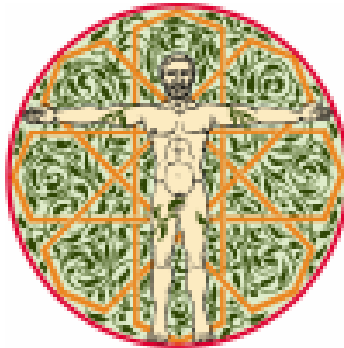




I Jornadas Iberoamericanas Sobre Cierre de Minas

**La Rábida, Huelva, España,
Del 25 al 29 de septiembre del 2000**



Universidad Internacional de Andalucía

Mine Closure: *Selected Highlights*

Eduardo Vale, Economista
Doutorando em Economia Mineral
Diretor da Bamburra Ltda.
E-mail: bamburra@highway.com.br

I - Mining & Environment

◆ Environmental Impacts

- ◆ Destruction of natural habitats & changes in landscape;
- ◆ Change in water courses & river regimes, clogged streams;
- ◆ Land degradation & instability;
- ◆ Abandoned equipment & buildings;
- ◆ Abandoned surface structures & opened underground access etc.

◆ Pollution Impacts

- ◆ Air emission;
- ◆ Effluents from concentration & processing;
- ◆ Soil contamination;
- ◆ Acid Drainage, spills and leaching etc.

◆ Health & Safety Conditions

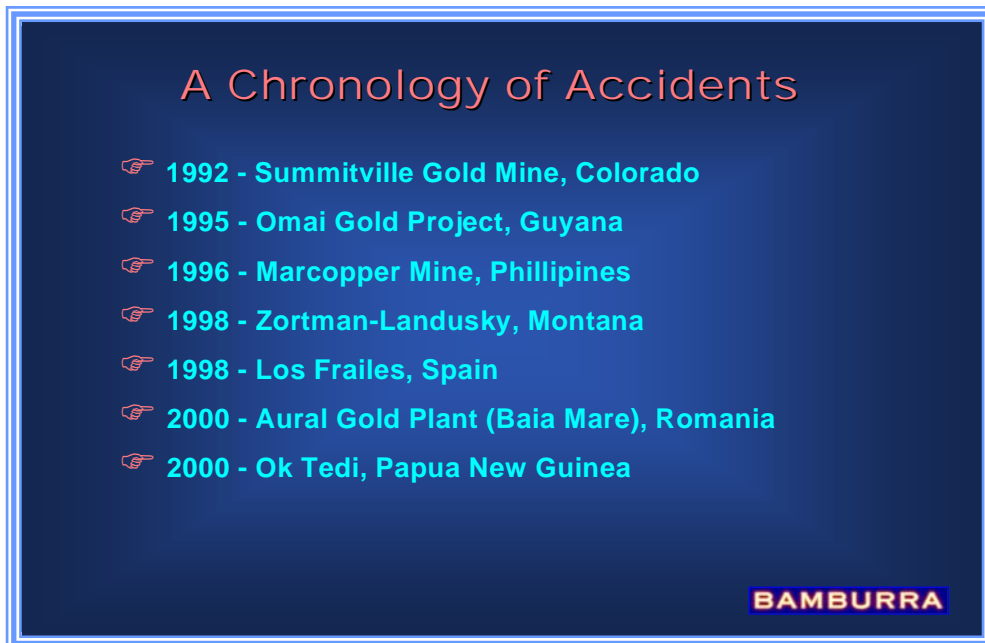
The nature and the diversity of costs and disarray imposed on environment are exacerbated by means of the following aspects:

- ❖ Location Rigidity;
- ❖ Competition with other Natural Resources;
- ❖ Competition with other Uses;
- ❖ Mutually Exclusive Conditions;

- ❖ **Economic & Social Community Relations;**
- ❖ **Opportunity Costs: *public & private*;**
- ❖ **Opportunity Costs: *present & future*;**
- ❖ **Cost / Benefits: *tangibles & intangibles*;**
- ❖ **Nature of Impacts: *irreversible & perpetual*.**

In fact, the real level of sustainability commitment of the mining industry has been under increasing vigilance and questioning considering a series of accidents occurred in the last years (Figure 1).

Figure 1 - A Chronology of Accidents



The majority of problems have been associated with:

- ✓ - **Errors in conception & design**
- ✓ - **Poor operating conditions**
- ✓ - **Spills of cyanide & heavy metals by means of breach & overflow**
- ✓ - **Acid Rock Drainage**

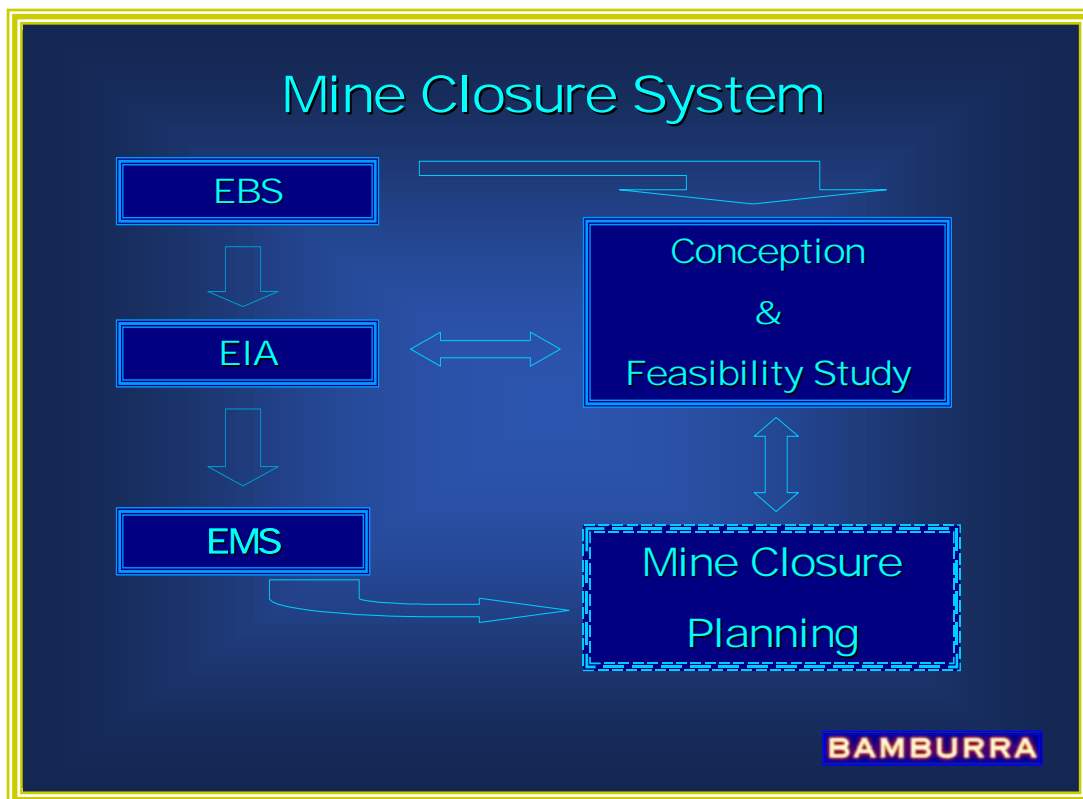
II - Mine Closure System

The challenge imposed by closure of mines can be approached like a system composed by five fundamental vectors:

- **EBS - Environmental Baseline Study**
- **EIA - Environmental Impact Assessment**
- **EMS - Environmental Management System**
- **Conception & Feasibility Study**
- **Mine Closure Planning**

Figure 2 presents a profile of the relationship between the principal vectors of a Mine Closure System.

Figure 2 - Mine Closure System



Reclamation & Closure permeates the conception & feasibility interface at the level of its three fundamental dimensions (Figure 3):

- **Geological Assurance;**
- **Engineering Conception; and**
- **Mineral Economics.**

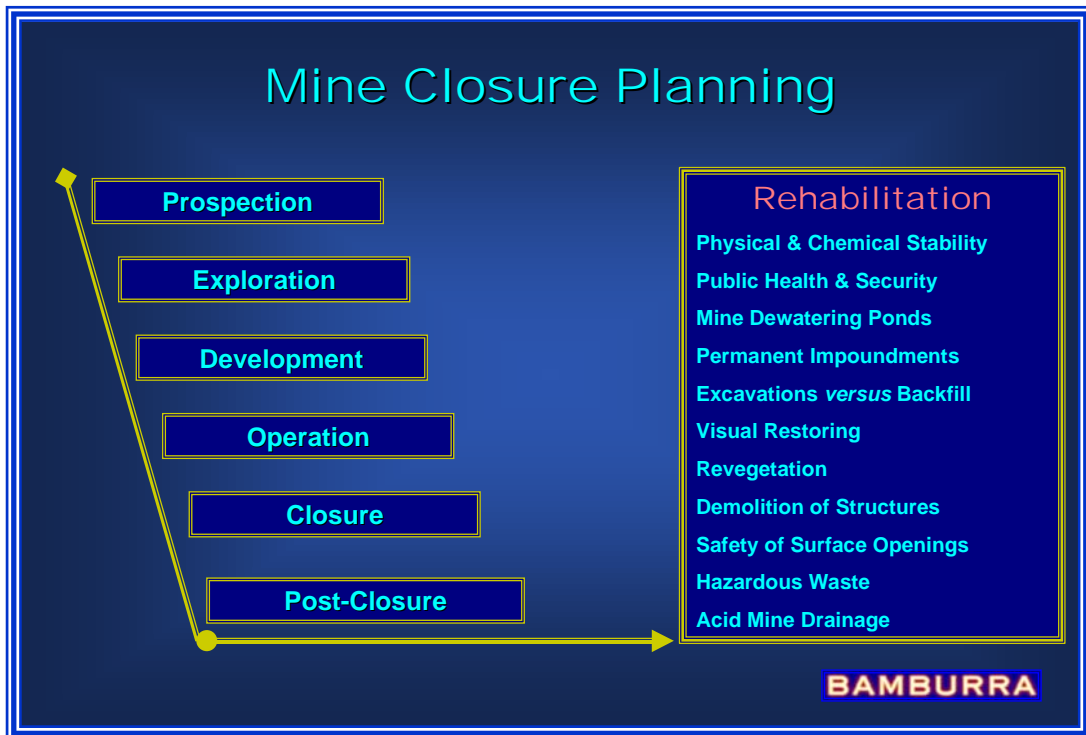
Figure 3 - Mine Project Interface

Conception & Feasibility Interface		
Geological Assurance	Engineering Conception	Mineral Economics
Resources & Reserves Continuity of Mineralization Drilling & Sampling Representativity of Sampling Assay Methods & Integrity Margins of Errors Confidence Intervals Quality Assurance & Control Tonnage & Grade Estimates Reclamation & Closure	Tonnage / Grade Relations Stripping Ratio Cut-Off Grade Policy Sequence of Mining Open Pit Design Minimum Minable Width Dilution & Specific Gravity Mining & Processing Routes Mining & Process. Recoveries Oper. Costs & Investments Reclamation & Closure	Supply & Demand Project's Market Price Behavior Oper. Costs & Investments Leasing & Contracting Mine Life Economic Evaluation Financial Engineering Taxation Planning Competitive Analysis Risk Analysis Reclamation & Closure
Source: VALE, Eduardo. (1998) BAMBURRA		

III - Mine Closure Planning

That depending of the region and the institutional regime mine closure planning activities embrace all the core segments of the mining industry and the closure and post-closure phases as well. Its basically focused on the rehabilitation and stability of the mine site and the protection of its area of influence. Figure 4 lists the principal areas of concern of a mine closure planning.

Figure 4 - Mine Closure Planning



In terms of mine closure budgeting the principal topics are:

- | | |
|--|---|
| ➤ Demolition & Dismantle | ➤ Close of Openings & Underground Access |
| ➤ Remotion of Infrastructure & Superstructure | ➤ Maintenance & Monitoring |
| ➤ Assets Recovery | ➤ Management |
| ➤ Landscape Reclaiming | ➤ Training & Realocation |
| ➤ Acid Mine Drainage | ➤ Socio-Economics |
| ➤ Restoration & Redemption | |

By definition, closure budgeting should be included at the environmental impact assessment and feasibility study levels since it can influence the conception of the project and even degrade its attractiveness. Anticipation of impacts and available options, turns feasible the insertion of the following actions:

- **Prevention & Protection;**
- **Control & Monitoring;**
- **Descommissioning & Closure;**
- **Remediation & Rehabilitation.**

IV - Closure Bonding

- **Bond Calculation** - Closure budgeting
- **Life of Project Bond** - A lump sum deposit
- **Phased Bonding** - Gradual integralization of the financial guarantee. Usually, during development and operation.

V - Financial Assurance - Options

- **Cash**
- **Surety ou Performance Bond**
- **Irrevocable Letter of Credit**
- **Dedicated Trust Fund**
- **Properties & Assets**
- **Certificates of Deposit**
- **Savings Account**
- **Self-Bonding**
- **Surety by other Company**
- **Government Bonds**
- **Insurance**

References

- **VALE**, Eduardo; Evaluation of Mineral Properties: Part I - Relevance of Establishing Standards - Mining Magazine - August, 1998 - London - pp. 80 - 84
- **SASSOON**, Meredith. Closure or Abandonment? Mining Magazine. August, 1996. pp 96-100
- **MILLER**, George C.. Use of Financial Surety for Environmental Purposes. ICME - International Council on Metals and the Environment Ottawa, Canadá.