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Linking Long-Term Environmental Liability and Closure: A Necessary Development Towards Walk-Away Closure

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ABSTRACT: Long-term liability is a risk that must be considered prior to permanent mine closure. Current definitions of closure do not link liability release with the attainment of environmental performance standards. Indeed, contaminated sites laws of major mineral producing nations hold me mine owner, and long-term corporate profitability, accountable not only for current environmental regulations but for future regulations as well. This is known as absolute and retroactive liability. This paper uses the South African situation to address the impact that absolute and retroactive liability has on the long-term profitability of the raining industry and then uses internationally published definitions of mine closure to demonstrate the desirability of linking 'closure' with liability release. Once liability and closure have been linked, all that prevent 'walk-away' closure is the determination of the financial implications of future environmental degradation at the site.

1 INTRODUCTION

Internationally, published definitions of mine closure generally indicate that closure occurs following the cessation of extractive operations at the site. South African, Canadian, and Australian mines reach closure following decommissioning and final rehabilitation, while closure initiates decommissioning and final rehabilitation at mines in the United States of America. Current definitions do not address the long-term liability for the site following closure. Linking closure to liability release means that mine closure occurs when the state accepts responsibility for the decommissioned site. In the case of South Africa, site liability varies between the three principal acts governing mine environmental management and is currently preventing closure from occurring.

Closure is a necessary step in the management of South African mines because mine assets cannot be sold until a Certificate of Closure has be issued by the Department of Mineral and Energy Affairs. The current confusion surrounding closure threatens the economic survival of mining corporations in South Africa and must be resolved. Industry should take the initiative by assuming that mine owner's have absolute and retroactive liability for the impacts of mining. Although this represents 'worst case liability', it insulates the mine owner and operation from changing environmental performance standards. The Australian concept of 'safe and stable' mines provides site specific and quantifiable means for determining the impacts of mining following closure.

2 THE DEFINITION OF MINE CLOSURE

Traditionally, the environmental management of collieries ceased following permanent closure. The long-term liability imposed by the 'polluter-pays-principle' fundamentally alters the 'operating environment' of coal corporations. This 'new' reality forces are-examination of conventional definitions of'closure* and 'impact' and the mining lifecycle.

2.1 *Current international definitions of mine closure*

The operating environment of coal corporations is a dynamic system. Individual operations are sensitive to changes in corporate priorities, commodity prices, and extraction costs. Mining is venture capitalism, albeit on a grand scale. Traditionally, closure represented the final stage of the mining life cycle. Corporate involvement and site responsibility ceased following closure and the property lapsed into abandonment. Indeed, this view pervades the mining industry. Consider the following definitions:

United States of America (Hardrock)

"Closure - Closure involves the removal of structures/buildings, and other infrastructure, and

initiation of reclamation on the yet unreclaimed ' portions of the mine" (Taggart and Kieth, 1997).

"Closure is defined as the activity of a mining company related to the shutdown and reclamation of mining projects in a cost-effective manner" (Licari, 1997).

"Closure/post-closure Phase - Structures are removed and ground surfaces are recontoured and revegetated. Underground mines may be plugged and other measures for the control of acid mine drainage are initiated" (Murray, 1997).

"Closure entails:

- End of processing, deposition, or use;
- Drain-down, treatment, and release of process water;
- Construction of containment structures;
- Plugging of drill holes, adits, or drifts;
- Detoxification of process equipment;
- Machinery salvage;
- Removal of buildings, pipelines, and structures; and
- Final reclamation/revegetation" (Williams, 1998).

United States of America (Coal)

"Upon permanent cessation of operations, the operator shall complete the reclamation plan submitted under 11 AAC 90.083 - 11 AAC 90.099 as approved by the commissioner" (Anon, 1999).

Australia

The Minerals Council of Australia (Anon., 1997) has determined that closure is the "permanent cessation by a company of operations at a mine or mineral processing site after the completion of decommissioning process which is signified by tenement relinquishment." Closure follows the rehabilitation and decommissioning of the mine site.

Canada

The regulatory authority for Canadian mining operations resides, primarily, with provincial governments. However, the closure definition, used and implied, is similar to the Australian definition. The adopted definition is that closure follows decommissioning and final rehabilitation. However, the mine owner's liability following closure varies significantly between provinces (Cowan, 1996; Bourassa, 1996; Daigneault, 1996; and Overholt, 1996).

2.2 *Current South African mine closure definition*

The Environmental Management Programme Report Process (EMPR) sets fort a definition of closure for South African Mines. The Aide Memoire (Anon. 1992) indicates that: "Closure, in the case of mining operations discontinued or abandoned prior to the coming into force of the Minerals Act, 1991, means that a closure certificate has been issued in terms of Regulations 2.11 under the Mines and Works Act, 1956, or in a.iy other case, mat a closure certificate has been issued in terms of Section 12 of the Minerals Act, 1991, or in terms of regulation 2.11 thereunder, and that a closure certificate provided for in Section 32(2) of the Atmospheric Pollution Prevention Act, 1956, has been issued."

As in the case of Australia, closure at South African mines occurs following site decommissioning. More importantly, there is no link between closure and liability.

All of the above definitions indicate that once extractive operations cease, the mine enters closure. In the case of definitions used in the United States, this point demarcates the beginning of site decommissioning and final rehabilitation. In Canada, Australia, and South Africa closure follows decommissioning and final rehabilitation. Thus, closure represents a discreet point m time. Because economically viable mineral deposits are finite, all mines will eventually cease extraction and close. This perception is implicit in the expectation that closure is merely a formality for mines, assuming that proper environmental control was exercised during operations (Greef, 1993; Anon 1993). The assumption or expectation that mine closure releases the owner from long-term environmental liability is inconsistent with the 'polluter-pays-principle'. Commenting on the closure of a mine near Faro, Yukon Territory, White (1996) states that:

"Closure is not an open and shut case. It is a process of reconciliation for, at any point in time, [minmg] costs that may represent the price of past failures that were not seen [as failures] at the time. Looking back, it is tempting to blame unwillingness, neglect, ignorance, or attitude. This is unfair. In looking at the past, there is clear evidence that the standards of the day and the knowledge of the times were frequently applied. So, perhaps the attempt to find blame is really overreaction that ignores the historical evolution of simple economics imposed upon us by uncontrollable, external factors that have nothing to do with what we would like to do, but more with what can be afforded - then and now."

White's observation introduces two fundamental issues that must be addressed prior to permanent closure. First, mine owners will be held financially accountable for the failures of environmental management during operations regardless of cause. Second, mine closure is not simply a phase of the mining cycle but is inextricably linked to environmental liability.

3 LEGAL LIABILITIES FOLLOWING PERMANENT CLOSURE

The 'polluter-pays-principle' introduces the concept of site responsibility following permanent closure. Legislated liabilities and economic necessities compel mine owners to reconsider the conventional view of closure. The liability issue at, and following closure, is not unique. In fact legislated long-term liability is commonplace for mineral producing nations.

3.1 *Legislated long-term environmental liability in mineral producing nations*

The regulatory environment defines the constraints placed on mines following closure. Pertinent constraints include long-term liability provisions, scope of liability, and the duration of liability. The following section contains selected examples of long-term liability provisions in mineral producing nations.

United States of America

The Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) is the most notorious environmental liability statute in die world. CERCLA and subsequent amendments, commonly referred to as Superfund, were enacted to force potentially responsible parties (PRPs) that cause or have caused contamination of soil, air, or water to pay for clean-up efforts. CERCLA establishes strict liability for the site, which means that no evidence of wrongdoing is necessary for enforcement action against PRPs. In general, the government, acting through the Environmental Protection Agency (EPA), establishes a 'joint and several liability' claim against one or more of the PRPs. 'Joint and several' means that any one of the PRPs is responsible for the costs of clean up. It is then up to the affected PRP to seek reimbursement from other PRPs through legal action. This statute applies to all industrial facilities mat generate hazardous wastes, including mining operations (Cowan, 1997). According to Cowan (1997) typical mining problems that result in CERCLA enforcement include:

- Acid mine drainage;
- Trace metal releases from tailings impoundments;
- Contaminated soils; and
- Radioactive mine wastes.

CERCLA enforcement action in the United States is not limited to historical operations. In a study of mine sites on the National Priorities List (NPL) Housman and Hoffman (1992) found that of the 52 mine sites listed, 12 were active. In their estimation only half of the 52 sites represented 'historical mining practices'. It is important to bear in mind that these 52 sites are estimated to cost the U.S. mining industry 21 billion dollars in clean-up costs. These costs do not include the costs of legal action (Housman and Hoffman, 1992). Indeed, legal costs in the form of class-action lawsuits may dwarf the actual expenditure for site clean-up (Kumamoto and Henley, 1996). Thus, in the United States of America a mine site is never closed from a liability standpoint.

Australia

In Australia, the closed mine site must be both safe and stable before the mine owner is absolved of fiscal liability. Safe refers to "the condition of a closed mine such that the risk of adverse effects to people, livestock, other fauna and the environment in general has been reduced to a level acceptable by all stakeholders (Anon., 1997). Stable refers to "the condition of a closed mine such that the rate of change of reference parameters does not exceed those rates occurring on the site prior to mining or on comparable unmined land in the same locality. Stability is dependent on the geomorphology of the surrounding landfonn and the proposed post-mining land use. The reference parameters can cover fields such as geotechnical slope stability, soil erosion, downstream water quality, or sustainability of revegetation" (Anon., 1996). Thus, a mine owner can achieve liability free closure if the site meets these conditions. The major problem with this approach is that this may take many decades to achieve, during which time the mine owner remains financially responsible for the site.

Canada

Canada, unlike the United States of America and Australia, does not have national legislation mandating long-term liability for contaminated sites. Instead, Provincial legislation determines the requirements for long-term environmental liability. These requirements vary in scope from no responsibility to full responsibility. The Province of Ontario represents the former, while the Province of British Columbia represents the latter.

Provincial legislation in Ontario grants mine owners an 'exit-ticket'. In Ontario, the crown accepts responsibility for the site following the voluntary surrender of the land from a proponent on the conditions specified by the Minister of Mines (Cowan, 1996 and Bourassa, 1996). Significantly, this provision exempts the mine owner from other legislation requiring long-term liability following

closure. The only caveat to this 'exit-ticket' is discretionary and that "the site is closed out and that necessary fiinds are placed in a special purpose account for use in rehabilitation of mining lands in general" (Cowan, 1996). Cowan makes the following observation regarding the financial provision:

"It must be stressed, that where long term monitoring, care, and maintenance are required, the determination of costs has a high risk factor and the accrual of public financial liability will be a primary consideration in decision making."

It is therefore possible for mine owners in Ontario to obtain 'walk-away-closure' if financial provision is made.

The long-term liability issue in British Columbia resembles that of the United States. Non-mining legislation establishes that Responsible Parties (RPs) "are absolutely, retroactively, and jointly and severally liable for clean-up costs (Overholt, 1996). By establishing 'Absolute liability", British Columbia has exceeded even the CERCLA (Superfund) program of the United States of America because "Absolute liability precludes 'due diligence' defences (Overholt, 1996). According to British Columbia law, all parties, including current and former owners and operators of closed or abandoned mine sites, are fiscally responsible for environmental degradation following closure "regardless of whether the original mining remediation activity complied with the laws of the day or with permits held at the time of activity"(Overholt, 1996). From this Overholt (1996) concludes that "in British Columbia a closed mine is never a closed mine for liability purposes."

It is clear that, internationally, mine owners remain financially liable for the environmental impacts of mining following closure. Even Ontario requires financial provision to be made for site maintenance, mitigation, and treatment following the assumption of liability by the province. South Africa is a microcosm of the current issues surrounding closure and liability affecting mineral producing nations world-wide.

3.2 *Legislated long-term environmental liability in the republic of South Africa*

Environmental management at South African collieries is performed in accordance with the Environmental management Programme Report (EMPR) process. When a mine applies for permanent closure, Section 5 {Impact Assessment and Section 6 (Environmental Management Programme) of the EMPR assume a dominant role in the decision making process.

Section 5 of the EMPR contains the potential environmental impacts of the project. All impacts are ranked İn terms of significance, which is determined by the context and intensity of effects. The significance is evaluated in terms of present and future site conditions in terms of direct, synergistic, and cumulative effects on the environment. As part of the EMPR process, the proponent is required to assess the residual impacts of mining. Specific effects that must be evaluated include (Anon., 1992):

- The potential for acid mine drainage or poor quality leachates emanating from the mine or residue deposits (Sect. 5.4.1);
- The long-term impacts to groundwater (Sect 5.4.2);
- The long-term stability of rehabilitated ground and residue deposits (Sect. 5.4.3); and
- The long-term impacts arising from river diversions (Sect. 5.4.4).

The list of residual impacts contained in the Aide-Memoire is incomplete (Packee, 1997). There are provisions in the Mineral Act, Water Act, and Atmospheric Pollution Prevention Act that impose long-term liability on collieries.

The Mineral Act stipulates that the owner of lands affected by mining activity is entitled to compensation, under certain circumstances. According to the Minerals Act "such person is entitled to compensation if [he] has suffered or is likely to suffer damage as a result of:"

- Subsidence (§ 42 Ss. 1 paragraph i (aa));
- An obstruction that is placed on the land by the mine (§ 42 Ss. 1 paragraph i (bb)); or,
- Agricultural losses attributable to mining activity (§ 42 Ss. 1 paragraph a. (i and İİ)).

The Minerals Act does not define 'subsidence*. For the purpose herein, subsidence "implies the total phenomenon of surface effects associated with the mining of minerals and not just only the vertical displacement of the surface as is sometimes inferred in the literature" (Singh, 1992). When identifying the residual impacts of mining all of the effects of subsidence must be considered (both surface and subsurface).

The Minerals Act defines 'obstruction' as "any immovable property established on land for mining operations or operations in connection therewith by the person entitled to mine on such land, and includes any dam, or dump of slimes, rock, or any other residue produced in the course of mining operations on such land" (§ 42 Ss. 1 paragraph a. (i and ii)). Compensatory requirements for waste deposits are, as a rule of thumb, best dealt with prior to construction. Following closure, compensation may be required if there is a geotechnical failure, which needs to be considered when negotiating financial remuneration with the landowner.

Compensatory damages for agricultural losses fall into two categories. The Minerals Act requires compensation when either

- "the use or intended use of such land, or any portion thereof, by such person for the mining of minerals or purposes in connection therewith, prevents, hinders, or is likely to prevent or hinder the proper use of such land or such portion for farming purposes" (§ 42 Ss. 1 paragraph a. (i)) or
- "any portion such land which is not being used or not likely to be used by such person for mining purposes or purposes in connection therewith, is or is likely to become an uneconomic farming unit" (§ 42 Ss. 1 paragraph a. (ii))

Settlements for mining induced damage are negotiated in accordance with Expropriation Act of 1975 as if "an expropriation of property or the taking of a right has taken place." Compensatory awards must take into account both rehabilitation performed, or to be performed, and compensation paid to the owner previously. Once a dispensation has been made for a particular effect, the mining company is absolved of responsibility for that particular impact. The limits of financial responsibility transcend land title transfers and exclude reservations existing prior to mining activity.

Additional liability is imposed on mine owners by the Water Act of 1956. Prior to closure, the mine owner must take steps to:

- prevent water pollution;
- prevent further degradation of water quality, if pollution has already occurred;
- bear the financial responsibility for clean-up costs on adjacent land;
- bear the financial responsibility for clean-up costs at the site; and,
- bear the financial costs of ' emergency clean-up actions' undertaken by the Department of Water Affairs and Forestry.

Similar to other liability assessing legislation (Overholt, 1996 and Cowan, 1997), the Water Act defines a responsible party (RP) for site clean-up costs. The RP is "any person who wilfully or negligently does any act which could pollute public or private water, including underground water, or sea water, in such a way as to render it less fit" (Water Act. 'Less fit' implies that the impacted waters do not meet the South African Water Quality Standards, as defined by regulation, upon discharge to a public or privet water body. This liability is strict, not absolute, and may not be transferred to a party other than the responsible party.

The Atmospheric Pollution Prevention Act (APPA) has special implications at collieries. As the name of the act implies, the purpose of the APPA is to prevent air pollution. Like the Water Act, this legislation establishes liability for degradation of atmospheric quality. The RP is defined as:

"Any person who in a dust control area -

caries on any industrial process the operation of which in the opinion of the chief officer causes or is liable to cause a nuisance to persons residing or present in the vicinity on account f dust originating from such process becoming dispersed in the atmosphere; or

has at any time or from time to time, whether before or after the commencement of this act, deposited or caused to be deposited on any land, a quantity of matter which exceeds, or two or more quantities which together exceed twenty thousand cubic meters in volume...shall take the prescribed steps or where no steps have been prescribed adopt the best practicable means for preventing such dust from becoming so dispersed or causing such nuisance"

The liability for dust control and mitigation is strict, and resides with the mine owner or operator following closure. If the mine owner is insolvent or cannot be determined, moneys from dust levy accounts are used for remedial action. Typical dust sources at closed mines include waste dumps, tailings impoundments, and denuded areas.

Smoke and combustion by-products, originating from burning waste deposits or residual coals, fall under the provisions of the APPA. If smoke or combustion by-products become a nuisance, "the local authority shall cause to be served on the person responsible for such nuisance a notice calling upon him to abate the nuisance within a period determined by the local authority...and to take all such steps as may be necessary to prevent a recurrence of the nuisance"([ref!)]. The APPA does not make a distinction as to whom the responsible party İs or as to the transferability of the liability.

South African legislation is non-committal regarding the mine owner's long-term environmental liability. Like other mining nations, the paradox between limited liability and absolute liability is contained in national legislation. The Minerals Act indicates that the mine owner's liability ends with receipt of a closure certificate. This is similar to the 'exit-ticket' of the Province of Ontario. However, the South African Closure Certificate does not exempt the mine owner from the provisions of other legislation. The Water Act, specifically Section 22, establishes strict and absolute liability for water pollution prevention and mitigation. In respect to mining's liability for water resource degradation, South Africa more closely resembles the United States CERCLA program and the contaminated sites legislation of the Province of British Columbia. The fact that no large colliery has received a Certificate of Closure from the Department of Mineral and Energy Affairs (DMEA) indicates that conflicting liability provisions between

the three principal acts have created an impasse with respect to colliery closure in South Africa.

4 RESOLVING LIABILITY CONFLICTS BETWEEN SOUTH AFRICAN LEGISLATION

At first blush, the problems being experienced with divergent liability appear irreconcilable. The divergence is caused by the degree of liability imposed by individual legislation. The most stringent financial responsibility following closure is 'strict, absolute, and retroactive' liability. This is where the mine owner held solely responsible for impacts attributable to mining, including those attributable to changing regulatory standards. This is a worst case assumption. However, the concepts of 'safe and stable' used İn Australia and the 'exit-ticket' of Ontario, provide a conceptual approach to resolving the issue of liability following closure.

4.1 *Complying with absolute liability*

Absolute liability implies that the financial responsibility for clean up remains the owner or operator that caused environmental degradation. In effect, Üiis is strict interpretation of the "polluter-pays-principle'. In practical terms, absolute liability is a mechanism for insuring that mines are not abandoned following closure, which İs the objective of the Minerals Act (Oberholzer, 1995).

The exit ticket strategy of the Province of Ontario indicates that 'walk-away-closure' may be obtained at the discretion of regulatory agency and providing mat sufficient funds exist to cover the environmental risks associated with the site. As stated by the Director of Mine Rehabilitation for the Ontario Ministry of Northern Development and Mines (White, 1996) "the accrual of public financial liability will be a primary consideration İs decision making." Thus, if the mine owner can demonstrate that no financial liability resides with the government following the transfer of liability, the mine will be granted 'walk-away-closure'. This would satisfy the of the liability provisions contained in all South African legislation, past and future, including the Water Act. The advantage is that the mine owner has addressed financial responsibility from the most stringent possible perspective. This however does not resolve the issue of retroactive liability following closure.

4.2 *Complying with retroactive liability*

Retroactive liability implies that the mine owner is responsible for all die environmental impacts of mining, irrespective of standards in place at the time of closure. In effect, this prevents changing environmental standards from affecting the long-term financial returns of mining companies. Currently, The South African government holds mining companies responsible for impacts, attributable to mineral extraction or associated activities, which violate current environmental performance standards. However, precedents exist which hold mine owners financially responsible for activities mat were legal at the time they were performed (Overholt, 1996 and Cowan, 1997). As was the case with strict liability, this assumption represents worst case legislation from an industrial perspective.

The use of safe and stable' as a closure objective in Australia is a statement of retroactive liability. By definition (Anon., 1997) the site conditions must be similar to those existing prior to mining or existing at adjacent immined sites. In simple terms, stable implies that the site is in equilibrium with the environment. A stable condition may take years or decades to attain. In the interim, the mine owner remains fiscally responsible for the site.

4.3 *Definition of impact for absolute and retroactive liability*

Strict and retroactive liability forces the mine owner to consider all potential environmental impacts of the project. Often, impact is linked to regulatory compliance, which leads to complaints of shifting 'goal posts' for closure (Williams, 1998; Swart and Pulles, 1997). Using 'stable' as a closure objective simplifies impact identification. An impact is simply any change from either baseline conditions or surrounding sites resulting from the project. It is important to note that these changes can be positive and negative. The advantage to non-compliance related impacts identification is that changing regulatory performance standards will not affect environmental management before or after closure. Additionally, the use of baseline or reference site data provides the mine owner with discreet and quantifiable environmental standards that do not vary significantly over time.

5 FINANCIAL CONSTRAINTS AT CLOSURE

In general, mine cash flow peaks during production and steadily declines as the operation approaches the 'end of mine life' and closure. The mine owner is in the precarious position of balancing decommissioning and final rehabilitation costs and the long-term liabilities imposed by regulation with declining revenues. Internationally, governments seek to ensure that decommissioning and closure will occur by requiring financial provision be made for diese tasks. South Africa takes this one step further by requiring that all assets remain in place until a Closure Certificate is granted. For South African collieries closure is not merely a desirable situation but is an economic necessity.

5.1 *Cashflow of mining operations from exploration through closure*

The activities occurring at a mine change dramatically over time. The conventional mine life cycle is depicted in figure 3.1. Mining operations begin with Discovery. During the first stage of discovery, the mineralised area or district is identified (Figure 1 'A'). The second stage of discovery, geologists and engineers investigate and map the mineral district (Figure 1 'B'). If subsequent investigations indicate the existence of a potentially commercially viable deposit, the mine progresses into Exploration (Figure 1 'C').

Exploration "includes all activities involved in the discovery and evaluation of a mineral deposit, establishing the size, grade, initial flow sheet, and annual output of the new extractive operation. Once exploration is completed, site activities focus on operations planning (Figure 1 'D').

The Pre-operational stage is die interval between Exploration and Production and includes feasibility studies, mine financing, and construction. Once construction İs complete, the mine begins Operations. Hartman and Lacey (1992) subdivide mine operations based on changes in gross production rate. Following the 'pre-production' stage, mine gross production rates increase rapidly. The rapid growth in production following construction is the 'Expanding Production' stage of operations (Figure 1 'E'). During this initial growth the mine is focused on debt repayment and vertical and horizontal growth The Expanding Production stage ends when production rates stabilise near the production target set in the feasibility study. At this point, production İs considered Mature (Figure 1 'F'). During Mature Production, the mine focuses on local exploration and cost reduction. The local exploration is required to determine the limits of the mineral deposit. Cost reductions in terms of innovation and efficiency related work allow the mine to enhance its cash flow. At the end of Mature Production, the gross mine production starts to fall as the mineral deposit is depleted

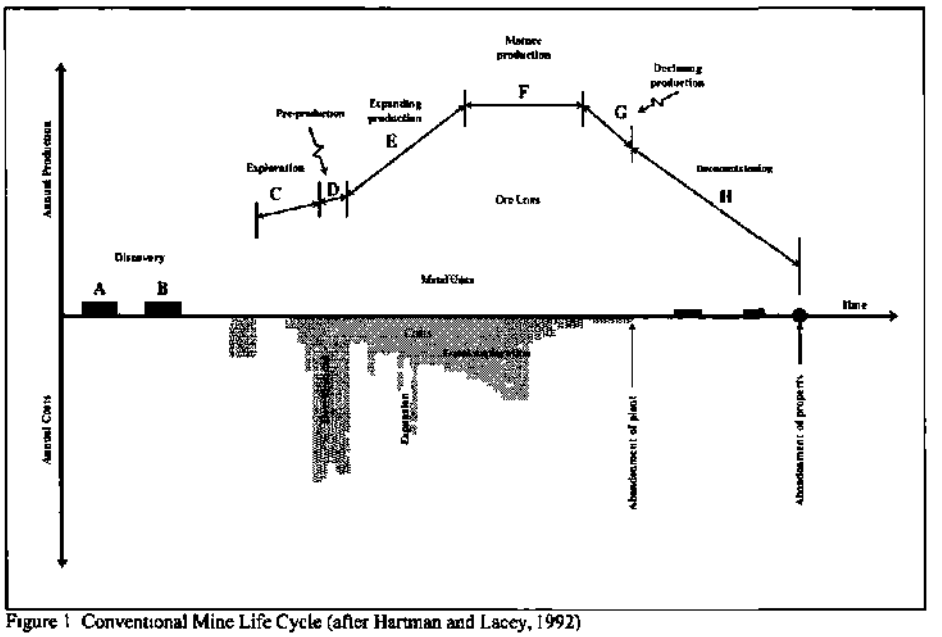

Figure 1 Conventional Mine Life Cycle (after Hartman and Lacey, 1992)

The mine enters a period of Declining Production as the end of the mining cycle approaches (Figure 1 G '). Hartman and Lacey refer to the period following operations as Abandonment (Figure 1 'H'). The focus of mine efforts during abandonment is equipment salvage and site restoration. Hartman and Lacey (1992) use the common definition of mine closure encountered in the United States. According to the mine life cycle presented the mining cycle ends with abandonment (closure in the South African context) of the property.

In the South African context, die final stages of mine life are decommissioning and closure. The EMPR stipulates evaluation and contingency planning for impacts following site abandonment, which is consistent with absolute and retroactive liability. Effectively, the mining cycle now extends past the point of closure and die final phase is Post Closure (Figure 2) Although Figure 2 reflects mineral policy in South Africa, it accurately portrays conditions m countries mat adhere to die polluter-pays-principle.

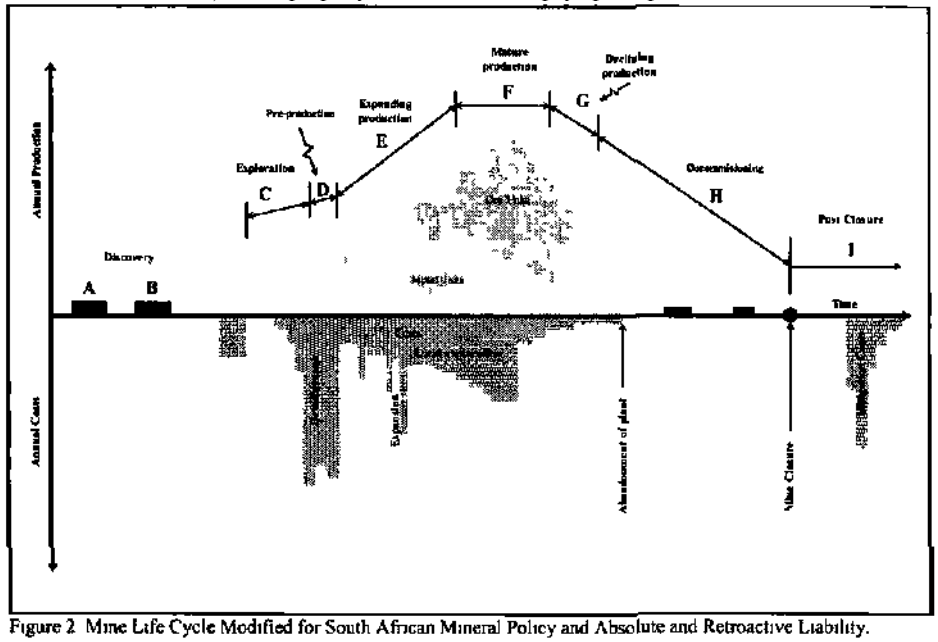

Figure 2 Mine Life Cycle Modified for South African Mineral Policy and Absolute and Retroactive Liability.

5.2 *Financial implication of closure in South Africa*

Short-to-medium term effects of environmental compliance costs on corporate profitability effectively reduce the rate of return on most mining projects. "In recent years, the national and, to a lesser but growing extent, the international operating environment of mining properties has been impacted significantly by environmental and other regulatory requirements. These constraints have invariably increased operating and capital cost requirements for the industry and have reduced or delayed production of mineral commodities. The operating environment of mining operations is also affected by direct economic variables such as royalties and taxes...All these costs, whether direct or indirect, impact profit margins, ore reserves, mineral conservation, and ultimately project viability" (Gentry and Jarnigan, 1993). Additional costs incurred following operations and decommissioning will negatively affect corporate profitability. Potential costs following decommissioning include asset depreciation, site administration, and monitoring. These costs eventually translate themselves into decreased economic activity in the mining sector (Parrish, 1991).

5.3 *Financial provisions for decommissioning and closure*

In today's global economy, transferring environmental liability to the public sector is perceived as government subsidies that confer competitive advantage in the marketplace. Consider two mines, Mine 'A' has absolute and retroactive environmental responsibility and the other (Mine 'B') has no responsibility for the site following closure. The competitive advantage conferred to Mme 'B' İs immeasurable. Mine 'B' not only saves the costs of environmental compliance during operations, but also can apply the full net profit of

the mine to purchase and construct 'new* operations. Mine 'A' commodities not only cost more, due to operational expenditure for environmental compliance, but the mining corporation must retain part of its net profit in reserve for unanticipated costs arising at closed mines. Thus, environmental liability places Mine 'A' at a tremendous disadvantage in the marketplace. It is not a mistake that industrialised nations of the Northern Hemisphere have demanded, through treaty, that all nations adopt environmental legislation for industrial activities.

The intent of the polluter-pays-principle[1] is to insure that governments do not aid industry with environmental compliance. Thus, the primary interest of the government at closure is to ensure that financial liability does not accrue to the public sector. The fundamental problem İs that, especially in the case of mining, liquid assets must be used to finance the next project. Thus, closure forces two parties with opposing self-interests to the negotiating table. The subject of these negotiations is the amount of the closure provision: Industry will seek to minimise the amount, while government will seek to maximise it. Currently, no process, procedure, or policy exists to determine what the actual amount will be. This has created an impasse at closure that must be resolved if mines are to achieve 'walk-away' closure.

6 CONCLUSION

World-wide, mine closure is accepted as being the last step in the active management of mines. Legislation mandating long-term liability forces mine owners to consider the post-closure environmental impacts of mining. These stipulations range from none (Ontario) to absolute and retroactive liability (United States of America and British Columbia). With respect to long-term liability, South African legislation displays the same variability encountered at the international level. This has created considerable confusion as to post-closure site responsibility of mine owners. The situation, as existing, is not conducive to closing mines. Indeed, the current situation threatens the long-term survival of mining companies by holding assets and profits hostage until closure is attained. The fundamental issue is protecting the mine owner from the long-term financial implications of post-closure care without transferring them to the public sector.

It is suggested that the mine owner assume absolute and retroactive liability until the site is 'safe and stable'. This represents the worst possible case from an industry perspective. However, the advantage is that impacts identification, environmental management, and site liability becomes independent of legislated or regulated environmental performance standards. Further, the general performance standard following closure (safe and stable) is site specific and based upon quantifiable environmental attributes. To insure that financial responsibility does not default to the public sector, mines will have to provide financial surety that covers the costs of post-closure care, maintenance, and mitigation of the site. On the basis of these assumptions, all that remains is determining site costs following closure.

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