities to prepare them for negotiations. The reader is referred to the report by Gibson (2001) available at: www.iied.org/mmsd/mmsd_pdfs/033_gibson.pdf.

61. See also Antypas (2005).

ers (as best as can be done). This is dynamic and an evolving area where trained people are in short supply.[62]

3.1 WHO AND WHAT ARE MINING STAKEHOLDERS?

In order to support this discussion of stakeholders, a framework and approach developed by Mitchell, Agle and Wood (1997) will be utilised.[63]

If we commence with a broad definition of stakeholder as proposed by Freeman (1984) as:

> *any group or individual who can affect or is affected by the achievement of an organization's objectives,*

then it is clear that there are many actors and individual for whom the conduct of mining operations affects in relevant ways, or can affect the conduct of minerals related activities. Further examination reveals that such interactions are relevant within all levels of the sustainable development debate – environmental, social, developmental and economic.

Moreover, it can be seen that the presence of mining legacies in the form of abandoned or orphaned sites will also interact with a broad range of social actors. Thus, it is clear that some insight into *which stakeholders are most important* is required – as is a consistent framework within which to categorise them. This is held to be particularly true if this document is to address regional decision-makers, policy makers, and leading industrial actors. Similarly, we must have some understanding of the manner in which such actors can affect minerals related activities (or the making safe of mining legacies), how they can productively contribute to a improvement of the current situation, why they are motivated to be involved (and so forth).

The groupings of stakeholders used here will be based around such the mining operations that they have a "stake" in and thus (in this part of the discussion) the "operative organizations" that conduct the mining operations. As such, the prime audience for this document will be classified as a stakeholder to the activities of such operative organizations. As this discussion will outline, policy makers and regulators are dominant stakeholders but are not the only stakeholders of marked salience to an organization engaged in mining activities.

Mitchell *et al* (1997), propose that classes of stakeholders can be identified by their possession of key attributes, or the nature of their key attributes. These attributes include:

1. **the power** to influence an organization,
2. **the legitimacy** of their relationship with the organization, or
3. **the urgency** of the stakeholder's claim on the firm.

In simplistic terms, the most important stakeholders for an organization involved in carrying out some activity, are those who combine all three such attributes.

Power is simplified to a definition following where it is held to be *"a relationship among social actors in which one social actor, A, can get another social actor, B, to do something that B would not otherwise have done"* (Pfeffer, 1981). Stakeholders with power in such relationships have access to coercive, utilitarian (generally material rewards as goods or services, including money) or normative means to impose their own will in a relationship. It is important to recognise that there are some stakeholders with the power to influence whether they have legitimate claims or not.

62. In this vein, Alexios Antypas of the Department of Environmental Sciences and Policy at the Central European University (personal communication: Central European University, 2005, 24 July) indicates that negotiated agreements with communities offer both sides an opportunity to develop a win-win situation, or at least to minimize the harm and maximize the benefits to communities by focusing proactively on community rights and interests. He indicates that many communities in the world have actually been made poorer by mining projects rather than enriched, and that communities can bear by far the greatest environmental and social burden that such projects entail – both during operation and in the post-closure phase. Further, he notes that now that mining communities are increasingly linked to international NGO networks that have the capacity to disrupt projects, the mining industry has practical as well as moral interests in making sure that communities are brought into the development process and benefit from their projects. He also indicates that negotiated agreements between communities and mining companies can take many forms and include any number of issues important to both parties. They can be reached at any time, but the best time to make this is while the project is still being developed so that communities can help shape the project so it imposes the least burdens and brings the greatest benefits to them.

63. Mitchell, R.K., Agle B. A. and Wood D.J., Toward a Theory of Stakeholder Identification and Salience: Defining the Principle of Who and What Really Counts. The Academy of Management Review, Vol. 22, No. 4 (Oct., 1997), 853-886

Legitimacy is generally based on contract, exchange, legal title, legal right, moral right, at-risk status, or moral interest in the harms and benefits generated by company actions (Mitchell, 1997). Here, this term will generally imply a perception or assumption that the actions of an entity are desirable, proper or appropriate within some socially constructed system of norms, values, beliefs or definitions.[64] Individuals, organizations or societies can hold such norms.

Urgency implies terms such as compelling, driving, imperative and is related to two key conditions:

- time sensitivity – the degree to which managerial delay in attending to the claim or relationship is unacceptable to the stakeholder, and
- criticality – the importance of the claim or the relationship to the stakeholder or as such, the degree to which stakeholder claims call for immediate attention.[65]

A representation of stakeholder groups developed for the context of this document is shown in Figure 3.1. These constellations, the manner in which they have been derived, and some important implications of the model applied are discussed in the following pages. Note that for simplicity, the terms applied in Mitchell et al (1997) have been maintained in the application of the model here. The descriptors are *not* intended to be derogatory.

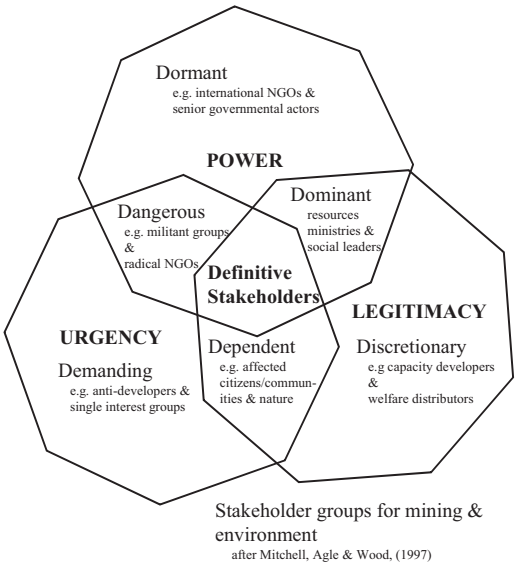


Figure 3.1 **Stakeholder groups & attributes for mining and environment**

3.1.1 LATENT STAKEHOLDERS

A first category of stakeholders to be addressed in this discussion include powerful actors lying "at rest" (dormant stakeholders), respected actors who depend on support granted at the discretion of others (discretionary stakeholders), and angry or upset stakeholders who despite the importance of the issue to them, lack power or a legitimate status (demanding stakeholders). Members of this group are described as latent stakeholders and form the outer ring in Figure 3.1. More detailed delineation of these categories and examples with a mining context are included below.

Dormant stakeholders can be said to be those who possess power to impose their will upon an organization, but lack a legitimate relationship or an urgent claim. Power can be held by those that have significant financial resources (utilitarian power), or can command the attention of the media (symbolic/normative). If such actors acquire urgency or legitimacy, or both, then they can quickly shift to a status of great importance to an organization. Stakeholders relevant to mining activities in this regard include powerful international NGOs currently dealing with other issues, senior governmental actors currently satisfied with the status quo, or not immediately responsible for mining activities, internal actors with direct access to the media, and so forth.

Discretionary stakeholders can be said to be those that possess the attribute of legitimacy but lack power and urgent claims. Such groups are those most likely to be the recipients of discretionary corporate social responsibility (giving) activities. In a mining context, actors in this category can include: schools and similar institutions receiving material resources from a mining actor, capacity building activities supplied to ethnic or indigenous groups from miners, sector NGOs or academic institutions as recipients of research grants or other funding to support generation of "best environmental practice" documentation, and so forth.

64. As such, following Suchman (1995).

65. *Criticality* is an important concept where examples aid in understanding. Examples of why a stakeholder might view its relationship with an organisation to be critical include: the stakeholder providing *firm-specific assets* that lose their value if used by another firm or in a different way; *sentiment* due to the involvement of family members in firm activities over several generations; *expectation* of continued great value such as employment and benefits; and so forth.

Demanding stakeholders can be said to be those stakeholders whose sole relevant attribute (at present) is urgency. Lacking power or legitimacy, such actors nevertheless constitute the vocal "mosquitoes buzzing in the ears of management". In a mining context, actors in this category can include: community interest groups; single interest environmental or historic preservation groups; national and/or international "anti-mining" or "anti-development" interest groups;[66] and so forth.

3.1.2 EXPECTANT STAKEHOLDERS

The second category of stakeholders to be addressed in this discussion is deemed to be expectant. This group includes powerful actors with an issue of interest (dominant) who despite this, currently see no urgency in the issue; suffering or otherwise legitimately affected actors who depend on support granted by one more powerful (dependent); and angry or upset stakeholders with power who lack a legitimate status (dangerous). Again, more detailed delineation of these categories and examples with a mining context are included below.

Dominant stakeholders include powerful and legitimate actors. Simply put, such actors possess legitimate claims and have the necessary resources or means with which to act upon such claims. As has previously been stated, this actor group is generally (or traditionally) deemed the most important and is granted most attention by industrial actors. Organizations commonly produce reports to legitimate, powerful stakeholders such as these (e.g. environmental and social responsibility reports as well as more traditional annual corporate reports). While such stakeholders are central, they are not always the most important when issues of concern arise. In the context of this document, such actors include the owners and creditors of minerals related organizations, community leaders, ministries of natural resources and environment, international development agencies, and so forth.

Dependent stakeholders have urgent and legitimate claims but depend on others for the power to carry out their will or to meet their calls for aid. As power is not reciprocal in their relationship with organizations or industry, then exercise is governed by advocacy or guardianship of others (e.g. government, legislators or other powerful actor groups must engage on their behalf). In the context of minerals related activities, relevant groups in this category could include: near-mine or near-minesite residents, downstream water users, and transboundary communities and/or political actors across jurisdictional boundaries. Further, this group is also deemed to encompass non-human actors such as mammals and birds, aquatic species – and indeed nature itself.

Dangerous stakeholders can arise where urgency and power combine within an actor that lacks legitimacy. Such actors can be coercive or even violent, are deemed "dangerous", and can utilise measures such as wildcat strikes, sabotage, or even terrorism in order to achieve their aims. There are a number of stakeholders relevant to mining activities in this regard and the importance of this group cannot be understated in Nation states or sub-regions where political instability is, or has recently been prevalent. Possible actor groups in this category that are of relevance include militant political groups, radical NGOs, marginalised ethnic groups and so forth.

3.1.3 DEFINITIVE & POTENTIAL STAKEHOLDERS

The stakeholders of most marked salience within this framework (and thus to an organization engaged in mining activities in the context of this discussion) are those who combine all three definitive attributes. Stakeholders holding power and legitimacy (by definition dominant) are those most likely to evolve to this category. This occurs when some incident or development lifts the criticality of the issue for them. When such stakeholders discover an issue, or a claim that is urgent, then managers (or other responsible parties) have a clear and immediate mandate for action.

Moreover, it is most important to note that there is interaction between groups. For example, dependent stakeholders may move into the definitive position by having their urgent and legitimate claims picked up by a dominant stakeholder (e.g. Mitchell *et al* (1997) describe Alaskan communities moving in this manner in the Exxon Valdez case when the government became an important ally); or dangerous actors migrating to a definitive position via the legitimization of their claim (e.g. the evolution of the African National Congress [ANC] from an organiza-

66. In most nations and societies, the NIMBY (Not In My Back-Yard) syndrome must be dealt with to some extent. In situations where trust in authorities and industrial actors is low, then it appears reasonable that the BANANA (Build Absolutely Nothing Anywhere Near Anything) syndrome may also be relevant.

tion considered by industrial interests to be "dangerous" to a definitive stakeholder when it acquired legitimacy via success in free national elections). Certainly in a mining context, the ability of parties such as NGOs – even small local NGOs – to broadcast their issues (via the internet for example) and to rally support from a diverse range of actors has grown markedly in recent years (Antypas, 2005). When powerful and influential actors take up their issues such stakeholders can become definitive.

Finally, it is important to note that social actors generally exist that have none of the important attributes at a certain point in time. This does not imply however, that they will not at some stage acquire one or more attributes. The class of potential stakeholders is real and can evolve into an active category at any time.

3.2 STAKEHOLDERS & THE POTENTIAL USE OF THIS DOCUMENT

The motivations for inclusion of Section 3 in this document have been threefold. Firstly, it is considered valuable to provide an outline of the manner in which stakeholders may have salience to a mining development or abandoned or orphaned site. In this case, the three determinants power, legitimacy and urgency have been utilised. Secondly, it has been sought to provide a manner in which to map stakeholders. Here a diagrammatic representation has been utilised for that purpose (after the work of Mitchell, 1997). Thirdly, it has been sought to show in some small way, the pathways via which stakeholders can gain such ascendancy that they have the means to dictate the manner course that a mining development might take – particularly in situations where they consider that the mining activities or their legacies affect their lives negatively.

As an example of this in a mining context, Figure 3.2 indicates a theoretical transition to a definitive position by a dependent community near a mining activity. Here, their urgent and legitimate claims against a mining activity are brought to the notice of, and taken up by dominant stakeholders. In this instance power is provided then by senior politicians or international NGOs – actors who have the power to force changes, but who until this point did not perceive the issue to have urgency. Such a process has been facilitated in this theoretical case, by demanding stakeholders such as National NGOs who lack the legitimate claim of the local communities but can amplify the voice of the community – and who through the community, may also find a legitimate platform for their opposition to a development. Parallels to such a migration of influence can be found in mining and other industrial settings all around the world.

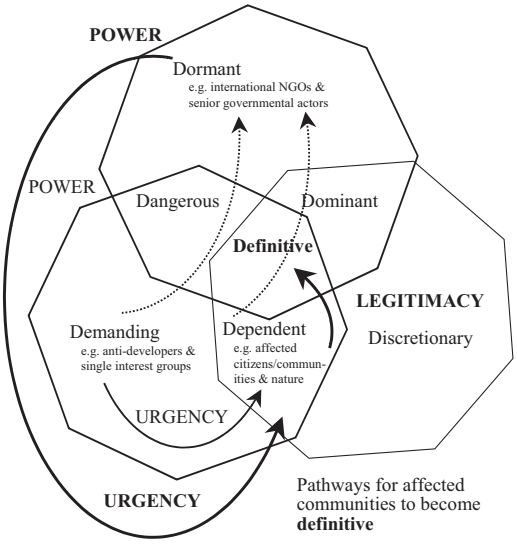


Figure 3.2 **Transformation from a dependant into a *definitive* stakeholder**

As such, the material in this section should, *inter alia*:

- help clarify who can be important to the conduct of mining activities;
- help clarify why such actors are motivated and/or active – or dormant;
- heighten awareness amongst miners and decision-makers of what can happen;
- provide understanding of how such events can transpire – e.g. the manner in which control of natural mineral resources can be lost or projects delayed.

In the context of *Mining for Closure*, a mapping of the relevant stakeholders with clearly identified parameters of salience is intended to help clarify those consequences that may arise if *best environmental practice for mining* is not carried out, if the underlying motivations for *Mining for Closure* are not clearly communicated to constituencies, and if effective dialogue with affected stakeholders is not achieved. Conversely, these conceptual frames should help clarify the benefits of mining best environmental practice, clear communication and awareness of constituencies.

To further clarify the intention of this document, and the manner in which it is related to the types of stakeholders outlined above, the following notes are provided regarding a limited number of key stakeholders. These points also build on the content of other parts of this document.

Administrators of minerals activities (dominant and dormant stakeholders). This brief document is intended to outline the expectations of society and the international community, the general content of mining best environmental and social practice, and its degree of international uptake. This should serve to guide the building of the foundations for good mining policy and administration. Further, such stakeholders can use this document to help inform their own expectations for practice and to stimulate innovation and creation of solutions tailored to their own circumstance (as is discussed earlier in this document, a number of practices or investments required elsewhere will not suffice here, nor can they be afforded). This document should also help inform the stance of such actors regarding the granting of legitimacy or the granting of power to proponents or opponents of minerals related activity.

Communities adjacent to minerals activities (dependent stakeholders). The content presented within this discussion should help guide the expectations of such dependent actors. General guidance regarding reasonable expectations for safety, accident preparedness, operational emissions, *Mining for Closure*, closure plans, site monitoring and so forth is available in this text. Much more specific guidance is available in the sources utilised in generating this text This document should also provide aid in understanding the motives and the approaches of those directly involved in minerals related activities. The content can also help such communities where they need to seek power to support legitimate claims. This could be in the form of guardianship of administrations or the support and voice of the international community.

Downstream or risk-affected neighbours & nations (dependent or dangerous stakeholders). "Downstream" or "receiving" neighbours, particularly nation states can also utilise this document in the manner outlined for the dependant stakeholders above. The principal difference here are the scale, level of capacity and ability to pose some form of danger to the mining development in situations where jurisdictional legitimacy may be absent, but the means to act may not be.

National and international NGOs (demanding and dormant stakeholders). Again, the content presented within this discussion should help guide the expectations of such actors regarding reasonable expectations for safety, accident preparedness, operational emissions, Mining for Closure, closure plans, site monitoring and so forth. Further, this document should also provide aid in understanding the motives and the approaches of those directly involved in minerals related activities.

Intergovernmental bodies and development agencies (dormant, demanding or dominant stakeholders). Dependant upon factors such as the degree of urgency perceived and the ability to supply or withhold development funds, the application of this document amongst such actors will vary. Across the board, it appears reasonable to state that the content presented here will help such bodies formulate their expectations regarding *Mining for Closure*.

In the outlines presented in Figure 3.1 and Figure 3.2 the mining company (a proponent of mining) was presented as the central actor tied to a mining development – upon which all other stakeholders looked. Although not explicitly portrayed in those figures, it is clear that such actors are also central stakeholders in the mining development. Where they have a mining lease and official role (right of law) in society, there is legitimacy; where there are financial resources and human capacity then they have power; when they have committed resources to a project, there is time sensitivity and criticality.

Proponents of minerals activities (dominant or definitive stakeholders). For such actors, the material presented here should help underline the expectations of other parties – expectations that should be anticipated by proponents of mineral development. Further, this document aims to present a balanced account of the underlying economic and operational common sense of *Mining for Closure*. Within this facet, actions and practices performed so as to gain the trust of their opponents should be important to such actors. Even when trust may not be obtained, problems of opposition may be circumvented or defused by genuine displays of best practice that serve to reduce the legitimacy of claims made by opponents.

4. CLOSURE AND ABANDONMENT OF MINES

This section is intended to provide more background in three key areas. Firstly, the reasons for mine closure are addressed and these underlying reasons are linked to possible outcome scenarios – some far less desirable than others. Secondly, the global problem of abandoned and orphaned mine sites and the types of initiatives required to deal with this problem are discussed. Thirdly, the general form of stakeholder expectations regarding mine closure is presented. These expectations are then juxtaposed with closure requirements on the one hand and emerging post-closure considerations on the other.

4.1 WHY DO MINES CEASE ACTIVITY AND HOW DOES THIS AFFECT CLOSURE?

New orebodies and mineral resources are constantly being discovered through exploration but the reserves contained in any particular deposit on which a project is based are finite. All things being equal, it is thus logical that all mining activities at a certain mine site must come to a close at some stage within a foreseeable future.

In much of the previous discussion, it has been indicated that *the overall mine decommissioning process should be integrated with the overall mine operation planning process*. This appears in many instances to bear with it an implicit assumption that mine decommissioning usually occurs at a point in the life of an operation where the economic recovery of minerals has ceased *according to some plan*. Further, that this cessation is an ordered outcome. If earlier discussions of integrated mine planning hold, then it is feasible that a mine can be designed and operated with a continual focus on expected closure outcomes and according to a well-known timetable. As such, a process of progressive decommissioning should be undertaken.

This is of course feasible and some mines have been designed operated and closed according to predetermined plans. However, this has hardly been the standard *modus operandi* of mining. History has shown that mining activity can cease for many reasons and almost at any time. Many mining legacies are much more than the result of mine abandonment in the absence of legal and regulatory frameworks to ensure adequate decommissioning works.[67] In many instances they have been a part of larger economic or social situations that are in themselves stressful for communities dependent upon mining – and may in themselves have contributed to the cessation of mining activity.

Factors contributing to cessation of mining activities include *inter alia* (largely after Environment Australia (2002a; 2002b), and Smith & Underwood (2000):

- depletion of mineable reserves, that is as a result of the total extraction of the mineral reserves within the physical limits of a deposit or the mine area;
- unexpected changes/deterioration in geological conditions;
- changes in market conditions;
- changes in other external economic factors that make reserves unworkable at a given time (changes in liability conditions should be included in this category);
- financial (non)viability of the company;
- adverse environmental conditions or;
- adverse political conditions or social disruption.

Further, it is important to note that in some cases mining may only be suspended for a period of time and the project is placed under care and maintenance (Environment Australia, 2002a). How long this period is – or how intensive the degree of "care and maintenance" is, may vary significantly (Environment Australia, 2002a, 2002b; Environmental Protection Agency, 1995a; Robertson & Shaw, 1998; Robertson, 1998). However, in circumstances where it is clear that economic or other limits of the operations have been reached, decommissioning and final closure is required for such sites as well. In some instances, the delineation between a mine officially categorised as being on care and maintenance – and one that is abandoned may be difficult to make.

67. The reader is reminded, that until relatively recently in a limited number of countries, that decommissioning and closure works were generally not required.

In the context of SEE/TRB and regional neighbours, rapidly changing economic conditions, and socio-political upheaval have caused cessation of activities, or are causing cessation for a large number of mines. In general it can be said that such cessation (or at least moves into care and maintenance regimes) has often been at short notice and before adequate planning for closure has been carried out (Smith & Underwood, 2000).

Following the listing of potential reasons for mine activity cessation listed above, five possible scenarios for the cessation of activity/closure – and their implications can be generated in order to highlight differing paths and outcomes. Note that this is just a sample of the potential outcomes that may arise.

Ordered advance and completion – integrated mine planning and sound management of the financial aspects of mine planning, including provisions for closure can result in the conduct of mining essentially from the pre-mining planning stage until the economic depletion of mineable reserves. Economic depletion is followed by *completion of* decommissioning and rehabilitation works that have been conducted in an ongoing fashion (progressive rehabilitation) during mine life.[68] When conducted "according to plan", this scenario results in physical and chemical stability of environmental resources, protection of public health and beneficial and sustainable after-use of the site in the long term (and so forth).

Strategic re-visioning of final mine-life years – existing and ongoing mining operations commenced in the absence of *Mining for Closure* practices still have options for the incorporation of mine closure planning and the management of the financial aspects of closure in the years that remain until expected economic depletion of mineable reserves. While the options available, and the ease, effectiveness and efficiency of decommissioning and rehabilitation works are likely to be less than in a "planned for closure mine", this scenario can still result in the desired closure outcomes listed in the previous scenario.

Ordered retreat – changes in external and/or internal economic factors that make reserves unworkable prior to anticipated closure time – in the *presence* of planning and provision for closure an "ordered retreat" can result in adequate and acceptable decommissioning and rehabilitation works.

68. Applicable in varying degrees according to the specific morphology of a mining operation.

Retreat in disarray – changes in external and/or internal economic factors that make reserves unworkable prior to anticipated closure time – in the *absence* of planning and provision for closure such situations are likely to result in mining legacies. Further, this scenario suggests the potential for ongoing legal action (or similar) where authorities seek to recover some of the likely cost for the conduct of adequate decommissioning and rehabilitation works. The successful conduct of such legal processes (and/or conduct of mine site rehabilitation) may however be unlikely, particularly where a mining company has already gone into receivership or become insolvent.

Dereliction of duty – experiences around the globe indicate that dereliction of legal or moral duty by mining organizations has taken place in the past and can be anticipated in the future. In such scenarios, the potential for closure/rehabilitation accountability may lead an organization to engage in asset stripping (or other) activities aiming to remove recoverable assets that may have been available to pay for closure from the reach of governing bodies. While this scenario again suggests the potential for ongoing legal action (or similar) where authorities seek to recover some of the likely cost for the conduct of adequate decommissioning and rehabilitation works, the conduct of such processes will likely be more difficult than even in the previous scenario. Here deliberate criminal (or morally delinquent actions) are again likely to leave the state with an abandoned or orphaned site to add to its ledgers.

Throughout this document it has been argued that only the first three of the above scenarios are acceptable. *Mining for Closure* approaches represent the only manner in which this situation can be achieved. This however, represents a major challenge for all jurisdictions as Clark *et al.* (2000) summarise below:

> *Comprehensive mine closure for abandoned mines, presently operating mines, and future mines remains a major challenge for virtually every mining nation in the world. To accommodate the need to close abandoned mines and to ensure that existing and future mines are appropriately closed will require the cooperation of a diverse stakeholder community, new and innovative methods of enhancing closure and major policy and legislative change in most nations to ensure post-mining sustainable development.*

Having briefly addressed the multiple reasons for cessation of mining activities and having portrayed a number of courses of action that may eventuate, further discussion is relevant regarding orphaned sites. That is, sites with no identifiable owner. This topic is addressed in the following section. More rationalization of why mine sites are abandoned is provided in Section 4.3.

4.2 A SPECIAL PROBLEM WITH "ORPHANED SITES"

The whole topic of environmentally and socially responsible mining is often a forward-looking debate focused upon present or future mines. However, we must nevertheless apply focus to the legacies of the past in the form of abandoned and orphan sites of minerals related activity. This is where the problem is at its most intractable, where the need for new action is greatest, and where the challenges of innovation and new action frameworks still need to be met (Balkau, 2005b).

Among the environmental problems still to be confronted by the mining industry, that of abandoned mine sites, has been particularly slow to be tackled. Historically, it was common practice to 'abandon' a mine site when mineral extraction was completed. The land was left unvegetated and exposed, while waste materials were left in piles or haphazardly dumped into mine cavities or pits. There was little concern for the environment and no thought of how mining might adversely affect the surrounding ecosystem in coming years (van Zyl, Sassoon, Fleury, & Kyeyune, 2002b).

In many such cases, there is no clearly assigned (or assumed) responsible party or the legal, financial and technical instruments being used, and the approaches to social issues, are inappropriate for such sites and their neighbouring communities (Balkau, 2005a; Post Mining Alliance, 2005). Further, factors such as the potential costs of wide scale rehabilitation and the absence of criteria and standards for rehabilitation have delayed action by both the industry and by public authorities (Balkau, 2005a). Indeed, while there have been calls of varying intensity for action from international actors (European Environmental Bureau, 2000; Miller, 1998, 2005; Onorato *et al.*, 1997; Strongman, 2000) there have been few attempts by international bodies thus far to examine the issue and provide concrete guidance to national institutions. Such guidance is required.

> *At issue is the development of an effective and efficient approach to the funding of closure that enables mine rehabilitation and other environmental objectives to be achieved and also facilitates and encourages industry to comply with the requirements of Government and the community (ANZMEC MCA, 2000, p. v)*

One place to commence is by examining how widespread the problem really is. A fact is clear – there are hundreds of thousands of orphaned and abandoned mines worldwide (Post Mining Alliance, 2005; U.S. Department of Interior, 1998; van Zyl *et al.*, 2002b). Attempts at quantifying the number of abandoned sites yield astoundingly high figures.

In the US alone around over 400 000 sites on Federal Land alone are reported (U.S. Department of Interior, 1998; UNEP, 2001). Balkau (2005a; 2005b) indicates that some 500 000 sites are probable with at least 100 000 demanding some action. The seriousness of the challenges in the US is highlighted in the quote below:

> *Over 400,000 abandoned mines are found on Federal lands. In addition, many more are adjacent to Federal lands or are affecting water quality and biological resources under Federal stewardship. Defunct mines have contaminated public and private lands with more than 50 billion tons of untreated mine waste. In the Appalachian coal region, acid mine drainage has degraded more than 8,000 miles of streams and has left some aquatic habitats virtually lifeless. The cleanup and remediation of abandoned mine sites will require a huge investment of taxpayers' dollars. In West Virginia alone, the coal industry is spending approximately $1 million each day to treat acid mine drainage (U.S. Department of Interior, 1998).*

Much closer (or indeed geographically a part of) to the SEE/TRB region, Slovakia, registered more than 17 000 old mining sites, while Hungary has reported some 6 000. In most countries however, data are scarce and we are forced to rely on anecdotal evidence. Further, the social and economic impacts of these sites have never been systematically evaluated. We can however, safely suppose they are substantial (Balkau, 2005a).

While the numbers can be supposed to be substantial, fortunately not all sites will be problematical when viewed from environmental, health and safety or social viewpoints. A sense of the likely proportion is provided in the following excerpt from UNEP (2001) by George Stone of the United States Bureau of Land Management (BLM).[69]

> *"The Bureau has estimated that there are between 100,000 and 500,000+ small and midsize abandoned hard rock mines in the west. Most sites are not posing problems. Of those that are, 25 per cent relate to health and safety matters and 5 per cent to environment, primarily issues of water pollution. There are some 13,000 abandoned coal mines, mostly small and mid-sized in the east. These are causing mainly health and safety problems."*

This summary of the US situation provides some useful insight into the relative percentage risk types. It is likely that similar ratios will be experienced in SEE and the TRB.

If remediation is examined, it becomes clear that while some of the more high-profile sites are being remediated and pollution is being treated, this is taking place in only a few countries – and generally in wealthy mining countries such as Australia, Canada, Germany and the US. Most sites around the world receive no attention, and many are not secure.

Although the problem is clearly of global scale, the enormous financial liability embedded in any systematic rehabilitation programme constitutes a major disincentive for the association of economic actors with orphaned and abandoned mine sites. Even a small percentage of the total cost burden – if it were to be legally attributed – could cripple the target body. Attempts to assign responsibility to the mining sector are met with the response that it was not the present companies that caused the problem, the government has had the benefit of the taxes and royalties from the past activity and as a result, the government should now look after the consequences. The lack of current legal owners of old sites thus seems to place the accountability in the government arena. However few governments have the resources or the expertise to take on physical and financial responsibility for dealing with such orphaned sites. The approach of trying to find a guilty party is ultimately sterile for a very practical reason – the global (and often even national) problem is beyond any single actor's financial or organizational resources to solve alone in a conventional manner.

It is clear that a new approach is required to find more innovative solutions. Further, a recent international mining initiative (Post Mining Alliance, 2005) holds that at the international level, a series of recent political developments support the timeliness of the idea. They indicate that the management response to the recent Extractive Industries Review at the World Bank Group, the proposed Intergovernmental Forum of Governments on Mining/Metals and Sustainable Development and revisions to EU mine waste legislation, all call for more attention to be paid to who can, and how to, address the challenges of post-mining communities and landscapes.

4.2.1 AN INTERNATIONAL POST MINING ALLIANCE

In the light of such developments, a brief examination of the proposed approach for an international body intending to contribute to progress is undertaken in this section. This will then be followed by examination of parts of an ongoing Canadian programme. While the latter focuses upon national challenges, most of the items addressed are of direct relevance in an international context.

Box 3 detailing the recent launching of the PMA, an international body intending to contribute to progress is presented below. It can be seen that many of the issues highlighted thus far in this report are given attention.

Taking the concept related above as being representative of international calls in this regard,[70] the content of such an initiative can be examined for its contribution to areas where behaviour of key stakeholders can be influenced. Key areas addressed

69. Albeit, first some idea of the number of "problematical" sites must be obtained. While the first citation above does indicate that this could be as high as 25%, this can only be seen as speculative. If that were the case, then one might expect some 5-10% of sites to pose health and safety risks, and some 1-2% of sites to be problematical with regards environment. Note however, that the "area" where mining activities have taken place may contain very many individual "sites".

70. A reasonable presumption at the time of writing as the PMA has initial partners that include the Eden Project, Rio Tinto, Anglo American, English Partnerships, English Nature, Imerys and the Mineral Industry Research Organisation and is seeking partnership with other multinational mining companies, the International Council on Mining and Metals, NGOs including the WWF, IUCN, Conservation International, Earthworks and development aid groups. Further, it has sought active input from intergovernmental bodies such as the World Bank Group, the United Nations Environment Programme and representatives from the US Environmental Protection Agency in its early planning work.

Box 3 **A proposed approach for the Post-Mining Alliance** (Post Mining Alliance, 2005)

The Approach

The Post-Mining Alliance aims to become the world leader in co-ordinating information exchange and facilitating the implementation of good practice in integrated mine closure planning, and in dealing with the adverse social and environmental legacy of orphaned and abandoned mines. It will promote a multi-stakeholder approach in which risks, responsibilities and opportunities are shared. It will optimise engagement between mining sector stakeholders, and build a network to transfer ideas, knowledge and technology globally and deliver action locally.

Action on these issues will require innovation on a number of fronts:

- Inventive technological solutions – both engineering and biological
- Creative financial mechanisms – to release funds from diverse sources
- New legal instruments – to overcome the historical stumbling blocks
- Unconventional partnerships – involving both the public and private sectors, and embracing players who are not usually engaged in post-mining regeneration.

The Alliance will be an international organisation in subject scope, membership and operational influence. The critical audiences have been identified as policy makers and legislators at all levels of government, companies, the investment community, local communities and non-governmental organisations.

A small secretariat coordinates the Alliance at the Eden Project, Cornwall, UK. Key activities of the Alliance will include:

- Benchmarking good practice
- Developing demonstration models
- Convening & facilitating workshops

The underlying philosophy of the initiative is that mine closure planning and the adverse impacts of mining legacy should be addressed by a wider constituency than mining companies alone. While there is significant activity in post-mining regeneration being undertaken worldwide, there is a clear need for co-ordination in identifying, collating and disseminating good practices, and further integrating social, economic and environmental factors. One of the key challenges is to promote much wider adoption of current good practice in integrated closure by those who, for a variety of reasons, do not conform to this standard or expectation. There is a need to understand what constrains the adoption of good practice. At the same time, particularly in developing countries, regulators and other stakeholders are calling for more guidance and capacity-building to ensure that good practice can be more easily identified, understood, acknowledged and implemented.

here include 1) coercive measures; 2) utilitarian measures supplying some form of material incentive; 3) measures intended to supply or enhance capacity and 4) measures taken to influence the norms of industry and other stakeholders.[71] These categories, assessed in Table 2 indicate that the focus of this initiative (and similar initiatives) are predominantly targeted at influencing capacity related and normative factors within the shift to more sustainable mining practice (i.e. what capacity actors have to perform, and what social norms actors seek to comply to or feel bound to comply with).[72]

The brief examination documented in the table indicates that the key focus of the initiative is upon the influencing of norms, and the stimulation of capacity building. The stimulation of suitable coercive measures to frame absolute requirements for *Mining for Closure* and the creation of models for utilitarian measures that can encourage uptake remain largely outside the remit for such initiatives. This provides some indication of the gap that this document must seek to fill.

Further, it is desirable that concrete examples of the types of works required are available upon which to base initiatives in SEE. Here, notable actions are being undertaken in some national jurisdictions. One leading example shall be taken up prior to moving to an examination of the underlying reasons for mine abandonment in Section 4.3.

71. Delineation of such approaches – or the manner in which stakeholders influence, and can be influenced, can be found in sources such as Mitchell et al (1997). Refer also to the discussion of policy measures in Section 1.5.

72. Note that some proposed work areas address more than one area or measure.

Table 2 **Pathways to influence important Stakeholders: The PMA**

Influencing measure typology	Description of modality	Manner in which apparently addressed or implied
Coercion	measures involving force or coercion such as laws, regulations and so forth	New legal instruments to overcome historical stumbling blocks
Utilitarian measure	measures supplying some form of material or fiscal incentive (and/or disincentive). These can include subsidies, taxes, tax-breaks, and so forth.	Creative financial mechanisms to release funds from diverse sources
Capacity building	measures increasing the capacity of actors to act upon opportunities, understand issues, to physically conduct processes, and so forth.	networks to transfer ideas, knowledge and technology promotion of inventive engineering and biological technological solutions Developing demonstration models Convening & facilitating workshops Unconventional partnerships – involving both the public and private sectors, and non post-mining regenerators
Normative	measures stimulating evolution of views held regarding what is, socially responsible, acceptable, valid and so forth.	to promote much wider adoption of current good practice in integrated closure optimise engagement between mining sector stakeholders a network to transfer ideas, knowledge and technology globally and deliver action locally Unconventional partnerships – involving both the public and private sectors, and non post-mining regenerators Benchmarking good practice

4.2.2 THE CANADIAN NOAMI PROGRAMME

Significant works are being undertaken in Canada to deal with contaminated mining sites and abandoned/orphaned mine sites (OAMs in Canadian terminology). Tremblay (2005) reports that Canada's long history in mining has resulted in more than 10 000 orphaned or abandoned sites that require varying degrees of rehabilitation and that the National Orphaned/Abandoned Mines Initiative (NOAMI) was established in 2002 in response to a call from the various Canadian Mines Ministers.[73] It was desired that that a multi-stakeholder advisory committee be set-up to study various issues and initiatives concerning the implementation of remediation programs across Canada. NOAMI is now a co-operative programme guided by an Advisory Committee that is sourced from the mining industry, federal/provincial/territorial governments, environmental non-government organizations and First Nations.

Five groups have been formed since the initiation of NOAMI to address challenges in the following key programme areas:

- Information Gathering;
- Community Involvement;
- Legislative Barriers to Collaboration;
- Funding Approaches, and
- Guidelines to Legislation Review.[74]

The programme has already achieved notable outputs and NOAMI has completed several studies including a review of funding models and community involvement. Further, work is ongoing with guidelines for jurisdictional legislative reviews with respect to collaboration, liability and funding. The work aims to ensure that approaches across ju-

73. Mining is generally regulated at the provincial level, although the federal Government maintains most of the responsibility for mines in northern Canada (north of the 60th parallel).

74. All reports generated by NOAMI are now available from www.abandoned-mines.org

risdictions are consistent, clear, transparent, coordinated and efficient for orphaned and abandoned mines in Canada. A short précis of work in the key programme areas (summarised from Tremblay (2005)) is supplied below.

Information Gathering – The principal objective in this area is to develop capacity for a national inventory of orphaned and abandoned mine sites based on compatible inventories from each province and territory, and including an acceptable system for categorization and priority ranking.[75,76]

Community Involvement – Work in this area has focused on the development of a plan to foster community involvement in decision-making about closure and reclamation, and to ensure that targeted end-use and reclamation standards are acceptable to local communities. In 2002, case studies related to community involvement were completed for three Canadian mine sites, along with experiences in community involvement at abandoned mines in the United States were completed (See NOAMI (2003b)). The "lessons learned" from these studies were developed into a series of guidelines (11 guiding principles) and published in the pamphlet "Best Practices in Community Involvement" (NOAMI, 2003a).

Barriers To Collaboration – In order to assess barriers to collaboration, a review was undertaken to examine legislative requirements in Canada and selected other international jurisdictions. The study addresses regulatory or institutional barriers, liability disincentives, and collaborative opportunities regarding voluntary abatement, remediation, and reclamation of orphaned/abandoned mines. Particular emphasis was placed on four approaches:

- 'Good Samaritan' legislation;[77]
- permit blocking;
- allocative versus joint and several responsibility; and
- non-compliance registries.

The final report for this work titled "Barriers to Collaboration: Orphaned/Abandoned Mines in Canada" was completed in 2002 (Castrilli, 2002).

Funding Approaches – As a key output for this work, a report titled "Potential Funding Approaches for Orphaned/Abandoned Mines in Canada" (Castrilli, 2003) was prepared. The report outlines variety of funding approaches to be considered for the clean up or management of liabilities related to OAMs. Individuals with expertise in this area were surveyed, and the report incorporated their views as well as those of the authors. Advantages and disadvantages of each approach were evaluated and preferred options were recommended for consideration by governments. As part of ongoing work in this area, NOAMI is currently in the process of organising an "Assessing Liabilities and Funding Workshop" that shall take place in November 2005 in Ottawa, Canada.[78]

Guidelines For Legislative Review – A study is being undertaken to address both the broad application of legislation and policies and the wide spectrum of regulatory agencies that regulate contaminated sites, operating mines, and orphaned and abandoned mine sites in Canada. It involves jurisdictional legislative reviews with respect to collaboration, liability and funding to ensure that approaches across jurisdictions are consistent, clear, transparent, coordinated and efficient for orphaned and abandoned mines in Canada. These guidelines are intended to provide a consistent approach to the completion of a review of legislation (acts and regulations) and related policies and practices (such as permitting, licensing and approval processes) that relate to orphaned and abandoned mine sites as well as contaminated and operating sites if there is demonstrated relevancy to legacy issues. The guidelines are set up in the form of a checklist with associated questions, which will be completed during the study.

Not least due to their relevance to SEE/TRB jurisdictions, the sections *Funding Approaches and Barriers to Collaboration* are taken up in Sections 5.1.2 and 5.1.3 as examples.

75. In the Canadian study it was also found that there is a great deal to be learnt from experiences in the US. Both this study, and an earlier Canadian effort (see Mackasey, W.O. (2000): Abandoned Mines in Canada. www.miningwatch.ca/publications/Mackasey_abandoned_mines.html) concur that the United States has by far the most advanced inventories dealing with the abandoned mine issue.

76. The reader should note that the European Union has now also released guidelines for creating inventories of mine waste sites. See Appendix B for details of the report EUR21186EN, "Options for compiling an inventory of mining waste sites throughout Europe" edited by S. Sommer.

77. Environmental Good Samaritan legislation in the context of this ENVSEC document refers to legislative measures designed to encourage volunteer reclamation and water pollution abatement by the placing of limits on civil and environmental liability. As an example, such legislation may grant civil and environmental relief to landowners, persons or watershed groups performing reclamation and other pollution abatement activities on land and water adversely affected by mining or similar activities.

78. A number of case studies will be featured (i.e. showing how the funds were available/not available; financial-bonding assurance). The plan is to have about 75% of the presentations on methods used to assess liability and the remaining 25% on funding approaches.

Dissemination of information to the partners and the public in a timely manner is considered an important function for multi-stakeholder programs undertaken in Canada. NOAMI has been active in its transfer of information and utilises a number of routes. An abandoned mines Internet site (www.abandoned-mines.org) has been established and is regularly updated with information, reports and newsletters. The Secretariat issues communication documents, such as newsletters, on the activities of the orphaned and abandoned mines initiative. These newsletters are posted on the website, as well as electronically distributed to the Secretariat's mailing lists.

4.3 WHY ARE MINE SITES ABANDONED?

This discussion is intended to build upon that presented in Section 4.1, however the focus in this text is upon the actual motivation for abandonment rather than just cessation/closure. The following quote from Nazari (1999) is provided to set context for this discussion.

> *Mine closure is, typically, required at a time when the operation is no longer economically viable, when cashflow is often severely restricted or negative, and when the value of assets is below the expenditures required to achieve the environmental objective of mine closure. The objective of securing mine closure funding at an early project development and implementation stage is to mitigate against the risk that an enterprise may either be unwilling or unable to undertake mine closure due to lack of funding*

A range of reasons for mine abandonment are presented in literature surrounding the industry (Environmental Protection Agency, 1995b; Mulligan, 1996; Nazari, 1999; Sengupta, 1993; Smith & Underwood, 2000; van Zyl *et al.*, 2002b; WOM Geological Associates, 2000). A number of the mining related elements that are held to contribute to the creation of abandoned mines include:

- the general absence of mine reclamation policies and regulations until the latter part of the twentieth century;
- ineffective enforcement of mine reclamation policies and regulations if, and where in existence;
- the absence of financial security mechanisms to ensure funds for parties such as government to conduct remediation in the event a mining company going bankrupt and being unable to cover the costs of rehabilitation;
- inadequate financial security to address remediation if, and where such funds were set aside;
- unforeseen economic events that caused early cessation of activities or left companies bankrupt, such as a sudden drop in metal prices, insurmountable difficulties with mining/milling, and/or infrastructure problems;
- past technical practices undertaken such as the sinking of numerous exploration shafts and mineral deposit test pits that were never back-filled prior to the introduction of drilling equipment for mineral deposit evaluation;
- national security issues such as the supply cut-off for strategic metals in times of conflict leading to rapid mining activity with scant consideration of closure requirements or operational longevity;
- Loss of mine data including records of underground workings and surface openings due to natural disaster, regulatory flux, unscheduled cessation of activities, political disruption and conflict;
- Political unrest, conflict and political instability leading to unscheduled cessation of activities of a number of mines;[79]
- Small scale mining conducted by artisanal or illegal miners, also including the uncontrolled occupation of mine sites.

Since abandonment today is usually sudden and unplanned, governments are often left responsible for mine closure and rehabilitation. Clark *et al.* (2000)) stated the following about the costs associated with abandoned mines:

> *closure and rehabilitation costs must be directly or indirectly born by the State. As such the abandoned mines represent not only a major liability for the government but for the affected communities, adjacent areas and society at large: the latter must ultimately bear the financial burden of ensuring appropriate closure.*

It is clear that most of the points outlined above can be planned for, or are preventable in some way. Indeed there are growing expectations around the

79. Examples include the Kilembe copper mine in Uganda that was abandoned in the early eighties due to political unrest and the Bougainville mine in Papua New Guinea was abandoned in 1989 due to a landowner rebellion (van Zyl *et al.*, 2002b).

world that preventative measures leading to adequate mine closure be always put in place. The next section summarises common expectations regarding responsible mining and responsible governance of mining activities.

4.4 COMMON EXPECTATIONS AND EMERGENT BEST ENVIRONMENTAL PRACTICE

As has been made clear throughout this document, significant advances have been made in mining practice over the past two decades or so – particularly in "leading" mining countries. These advances cannot be divorced from their central drivers – public expectations, governmental measures that are stimulated by the expectations of other stakeholders, and general awareness of the implications of legacies and the need to prevent more. As has been outlined in Section 3, the stakeholders that generate "common expectations" are diverse and can act alone on in constellations depending upon individual situations. One trend is certain – expectations regarding the levels of environmental and sustainability-related practice in mining and for mine closure are increasing.

4.4.1 BASE EXPECTATIONS REGARDING CLOSURE

According to van Zyl *et al* (2002a), the activities during the final closure stage for a mine site include: (1) the removal of infrastructure, (2) the implementation of public safety measures, (3) re-contouring and revegetation (rehabilitation), (4) ongoing maintenance of site structures and monitoring of environmental issues, (5) the operation of site facilities required to mitigate or prevent long term environmental degradation and (6) the completion of company involvement in sustainable community economic and social programmes.

> *Mine decommissioning and closure is the process of shutting down a mining operation with the broad objective of leaving the area in a safe and stable condition that is consistent with the surrounding physical and social environment and does not need ongoing maintenance (Environment Australia, 2002a).*

The following text will address that which this discussion deems these points to mean.

As has been alluded to in the introductory section and in Section 2, expectations regarding the manner in which mining activities are planned and regulated (encompassing planning, implementation, closure and post-closure cycles) encompass at least the following *planning expectations*:

- planning defines a vision of the end result for mining land and sets out concrete objectives to implement that vision;
- mine closure plan is an integral part of a project life cycle;
- the preparation of a mine closure plan takes place early in the process of mine development and in consultation with the regulating authority and local communities;
- planning for mining operations should include environmental, social and economic aspects.

> *In general terms this context includes a process that extends from the pre-mine planning phase, through construction, mining, and mine closure to post-mine stewardship (Environment Australia, 2002b).*

It is also important that planning expectations continually evolve to maintain relevancy in the eyes of key social actors. Social expectations continually grow in a wide range of areas as was highlighted in Sections 2.3.4 and 2.3.5 where principles for investment were outlined. Despite the fact that those example are for investment in mining projects, the reader is encouraged again to examine the content Appendix C – The Equator Principles and Appendix D – Governance Principles for FDI in Hazardous Activities in order to gain a picture of what "current best practice" expectations may be.

When shifting to the environmental outcomes of mine closure, expectations include that mine closure is to provide long-term stabilization of the geochemical and geotechnical conditions of the disturbed mining areas to protect public health, and minimise and prevent any abnormal additional or on-going environmental degradation. As such, and as defined earlier, the base *environmental expectations* are:

- Future public health and safety are not compromised;
- Environmental resources are not subject to physical and chemical deterioration;

When dealing with environmental parameters, the situation may often be that "official expectations" require (at least in theory) that at mine closure, mining companies have restored the area affected

by mining and mining related activities to the *status quo ante*. This entails the removal, demolition and rehabilitation not merely of the mining infrastructure but also of support infrastructure, such as mining towns, hostels, the associated roads, metallurgical plants, sewage works and mining recreational facilities (Reichardt, 2002, p 2B-2). As such, the achievement of a mine site status is suggested in Figure 4.1. This illustrates a cyclic use of land and its reclamation with the site being returned to a self-sustainable land use.

This however, may not always be consistent with expectations regarding the socio-economic status enfolding the site post-closure – factors this document has already highlighted as important among planning expectations. Nor may it always be economical – both these are topics discussed in the next section. Before this, however this discussion shall address some socio-economic aspects of mine site closure.

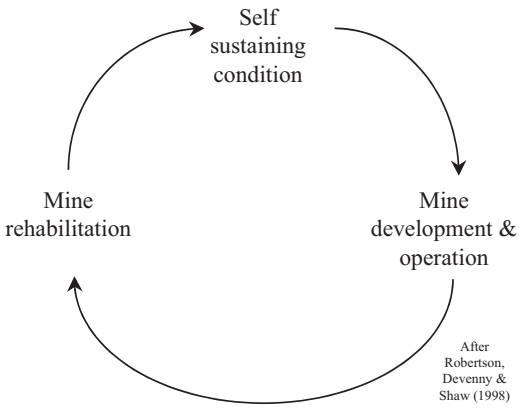


Figure 4.1 **Long term developed self-sustaining conditions for land**

The *socio-economic expectations* include at least the following:

- the after-use of the site is beneficial and sustainable in the long term;
- adverse socio-economic impacts are minimized; and
- socio-economic benefits are maximized.

> *Successful mine planning for environmental protection avoids or minimises potentially adverse environmental impacts over the life of the mine and into the future by carefully considering the layout and design of the various components of a mine. The process must integrate community expectations and concerns, governmental requirements, and profitability of the mining project, while minimising environmental impacts (Environment Australia, 2002b).*

While the challenges of integrating community expectations and concerns, governmental requirements and profitability all while minimising environmental and social impacts are relevant in all settings, they are particularly so in developing countries and in economies in transition. This is particularly relevant when national fiscal reserves and/or welfare systems are minimal or non-existent as in such settings. Greater innovation and flexibility is likely to be required in such jurisdictions than is required in more developed economies.

As one example of this, in developing and transitional economies, the removal, demolition and rehabilitation not only of the mining infrastructure but also of support infrastructure may be far less appropriate than in other settings. In countries desperately short of infrastructure such as houses, social service facilities and roads, such facilities represent potentially valuable assets for the communities in which they are located (Reichardt, 2002). Innovative uses, if such can be found for them, may represent a favourable development pathway. Similarly, if on mine closure it is found that passive or active care must be maintained (such as ongoing maintenance of waterways etc), then it may be necessary or appropriate to reclaim to an alternative developed land use. It is likely that in such cases custodians will be present on the site (i.e. utilising the land) in the long term and have incentives to actively care for the land. To avoid the establishment and management of the "trust fund" and any long term financial risks associated with such funds, Robertson (1998) indicates that it is desirable to develop a post mining sustainable land-use which yields an adequate return. Such economic yields can form the basis of such incentives.[80]

This is one topic addressed in the next section of this discussion and also taken up in Section 5.1.2.

80. Gilles Tremblay of Natural Resources Canada (personal communication: Natural Resources Canada, 2005, 2 August) reports that one item being examined in Canada is to employ local communities to perform monitoring and so forth after the mine personnel have left the site in order to maintain long-term care. In a Canadian context, he indicates that aboriginal groups in the north would need training on what to look for, that they would be located close by, and that they would require access to emergency telephones etc to contact the owners in case of problems.

4.4.2 WHAT ABOUT POST-CLOSURE?

As was indicated in Section 2, there can be a fundamental divide between the interests of mining companies and the interests of the communities where mining takes place. While mining companies typically want to develop mines, achieve a good return for shareholders and then leave; communities on the other hand want to see wealth and income opportunities created in their midst that will last over time. Further, within current frameworks their custodial interest generally only commences when a closure plan is completed. This indicates that these key stakeholders should indeed be very interested in post-closure issues.

According to a South African mining leader (Reichardt, 2002):

> *It therefore is certain that mining companies closing or downscaling their operations in developing countries increasingly will be pressured into not merely finding alternative employment opportunities but also establishing retraining or development funds with which to ameliorate the impact of job losses on the local communities*

Moreover, the sustainability of community activities that are directly or indirectly supported by the mine is also put at risk. Measures and activities that can support or maintain post-mine economic activity and community development are central to such stakeholders.

While it is reported that effective stakeholder engagement can make it possible to develop innovative approaches to long-term land use at mine sites (van Zyl *et al.*, 2002a) it cannot be denied that this represents a major challenge. Progress however, must be made. Not least so that future custodian stakeholders are willing to accept a mine closure at all. Robertson *et al* (1998) indicate that poor experience with the success of closure plans (in general), as well as the recognition that many defects are not apparent (or not recognised) at the time of custodian transfer, has resulted in reluctance by the new custodians to accept transfer. They indicate that successful custodial transfer of land post-mining requires an extension of the concept of "designing for closure" and the development of a "post mining sustainable use plan" rather than a "closure plan". Here, it is held that the mining industry can do much to limit the liabilities associated with operation a mine by actively participating in, or leading efforts to define the custodial transfer process, and by developing a sustainable post mining land use.

As an example, it is not uncommon that a mining company directly sponsors many essential community services such as medical care, schools, and so forth during the period of mine operation. Sassoon (2000) argues that consultation with the government and community leaders will be necessary to identify how these services can be continued after mine closure. A number of foundations have been established in mining communities to provide long-term sustainability for some services, e.g. the Escondida Foundation in Antafogasta, Chile and the Rossing Foundation in Namibia (le Roux, 2000). Van Zyl *et al* (2002a) report that a similar approach is to establish a community trust fund that is protected against inflation. The income from the fund can allow the communities to take a long-term view of sustainability. Such a fund may also allow the communities to build their own capacity in order to manage the financial resources sustainably.

However, and as was indicated in the previous subsection, it may be undesirable to rely to heavily upon "trust funds" and may be far more productive to encourage a post mining "developed" sustainable land-use which yields an adequate return. Moreover in the context of SEE/TRB it may be desirable to engender situations where there is ongoing care for the land in order to ameliorate the costs of ongoing pollution control.

Following Robertson *et al* (1998), a developed use usually implies a financial yield and may require either passive care, such as would apply to rangeland or forestry, or active care, as would apply to any industrial site. Figure 4.2 provides a representation of such land-use. The cyclical representation of site use post-closure is intended to portray the manner in which the land should (theoretically) mature towards a minimal or no-maintenance condition with time.

Definitions provided in Table 3 refer to the figure and to the concepts described above.

It is important to note that there is likely to be a "grey zone" between the classifications of passive and active care as outlined above. Particularly where water pollution issues requiring some level of monitoring or "passive treatment" are associated with a site. For

comparison, the following clarifications regarding the difference between active and passive care from van Zyl *et al* (2002a) is provided:

> *"the passive care programme is a period of monitoring and management designed to demonstrate that the active care programme has been successful and the 'walk-away' state has been achieved. It must be noted that moving from the active care stage to the passive care stage requires that there is not ongoing mechanical water treatment on the site, such as a lime treatment plant for acid drainage. Similarly, moving from the active care stage to walk-away may not be accomplished at all at mine sites where passive treatment, water monitoring, and ongoing maintenance are required".*

This also serves to underline the difficulties for a miner to achieve traditional "closure" and walk-away where ongoing environmental issues – particularly water issues – remain.[81] It should also be noted that due to the relatively short history of site rehabilitation (as such "mine closure") it seems reasonable to assume that even advanced jurisdictions have much to learn – the true success of closures will only emerge in the longer term.

81. Where a mine has water quality issues, these typically continue well past closure and can be very significant in cost particularly if they require continuing treatment for decades after closure. This typically applies to most sulphide ore bodies but in view of neutral drainage this can apply to a larger group of mines. It should be noted that financial assurance requirements must address long-term care issues.

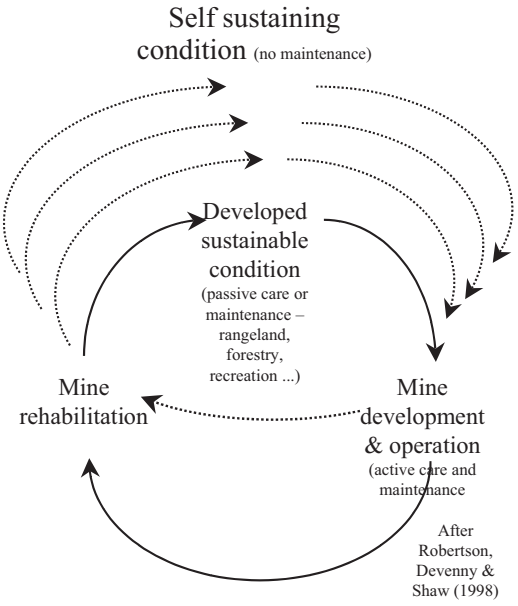


Figure 4.2 **Long term developed sustainable land use**

In summary, it can be underlined that current regulatory requirements in developed mining nations often favour or demand rehabilitation of mining or minerals processing sites to conditions approximate to pre-mining conditions. As such, regulatory requirements often aim for a return to self-sustaining eco-systems.

The point is made here however, and appears in the literature surrounding this topic, that requirements to re-grade to *original* topography; to re-establish *only* indigenous rather than commercially

Table 3 **Land-use definitions** (after Robertson *et al* (1998))

Term	**Definition**
Sustainable use	Use or uses that can be sustained indefinitely with the resources provided (including fiscal resources), or which can be generated by the use. Renewable resource uses (forestry, hydro development, commercial recreation, etc.) are typical examples. Uses that are subsidised (e.g. from a trust fund) are examples of fiscally augmented but sustainable use.
Self sustainable use	Use that is sustained by natural processes and does not require anthropogenic intervention. Examples include unmanaged wilderness or nature reserves with no maintenance.
Passive care sustainable use	Use that requires infrequent, periodic and low effort (anthropogenic input) in order to maintain the sustainable condition or use. Examples include grazing rangeland where passive care and maintenance is required.
Active care sustainable use	Use that requires frequent or continuous high level effort (anthropogenic input) in order to maintain the sustainable condition or use. Examples include the operation and maintenance of a water treatment plant for contaminated site discharges.

valuable species; to remove *all* infrastructure such as houses and roads; social service facilities and so forth may be counterproductive. Indeed, such plans may severely limit the potential for development of post-mining sustainable uses with adequate potential for financial yield (Robertson, 1998).

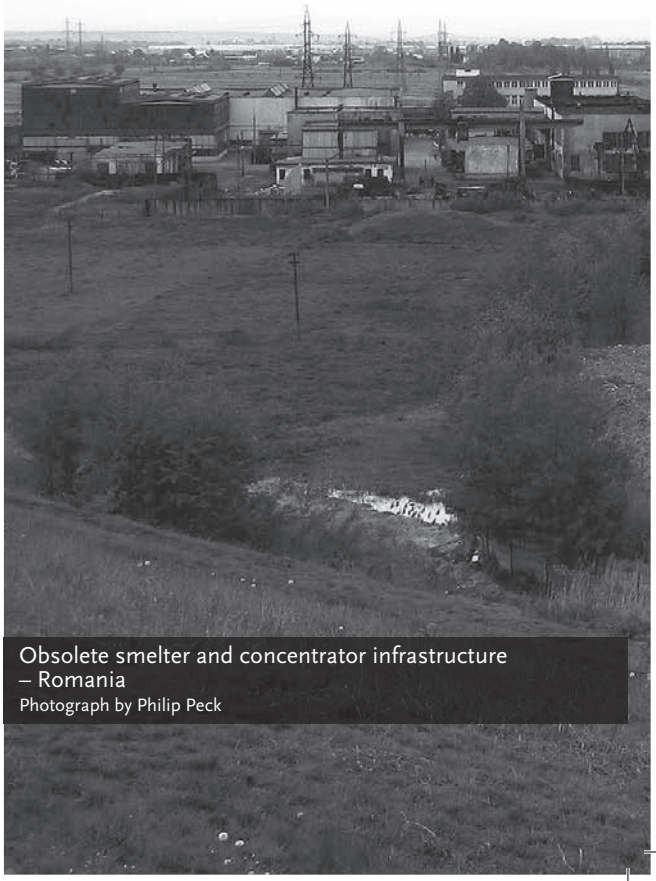
In many instances and especially in the context of economies in transition, it may be appropriate for regulatory agencies and mining companies to broaden the scope of alternative developments that can be investigated.

5. MINING FOR CLOSURE IN SEE/TRB

This section will draw together points from this document that are considered to be of particular salience in the SEE/TRB context. The choice of material here is influenced very much by a number of parameters (characteristics) that most of the SEE/TRB countries have in common. While other countries around the world share some of these characteristics, the mining countries of this part of Europe share a geographical location and historical pathway that combines with their geological resources in a unique manner. Some of the parameters shared by most or all countries in the region are that:

- the mining sector is a very important contributor to local and national economies and that ongoing and new mining activities will be required to underpin the economies in the future;
- the countries are (relatively) rich in mineral resources and have a long history of mineral resource extraction activities;
- there already exists a serious history of mining accidents, due in part to the widespread neglect of environmental safety and human security issues combined with sub-standard extraction and waste management activities, particularly in the post 1945 era;
- transboundary pollution risks associated with mining and mineral processing activities and the legacies of such past activities are many and marked;[82]
- nation states have been subject to marked changes in economic and political circumstances, conflict, and socio-economic hardship during the 1990s that have exacerbated the problems associated with some sites;
- accession to the European Union is imminent or foreseeable, and compliance with a range of EU environmental and safety regulations is required for that process to proceed;
- legislative frameworks addressing mining and minerals processing activities, extractive industry legacies as well as accountability (and jurisdictional remit) for the environmental aspects of these activities are still in a state of development or flux;
- documentation of sites of pollution and understanding of the geochemistry of extractive industry legacies, degrees of risk and understanding and so forth are relatively poor;
- capacity within institutions supporting the extractive industries as well as those guiding transboundary risk management and/or disaster response are currently insufficient to deal with the task at hand;
- as economies in transition, national fiscal reserves available for the financing of site reclamation work, and/or social welfare "nets" for the support of communities affected by the environmental impacts of the extractive industries, or the closure of mining operations, may be minimal or non-existent.

82. Countries are the producers or receivers of chronic and (potentially) acute pollution from their neighbours that can include: airborne transport of pollutants such as dust, smelter emissions, gases, vapours; mass movement of "solid" wastes (generally tailings containing heavy metals and toxic compounds); mass movement of liquid, or semi-liquid wastes (again, generally tailings containing heavy metals and toxic compounds); waterborne transport of wastes as suspended solids and as dissolved materials.



Obsolete smelter and concentrator infrastructure – Romania
Photograph by Philip Peck

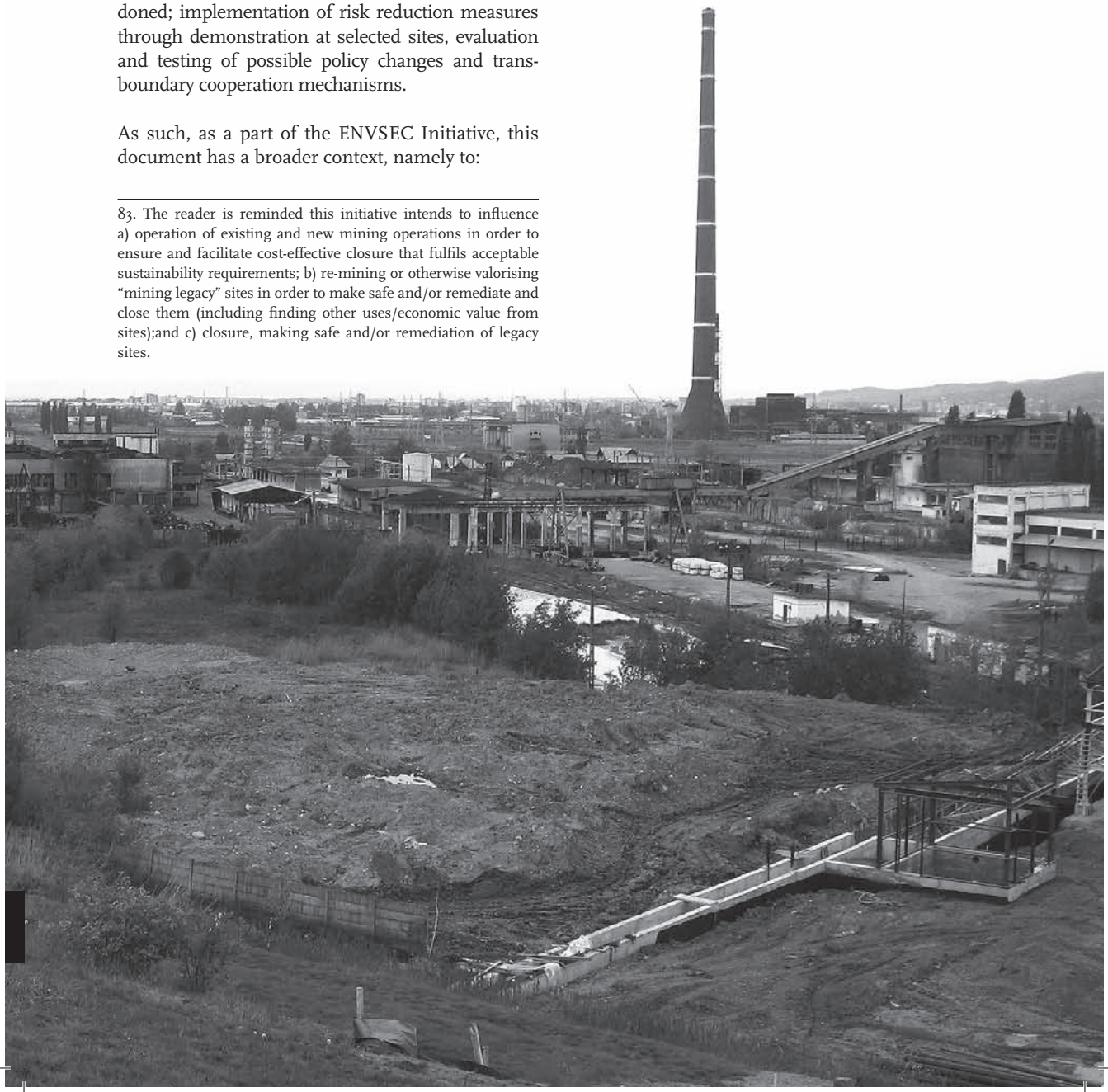
Further, this document has been produced by the ENVSEC partnership in line with an underlying assumption that there is a clear and unequivocal need *and an interest* from within the subject states in the promotion of flexible solutions to find other economic uses or value in abandoned or orphaned mine sites. However, at no stage has this aim been divorced from the broader perspective presented at the opening of this document where it was indicated that operational, new and abandoned/orphaned sites would be approached holistically.[83] Moreover, that it is necessary to support the ongoing assessment of transboundary environmental and human safety risks posed by substandard mining operations – both active and abandoned; implementation of risk reduction measures through demonstration at selected sites, evaluation and testing of possible policy changes and transboundary cooperation mechanisms.

As such, as a part of the ENVSEC Initiative, this document has a broader context, namely to:

present guidelines for mining policy development, capacity development and institutional development that can yield a sustainable mix of social, economic, and environmental outcomes in SEE/TRB, and to

support the ongoing assessment of transboundary environmental and human safety risks posed by sub-standard mining operations – both active and abandoned; implementation of risk reduction measures through demonstration at selected sites, evaluation and testing of possible policy changes and transboundary cooperation mechanisms.

83. The reader is reminded this initiative intends to influence a) operation of existing and new mining operations in order to ensure and facilitate cost-effective closure that fulfils acceptable sustainability requirements; b) re-mining or otherwise valorising "mining legacy" sites in order to make safe and/or remediate and close them (including finding other uses/economic value from sites);and c) closure, making safe and/or remediation of legacy sites.



With these points in mind, it is held that a tailored framework for the SEE/TRB region is required to support such endeavours. As the material presented in this document has demonstrated thus far, much of the content for such a framework is to be found throughout the world and many respected stakeholders are involved in progressing these issues. The task of these closing sections is to combine those parts that best serve the needs of jurisdictions in SEE/TRB.

5.1 MEETING CHALLENGES FOR ECONOMIES IN TRANSITION

As starting point for meeting the challenges outlined above, a report produced in 1999 by the (then) Principal Environmental Specialist, European Bank for Reconstruction & Development (EBRD) Mehrdad M. Nazari. The report titled *Financial Provisions for Mine Closure* (Nazari, 1999) addressed the securing of mine closure funding during the operational and profitable phase of mining projects. It had the explicit aim of seeking pathways for reducing the expectation or reliance on governments and donors to address this issue. It also sought to outline needs for a technical assistance programme to be provided to participating countries to assist them in developing the relevant policy and regulatory framework.

Despite significant progress, particularly in the area of reviewing and commencing the process of revising legislative frameworks (cf. Peck, 2004 for an outline of such steps in many of the regional jurisdictions); as this document has detailed, many of the points made by Nazari are as valid today as they were in 1999.

> *The mining sector is a very important contributor to local and national economies, including in central and eastern Europe (CEE) and the former Soviet Union (FSU). However, in parts of CEE and the FSU, the mining sector has often been characterised by inappropriate planning, operational and post-operational practices, including a lack of an adequate regulatory framework and inadequate implementation of mine rehabilitation and closure activities. In some of the regions associated with significant mining activities, this has resulted and continues to result in significant adverse environmental and health and safety impacts and related liabilities. As a result, donors and international organisations and agencies are frequently requested to provide financial assistance to alleviate the most heavily impacted areas.*
>
> *A programme to develop a policy and regulatory framework for financial provisioning related to mine rehabilitation and closure should be initiated. This programme would be able to assist participating countries in developing the required policy and regulatory framework to further promote and implement long term environmentally sound and sustainable development in the mining sector. The programme would also contribute to reducing the uncertainties associated with post-operational practices, and potentially related adverse environmental impacts and costs. It would also facilitate the introduction of a standardised approach to this issue, establishing a 'level playing field with fixed goal posts' for regulators, investors, mining companies, and operators.*[84] *The implementation of such a successful policy and regulatory framework would reduce the expectation and need to rely on governments and donors for financial assistance, effectively 'bailing out' the most severely impacted areas suffering from long term mining impacts.*

While the World Bank Group and other funding groups such as the Global Environment Facility (GEF)[85] are deeply involved in projects in the region[86] such levels of loan support will be difficult, if not impossible to replicate throughout the region.

The challenges must substantially be met from within the Nation states. This challenge will call for a range of innovative and flexible solutions. It is likely that new ideas – not yet conceptualised, developed or tested elsewhere – will need to be pioneered in the region.

84. A point strongly supported by the citation from the Government of Ontario in Section 2.3.1.

85. The Global Environment Facility (GEF), established in 1991, helps developing countries fund projects and programs that protect the global environment. GEF grants support projects related to biodiversity, climate change, international waters, land degradation, the ozone layer, and persistent organic pollutants. See http://www.gefweb.org/.

86. For instance Sora (2005) reports that loans to the tune of USD 15.25 million have been secured (5.64m from the WBG, 6.24m from GEF) to deal with immediate needs to reduce the risk of catastrophic mining accidents, aiming to protect the integrity of the Danube and Black Sea basins Work on three "hotspots" (including Rosia Poeini and Bai Borsa) are to be implemented over 5 years (October 2004 – December 2009). National Agency for Mineral Resources is responsible for its implementation and will work closely together with Ministry of Economy and Commerce, Ministry of Environment and Water Management, mine operators, local authorities, designers, local communities.

As was indicated in Section 4.2 where the special problems of orphan sites were discussed, various parties are examining the challenge in this area. However, as indicated, it appears that the formulation of suitable coercive measures to frame absolute requirements for *Mining for Closure*, and the creation of models for utilitarian measures that can encourage uptake, remain largely outside the remit for such initiatives. This next section addresses the latter subject – i.e. measures to encourage activity dealing with mining legacies. Some general ideas about how to proceed – expressed in general terms and without qualifications or provisos, are included in the following sections. These suggestions to be seen as a "seed" for future ideas – they are not yet in a form that seeks to fulfil practical requirements.

5.1.1 A SPECIAL CASE OF "ORPHAN SITES"[87]

It is now time to explore the potential of a different approach – that of a partnership to future remediation of orphan mining sites without assigning blame or legal liability to the extent that has been sought elsewhere. Such a partnership would be based on creating future economic and social values in the context of a healthy environment, rather than simply aiming to "clean up". This would require a considerable shift in the stance of all the partners, and is only likely where all of them see some gain from such a deal. However, by focussing on opportunities rather than liabilities it is more likely that such a major shift could be made. For such an approach to gather widespread support the potential opportunities need to be communicated to stakeholders such as local communities and to the mining industry (although many might argue that they should be self-evident). The emergence of such is partnerships is highlighted by the following mention of a joint venture from the Assistant Deputy Minister for the Province of Ontario's Ministry of Northern Development and Mines in 2002 – a joint venture that has now gone forward and made "on the ground" achievements.[88]

> *Ontario is currently negotiating a joint venture with the Ontario Mining Association to collectively work on legacy sites. This envisages the current industry providing expertise, equipment, supplies and personnel to be matched by government funding in addressing the legacy. Suitable indemnification for potential liabilities is proving to be a challenge To summarize this issue we have found inventorying and prioritizing amongst legacy sites to be of fundamental importance in ensuring the best use of pubic funds. Encouraging new exploration activity on old sites and engaging the current industries are examples of our exhortation to other jurisdictions facing these problems to: be creative! (Gammon, 2002, p3)*

Bundling the remediation costs into a larger development-oriented framework will require more creative solutions than simply assigning strict financial liability to one or several partners. Creative solutions should be based on maximizing the asset potential of abandoned sites, and creating value through policy changes and fiscal incentives. Indeed, examples exist that fall into a number of general categories for economic activity based upon:

- the use of operational wastes as a resource for more advanced mineral extraction (remining);
- the use of operational wastes as a resource for alternative product manufacture;
- the combination of site rehabilitation with the waste disposal requirements of other human activities;[89]
- the conversion of mining-related infrastructure for other uses, and the conversion of specialised mining infrastructure;

87. Much of the content in this section is derived directly from a position paper put forward by Fritz Balkau of UNEP DTIE Paris (2005b).

88. The Ontario Mining Association's (OMA) partnership with the Ministry of Northern Development and Mines mentioned in the above citation has gone forward now successfully completed its first major project. The following excerpt is taken from the OMA's website at http://www.oma.on.ca/environment/goodsamaritan.asp. *"In 2003, the Ontario Mining Association signed a Memorandum of Understanding with the Ministry of Northern Development and Mines. The MOU, which is in effect for five years, allows for the identification and rehabilitation of specific abandoned mine sites on Crown lands. The OMA/MNDM agreement creates a joint advisory committee to identify projects on Crown lands and manage those rehabilitation initiatives and contributions from companies are considered as "gifts to the Crown" for tax purposes. The MOU allows companies to make voluntary donations of $1 million, which will be matched by MNDM, to clear up evidence of historic mining activity. The MOU contains so-called "Good Samaritan" rules, which means companies can make these donations without assuming historic environmental liabilities of specific sites. Also, this MOU permits companies to make donations in kind such as doing the work - providing manpower and equipment - at specific sites. This agreement is a breakthrough in co-operation dealing with this legacy issue. A portion of the funds raised by the mining industry in 2003 were employed at the Kam Kotia property in Timmins. Work began in August 2004 and it was completed in September. The project involved repairing and vegetating a tailings dam. The dam was showing signs of damage and vegetation cover was needed to prevent further erosion. The total area of the tailings dam surface requiring repair and vegetations was about 123,000 square metres."*

89. For instance, Gilles Tremblay (personal communication: Natural Resources Canada, 2005, 2 August) reports that in Quebec a number of projects have utilised used paper mill sludge as cover material.

- the utilization of the land for periodic and low effort (anthropogenic input) uses such as grazing and forestry.

Site objectives should transcend environmental quality criteria to include employment and social outcomes, as well as long-term resource stewardship.[90]

Some other potential examples, all based to some extent upon initiatives that have taken place around the world are included below:

- using remaining site features to create sustainable local level employment over a longer timeframe – i.e.; new development initiatives based on land and remnant infrastructure such as pits and mounds and the extensive waste deposits on such sites;[91]
- making re-mining operations more attractive commercially via reduction in taxes and royalties, changes in land tenure laws, and through reduced legal liabilities for new operations (i.e. the government assumes some potential future liabilities itself, as for example in Germany);
- subsidies for economically marginal re-mining operations where this would still be cheaper to the government than underwriting the complete cost of rehabilitation;
- some sites could be opened to artisanal miners in a controlled fashion, accompanied by, or in exchange for, assistance with systematic rehabilitation;
- converting cleaned up sites to high-value land uses via government zoning changes. Remediation costs can be partially recovered from future sales of rehabilitated and rezoned land. Some land could be assigned to selected government uses;
- site conversion to local agro-forestry or non-food crops;
- redevelopment for and operation of old sites as 'biosphere reserves' or equivalent to add to the national inventory of natural areas (in many places abandoned sites are known to be a refuge for certain endangered species);
- redevelopment of sites that may also have tourism potential;[92]
- special partnerships with other natural resource utilization stakeholders (examples include a US trout fishing association taking on rehabilitation of streams affected by acid drainage).[93]

The above ideas are intended to illustrate that there do exist other options than simply cleaning-up and rehabilitating at high cost. However, it is clear that not all sites would be amenable to the above, and indeed some experiences in other countries have shown that it is "easier said than done" to create economic activity on former mining sites.

One early task is to study the conditions under which such scenarios would be feasible, and what community benefits can be expected. The options will be country and location specific. For example, impoverished regions with a large pool of unemployed and untrained people will have different possibilities than are available for sites in developed countries with sophisticated technologies, high labour costs and very high environmental expectations. An important change is to evaluate the potential of an abandoned site for local development opportunities rather than only in terms of the output of global commodities. In other words, just as the site objectives need to go beyond "clean-up", so the development potential needs to consider aspects at the local level.

The situation is potentially applicable to a large number of developing countries and in economies in transition. Some recent international meetings on mining policy showed a surprising degree of interest in this problem, and called for further action by the UN to help address this issue (Balkau, 2005a, 2005b).

Further, and as indicated in Section 4.2.2, there are a range of challenges to be overcome related to information, community involvement, and legislative barriers to collaboration that add to this. Having raised these issues, it appears of value to briefly take up the findings of a deal of the Canadian work conducted in that area. Among other things, these can serve as examples of: measures that may aid in the generation of funds for management of abandoned and orphaned sites; measures that need to

90. A suggestion of relevance to this discussion, for one site at least, received from is the formation of a regional research facility at an abandoned mine site where regionally appropriate technologies can be developed and (personal communication: University of Nevada, 2005, 28 July).

91. Utilisation of voids and/or underground workings for novel value added applications such as fish farming (voids) and mushroom growing (tunnels) are examples.

92. See the Eden Project as a landmark example http://www.edenproject.com. In Canada, "Butchart Gardens" represents a successful rehabilitation of an open limestone quarry that was converted to an internationally renowned garden. Most remarkable is that this project was undertaken nearly 100 years ago. See www.butchartgardens.com

93. See examples within the US based Trout Unlimited's homepage http://www.tu.org.

be taken on the legislative side to support funding, and measures required on the legislative side to allow works to proceed.

The first of these relates directly to activities describe in the call for action from the EBRD cited at the start of Section 5.1 and also reflects the content called for in the description of the PMA initiative included in Section 4.2.1.

5.1.2 FUNDING APPROACHES – AN EXAMPLE

As stated in Section 4.2.2, a report titled "Potential Funding Approaches for Orphaned/Abandoned Mines in Canada" (Castrilli, 2003) was prepared that outlined a variety of funding approaches to be considered for the clean up or management of liabilities related to OAMs. The report concludes that no single funding approach would constitute a complete solution and that a combination of a number of approaches would likely be required. Mechanisms to further discuss and develop funding approaches are still underway. As a part of this ongoing work, a multi-stakeholder workshop on "Strategies and Issues of Assessing Liabilities and Funding" is being planned for the fall of 2005.

A summary of the recommendations is included in Box 4.[94] While a great deal of this material is considered to be relevant in an SEE context, the reader is reminded that the findings presented here are as delivered to a Canadian governmental audience should be interpreted as examples only.

5.1.3 DEALING WITH REGULATORY AND INSTITUTIONAL BARRIERS – AN EXAMPLE

This second example is also drawn from the Canadian NOAMI program as reported by Castrilli (2002). Again, the reader should be aware that the findings presented here were delivered to a Canadian governmental audience and should be seen as examples only. This report, titled *"Barriers to Collaboration: Orphaned/Abandoned Mines in Canada"* examines existing legislative requirements in Canada, selected other North American jurisdictions, and a number of other countries that pertain to:

1. regulatory or institutional barriers;
2. liability disincentives, and
3. collaborative opportunities regarding voluntary abatement, remediation, and reclamation of orphaned/abandoned mine lands. In addressing the above three matters, particular emphasis was placed on four approaches:
   - 'Good Samaritan' legislation;[95]
   - Permit blocking;
   - Allocative versus joint and several responsibility; and
   - Non-compliance registries.

In essence, the report lists a number of very real barriers and disincentives that Canada must seek to deal with if real collaboration between different social actors is to be achieved in order to speed the restitution of lands affected by the legacies of mining.

More specifically, Castrilli reports that in regard to regulatory or institutional barriers, federal and provincial environmental and mining laws in Canada contain a number of permit, regulation, and other requirements that likely would have to be complied with by those voluntarily undertaking abandoned mine land abatement, remediation, and reclamation.

In regard to liability disincentives he indicates that federal and provincial law in Canada contains a variety of judge-made and statutory authorities that could impose quasi-criminal, civil, or administrative liability on those undertaking abandoned mine land abatement, remediation, and reclamation activities. While he notes exceptions to this, they appear limited.

In regard to collaborative opportunities, a number of voluntary assessments and abandoned mine land cleanups have been completed, or are on- going, by provincial governments in Canada. Interestingly, these initiatives have been undertaken without legislative reform. In general, Castrilli finds that there is no existing or proposed federal or provincial legislation in Canada regarding the subject of Good Samaritan legislation, though there may be some statutory developments that could be said to be analogous to, or precedents for, such legislation. Some existing law implicitly, though not explicitly, may have the same effect as permit blocking. Finally, there is some law, policy, and practice in existence regarding non-compliance registries and allocative versus joint and several liability.

In comparison, Castrilli notes that there appear to be many more legislative measures in place or proposed at the federal and state level in the United

94. Derived from Castrilli (2003) – in particular – pages 11-12 and Sections X & XI.
95. As described in footnotes to Section 4.2.2.

Box 4 **Potential Funding Approaches for Orphaned/Abandoned Mines in Canada**

1. Governments amend existing or enact new legislation adopting and implementing a funding regime for cleanup of orphaned/abandoned mines in their respective jurisdictions.
2. The funding regime should be designed to substantially eliminate the backlog of orphaned/abandoned mines in the jurisdiction in which the legislation is enacted within a reasonable timeframe.
3. Such legislative regimes should be based on a mix of all of the following funding approaches including:[96]
   - Government funding from general revenues coming from a single level of government;
   - Federal-provincial (or federal-territorial) government funded cost sharing arrangements from general revenues, where appropriate;[97]
   - Levies on mining industry production;
   - Government- industry partnerships;
   - Government re-direction of a portion of existing mining tax revenue, and reduction of existing incentives to the mining industry and application of both streams to orphaned/abandoned mine cleanup; and
   - Fund interest, fines and administrative penalties imposed on the mining industry, donations by individuals or others, etc.;
4. The legislative regime adopted in each jurisdiction also should include establishment of an Orphaned/Abandoned Mine Cleanup Fund ("OAMCF" or "Fund") into which general government revenue, industry levies, and other monies also are deposited on an annual basis.
5. The legislation should specify the minimum annual financial appropriation to be made by the government and the period over which that level of appropriation is to continue.
6. The legislation also should specify the annual levy or levy range to be imposed on each mining company, mining industry sector, or classes within a sector as a cost attributable to its activities in the jurisdiction and the period over which that level of contribution is to continue.
7. The legislation should set out the basis for government-industry partnerships and what effect, if any, they will have on the annual levy noted in recommendation 6 and tax and incentive measures noted in recommendation 8.
8. The legislation should amend federal and provincial tax laws to specifically identify (1) the annual quantum of mining tax revenue being re-directed to the Fund, and (2) the annual quantum reduction of existing incentives to the mining industry being re-directed to the Fund.
9. The legislation should set out the specific purposes of the funding regime.
10. The legislation should specify the lands and water eligible for cleanup.
11. The legislation should specify the orphaned/abandoned mine cleanup priorities under which the funding regime will operate.
12. The legislation should identify the administering entity for the funding regime. The authors recommend that this entity be either a department of government or special government agency created by the legislation establishing the funding regime.
13. The legislation should authorize promulgation of rules and regulations addressing matters pertaining to administration of the funding regime.
14. In conjunction with establishment of a funding regime, the process of cleanup of orphaned/abandoned mines should be facilitated through measures designed to eliminate barriers and facilitate community involvement identified by previous studies commissioned by NOAMI.

96. Within the report it is noted that the authors were unable to address what the percentage financial contribution of each of the funding approaches identified in recommendation 3 should be. The reasons for this include that at the time of writing the Report the authors did not have items such as: (1) an accurate estimate of the costs for cleanup of orphaned/abandoned mines in each jurisdiction in Canada; (2) assessments of the economic health of the mining industry for each jurisdiction in Canada; or (3) the timeframe that governments in each jurisdiction will want to use to achieve cleanup. While the authors recommend that the cleanup timeframe not exceed 2-3 decades, that is still a matter that governments will need to consider on a jurisdiction by jurisdiction basis. Such information requirements are clearly relevant for all SEE jurisdictions when planning for the financing of *Mining for Closure* is undertaken.

97. It should be recognized that where federal financing occurs that level of government will be entitled to establish national standards, should it so desire, pursuant to the federal spending power of the Canadian Constitution.

States explicitly addressing several of these subjects. In comparison, he indicates that national legislation in the United Kingdom and state legislation in Australia is in its infancy in addressing these matters. His overall findings are interesting in the context of this paper. Not least, as jurisdictions in SEE will be able to follow a considerable body of work that needs to be addressed.

> *Overall, however, the current legislative and regulatory regime in Canada is at best a patch-work, at worst indifferent to the problem. In most instances, legislators simply have not turned their attention to orphaned/abandoned mines to produce a principled and comprehensive solution to the problem. Some current laws are broadly worded in terms of providing regulation-making authority that could be a basis for measures that could facilitate voluntary cleanups without requiring amendments to existing legislation. However, the better view may be that both the Parliament of Canada and provincial legislatures also will have to speak directly to the problem (Castrilli, 2002, p.ii)*

Box 5 **Legislative and regulatory adjustments to support mine legacy management** after Castrilli (2002)

- Amend existing or enact new law that encourages volunteers to abate, remediate, and reclaim abandoned mine lands,
- Exempt volunteers from being "responsible persons" under contaminated site, water pollution, or related laws as a result of carrying out "good samaritan" remediation,
- Establish an abandoned mine reclamation "good samaritan" permit programme, which would require permittees to specify reclamation plans and meet certain standards for cleanup, ensure public participation, and environment ministry oversight of cleanups,
- Require remining operators to implement strategies that control pollutant releases and ensure that pollutant discharges during remining activities are less than the pollutant levels released from the abandoned site prior to remining,
- Create exemptions from remediation liability at "historic mine sites", and
- Adoption of collaborative opportunities under federal and provincial environmental and mining laws in Canada.

A number of the key recommendations from Part V of the report are provided in Box 5 below for reference. They include a short list of possible components or options for a federal and provincial legislative/regulatory approach to facilitating voluntary abandoned mine land abatement, remediation, and reclamation.

5.2 EXAMPLES FOR INNOVATIVE THINKING

The following sections offer examples in order to spur new ideas and creativity for readers of this document. They should also serve to demonstrate that options may well be available for management of abandoned and orphaned mine sites, or for the ongoing developed land use with passive or active care that is required to maintain sites that can never be returned to a self sustaining state. These examples should also be viewed in the light of the examples provided in previous sections regarding the securing of funding and the removal or amelioration of institutional barriers.

5.2.1 ALTERNATIVE SITE APPLICATIONS

To provide a firm basis for thinking, a number of case study examples are briefly documented here. Important to most of these is that they need to combine most or all of the following key parameters (after Reichardt, 2002):

- the use of redundant mining and associated infrastructure as zero or low cost assets for new business ventures
- the development of business structures and operations in a way that capitalises on the characteristics of the redundant infrastructure, thereby conveying a competitive advantage for the new business,
- the active participation of the mining company or its agents in the establishment and commercial stabilization of the new business along purely commercial lines.
- the acceptance by the mining company or party responsible for the site that such businesses yield tangible if not immediately quantifiable benefits.

These first five case studies are taken from a paper produced by the Manager: Corporate Environmental Affairs, AngloGold Ltd. in South Africa (Rei-

chardt, 2002).[98] Here it is important to note the underlying factors for failures – none are directly related to insufficient economic returns. Rather, it is institutional failures that dominate.

Box 6 **Bricks from tailings**

Case example	**Bricks from tailings**
Market opportunity	Tailings and waste rock in some instances make a very suitable substitute to river sand as an input to cementatious building aggregate.
Capital expenditure	Minimal
Longevity	Elands Brick operated at Elandsrand Gold Mine for five years.
Infrastructure	Established on a redundant mine tennis court.
Employment	42 people.
Market	Supplied regional low-cost housing projects and mines at competitive prices.
Additional benefit	Saved mine the cost of relocation of tailings from ad-hoc clean-up operations and pipebursts.
Fate	Failed due to personal conflict between entrepreneurial partners.

Box 7 **School from mine buildings**

Case example	**Redundant Hostel/School Conversion**
Market opportunity	Redundant Hostel – expensive to convert to residential or apartment usage. Design ideal for boarding school – secure facility and accommodation. If replicated at 4 earmarked sites closure savings could have exceeded 18 million South African Rand (ZAR).
Capital expenditure	ZAR 3 million
Longevity	Not pursued for political reasons
Infrastructure	Redundant worker hostel
Employment	(Projected) 59 mostly mineworker spouses, 72 temporary construction jobs.
Market	Teaching & Boarding Facilities for 900 students. Addressing a critical social need – affordable quality education at rates competitive to public schools.
Additional benefit	Avoidance of Closure cost in excess of ZAR 4 million. Transfer of asset at zero cost a key factor in commercial viability.
Fate	Not pursued due to union objections to entrepreneur not being a Previously Disadvantaged Individual (PDI) Company (a PDI company is a company that is black owned, or black people are the majority shareholders of that company, i.e. they own 51% or more of shares of the company)

98. This is available online on the Mining, Minerals and Sustainable Development site hosted by the IIIED at: http://www.iied.org/mmsd/rrep/s_afr.html

Box 8 **Drainage tunnel mushroom farms**	
Case example	**Tunnel Closure – Diamond Mushroom Farms**
Market opportunity	Tunnels stable environment and climate provides competitive advantage for mushroom grower
Capital expenditure	ZAR 600 000
Longevity	Ongoing
Infrastructure	Underground drainage tunnels in historical mining area around the "Big Hole" of Kimberley
Employment	12 persons
Market	Leading supplier of specialty mushrooms with southern African distribution network. Turnover ZAR 800 000/p.a.
Additional benefit	Underground drainage tunnels an ongoing maintenance liability for De Beers. This was turned into rental income.
Fate	Project acquired by De Beers for use as an empowerment vehicle.

Box 9 **Metallurgical plant fish farm**	
Case example	**Metallurgical Plant Closure – AngloGoldFish (West Rand)**
Market opportunity	Ponds ideal for managing water conditions for fish farming – such operations carried out by existing business actors
Capital expenditure	ZAR 2.5 million
Longevity	Ongoing.
Infrastructure	Metallurgical Plants designed for the circulation of liquids
Employment	18
Market	Outgrower to existing exporter. Turnover ZAR 3.6 million/p.a.
Additional benefit	If replicated at 4 earmarked sites closure savings could have exceeded ZAR 45 million and result in a world class player in the ornamental fish business.
Fate	Avoidance of closure cost in excess of ZAR 7 million

Box 10 **Final void fish and seaweed farm**	
Case example	**Final Void Closure – Diamond Coast Aquaculture Venture**
Market opportunity	Ponds and infrastructure suitable for shellfish and seaweed farming. Opportunity for remote but picturesque town to explore its long-term tourism potential.
Capital expenditure	Not known however, ZAR 30 million saving in pumping infrastructure for new business.
Longevity	On hold.
Infrastructure	Aquaculture venture uses these open cast excavations as well as existing pumping infrastructure in order to reduce its conventional capital expenditure (about R 30 million).
Employment	The operation will eventually employ 54 people farming seaweed and shellfish
Market	Not known.
Additional benefit	De Beers faces a ZAR 150 million rehabilitation liability with respect to the open cast mining activity that it has conducted along the Namaqualand coast over the past sixty years. By utilizing pits marked for rehabilitation and pumping infrastructure cuts rehabilitation costs by about ZAR 2 million. By providing part of the economic base on which the mining town infrastructure can be sustained after mining ceases, the venture would also allow De Beers to receive a return on its investment into Kleinsee. This could avoid the demolition of the remote but picturesque town allowing it to explore its long-term tourism potential.
Fate	Project placed on hold due to inadequate government permitting capacity

Pursuant to the above examples, Reichardt (2002) offered a number of comments. Firstly for mining companies – or the holder of assets/physical liabilities – he indicates that:

- achievement of such projects requires personnel to take a long term view in planning;
- a remit for innovators must be signalled from the top of the accountable organization;
- thinking sustainably and creatively can yield concrete financial and social returns;
- economics and ecology are not inherently at odds;
- project development of this kind requires a different mindset and the introduction of different skills;
- it must be accepted that feasibility studies can indeed yield negative outcomes;
- avoidance of demolition and closure costs for part of a site are possible via such pathways;
- the transfer of long-term maintenance requirements to another viable and sustainable entity is feasible;
- it is possible to create equity stakes in financially viable businesses that can then be profitably disposed of at a later stage;
- improvement in government and labour relations and the resultant greater flexibility in managing any downscaling or closure processes can be yielded by such exercises;
- such activities can serve as a concrete demonstration of commitment to sustainable development, as a demonstration of creative capabilities to problem solving to enhance corporate image and as such can yield better chances at accessing new prospecting and mining licences.

In the context of this report, it is also highlighted that the case studies provided above underline the key role of government and regulatory bodies – both in terms of flexibility and capacity – in making such initiatives successful.

5.2.2 RE-MINING

Re-mining projects are those where the wastes (or rejects) of previous mining operations are reprocessed in order to recover valuable minerals that remain. Technology advances over the past decades (or even centuries) make it possible for profitable operations to take place in such circumstances and such technology advances continue. As a result, there are many profitable re-mining operations taking place all around the world.

Box 11 **Remining tradeoff at Coeur Rochester's Nevada Packard Project** (van Zyl *et al*., 2002b)

Case example	**Coeur Rochester's Nevada Packard Project**
Project description	The Nevada Packard Project is located approximately 17 miles northeast of the town of Lovelock in Northern Nevada. It will consist of a small satellite open pit mine near the Coeur Rochester Mine. The Coeur Rochester is a silver and gold open pit mine that commenced operations in 1986. The Nevada Packard Project is located in the historic Rochester mining district; an area that has been extensively mined in the past, resulting in numerous small waste stockpiles and borrow pits, as well as adits and shafts. Parallel with the Nevada Packard Project development, Coeur is proposing to reclaim approximately 63 acres of older abandoned mining disturbances created by previous operators located within the project boundary.
Incentives	The authorities have agreed to expedite the permitting process and allow the company to carry out an environmental audit rather than an environmental impact assessment.
Rehabilitation works carried out as part of mining operations	The rehabilitation includes the following: • A nine-acre heap leach pad will be recontoured to a 2.5:1 slope and reclaimed in place using suitable growth media and revegetated cover; • Water wells would be plugged to Nevada Division of Environmental Protection standards; • The historic tailings located within the project area will be covered with waste rock and overburden, recontoured to a 3:1 slope and then revegetated; • The drainage in the area of the historic tailings will be modified, if necessary, to minimize erosion; • The historic tailings outside the project area will be covered with waste rock and overburden and regraded to a 2.5:1 slope to minimize erosion. • Any pre-Coeur exploration roads outside the open pit will be reclaimed, with the exception of some older roads and those required for public access as part of the post-mining land use. Following rehabilitation all previously existing and new surface disturbance would be recontoured and revegetated except for approximately 47 acres of the open pit. This remaining open pit will be partially backfilled

In many cases at the current time however, such projects may not be profitable or attractive, especially in jurisdictions where taxation or royalty payments are particularly demanding, or where liability concerns associated with the facilities pose an unacceptable financial risk to prospective "re-miners". Further, the division between a "re-mining" project and a mining project may be difficult to find at times. Three case studies are offered here of re-mining projects that have each resulted in markedly improved environmental conditions as well as other socio-economic benefits. Despite the absence of hard cost data for the re-mining projects listed in this section, the underlying assumption is that the majority of those raised here are profitable within existing market frameworks. Where the rehabilitation works described exceed the requirements of regulators, it can reasonably be assumed that the responsible company has consciously attached some other business or social value to their undertakings.

New tailings re-processing facilities under construction with obsolete smelter infrastructure in background – Baia Mare, Romania
Photograph by Philip Peck

Box 12 **Synergistic benefits of coal reject remining**[99]

Case example	**Wildwood coal remining project, Pennsylvania**
Project description	ACV Power Corporation at its Wildwood Project in Allegheny County near Hampton Township, Pennsylvania. This five person operation reclaimed 42.5 acres of abandoned mine land adjacent to North park, a large public park in the Pittsburgh suburbs, through the remining of a 50-year-old abandoned coal refuse pile that was burning.
Incentives/benefits	Landscape remediation at zero cost to taxpayers Increased property values Assumed profitable operation by entrepreneur
Rehabilitation works carried out as part of mining operations	The project dramatically improved ground and surface water in the area and increased the value of the surrounding properties. Through Pennsylvania's remining programme, the project, which removed approximately 900,000 tons of acidic waste coal from the landscape, was completed at no cost to taxpayers. In addition, AVC's relationship with the power plant allowed for the exchange of the waste coal material for Circulating Fluidized Bed Combustion (CFBC) alkaline ash material that was used in the reclamation of the site. By utilizing CFBC ash, ACV created a fertile seedbed and effectively eliminated the leaching of pollutants into nearby Pine Creek and the area's groundwater. Local officials were initially against this project due to concerns about increased truck traffic, potential dust and noise problems, and the potential for pollution. However, upon completion of the site, township officials issued a letter of commendation to ACV recognizing that "the long-term benefit well outweighs the minor inconvenience [related to truck traffic]." This small waste coal company, ACV Power, was able to make a significant impact at the Wildwood site both esthetically and environmentally

Box 13 **Beyond compliance reclamation in ongoing quarry works**

Case example	**Baggaley quarry remining**
Project description	Hanson Aggregates, at its Baggaley Quarry located in Pennsylvania, reclaimed an entire site, even though it was legally obligated to reclaim only those areas affected after 1972. The final open pit highwall was 900m long (3000 feet) and averaged 52m (170 feet) in height.
Incentives	Not listed
Rehabilitation works carried out as part of mining operations	Despite limited onsite material and significant challenges due to the elevation, the area was completely reclaimed. Rolling hills have replaced the highwalls and the quality of a nearby trout stream has been maintained. The post-mining land use was designed with multiple purposes in mind, including fish and wildlife habitat as well as an industrial site in an area where flat land is at a premium. The Baggaley Quarry was essentially a remining operation in a high quality, sensitive watershed. Through a combination of extensive monitoring and well-designed reclamation techniques, the nearby stream - which is classified as a high quality, cold water fishery - was preserved. Additionally, the natural wildlife habitat that was created has attracted whitetail deer, wild turkey, black bear, various ducks and geese along with raptors common to such areas such as owls and hawks. During the course of its operation, the Baggaley Quarry had an excellent compliance record.

99. Examples shown in Box 12 and Box 13 are drawn from *IMCC Presents 2001 National Reclamation Awards* at http://www.imcc.isa.us/NewsLetters/NewsMay2001.htm The Interstate Mining Compact Commission, based in Washington D.C. is a multi-state governmental agency / organization that represents the natural resource interests of its member states. First envisioned in 1964, the Commission came into existence in 1970 with the entry of its first four states. Since that time, 13 additional states have enacted legislation bringing them into the Compact, and 3 additional states have become associate members as they pursue enactment of legislation which will make them full members. The Commission operates through several committees composed of duly appointed representatives of the Governors from their respective Departments of Natural Resources or Environmental Protection.

6. IMPROVING MINING FRAMEWORKS IN SEE/TRB

In Sections 1.3 to 1.5 the objectives for this document were outlined. Much of the ensuing content has sought to "make the case" for Mining for Closure – and to provide some examples of what this can mean. In those introductory sections, references were made to previous studies that focused upon aspects of mining and mining legacies in SEE/TRB (Burnod-Requia, 2004; Peck, 2004). Among other things, these studies concluded that input was required in order to start the process of generating legal and/or regulatory frameworks for key mining actors. Further, that utilitarian measures needed to be designed to provide material incentives that could improve performance in problem areas – however, it was stressed that this process must likely be two-way. That Government must seek to "give" as well as "demand".

Further, it was indicated that measures intended to supply or enhance capacity within the mining sector – and the regulatory frameworks that enfold it – were required. Also that the prevalent norms among industrial, regulatory and social actors needed to be shifted in order to promote (and allow) improved mining performance.

Pursuant to that earlier work, four key areas for action among regional decision-makers, policy makers, and leading industrial actors were listed:

- **risk reduction at abandoned or orphaned sites** – actions among regional actors that can facilitate the reduction of the very significant risks associated with non-operational, abandoned and/or orphaned sites where large quantities of physically and chemically unstable, and/or poorly contained mine wastes are stored;
- **risk reduction at operational sites** – actions that can facilitate the reduction of the very significant risks associated at sites of mining or minerals processing that are operational via enablement of the existing economic actors and industrial activities with a key part of this being the development of an effective and efficient approach to the funding of closure that enables mine rehabilitation;
- **development of new resources and re-mining aligned with sustainable development** – actions that can stimulate development of institutional capacity, a culture of risk control, and markedly improved operational procedures throughout the region to create a norm of mine planning that encompasses mine closure plans as an integral part of a project life cycle;
- **fostering of institutional frameworks for abandoned or orphaned site management and sustainable mining and minerals processing practice** – further development of legislative frameworks addressing mining and minerals processing legacies; clear accountability (and jurisdictional remit) for the environmental aspects of mining and minerals processing activities in the region; and the further development of institutions supporting transboundary risk management and/or disaster response.

Section 2 then outlined why a range of stakeholders consider *Mining for Closure* and the issue of abandoned or orphaned sites to be so important to sustainable development around the world. Section 3 examined how these actors can work together; how the relative importance of stakeholders can change over time and when they form differing constellations. Pursuant to that, Section 4 provided a précis of why mines close – and more importantly in the context of this document, why so many have been abandoned without adequate works to ensure that they do not pose risks to the environment and to society. Section 5 then specified the somewhat unique needs of the SEE/TRB states and has provided some examples in order to provide "substance" to so many of the arguments presented earlier. As such, the material provided conclusively demonstrates that *Mining for Closure* makes the first three key areas for action possible, while the fourth area is vital for progress towards such objectives.

Thus a point has been reached in this report where the actions deemed to be required after earlier studies can be confirmed and where more specific items identified as a result of the content of this document can be summarised. Each of the four action areas identified at the outset of this document will be examined in turn, then some additional notes will be supplied regarding some general issues enfolding mine closure policy formulation.

This document will then conclude with a number of suggestions regarding the way forward to achieving *Mining for Closure* in SEE/TRB. The text addresses each of the following queries areas in turn: *what* the key issues are; *why* they should be dealt with; *how* such issues can be progressed, *who* should or can take action and *when* action should be taken.

6.1 ORPHANED AND ABANDONED SITES

The reader is reminded that within this report the term *abandoned* mine site refers to an area formerly used for mining and mineral processing (mining operations or facilities) where closure (including rehabilitation) is incomplete but whose legal owners still exist, while an *orphaned* mine site is deemed to be an abandoned mining operations or facilities for which the responsible party no longer exists or cannot be located.

This distinction is important to note in the text that is included in this sub-section and the sections that follow.

WHAT ARE SOME KEY ISSUES REGARDING ORPHANED AND ABANDONED SITES IN SEE/TRB?

A large number of mineral extractive industry related sites that are of high hazard exist in SEE/TRB and many have significant risks associated with them that threaten the environment, public health and safety, and/or regional socio-political stability in the South Eastern European countries.

The enormous financial liability embedded in any systematic rehabilitation programme for mining legacies constitutes a challenge that is beyond any single social actor's financial or organizational resources to solve alone in a conventional manner.

There is a lack of quantitative data describing the morphology of sites, their geochemistry, their general degree of risk, and which actors who should be accountable, or can be made accountable for such sites.

While, the lack of current legal owners of orphaned mine sites often places the accountability in the governmental hands, few governments anywhere have the resources or the expertise to take on physical and financial responsibility for dealing with such orphaned sites.

(Evidence suggests that) current liability regimes act as a disincentive for economic actors to associate themselves with orphaned and abandoned mine sites.

The approaches to social issues taken in rehabilitation programmes are often inappropriate at such sites and for their neighbouring communities.

The absence of clear criteria and standards for rehabilitation in many jurisdictions delay action by both the industry and by public authorities

Many national institutions or jurisdictions lack direction and require guidance. Further, it is clear that new approaches are required to find more innovative solutions.

WHY SHOULD THESE ISSUES BE DEALT WITH?

There are very significant risks associated with non-operational, abandoned and/or orphaned sites

Physical and chemical erosion of mine pit walls at a copper mine – Romania
Photograph by Philip Peck

and/or where large quantities of physically and chemically unstable, and/or poorly contained mine wastes are stored. There are a considerable number of sites of this kind in the region and while the most significant regional risks are related to the mass release of tailings wastes to waterways, there are other less serious, local, national and transboundary pollution types of varying degrees of severity.

Costs due to pollution and loss of natural/ecological service are real and ongoing. Such costs are direct and indirect, tangible and intangible.

Damage to natural and anthropological systems (particularly in SEE/TRB) is ongoing and increasing in many instances.

Transboundary pollution is ongoing and has the potential to undermine transboundary relationships.

Stakeholder related expectations are rising. These include *inter alia*: expectations for environmental protection; rising demands for reduced human health risks; increasing competition for land; and increasing perceptions of the value of the natural environment as recreational space. Moreover, there are growing desires to preserve land areas as a repository for valuable biological assets, for natural environmental services and for aesthetic appeal.

HOW CAN THESE ISSUES BE PROGRESSED?

Firstly and most importantly – by inventorying and prioritizing amongst abandoned and orphaned sites in order to ensure the best use of public and private funds. The process of prioritization will unavoidably require scientific assessment of key physical and geochemical parameters and broad risk assessments.

By exploring potential partnerships for remediation of orphan and abandoned mining sites that focus on the creation of future economic and social values in the context of a healthy environment, rather than simply aiming to "clean up". Such partnerships could involve both the public and private sectors, and may well embrace players who are not usually engaged in post-mining regeneration. It is vital that partnerships include communities of interest.

By exploring the actions expected of, and desired by, communities and NGOs thoroughly, in order to allow them to contribute to the formulation of solutions.

By encouraging the current industrial actors to provide expertise, equipment, supplies and personnel to support government funding in addressing legacies while concomitantly creating innovative, flexible and forgiving frameworks for indemnification against potential liabilities.

By encouraging – where and if appropriate with economic incentives or liability relief – new exploration activity on old sites and engaging the current industries to re-mine and rehabilitate.

By creating new legal and financial instruments and by encouraging innovation for the development of engineering and biological technological solutions

By benchmarking good practice, developing demonstration models and by disseminating experiences.

By seeking to be innovative and flexible in order to protect the public and the environment from the risks posed by mining legacies (within the significant constraints imposed by limited fiscal resources).

WHO SHOULD ACT AND WHERE?

Governments will need to lead the way because it is not practically possible to apply the "polluter pays" principle in dealing with most abandoned or orphaned sites. The original operators have long disappeared, the commodities produced have been consumed and the taxes paid have been incorporated in general revenues. It appears that there is no real alternative to the allocation of public funds to deal with the worst sites. However few governments, let alone most governments in SEE/TRB, have the resources or the expertise to take on physical and financial responsibility for dealing with orphaned (or abandoned) sites. The costs of ameliorating the most difficult problems may also need to be spread among parties that would benefit the most from the solutions to the problems.

Collaborative ventures between stakeholders will be vital in order to deal with abandoned and orphaned mining sites in SEE/TRB. Key actors have been identified as being policy makers and legislators at all levels of government, companies, the investment community, local communities and non-governmental organizations.

Responsible parties for abandoned sites should be involved in the process and financial accountability within practical limits where they can be identified. In the context of SEE/TRB, "collaborative involvement" strategies may be more productive than liability actions.

WHEN SHOULD THESE ACTIONS BE TAKEN?

Action needs to take place as soon as is practicable.

There is significant potential for ongoing deterioration in the regional risk situation. This is due in part, to the cessation of industrial activities without planned closure measures (be it as a result of socio-economic turbulence, or for other reasons). Cessation of activities is often associated with rapid deterioration in the condition of waste storage areas in the absence of maintenance activity and/or any form of monitoring. There are numerous abandoned or "temporarily abandoned" sites in the region that are gradually (or even rapidly) deteriorating with commensurate increase in risks to both local communities and international relations.

Actions and sites for action must be prioritised. All sites *cannot* be dealt with immediately. The action that must be advanced with all possible haste is the prioritization of "hot-spots" in each country and description of potential impacts associated with each of them, in particular impacts that may cause trans-boundary tensions and security risks.

6.2 OPERATIONAL SITES

WHAT ARE THE KEY ISSUES REGARDING OPERATIONAL MINING SITES?

The many operational mining sites in the region have great potential to become mining legacies. In this discussion's context it is important to note that an abandoned or orphaned site should be considered to include both the physical aspects (the mine site) and the social aspects (the stakeholders).

That enhancement of *all* options to ensure adequate mine closure is vital. While mines that are in the middle of their operating life have significant opportunities to ensure best practice closure, operating mines that are close to the end of their economic life have limited options available.

The preservation of ongoing activities at potential legacy sites in order to allow ongoing site reclamation may be an important – if not critical – strategy in ensuring improved outcomes. Where mine operators have become insolvent, or are unable to finance the costs of reclamation, responsibilities revert to the State, however State run initiatives may not be the most efficient or effective manner in which to reclaim or make safe sites.

That adequate policy and/or regulatory frameworks are absent or in their infancy.

That the frameworks and capacity to implement *Mining for Closure* approaches as outlined in this document are not yet in place in the region, yet it is such approaches that are required to address many of the challenges.

That current mining operations have not yet adopted *Mining for Closure* approaches in SEE/TRB.

WHY SHOULD THESE ISSUES BE DEALT WITH?

Dealing with these issues is required to best serve the interests of all mining stakeholders.

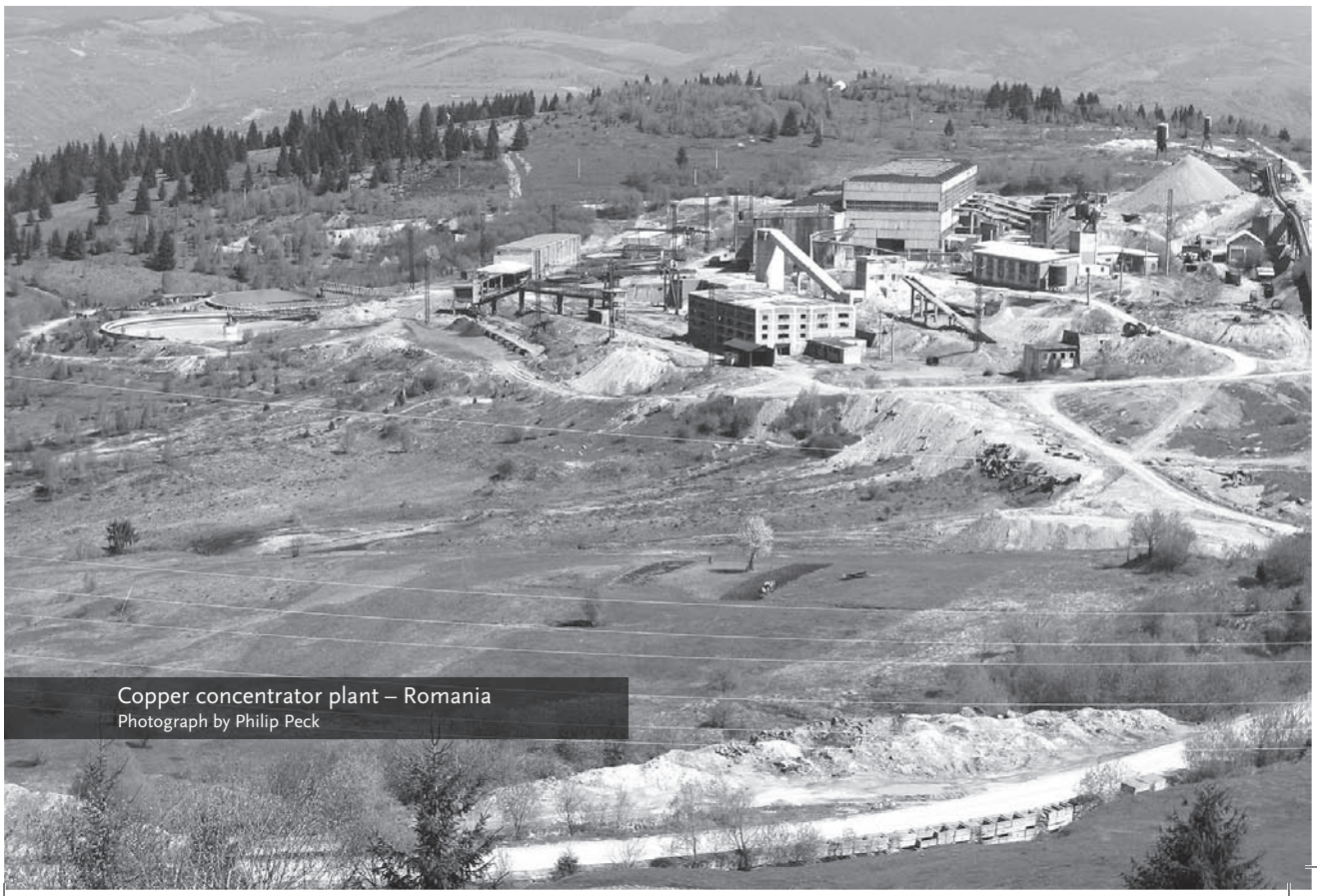
Central to the governmental case ensuring that *Mining for Closure* practices are built into the remaining operational life for mine is that such approaches serve to:[100]

- prevent harmful environmental and social impacts,
- lower the risk of non-compliances – both in terms of operational emission/effluents and in closure terms;
- engender greater acceptance/less resistance from key stakeholders (in particular local communities and land owners);
- reduce financial burdens to the national purse for mine closure and rehabilitation;
- lower the risk of significant liabilities post-closure – including national and trans-national pollution issues.

Central to the business case for the pursuit of Mining for Closure are that such approaches serve to:

- continually reduce liabilities via optimization of rehabilitation works undertaken during the productive phase of mining operations rather than deferringof costs to the end of the project;
- provide a basis for estimating rehabilitation costs prior to final closure so that sufficient financial and material resources can be set aside;
- provide ongoing testing, assessment and feedback regarding the effectiveness of rehabilitation designs and/or processes in a site specific fashion during the active mine life;
- increase efficiency in the execution of work (e.g. in reduction of double-handling for waste materials and topsoil);
- increase possibilities to continually optimise mine planning for efficient resource extraction and return of eco-systemS to a functional form;
- reduce areas of land disturbance through use of smaller waste landforms and mining paths, and in some circumstances progressive backfilling;
- allow identification of areas of high risk as priorities for ongoing research and/or remediation;
- stimulate direct involvement and empowerment of operations personnel in achieving mine rehabilitation outcomes;
- stimulate involvement of key stakeholders (especially local communities) in setting priorities for mine rehabilitation;
- reduce ongoing responsibilities for the site and facilitate the timely relinquishment of tenements and bond recovery;

100. Note that the scale of benefits is clearly linked to how early in a mine life such approaches are adopted.



Copper concentrator plant – Romania
Photograph by Philip Peck

- reduce impacts on local communities in terms of environmental, social and economic impacts of mine operations;
- reduce organizational exposure to contingent liabilities related to public safety and environmental hazards and risks;
- lower the risk of regulatory non-compliances;
- increase the degree of acceptance or reduce the resistance from key stakeholders (in particular local communities and land owners),
- improve access to land resources from governments;
- improve access to capital from reputable lending institutions;
- provide potential for reduced cost of capital and liability insurance;
- provide continual feedback upon the manner in which community expectations are being achieved.

In general terms the pursuit of *Mining for Closure* should be attractive as it has been clearly shown that the manner in which a mine is planned can have major positive influences on the magnitude and duration of impacts over the life of the development and following its closure. Further, and as the points above indicate, such approaches are the most inclusive with regards to communities and other external stakeholders.

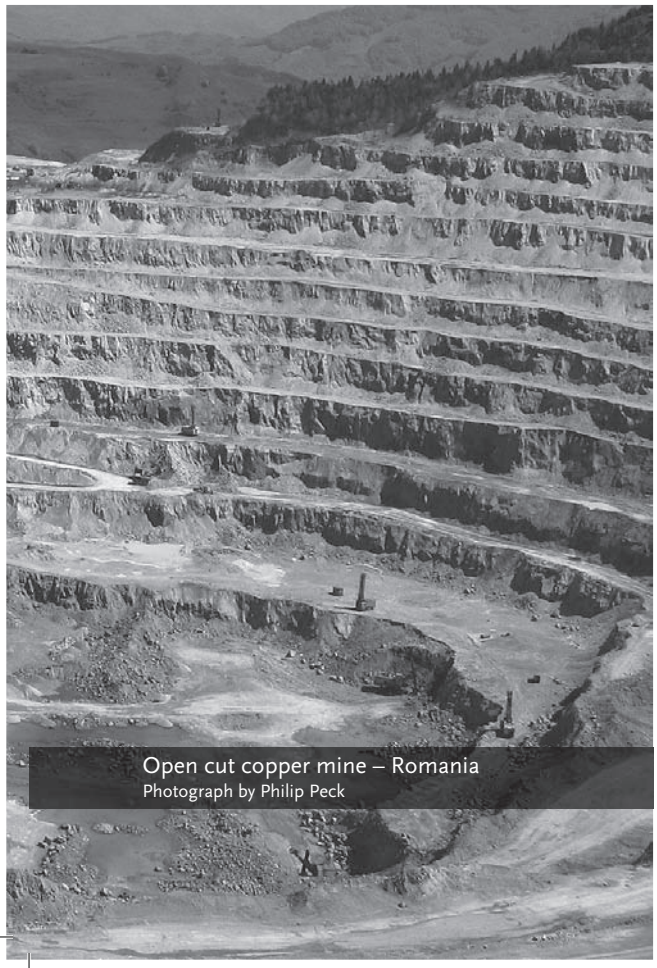
HOW CAN THESE ISSUES BE PROGRESSED?

It has been demonstrated throughout this discourse that the successful implementation of (integrated) *Mining for Closure* approaches is dependent upon the presence of relatively strict financial assurance tools addressing mine closure and reclamation.[101] Thus, these issues can be progressed via adoption of such measures should fulfil a number of criteria :

- Legislation should provide that the owner or operator is responsible for execution and completion of successful reclamation activities to an appropriate and agreed technical standard.
- Where long-term care is involved, the operator should be responsible to provide it until relieved of liability.

101. Note that the majority of material here is drawn from Miller (2005). His work was summarised in Section 2.3.1.

- Reclamation should return the site to a safe and stable condition, free of safety hazards (such as unsafe buildings, equipment, open holes, etc.) and should return the mine site to viable and, wherever practicable, self-sustaining ecosystems that are compatible with a healthy environment and with human activities.
- Recognition that while there should be measures to address and prevent ongoing pollution from the site, all encompassing requirements to return a site to its original condition or to a condition permitting particular land uses may be inappropriate. Governments should have a general policy of requiring financial assurance that is prudent in light of all reasonably foreseeable risks, but there must be recognition that insistence upon on protection against extremely unlikely events will impose excessive costs and as a consequence investment incentives may be significantly reduced. Again, it is vital to include communities of interest (and/or relevant NGOs) thoroughly in the process of formulating rehabilitation goals in order to allow them to contribute to the formulation of solutions.



Open cut copper mine – Romania
Photograph by Philip Peck

- Requirements for financial assurance, or any change in the required standard of reclamation, should be identified as early as possible in discussions between company and government.
- Where a government seeks to alter the required standard of reclamation, or to require a financial assurance instrument where none was required previously, particularly where the mine is only marginally profitable or is approaching the end of its life, a creative approach to the design of the instrument may be called for.
- It is appropriate that the tax regime of the country recognize that financial assurance imposes some costs on the operator, in particular, hard forms of security (such as letter of credit, cash bonds or trust funds), which impose two kinds of cost: direct carrying cost and loss of use of the funds for productive investment.
- It is reasonable to demand that Miners accept the costs and liability for environmental protection of the site during operations and for reclaiming the site upon closure. Where conditions such as acid mine drainage exist, it is reasonable that companies also accept the necessity of funding long-term care and management. However, government legislation should explicitly provide that at a certain moment the company could be relieved of future liabilities for the site. In most cases, this relief would be given as soon as site reclamation has been successfully completed. In the case of acid drainage, it should be considered as soon as necessary funding arrangements have been established for long-term care.

A number of actions and/or adoption of new approaches are also necessary so that negative social legacies of mining can be circumvented. Approaches should be sought where site objectives can transcend environmental quality criteria alone to include employment and social outcomes, as well as long-term resource stewardship. Instances exist where the combination of solutions (or preventative strategies) for physical and social legacies can be combined. Measures that can help achieve this include *inter alia*:

- the use of operational wastes as a resource for alternative product manufacture;
- the utilization of the land for periodic and low effort (anthropogenic input) uses such as grazing, local agro-forestry or non-food crops;
- the valorization of site features or mining-related infrastructure in new development initiatives to create sustainable local level employment over a longer period;

- subsidies for economically marginal re-mining operations where this would still be cheaper to the government than underwriting the costs of rehabilitation;
- redevelopment for and operation of post-mining sites as 'biosphere reserves' or equivalent to add to the national inventory of natural areas;
- redevelopment of sites that may also have tourism potential.

Moreover, consultation with the government and community leaders will be necessary to identify how essential community services such as medical care, schools, and so forth can be continued after mine closure (particularly those sponsored by mining companies during operational life). Pathways can involve the establishment of foundations to provide long-term sustainability for such services or direct linking of them to economic activities in post-mining areas such as those listed above. A similar approach is to establish a community trust fund that is protected against inflation. The income from the fund can allow the communities to take a long-term view of sustainability. Such a fund may also allow the communities to build their own capacity in order to manage the financial resources sustainable.

WHO SHOULD ACT AND WHERE?

In this case there are actions required of most major stakeholders in mining projects.

Government should bear the central accountability for social and community issues and for planning to ensure that communities are left in a self-sustaining condition post-closure, however mining companies can (and do in many jurisdictions) provide assistance or facilitate a consultative process with stakeholders.

Mining companies should bear the responsibility for the technical and safety aspects of mine closure working to the regulatory requirements or within the frames of agreements of the government.

Mining companies should also carry the responsibility for the identification and management of risks (both operational and residual). However, certainty in environmental issues is rare, and governments must clearly define the level of risk that they are willing to accept at closure. Firm and fair agreements must be established between such parties as early as is practicable.

Miners and government should ensure that communities, NGOs and other social stakeholders are brought into the process and are involved in clarification of what level of risk are acceptable at the current time. Further, efforts should be made to project what levels of risk may be acceptable or unacceptable within a reasonable future and ongoing dialogue throughout the mine life needs to be undertaken in order to update and adjust plans.

Government needs to set a clear legislative and fiscal framework. The initial licensing procedures and requirements can be used to initiate the process of mine closure planning and community consultation.

Local/provincial government should, where practicable, integrate mining projects into the regional development plan with goals to reduce the dependency of the region on the mine and can create a context for planning and delivering social services (e.g. health and education) by government rather than by the mine by actors other than the mine.

Miners and provincial governments may seek to address community and social issues via the establishment of foundations structured to exist for a period of time after mine life. An additional role that such bodies can serve is to work with the government to develop governmental capacity where it is lacking.

WHEN SHOULD THESE ACTIONS BE TAKEN?

The earlier the better! It is in the best interest of business, government and external stakeholders for such activities to take place at the right phase of mine life in order to minimise expenditures and minimise overall environmental and health related nuisances. Further, as mine decommissioning usually occurs at a point in the life of an operation where the economic recovery of minerals has ceased, and cash flows are minimal or non-existent, then this is not the time to be undertaking the bulk of rehabilitation operations. Similarly, social issues are best planned for early in a project lifetime.

6.3 NEW MINING RESOURCES AND NEW RE-MINING PROJECTS

New mining projects and the conduct of re-mining offer a range of opportunities for environmental, social and economic improvement in SEE/TRB. If

conducted properly, these projects offer far more than an economic basis for (social) development – they also offer an opportunity to restore mining legacies. The majority of the answers to the queries posed in this section, and salient points to be addressed mirror the previous sub-section. Such information is not repeated here but this section should be read with the previous in mind.

Prior to moving into this material, an important point is to be made. New projects require finance – and responsible financing is a topic that was addressed in Sections 2.3.4 and 2.3.5.

WHAT ARE THE KEY ISSUES REGARDING NEW MINING OR RE-MINING PROJECTS?

To ensure that successful planning yields the maximum freedom to address sustainable development goals during mine operation and at the time of mine closure.

To include communities of interest thoroughly in the process of project definition (including closure goals) so that they can contribute to the formulation of a successful and equitable mining project.

To leverage and encourage new mining projects that can restore mining legacies as a part of their ongoing operation.

The need to demonstrate institutional flexibility and a willingness to shape attractive frameworks for new mining and re-mining projects from reputable mining actors.

WHY SHOULD THESE ISSUES BE DEALT WITH?

The arguments for new mining projects are listed in the equivalent part of Section 6.2 – the major difference is that much greater possibilities to capitalise on opportunities exist for new projects. For new projects, the economic recovery of minerals has not yet commenced and economic calculations must incorporate allowances for mine decommissioning to take place.

HOW CAN THESE ISSUES BE PROGRESSED?

By developing reclamation and decommissioning standards that are in-keeping with leading mining nations; that address closure options, processing and ongoing reclamation; that have appropriate terms and conditions for site reclamation and decommissioning; that ensure that closure plans are updated, and that ensure that sufficient financial security (bonds, assurances, etc.) are in place prior to development. Guidelines for such frameworks are included in the equivalent part of Section 6.2 – and in the key references to this document.

By ensuring the effective conduct of inspection and enforcement of rules and regulations once they are in place.

By making re-mining operations more commercially attractive via reduction in taxes and royalties, changes in land tenure laws, and through reduced legal liabilities for operations that engage in rehabilitation processes for legacy sites in parallel to their core activities.

WHO SHOULD ACT AND WHERE?

The governments and minerals administrations of nation states in partnership with international expert resources should undertake the development of frameworks for *Mining for Closure* tailored to the needs of the region.

Mining organizations (the entity that seeks to profit from the activity) should undertake responsibility for mine closure and reclamation for all new mines and re-mining projects within the frameworks developed by government.

WHEN SHOULD THESE ACTIONS BE TAKEN?

Again, implementation of such frameworks should be undertaken as soon as is practicable. These are preventative measures and the costs associated with their implementation are minor in comparison to the economic, environmental and health related benefits they can yield.

6.4 FOSTERING INSTITUTIONAL FRAMEWORKS

Institutional frameworks enfolding mining are discussed from two perspectives here. The first is in line with the focus of this document – i.e. *Mining for Closure*. The second is related to the broader

much larger issue of environment and security risks posed by mining related in SEE/TRB.[102]

WHAT ARE THE KEY INSTITUTIONAL ISSUES IN SEE/TRB?[103]

Mining for closure issues

Institutionalised practices aligned with the precepts of *Mining for Closure* are undeveloped in SEE/TRB – *Mining for Closure* activities should commence before approvals are given for the development of a mining project. Among other things a conceptual mine closure plan should be submitted at the feasibility stage that include plans for decommissioning and rehabilitation of each component of the mining area with cost estimates.

Experiences with financial assurance tools and funding mechanisms for closure in general are limited – appropriate funding mechanisms are essential to ensure sufficient funds are available for mine closure activities and the completion of all decommissioning and rehabilitation requirements.

Traditions of review processes and stakeholder consultations are lacking – *Mining for Closure* plans must be reviewed periodically throughout a mine life in order to cater for changes in the overall mining plan, changes pursuant to environmental reviews, and needs and aspirations of the communities. Consultation with all external stakeholders and their participation are vital for the successful planning, operation and closure of any mine and to ensure social and economic activities are maintained.

Technical, ecological, risk related and "sustainable development related institutional capacities are insufficient – *Mining for Closure* demands combinations of the aforementioned expertise. These are uncommon in most mining countries, let alone in countries that have experienced recent institutional flux. The primary concerns for decommissioning and rehabilitation are to ensure public safety and health, environmentally stable conditions compatible with the surrounding environment are achieved and to minimize environmental impacts caused by mining. The overall objectives are to achieve a social, economical and environmental sustainable development.

Further, present mining legacies around the world indicate that insufficient institutional capacity and/or a lack of development in institutional frameworks are prevalent problems in most countries involved in mining – including developed nations. Weaknesses in the following institutional parameters are common:

- the general absence of mine reclamation policies and regulations until the latter part of the twentieth century indicates that most remain in their infancy or relatively untested;
- ineffective enforcement of mine reclamation policies and regulations if, and where in existence has been common;
- the absence of financial security mechanisms to ensure funds for parties such as government to conduct remediation in the event of miner default has been the rule rather than the exception; inadequate financial security to address remediation if, and where such funds were set aside has been common;
- avoidable and/or unnecessarily damaging technical practices remain in use in many mining jurisdictions;
- loss of mine data including records of underground workings and surface openings may remain an issue;
- political unrest, conflict and political instability leading to unscheduled cessation of activities at mines is still common.

Broader environment and security related issues

Skills (capacity) availability in the region is often insufficient to perform adequate national and trans-boundary hazard and risk management.

Data (both qualitative and quantitative) availability in the region is insufficient to perform adequate national and trans-boundary hazard and risk management.

Dialogue with key stakeholders such as national and international NGOs, affected citizens, and so forth is insufficient.

WHY SHOULD THESE ISSUES BE DEALT WITH?

Mining for closure issues

These issues should be combated with corporate governance approaches, regulatory frameworks,

102. Refer to Peck (2004) and Burnod-Requia (2004) for UNEP related output. There are also a number of other publications produced by the Romanian Government of great relevance as well as documents such as that produced by Zinke/ICPDR (ICPDR/Zinke Environment Consulting, 2000).

103. Many of these points are derived from a paper from the Chilean Copper Commission (Cohilco: Chilean Copper Commission, 2002).

or financial and insurance markets that adequately address mine closure rules or funding because such frames:

- prevent delays in developing projects and investments in this sector,
- ensure equitable distribution and internalization of closure costs,
- avoid the need for costly and time consuming tailor-made solutions on a case-by-case basis, and
- ensure that the best investor groups and miners are attracted to national resources.

Broader environment and security related issues

In order to reduce transboundary environmental and human safety risks posed by sub-standard mining operations – both active and abandoned – in the region.

HOW CAN THESE ISSUES BE PROGRESSED?

A major step forward would be the establishment of detailed and consistent mine closure requirements and procedures across the region to replace the general regulatory vacuum. For most countries it appears that there are presently few or no applicable laws, regulations, standards and norms.[104]

According to the authors of *Research on Mine Closure Policy* (Cohilco: Chilean Copper Commission, 2002, p4) it seems that it works better to have an independent mine closure law that establishes a single agency for implementation. Such models provide the business community with added confidence that one agency will take the lead on its problems and that it will not have to answer to many differing opinions on how operation, reclamation and closure success will be measured. Further, this also allows the public and NGOs a single place to go for information on mining regulation.

Another source (personal communication: University of Nevada, 2005, 28 July) adds that the mine closure agency should be the same agency that permits operations so that there is continuity between design aspects focused upon operations and design aspects dealing with closure. Finally, it is logical that laws are consistent with other such laws within the same regulatory framework and preferably (and where possible) with those developed by the other countries in the region, and that requirements should not be duplicated.

However, in the context of SEE/TRB, the task at hand encompasses more than ensuring mine closure and rehabilitating mining legacies. The strengthening of institutional frameworks is also required to manage and reduce trans-boundary risks related to such hazardous activities, to facilitate the successful management of trans-boundary natural resources and to influence the evolution of social norms.

As such there is a clear need for a capacity-building programme to enhance the ability of national agencies and mines inspectorates to deal with the legacy of mining sites in the region, and to ensure that new mining projects are based on sound environmental and security principles. Such a programme should apply a combination of capacity-building tools including knowledge transfer, case study analysis, regional workshop(s) to exchange experience, and development of country action programmes. Such works should focus upon building agency capacity in the following areas:

- Environmental impact and risk assessment, and screening of new mining projects
- Incorporation of public security measures and emergency preparedness into mining permits and licences
- Dealing with non-active mines, including abandoned sites

Further, it is considered that the following activities are required to progress risk-related issues:

- multi-lateral participation in the establishment of officially sanctioned bodies or working groups with the responsibility of scoping programmes for hotspot site remediation and seeking international funding for execution of priority works;
- establishment of officially sanctioned bodies or working groups for the assessment and management of transboundary risk – such bodies will need to include representatives from generating territories and receiving territories, and as required include international experts and international bodies involved in transboundary environmental and regional security issues and opportunities should be explored to expand the remit of existing functional entities to reduce bureaucracy, build on existing capacity, and maximise efficient use of limited resources;

104. The Desk Study: *Reducing Environment & Security Risks from Mining in South Eastern Europe* (Peck, 2004), documents the infancy of such frameworks in many SEE/TRB countries.

- establishment of transboundary notification and disaster response systems linked to the parties mentioned above;
- establishment of monitoring programmes, and/or early warning systems for the assessment of ongoing chronic pollution, and for the detection of pollution events;
- capacity building for governmental and regulatory actors involved, or to be involved in activities such as those listed above.

WHO SHOULD ACT AND WHO SHOULD PARTICIPATE?

In this text, items related directly to *Mining for Closure* and broader SEE/TRB mining related issues are addressed. The key tasks are listed first, the parties who should be involved second.

Mining for Closure issues

Capacity building within institutional actors such as governmental regulatory agencies, mines inspectorates and so forth is needed in order to support legacy management and as preparation for future mining and minerals processing activities. Such work could be formulated and coordinated by international bodies and experts in liaison with national environmental agencies, and in liaison other key stakeholders. It could be conducted by consortia of international experts and academic institutions in association with national academic institutions.[105]

Capacity building within industrial actors such as miners, mineral processors and their associated industry bodies will be required to support management of abandoned and orphaned sites and as preparation for future mining and minerals processing activities. Formulation and conduct as above.

Broader environment and security related issues

Hazard and risk-related uncertainty reduction via focused information collection needs to be undertaken. Such work could be formulated and coordinated by national environmental agencies in association with international and national experts, and conducted by mines inspectorates and national experts.

Management of risks associated with the legacies of mining and minerals processing activities is vital. Such work could be coordinated by national environmental agencies and transboundary constellations of such agencies; formulated by bodies such as mines inspectorates, national and international experts, and academic institutions in association with key stakeholders, and; conducted by industrial actors within mining and related branches.

Dialogue with key stakeholders such as national and international NGOs, affected citizens, and so forth will need to be pursued. Dialogue is required in order to support the conduct of all the works described above. At the current time, such work should likely be limited to a focus upon the specific tasks above. It could be formulated and coordinated by international bodies and experts in liaison with national environmental agencies and academic institutions and conducted by consortia of international experts and academic institutions in association with national academic institutions.

WHEN SHOULD THESE ACTIONS BE TAKEN?

These items are closely related to those listed in Section 6.3, as such, implementation of such frameworks should be undertaken as soon as is practicable. Again, these are preventative measures and the costs associated with their implementation are minor in comparison to the economic, environmental and health related benefits they can yield.

105. Dirk van Zyl of the Mining Life-Cycle Center at the University of Nevada (personal communication: University of Nevada, 2005, 28 July) notes that lack of capacity is a major barrier to the development of a culture of *"Mining for Closure"* or sustainable mining practices. He calls for concrete actions that can be taken to initiate the process, and in this regards points to the actions of Peru in the early 1990s as an example. The first step taken in that country was for each mine to develop an environmental review (in essence an "impact assessment") to identify all the steps that would have to be taken to bring it up to acceptable environmental performance. He notes that "community performance" can be added to this. In Peru, foreign consultants (US or Chilean) performed much of the initial work but they developed local contacts and associations and many opened country offices. The mines also had to set a timetable for implementing all the steps and provide a cost estimate – a process that could cover more than five years. These first steps initiated the development of capacity in Peru at all levels: mining companies, consultants and regulatory personnel. While Peru did not require closure plans as part of the environmental review, van Zyl considers it very appropriate to do so if this path is followed in SEE/TRB. He adds that another approach that may accelerate the process is to organize a series of short courses through Universities – a measure that may require initial and intense building of academic capacity in this regard. Such courses could involve review the basics and then development of an environmental and closure plan – with all steps being focused on development of the culture at that level. Van Zyl stresses that capacity building of in-country consultants/engineers will be of much more benefit to developing the a culture of *"Mining for Closure"* than to have foreign consultants do the majority of the work.

6.5 MINE CLOSURE POLICIES IN GENERAL

WHAT OTHER KEY ISSUES EXIST REGARDING MINE CLOSURE POLICIES?

The ongoing fundamental divide between the interests of mining companies and the interests of the communities where mining is hosted represents a challenge that must be ameliorated.

The determination of bonds size – the key parameter of financial assurance for mine closure and reclamation – is problematical.

The integrity of financial securities is vital.

Ongoing improvement of existing *and new* closure policies and regulations is necessary and must be planned for.

Poorly considered distribution of redundancy schemes, provision of redundancy payments, and application of re-training schemes (even where fair and adequate) can lead to follow-on problems (rebound effects).

WHY SHOULD THESE ISSUES BE DEALT WITH?

If items such as those listed above generally refer to challenges to be faced when implementing good practice that one has striven after. Such issues demonstrate that even when *Mining for Closure* practices have been established within sound institutional frameworks and then put in place, they must still be managed carefully. Further, that flexibility and the need for revision must be recognised. The alternatives are sub-optimal solutions or even failure of the measures.

HOW CAN THESE ISSUES BE PROGRESSED?

These items are essentially planning related and can be catered for (if not resolved) by planning processes that integrate a range of safeguard measures. In general terms, such processes should involve:

- the definition of a vision of the end result for mining land that sets out concrete objectives for implementation;
- ensuring that the mine closure plan is an integral part of a project life cycle;
- the preparation of a mine closure plan early in the process of mine development and in consultation with the regulating authority and local communities;
- the explicit inclusion of environmental, social and economic aspects in the planning for mining operations;
- allowances for review and evolution that stretch from the pre-mine planning phase, through construction, mining, and mine closure to post-mine stewardship.

As more specific items, such processes should incorporate:

- the concerns/participation of other stakeholders in the reclamation objectives;
- plans for action if ownership reverts to the state despite all efforts to ensure otherwise;
- the preservation of mine management and geological records;
- early delineation of project creditors' claims on the site;
- legal considerations for ownership, both now and in the past;.
- maintenance of control over tenure if leases expire and another party wants to obtain rights to the surface/subsurface;
- adequate capacity among regulatory personnel;
- ongoing research and testing of remediation strategies and technologies and integration of results in *Mining for Closure* review processes;
- surveillance of the views and desires for the involvement of local communities (in particular where such parties wish to ensure the quality of information that they are receiving – demanding a role in site monitoring and access to information to ensure accountability of operator and governments are examples);
- ensuring that communication exists between private and public bodies to improve closure policy and regulations;
- ongoing searches for financing measures for clean-up; disaster response; spills management and so forth, particularly for orphaned sites.

In closing, it is necessary to underline that it is the role of government (as the representative of stakeholders in the nation state) to ensure that the expectations of stakeholders are met. Further, it must be noted that stakeholder expectations are inherently fluid – and indeed that such expectations can be influenced, and perhaps should be where they do not best reflect the interests of all.

As a very foundation to all of this however, are the expectations that mine closure is to provide long-term stabilization of the geochemical and geotechnical conditions of the disturbed mining areas to protect public health, and minimise and prevent any additional or on-going environmental degradation. As such the base environmental expectations are *that future public health and safety is not compromised* and that *environmental resources are not subject to abnormal physical and chemical deterioration*.

These fundamental expectations will not be particularly subject to change.

WHO SHOULD ACT AND WHERE?

These issues largely require the steady hand (or at least the watchful eye) of good Government. The fact remains that mining companies typically want to serve their shareholders by developing mines, achieving a good financial return for their owners, then leave when production is finished – so that they can continue their line of business elsewhere. Communities on the other hand want to see wealth and income opportunities created that will last over time. It is the role of Government to ensure that these somewhat disparate aims be made synergistic. Tradeoffs must be made and they need to be fair and amenable to all parties.

WHEN SHOULD THESE ACTIONS BE TAKEN?

The frameworks need to be put in place now. The process of implementing, refining, remodelling and negotiating must be ongoing throughout the lives of mines.

6.6 THE WAY FORWARD

This document was created in order to present principles, ideas and guidelines for mining policy development, capacity development and institutional development that can yield a sustainable mix of social, economic, and environmental outcomes in the South Eastern European region. It has been generated in recognition of a fundamental divide between the interests of mining companies who typically wish to develop mines, achieve a good return for shareholders, then leave when production is finished and the interests of the communities who desire wealth and income opportunities created in their midst that will last over time.

This said, this document has built a case for the strategic relevance of *Mining for Closure* for both the mining industry and for governments. Key actors on both sides clearly recognise that the very viability of the mining industry is challenged because of high expectations for environmental protection, desires for lower risk to human health, competing land use demands, and the increasing value of the natural environment as recreational space. The survival of the mining industry AND sustainable development of countries in SEE/TRB both require a vibrant industry that society accepts.

The previous sections have documented a raft of principles, ideas and guidelines. These address the mining policy development, capacity development and institutional development that need to be addressed in order to ensure the operation of existing and new mining operations in order for cost-effective closure fulfilling acceptable sustainability requirements can be achieved. Further, a wide range of ideas for exploration are presented regarding the re-mining or otherwise valorising of abandoned or orphaned sites in order to make safe and/or remediate and close them.

The earlier analysis and discussions have established that the way forward must include *fostering of institutional frameworks* for abandoned or orphaned site management and sustainable mining practices and minerals processing and that this will require immediate and ongoing *capacity building for institutional actors* as well as significant *capacity building among industrial actors*. Pursuant to that, the new skills and knowledge among institutional actors must be directed at key tasks of hazard and *risk-related uncertainty reduction* via focused information collection and by *risk reduction works* at abandoned or orphaned sites. Further, new skills and knowledge applied within sound institutional frameworks within all actors must be applied for *risk reduction at operational sites* and the *development of new resources and re-mining activities* that are aligned with sustainable development. All these must include *dialogue with key stakeholders* such as national and international NGOs, affected citizens, and so forth.

This work outlines trends in the expectations of society and the international community, the general content, and the degree of international uptake of best environmental and social practice in mining in a range of jurisdictions. As such, this should serve to guide National agencies responsible for mineral

exploitation, and National agencies responsible for environmental quality in their work of building the foundations for good mining policy and administration. Further, such stakeholders can use this document to help inform their own expectations for practice and to stimulate innovation and creation of solutions tailored to their own circumstance (as is discussed earlier in this document, a number of the practices or investments required elsewhere will not suffice here, nor can they all be afforded).

This final discussion will consist of two parts. The first will list a number of guiding principles for mining policy development work. The second will outline a number of steps that need to be taken in the near future.

6.6.1 A CODIFICATION OF PRINCIPLES

Pursuant to the experiences from around the world as documented in this discussion, this section will summarise a set of guiding principles. These can be used to guide the management of existing and new mining operations so that acceptable sustainability requirements and cost effective closure can be achieved. Further, these can be used to support work with abandoned and orphaned mining sites in order to make them safe and/or remediate, and close them. It should be noted that the items listed below should be seen as congruent and synergistic and not exclusive (e.g. such as strict versus flexible).

In order to *Mine for Closure*, jurisdictions, policies and work approaches should be:

Consistent – Mine closure requirements and procedures should be consistent with those in place in other territories of the region. This is particularly important where two countries share trans-boundary risks.

Centralised – Governments should strive for an independent mine closure law that establishes a single agency for implementation.

Strict – Legislation should apply the polluter pays principle strictly and should ensure that the owner or operator of a mining operation is responsible for execution and completion of successful reclamation.

Financially assured – Legislation should provide that (particularly for new operations and operations with considerable lifespan remaining) financial assurance is provided to ensure successful reclamation.

Long-term financed – Where conditions requiring long-term care exist, the funding of long-term care and management should be included in assurance. However, government legislation should explicitly provide that at a certain moment the company could be relieved of future liabilities for the site.

Temporally bounded – Where long-term care is involved, the operator should be responsible to provide it until relieved of liability, but amenable temporal bounds of such liability should be included in agreements. This requires that care be long-term financed.

Low hazard and viable – Viable, rather than *only* self-sustaining ecosystems, that are compatible with a healthy environment and with human activities and are low hazard should be left post-mining. Measures to address and prevent ongoing pollution from the site should be in place.

Considered and flexible – The target condition of a mining site should be carefully considered in the light of long-term environmental stability but not in the absence of social and economic uses that can contribute to making it safe. All encompassing requirements to return a site to its original condition or to a condition permitting a maximum range of land uses may be inappropriate. Jurisdictions should be flexible in devising solutions that match site-specific needs in terms of the types of mining operation, climate, topography, the sensitivity of the surrounding environment, and social requirements, and which deliver outcomes consistent with sustainable development principles and objectives

Synergistic – Synergies between actors, particularly actors with the capacity to provide rehabilitation service at lowest cost, should be pursued. This may be achieved by providing incentives for the current industrial actors to provide expertise, equipment, supplies and personnel to support government funding in addressing legacies.

Elastic – Innovative, flexible and forgiving frameworks for indemnification against potential liabilities should be sought, particularly in situations where this may provide the necessary incentives for multi-stakeholder participation in reclamation/rehabilitation works.

Reasonable – There must be recognition that insistence upon on protection against extremely unlikely events will impose excessive costs and as a conse-

quence incentive to investment may be significantly reduced. Reasonable approaches must be applied when jurisdictions seek assurance against the possibility of loss or damage to the environment.

Creative – In situations where the mine is only marginally profitable or is approaching the end of its life, a creative approach to the design of the instrument may be called for.

Incentive based and tax balanced – the tax or royalty regime of the country should recognise that financial assurance imposes some costs on the operator. This should be balanced to ensure that sustainable development objectives are assured.

Sustainability-oriented – Conditions imposed for closure will need to transcend only environmental quality criteria to include other important factors employment and social outcomes, as well as long-term resource stewardship.

Innovative – Jurisdictions should innovatively seek alternative economic yield from sites such as the valorization of wastes; alternative land utilization; infrastructure re-use; operational underwriting by tax yield; redevelopment and so forth.

Service oriented – *Mining for Closure* solutions must identify how essential community services such as medical care, schools, and so forth can be continued after mine closure.

Inclusive – *Mining for Closure* demands an inclusive stakeholder approach. This inclusiveness must stretch beyond consideration of stakeholders within national boundaries such as communities and include both regional nation states and international actors.

6.6.2 STEPS TO BE TAKEN

Within the immediately coming years there is considerable urgency to achieve development within institutional frameworks.

Establish detailed and consistent mine closure requirements and procedures across the region according to the principles outlined in this document and of relevant European and international legislation.

Encourage the development of an independent mine closure law that establishes a single agency for implementation in each country. Ensure that these laws are consistent with other such laws within the same regulatory framework and developed by the other countries in the region, and that requirements are not duplicated.

Embark on a capacity-building programme to enhance the ability of national agencies and mines inspectorates to deal with the legacy of mining sites in the region, and to ensure that new mining projects are based on sound environmental and security principles. Such works should focus upon building agency capacity in:

- environmental impact and risk assessment, and screening of new mining projects;
- incorporation of public security measures and emergency preparedness into mining permits and licences;
- dealing with non-active mines, including abandoned sites, and
- management of transboundary risk.

Similarly, within the immediately coming years there is some urgency to establish activities and sanctioned bodies – or strengthen and expand them where they exist – to progress risk reduction in general.

Participate in multi-lateral work for the establishment of officially sanctioned bodies or working groups with the responsibility of scoping programmes for hotspot site remediation and seeking international funding for execution of priority works.

Establish officially sanctioned bodies or working groups for the assessment and management of transboundary risk. Such bodies will likely need to include representatives from generating territories and receiving territories, and as required include international experts and international bodies involved in transboundary environmental and regional security issues. Within this, opportunities should be explored to expand the remit of existing functional entities to reduce bureaucracy, build on existing capacity, and maximise efficient use of limited resources.

Extend &/or establish transboundary notification and disaster response systems linked to the parties mentioned above.

Extend &/or establish monitoring programmes, and/or early warning systems for the assessment of ongoing chronic pollution, and for the detection of pollution events.

Similarly, within the immediately coming years there is some urgency to establish a number of activities to progress rehabilitation or risk amelioration at abandoned and orphaned mine sites. These next steps can be read in the context of flagship pilot remediation projects for learning.

Inventorise & prioritise amongst abandoned and orphaned sites in order to ensure the best use of public and private funds. It is unavoidable that this will require the building of detail inventories of mining activities and mine related sites in National jurisdictions. These will need to be filled with salient content such as complete details of current ownership and activity status for identified sites; assessment of the legal status of abandoned/orphaned mines; geographical detail such as relationship to watershed boundaries; basic engineering and infrastructural parameters and so forth.

Explore the potential of partnerships (including trans-national partnerships) for remediation of orphan and abandoned mining sites that focus on the creation of future economic and social values in the context of a healthy environment and involve both the public and private sectors.

Test & experiment with different forms of partnership and innovative, flexible and forgiving frameworks for indemnification against potential liabilities in the first "case study site" rehabilitation projects.

In closing this report, a finding regarding the understanding of the process of risk reduction in the South Eastern European context from the parallel desk-assessment report is cited. This comment, clearly calling for pilot projects, for a focus upon data collection and capacity building needs, and highlights the need for learning. These calls are deemed as valid now in this document's context as they were there.

Pursuant to activities of the type listed above, it is considered that pilot projects in risk reduction that target specific sites in a number of countries have the potential to provide significant tangible benefit. While work towards the amelioration of risks at individual sites is likely to yield environmental, social, developmental and regional security benefit, the prime benefit of any pilot activity should sought in the area of learning for future work. For example, the desk study indicates that better understanding in many areas is required. Examples of such areas are:

- *the challenges facing transboundary working groups (inter alia: cross border movement, geographical jurisdiction, sharing and compatibility of data, accountability, funding of activities, and so forth and so on);*
- *the manner in which gaps in legislative frameworks affect management of sites;*
- *how lack of institutional capacity limit progress with the management of transboundary risks;*
- *how general resource deficiencies (finance, equipment, technical capacity and so forth) place restraints on execution of works;*
- *pathways for stakeholder consultation that function best;*
- *models for industry/community cooperation that function best;*
- *technical knowledge gaps that prove most critical for success;*
- *models for financing risk amelioration;*

The scoping of any pilot projects within the region should take place pursuant to activities focused upon data collection and capacity building needs. Proposals to undertake such projects, and the determination of the specific objectives of any such projects can only take place if the desire to undertake such is expressed by representatives of the affected countries.

GLOSSARY OF MINING/ENVIRONMENT TERMINOLOGY

For the context of this report, the following definitions are provided for general mining and minerals sector related terminology:

Acid Deposition The falling of acids and acid-forming compounds from the atmosphere to the Earth's surface. Acid deposition is commonly known as acid rain, a term that refers only to wet deposition of droplets of acids and acid-forming compounds. Acid deposition includes the fallout of dry acid-forming compounds.

Acid Drainage Also referred to as Acid Mine Drainage (AMD) or Acid Rock Drainage (ARD). Acid drainage arises from the rapid oxidation of sulphide minerals and often occurs when such minerals are exposed to the atmosphere by excavation from the earth's crust. Incident rainfall or surface water is acidified when acid-forming compounds dissolve. Effects include acid drainage from waste rock stockpiles and tailings, development of acid conditions in exposed surface materials, increased solubility and or release of metals, and increased salinity or solute loads in waters.

Acidic Water Referring to water with a pH below 7 but generally referring to pH values of 4 and below. Any water solution where the concentration of hydrogen ions (H+) is greater than the concentration of hydroxide ions (OH-).

Aquifer Porous, water-saturated layers of sand, gravel, or bed rock that can yield an economically significant amount of water.

Backfill Material used to fill areas in underground mines made void by the extraction of ore. This material generally comprises coarse sand, rock and cement.

Beneficiation The process of separation of an ore mineral from the waste mineral material.

Bioavailability A measure of the availability (number of available pathways for exposure) for toxic substances (such as certain metallic compounds) to contact and affect humans, fauna or flora.

Biodiversity Variety of different species (species diversity), genetic variability among individuals within each species (genetic diversity), and variety of ecosystems (ecological diversity).

BOD Biological Oxygen Demand Amount of dissolved oxygen needed by aerobic decomposers to break down the organic material in a given volume of water at a certain temperature over a specified time period.

Carbon Dioxide (CO_2) A colourless, odourless, tasteless gas, approximately 1.5 times the density of air. The basis for plant respiration. Liberated when vegetable matter rots, burns and when oil and gas are burnt. Bound when plants grow.

Chlorofluorocarbons (CFCs) Abbreviation for various chemical compounds containing chlorine, fluorine and carbon. CFCs are produced in industrial processes, contribute to ozone layer depletion and are green house gases in the lower levels of the atmosphere.

COD, Chemical Oxygen Demand An indicator of the potential environmental impact of effluents to water. The COD is a laboratory measure of the quantity of oxygen required to oxidise the constituents of a liquid effluent. The lower the COD, the lower the potential for reduction in the concentration of dissolved oxygen in the receiving water.

Concentrate Concentrate is the product of ore treatment and contains metal at a higher concentration than the source ore. In metallurgical processes for the production of nickel and copper, concentrate is smelted to produce a metallic compound suitable for further refining.

Cuttings Earth and rock removed during a drilling operation to make an exploration hole. Cuttings are invariably contaminated with oil from drilling fluids (oil based and other muds).

Discharge This is used as a general term for all releases of contaminants into the environment, be they gas, liquid, or solid, or a combination thereof. The term "emission is used exclusively for releases in the atmosphere, "effluent" is restricted to releases into surface waters and "waste" is used for remaining releases, such as disposal to landfill or treatment by incineration. A contaminant is a compound which is present in the environment in concentrations higher than the background level, but not necessarily causing a negative impact.

Environmental Audit A programme to evaluate compliance with regulations, systems, programs and policies

Environmental Compliance When an organization is in strict compliance with an environmental law(s), regulation, or other regulatory condition imposed on an operation via a licence, approval, consent, environmental impact assessment or other regulatory process.

Fauna Animal life characteristic of a particular region or environment.

Flora Plant life characteristic of a specific geographic region or environment.

Greenhouse Effect Warming of the lower level of the atmosphere (troposphere) as a result of heat radiating

from the ground being absorbed by global warming gases.

Greenhouse Gases Or climate change gases, contributing to the global warming effect (carbon dioxide, methane, CFCs, ozone, dinitrogen oxide).

Groundwater All water present below the ground surface. Groundwater fills the voids between soil or rock particles. Groundwater is replenished by surface water infiltration.

Hazardous Material A material, which as a result of its physical, chemical or other properties, poses a hazard to human health or the environment when it is improperly handled, used treated, stored, disposed of, or otherwise managed.

Hazardous Waste Any solid, liquid, or containerised gas that can catch fire easily, is corrosive to skin tissue of metals, is unstable and can explode or release toxic fumes, or has harmful concentrations of one or more toxic material that can leach out.

Incident An unplanned event of chain of events which has, or could have caused injury or illness and/or damage to the environment, third parties or company assets.

Matte Such as nickel matte, a metallic nickel sulphide, containing approximately 75% metal. The material produced by smelting a metal concentrate.

Methane (CH_4) A global warming gas produced by anaerobic decay of organic material. The main component in natural gas. Is often held within coal seams. Conventionally not included in the category of gases called volatile organic compounds.

Mineral (Mineral resource) Concentration of naturally occurring solid, liquid, or gaseous material, in or on Earth's crust, in such form and amount that its extraction and conversion into useful materials or items is currently or potentially profitable. Mineral resources are classified as metallic, or non-metallic.

Neutral drainage A term generally referring to neutral Fe-rich water and subsequent precipitates. Acidic drainage is a common result from the exposure of sulphur containing coal and sulphide-bearing rocks. Acidic drainage is (generally) characterized by yellow, ferric hydroxide precipitates that drop out downstream from discharge points. However, similar precipitates also form naturally in places where Fe-bearing, anoxic (ground) waters discharge into streams. In these circum-neutral settings, the precipitates have red and red-orange hues.

Nitrous Oxides (NOx) A general term for nitrogen oxide gases. These are generally produced by combustion processes and can contribute to the formation of smog and acidification effects.

Non-compliance Environmental non-compliance means to be out of strict compliance with an environmental law, regulation, or other regulatory condition imposed on an operation via a licence, approval, consent, environmental impact assessment or other regulatory process.

Ore Part of a metal yielding material that can be economically and legally extracted. An ore typically contains two parts: the ore mineral, which contains the desired metal, and the waste mineral material (gangue).

Overburden Soil and weathered rock which is excavated and removed to reach underlying ore.

Ozone A reactive form of oxygen. Ozone plays an important role both at ground level and in the upper atmosphere. In the upper atmosphere it acts as a filter for ultraviolet radiation but is destroyed by halogenated hydrocarbons (halons and CFCs). At ground level it is produced by reactions with VOCs and NOx and is a constituent of photochemical smog, it is an irritant, can cause breathing difficulties, and can retard the growth of plants.

Ozone Layer Ozone formed in the upper atmosphere (stratosphere) under the effects of solar radiation. This layer absorbs much of the harmful ultraviolet radiation and prevents it from reaching the earth's surface.

Particulates Fine solid particles which remain individually dispersed in air.

Paste Paste refers to dewatered tailings with little or no water bleed that are non-segregating in nature.The advantages of paste backfill over hydraulic fill include reductions in binder consumption, slimes handling, stope preparation and surface disposal together with productivity improvements associated with an increased mining cycle.

Perfluorinated Carbon Compounds (PFCs) Also known as perfluorocarbons. Global warming gases contributed (principally) by aluminium smelting. The principal PFCs are CF_4 and C_2F_6, their global warming potential is 6300 and 12500 CO_2 equivalents respectively. While relatively small volumes are produced, a very significant environmental effect ensues. PFCs are produced during anode effects (AEs), perturbations of current flow at the anode in reduction cells.

Petrochemicals Chemicals obtained by refining crude oil. Used as raw materials in the manufcture of most industrial chemicals, fertilisers, pesticides, plastics, synthetic fibres, paints medicine and many other products.

Recycling Extraction and recovery of valuable materials from scrap or used products.

Rehabilitation Treatment of disturbed areas ultimately leading to stable, vegetated land forms consistent with the previous landforms or an acceptable alternative use.

Risk – and related terms.

Risk A description of the likelihood of the harm becoming actual. Importantly, risk is (at least) two-dimensional and consideration of risks must encom-

pass items such as the consequences of an event or set of circumstances and the likelihood of particular consequences being realised. Exposure pathways – that is, the manner in which people, property, or the biophysical, social, or cultural environment are exposed to a source of potential harm or a situation with a potential for harm are important is important when considering the likelihood of harm.

Harm Any damage to people, property, or the biophysical, social, or cultural environment.

Likelihood A qualitative term covering both probability and frequency. The use of this term can avoid problems caused by using frequency of defined events and probability of specific outcomes interchangeably. Exposure pathways – that is, the manner in which people, property, or the biophysical, social, or cultural environment are exposed to a source of potential harm or a situation with a potential for harm are important is important when considering the likelihood of harm.

Hazard A source of potential harm or a situation with a potential for harm, thus a potential cause of harm.

Consequence(s) The intermediate or final outcome(s) of an event or situation. Consequence is a term that contains elements of the social as well as biophysical world thus system response factors such as stakeholder reactions (e.g. outrage) to an event or situations are highly relevant here.

Sulphuric Acid (H_2SO_4) Acid commonly used in industry for the refining of metals, solvent extraction of uranium and in the manufacture of chemicals and fertiliser.

Sulphur Dioxide (SO_2) A gas that contributes to climate effects, acidification and other air quality problems.

Salinization The accumulation of salts in soil that can eventually make the soil unable to support plant growth.

Salinity Amount of various salts dissolved in a given volume of water.

Surplus Rock or Waste Rock Rock that must be extracted to reach economic ore but does not contain significant commercial mineralization.

Tailings Residue from metallurgical processing, mainly comprising finely ground rock. Tailings may contain process chemical residues.

Tailings Retention System Holding areas for process wastes (tailings), also referred to as Tailings Storage Facilities, Tailings Dams, and Process Waste Storage Facilities.

Topsoil The upper layer of soil which supports plant growth. Generally the layer containing nutrients, organic matter and seeds.

Toxic Chemical A chemical compound that is fatal to humans in low doses, or fatal to over 50% of test animals at stated concentrations.

Toxicity Measure of how harmful a substance is.

Units k = kilo (thousands – 10^3) as in kilogram (kg); G = giga (billions – 10^9) as in gigajoule (GJ); M = mega (millions – 10^6) as in megajoule (MJ); T = tera (one million million or 10^{12}) as in terajoule (TJ); ppm = parts per million; ppb = parts per billion.

VOCs Volatile Organic Compounds. Organic compounds (i.e. compounds of carbon) which evaporate at normal ambient temperatures. In addition to hydrocarbons (i.e. compounds of carbon and hydrogen) VOCs include oxygenated compounds and compounds containing sulphur and halogens. Methane (CH_4) is treated separately by convention. VOCs contribute to the formation of ground level ozone through reaction with NO_x and sunlight. VOCs can include toxics such as benzene and 1,3-butadiene.

Waste Rock see **Surplus Rock**

Water Table Upper surface of the zone of saturation, in which all available pores in the soil ands rock in the sub-surface are filled with water. Also called the phreatic surface.

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APPENDIXES

APPENDIX A
CLUJ DECLARATION
DECLARATION OF THE HIGH-LEVEL PANEL OF THE SUB-REGIONAL CONFERENCE ON "REDUCING ENVIRONMENT AND SECURITY RISKS FROM MINING IN SOUTH EASTERN EUROPE AND THE TISZA RIVER BASIN"

The High-Level Panel of the Conference on "Reducing Environment and Security Risks from Mining in South Eastern Europe and the Tisza River Basin", upon invitation of the Ministry of Environment and Water Management of Romania and facilitated by the UNEP, OSCE, UNDP and NATO Environment and Security (ENVSEC) Initiative,

Convening the Ministers of Environment of Hungary and Romania, high level representatives from Albania, Bosnia and Herzegovina, Bulgaria, Croatia, the Former Yugoslav Republic of Macedonia, Hungary, Romania, Serbia and Montenegro, Slovak Republic, the United Nations Interim Administration Mission in Kosovo (UNMIK), UNEP's Executive Director, UNDP Resident Representative in Romania, and high level representatives and experts of OSCE, REC, the NGO community and the private sector,

Having met in Cluj-Napoca, Romania on 13 May 2005,

Conscious that while mining is an important economic activity, it can also have significant environmental, social, cultural and health consequences, especially where old technologies and potentially inadequate control mechanisms are used,

Recognizing that economic, environmental, social, cultural and health consequences of mining activities may affect communities and ecosystems beyond the immediate surroundings of a mine site, and could even impact other countries that share the same watershed or atmospheric region,

Acknowledging that new mining operations should adopt the highest safety, environmental and social standards, and that existing ongoing mining operations should be brought up to such levels or closed down,

Being aware that abandoned and orphan mine sites that have not been properly closed down pose hazards to local and downstream communities, and action needs to be taken to reduce risks,

Recognizing the importance of the precautionary principle as an integral part of the risk-benefit analysis for any new mining project,

Realizing that effective procedures for environmental, social, cultural, health and economic risk assessment need to be put in place, in order to identify and address mining sites, which could present community hazards,

In the firm belief that mining related transboundary mechanisms of early warning, emergency response and local level preparedness of communities need to involve all relevant countries in the region according to the appropriate international conventions, and should be regularly reviewed,

Recognizing that environmentally sound management of new mines, and the upgrading of environmental protection measures for existing ones, will require the enforcement and enhancement of policies and regulations at national level, guided also by such regional mechanisms and agreements that already exist, in particular the European Union Directive relating to mining wastes.

Convinced that preventing and reducing the environmental, health and security risks of mining operations and legacies in South Eastern Europe and the Tisza River Basin will require a major effort of capacity building and maintenance for governments, communities, NGOs, and industry, and calling on appropriate international bodies to support such programmes that may be initiated in the region,

Having considered the key documents presented at the conference, and in particular:

- the Environment and Security Desk Assessment Study "Reducing Environment and Security Risks from Mining in South Eastern Europe",
- the UNEP "Environmental Assessment of the Tisza River Basin"
- the Environment and Security report "Mining for Closure: policies, practices and guidelines for sustainable mining and closure of mines in South Eastern Europe and the Tisza River Basin",

Taking note also of work by REC on investment and governance principles,

1. Welcomes the above assessment and technical reports as a basis for priority setting and action planning towards reducing and mitigating the environmental, health and security risks from mining in South Eastern Europe and the Tisza River Basin, including eventual implementation of the EU Directive on mining and wastes,

2. Welcomes and endorses the report "Mining for Closure: policies, practices and guidelines for sustainable mining and closure of mines in South Eastern Europe and the Tisza River Basin" as a guide and checklist for reducing and mitigating the environmental, health and security risks from mining practices,

3. Welcomes and endorses the outcome of the discussions on a priority programme for assessing and addressing environmental, health and security risks in South Eastern Europe and the Tisza River Basin, in particular;

- the need for Governments, in coordination and supported by the European Commission, the Environment and Security Initiative, and other stakeholders concerned to establish and take action on a selected number of priority mining hot spots in South Eastern Europe and the Tisza River Basin,

- the need for governments, supported by the Environment and Security initiative and other potential partners, including the European Union, in addressing mining to focus on:

    - improvement of the desk study by incorporating local information,
    - capacity building for national agencies in assessment, permitting and enforcement,
    - clean-up projects that involve community development outcomes,
    - strengthen existing and establish additional transboundary networks for emergency preparedness,
    - investigation and testing out of innovative approaches to mining legacy issues,
    - improved mechanisms for sharing information and experience in the region, with special attention to the local communities.

4. Encourages the involved governments to review minerals investment regulations and environmental control procedures so as to encourage best practice mining operations, and cost-effective clean up of hot spots and orphaned sites.

5. Recommends further that the "Mining for Closure" guide and checklist, as well as a shorter popular version in the languages of the region, be published and distributed widely, for use by policy makers and other stakeholders alike,

6. Requests Governments, the UNEP-UNDP-OSCE-NATO Environment and Security Initiative, the European Commission, relevant civil society organizations and the private sector, to intensify and strengthen their collaboration and support to policies, programmes and projects for reducing and preventing environmental, health, social, cultural, economic and security risks from mining operations and legacies in South Eastern Europe and the Tisza River Basin,

7. Further proposals that consultations take place between interested governments and the international partners, including EC, to select and address a limited number of hot spots, as pilot projects for improving the social, environmental and trans-boundary aspects of mining practices.

8. Requests Governments and the private sector to ensure public participation in decision-making and access to information, in particular of communities, civil society organizations and the general public concerned, and to recognize the rights of communities to maintain community stability, cultural values and traditions, and obtain material and social benefits from the mining development,

Expresses its gratitude and appreciation to the Ministry of the Environment and Water Management from Romania for hosting the Conference on "Reducing Environment and Security Risks from Mining in South Eastern Europe and the Tisza River Basin".

Done at Cluj-Napoca, Romania, on 13 May 2005.

APPENDIX B
KEY EUROPEAN UNION INFORMATION RESOURCES
DETAILS AND LINKS FOR A NUMBER OF KEY EU DOCUMENTS MENTIONED IN THE REPORT ARE INCLUDED HERE

a. Proposed "mine waste directive"

Proposal for a Directive Of The European Parliament And Of The Council on the management of waste from the extractive industries COM(2003) 319 final 2003/0107 (COD).

Available at: http://europa.eu.int/eur-lex/en/com/pdf/2003/com2003_0319en01.pdf

b. Seveso II directive

The so-called Seveso II Directive or *Council Directive 96/82/EC on the control of major-accident hazards (OJ No L 10 of 14 January 1997)* is available, with detail background material at http://europa.eu.int/comm/environment/seveso/

The Seveso II Directive is considered as the legal and technical instrument to fulfil the obligations of the European Community arising out of *The UN/ECE Convention on the Transboundary Effects of Industrial Accidents*.

For more information on the Convention go to: http://www.unece.org/env/teia/

c. Pecomines' reports

PECOMINES JRC Enlargement report
Mining, Mining Waste and Related Environmental Issues: Problems and Solutions in Central and Eastern European Candidate Countries (Editors: G. Jordan and M. D'Alessandro)

EUR 21185 EN report
Use of Remote sensing for Mapping and Evaluation of Mining Waste Anomalies at National to Multi-Country Scale (Authors: A.M Videa, S. Sommer, and W.Mehl)

EUR21186EN report
Options for compiling an inventory of mining waste sites throughout Europe (Editor: S. Sommer)

Available at: http://viso.ei.jrc.it/pecomines_ext/index.html

d. BREF document on "mine waste"

The so-called "Mine waste BREF" document *Reference Document on Best Available Techniques for Management of Tailings and Waste-Rock in Mining Activities* (ST/EIPPCB/MTWR_BREF_FINAL)

The details of all BREFs are available for download at: http://eippcb.jrc.es/pages/FActivities.htm

APPENDIX C
THE EQUATOR PRINCIPLES

THE EQUATOR PRINCIPLES ARE GUIDELINES FOR FINANCIAL INSTITUTIONS. THERE IS NO EQUATOR PRINCIPLES ORGANISATION. HOWEVER, THERE IS A SECRETARIAT FOR EQUATOR PRINCIPLES INFORMATION WITH CONTACT DETAILS: SECRETARIAT@EQUATOR-PRINCIPLES.COM. THIS TEXT IS DRAWN DIRECTLY FROM HTTP://WWW.EQUATOR-PRINCIPLES.COM/

The "Equator Principles"

An industry approach for financial institutions in determining, assessing and managing environmental & social risk in project financing

Preamble

Project financing plays an important role in financing development throughout the world. In providing financing, particularly in emerging markets, project financiers often encounter environmental and social policy issues. We recognize that our role as financiers affords us significant opportunities to promote responsible environmental stewardship and socially responsible development.

In adopting these principles, we seek to ensure that the projects we finance are developed in a manner that is socially responsible and reflect sound environmental management practices.

We believe that adoption of and adherence to these principles offers significant benefits to ourselves, our customers and other stakeholders. These principles will foster our ability to document and manage our risk exposures to environmental and social matters associated with the projects we finance, thereby allowing us to engage proactively with our stakeholders on environmental and social policy issues. Adherence to these principles will allow us to work with our customers in their management of environmental and social policy issues relating to their investments in the emerging markets.

These principles are intended to serve as a common baseline and framework for the implementation of our individual, internal environmental and social procedures and standards for our project financing activities across all industry sectors globally.

In adopting these principles, we undertake to review carefully all proposals for which our customers request project financing. We will not provide loans directly to projects where the borrower will not or is unable to comply with our environmental and social policies and processes.

Statement of Principles

We will only provide loans directly to projects in the following circumstances:

1. We have categorised the risk of a project in accordance with internal guidelines based upon the environmental and social screening criteria of the IFC as described in the attachment to these Principles (Exhibit I).

2. For all Category A and Category B projects, the borrower has completed an Environmental Assessment (EA), the preparation of which is consistent with the outcome of our categorisation process and addresses to our satisfaction key environmental and social issues identified during the categorisation process.

3. In the context of the business of the project, as applicable, the EA report has addressed:

    a) assessment of the baseline environmental and social conditions
    b) requirements under host country laws and regulations, applicable international treaties and agreements
    c) sustainable development and use of renewable natural resources
    d) protection of human health, cultural properties, and biodiversity, including endangered species and sensitive ecosystems
    e) use of dangerous substances
    f) major hazards
    g) occupational health and safety
    h) fire prevention and life safety
    i) socioeconomic impacts
    j) land acquisition and land use
    k) involuntary resettlement
    l) impacts on indigenous peoples and communities
    m) cumulative impacts of existing projects, the proposed project, and anticipated future projects
    n) participation of affected parties in the design, review and implementation of the project
    o) consideration of feasible environmentally and socially preferable alternatives
    p) efficient production, delivery and use of energy
    q) pollution prevention and waste minimization, pollution controls (liquid effluents and air emissions) and solid and chemical waste management

    Note: In each case, the EA will have addressed compliance with applicable host country laws, regulations and permits required by the project. Also,

reference will have been made to the minimum standards applicable under the World Bank and IFC Pollution Prevention and Abatement Guidelines (Exhibit III) and, for projects located in low and middle income countries as defined by the World Bank Development Indicators Database, the EA will have further taken into account the then applicable IFC Safeguard Policies (Exhibit II). In each case, the EA will have addressed, to our satisfaction, the project's overall compliance with (or justified deviations from) the respective above-referenced Guidelines and Safeguard Policies.

4. For all Category A projects, and as considered appropriate for Category B projects, the borrower or third party expert has prepared an Environmental Management Plan (EMP) which draws on the conclusions of the EA. The EMP has addressed mitigation, action plans, monitoring, management of risk and schedules.

5. For all Category A projects and, as considered appropriate for Category B projects, we are satisfied that the borrower or third party expert has consulted, in a structured and culturally appropriate way, with project affected groups, including indigenous peoples and local NGOs. The EA, or a summary thereof, has been made available to the public for a reasonable minimum period in local language and in a culturally appropriate manner. The EA and the EMP will take account of such consultations, and for Category A Projects, will be subject to independent expert review.

6. The borrower has covenanted to:
   a) comply with the EMP in the construction and operation of the project
   b) provide regular reports, prepared by in-house staff or third party experts, on compliance with the EMP and
   c) where applicable, decommission the facilities in accordance with an agreed Decommissioning Plan.

7. As necessary, lenders have appointed an independent environmental expert to provide additional monitoring and reporting services.

8. In circumstances where a borrower is not in compliance with its environmental and social covenants, such that any debt financing would be in default, we will engage the borrower in its efforts to seek solutions to bring it back into compliance with its covenants.

9. These principles apply to projects with a total capital cost of $50 million or more.

The adopting institutions view these principles as a framework for developing individual, internal practices and policies. As with all internal policies, these principles do not create any rights in, or liability to, any person, public or private. Banks are adopting and implementing these principles voluntarily and independently, without reliance on or recourse to IFC or the World Bank.

Exhibits are available via links at the website. The Exhibits include:

Exhibit I: Environmental and Social Screening Process
Exhibit II: IFC Safeguard Policies
Exhibit III: World Bank and IFC Specific Guidelines

APPENDIX D
GOVERNANCE PRINCIPLES FOR FDI IN HAZARDOUS ACTIVITIES

These governance principles are available at http://www.rec.org/REC/Programs/EnvironmentalLaw/PDF/Governance_Principles.pdf

THE REGIONAL ENVIRONMENTAL CENTER
for Central and Eastern Europe

GOVERNANCE PRINCIPLES FOR FOREIGN DIRECT INVESTMENT IN HAZARDOUS ACTIVITIES

Final (unedited) Version
October, 2004

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Governance Principles for Foreign Direct Investment in Hazardous Activities

The following governance principles are intended to apply primarily to foreign direct investment (FDI) in industrial, mining and other activities with particularly significant social and environmental impacts, especially in countries in transition, under-developed regions and developing countries. These principles have been designed to complement voluntary international codes of conduct, compacts and other instruments.

Corporate Good Citizenship

Principle 1
Investors should apply international standards and best practises for corporate "good citizenship" to their investment projects.

Responsibilities to and Relations with Recipient Countries

Principle 2
Investors should take all legal and regulatory steps required under the laws, regulations, and administrative practices of the countries in which they invest ("recipient countries") to protect the environment, sustainably use natural resources, and avoid accidents that would result in environmental harm or harm to human health.

Principle 3
Investors should take a pro-active stance towards regulatory agencies to guarantee the proper environmental and social oversight of their activities, recognising that the transitional status of recipient countries may create administrative and regulatory conditions that differ significantly from the conditions prevalent in the home country, to which end:

- Investors should gain a thorough knowledge of the legal and regulatory framework and requirements for environmental and social protection in recipient countries.
- Investors should, when appropriate, prompt relevant authorities in recipient countries to enforce all legal and regulatory requirements.

Principle 4
An investor which invests in a country that does not provide an adequate legal framework for regulating relevant activities, or properly resourced authorities with powers of approval, inspection and enforcement, must provide continuous independent and external verification that its activities comply with domestic legal and regulatory requirements and meet relevant international standards and norms.

Principle 5
Investors should support and promote the transfer of best available technology to the recipient country. The transfer of obsolete technology to the recipient country should in general be avoided.

Principle 6
Investors should abstain from creating competition between countries or regions within a country to attract a proposed investment on the basis of the level of environmental standards.

Principle 7
Investors should give due consideration to the role that their projects would play in the environmental and social/sustainable development aims and objectives of the recipient country. To this end, investors should provide national and local authorities with analyses of how proposed investments will help meet the long-term goals set in na-

tional environmental action plans, national development or sustainable development plans or policies, or other relevant plans or policies. Such analyses should take into account internationally accepted criteria and principles, such as those expressed in relevant declarations such as the Rio Declaration and the Johannesburg Declaration.

Principle 8
When Investors are involved in development of environmental and social policies of the recipient country or regions, they should seek to raise standards to international levels.

Principle 9
Investors should abstain from influencing (through financial or other means) recipient country officials or community leaders in development projects or enforcement settings where a conflict of interest may arise. Investments with ownership structures involving shares owned by governmental bodies or authorities that may be involved in regulation or oversight are of particular concern.

Principle 10
The operations of investors in hazardous activities should be marked by transparency, in particular in their relations with localities. Investors should share the results of their environmental and social performance evaluations with authorities, non-governmental organizations, and the public in recipient countries.

Investor Environmental and Related Social Policies

Principle 11
Investors should strive to continually improve their environmental and social performance and regularly review and update environmental policies, priorities, and procedures in the light of new information. Investors should establish environmental and social performance objectives and strategies in order to regularly monitor their environmental and social performance.

Principle 12
Investors should establish environmental management systems that meet or exceed the ISO 14000 series of standards and/or EMAS.

Principle 13
Investors should take steps to require that all suppliers and subcontractors meet national standards of environmental and relevant social performance, and should support and encourage suppliers and subcontractors in their efforts to meet international standards and to achieve relevant certification(s).

Principle 14
Investors should assume cradle-to-grave responsibility for all hazardous substances produced in and through their operations, even where such responsibility is not imposed on them as a matter of law. Investors should, in addition, take the necessary measures to ensure proper handling, storage and disposal of all hazardous substances obtained from others and used in their operations. Investors should employ product life cycle assessment where appropriate.

Principle 15
Investors should apply the polluter pays principle in their own operations and promote its application in the business community to which they belong.

Principle 16
Investors should adopt a precautionary approach to environmental challenges and environment related decisions. In accordance with Principle 15 of the Rio Declaration, lack of full scientific certainty should not be used as a reason for postponing or not implementing measures to protect the environment. The precautionary principle can be applied by:

- performing risk analyses for new products, processes, technologies, and actions that might have an environmental impact;
- demonstrating that new products, processes, technologies, and actions that might have an environmental impact are safe for the environment rather than waiting for evidence that they might be unsafe (applying a conservative burden of proof standard);
- building in safety margins when setting safety and environmental standards; and
- using the best available technology.

Principle 17
Investors engaged in hazardous activities should ensure the full life cycle operation of facilities, up to and including closure and remediation to the original state.

Principle 18
Investors should recognize that all investments should aid in the process of transition to sustainability. Proposed

operations therefore should work within the sustainability limits of the ecosystems within which they will be built, thus:

- Investors should develop or adopt sustainability indicators that meet international standards.
- Investors are encouraged to join the Global Reporting Initiative and regularly produce independently assured sustainability reports.
- Investors should ensure that environmental impact assessments conducted on their proposed operations take into account impacts on ecosystem structure, function, and composition.
- The utilisation of natural resources by investors should fall within limits of sustainable use for those resources.
- Sustainability limits for natural resource use should be set using a precautionary approach.

Principle 19
Investors should establish environmental monitoring programs. These should include monitoring of the effects of their operations on the surrounding ecosystem and environment, including fish and wildlife, and surface and groundwater, where applicable.

Principle 20
Home offices should promote environmental awareness and responsibility in all company locations.
Such support may be rendered operational by making environmental specialists available from the home office, providing home office oversight of environmental performance, and rewarding positive environmental performance.

Principle 21
The incentive structure of each company and facility should be reviewed to ensure that environmentally responsible behaviour is rewarded while environmentally irresponsible behaviour is punished, i.e.:

- Employees should be supported and rewarded for taking environmental initiatives.
- Investors should establish procedures and safe forums for employee grievances and "whistleblower" cases.
- "Whistleblowers" must be protected against retaliation.

Principle 22
Workers should be trained and educated in all relevant areas of environmental and related social responsibility.

Information, Participation and Stakeholder Relations

Principle 23
Investors should designate specific senior company officers to be responsible for environmental and related social matters including relevant communication with the public. Company environmental focal points should hold regular open meetings with the public and stakeholders to discuss issues of concern to any party, and be accessible to the public at reasonable times and places. Investors should build partnerships with the public, take advantage of local knowledge, and ensure that the public has a voice in environmental decision-making. Open meetings should be well advertised in local communities and among stakeholders, and be held in a spirit of collaboration. Senior company officers are encouraged to attend these meetings.

Principle 24
Investors shall promptly disclose to the potentially affected communities information in their possession or that comes to their attention with regard to the environmental and relevant social impacts of their operations. Claims of commercial confidentiality should not be used to avoid disclosing information that could potentially be used by members of the public to take action to reduce the extent of environmental and related social impacts of an investor's operations.

Principle 25
Where potential impacts of an investor's operations may be transboundary in scope, the investor should involve the public, authorities, and other stakeholders of the potentially affected country to the same extent as it would involve those of the country of location.

Principle 26
Investors should seek to achieve the broad support of affected communities (prior informed consent) and should respect and protect the rights of those affected by projects, in particular the rights of indigenous communities, minorities and the economically disadvantaged. Investors should grant opportunities and develop capacities of the public to participate in monitoring and enforcement.

Accident Prevention and Management

Principle 27
Investors should take every reasonable and prudent step necessary to prevent industrial accidents, including:

- Operations should apply safety management systems that include detailed risk assessments; strategies for reducing risks; emergency plans, and monitoring, auditing, and review of safety systems.
- Operations should employ the best available technology relevant to safety and accident prevention.
- Investors should dedicate substantial resources to training of personnel in accident prevention and response.
- The above-mentioned measures should include automated shutdown procedures for discreet units and entire operations.
- Local communities and other stakeholders should be involved in the development of emergency response plans and in periodic evaluation and revision of response plans and procedures.

Principle 28
Investors should be able to demonstrate sufficient financial assurance for the full and fair costs of compensation and remediation in the event of an accident or other damage, applying the "worst case scenario" approach, and should ensure the material and technical means for applying necessary emergency measures.

Principle 29
Planning for event horizons (such as thousand-year floods) should take into account an additional buffer due to the potential effects of climate change, employing a precautionary approach. The historical record of weather events cannot be considered indicative of future extreme weather events.

Principle 30
Investors should develop the following policies and regulations that protect the health and safety of workers:
- Investors should identify scenarios that might endanger workers and take measures to eliminate, reduce, and control them.
- Investors should periodically evaluate the effectiveness of health and safety measures and revise such measures accordingly.
- Investors should develop and implement emergency response plans and procedures in the event of workers sustaining injuries or being exposed to hazardous substances.

[OUTSIDE COVER PROVIDED AS SEPARATE FILE]