I Jornadas Iberoamericanas Sobre Cierre de Minas

Módulo
Econômico & Financeiro

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La Rábida, Huelva, España,
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Universidad Internacional de Andalucia

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Mine Closure
Economic & Financial Focus

- Mining & Environment
- Cronology of Accidents
- Mine Closure Concepts
- Mine Closure Challenges
- Coal in USA

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Mine Closure
Economic & Financial Focus

- Financial Assurance Options
- Financial Assurance Features
- Perpetual Impacts
- Risk Analysis
- TRAC Model
- Stimulus to Reflection

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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

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Mining & Environment

- Location Rigidity
- Competition with other Natural Resources
- Competition with other Uses
- Mutually Exclusive Conditions
- Irreversible & Perpetual Impacts
- Economic & Social Community Relations
- Opportunity Costs: public & private
- Tangibles & Intangibles

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A Cronology of Accidents

- 1992 - Summitville Gold Mine, Colorado
- 1995 - Omai Gold Project, Guyana
- 1996 - Marcopper Mine, Phillipines
- 1998 - Zortman-Landusky, Montana
- 1998 - Los Frailes, Spain
- 2000 - Aural Gold Plant (Baia Mare), Romania
- 2000 - Ok Tedi, Papua New Guinea

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A Cronology of Accidents

1992 - Summitville Gold Mine, Colorado

- ✓ Cyanide & heavy metals spill
- ✓ Degradation of 17 mile of Alamosa River
- ✓ Sunk Costs of US$ 160 million of EPA Superfund
- ✓ Total Costs can exceed US$ 200 million in the long range

1995 - Omai Gold Project, Guyana

- ✓ Spill of about 3.9 million m^3 cyanide
- ✓ Comprehensive impact over Omai & Essequibo Rivers

1996 - Marcopper Mine, Philippines

- ✓ Spill of 15 million of mine waste
- ✓ Comprehensive impact over Makulapnit & Boac Rivers and coastal zones

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A Cronology of Accidents

1998 - Zortman-Landusky, Montana

- ✓ Cyanide spills, Acid Drainage & water contamination
- ✓ Total Costs can exceed US$ 100 million

2000 - Aural Gold Plant (Baia Mare), Romania

- ✓ Spill of about 100,000 m^3 of tailings water containing cyanide
- ✓ Comprehensive direct impact over Lapus river
- ✓ Indirect impact over Somes, Tisza and Danube rivers
- ✓ Trans-boundary impact: Hungary and Yugoslavia

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A Cronology of Accidents
Some Simple Conclusions

- Engineering mistakes & failures can and do occur
- The majority of problems has been associated with:
  - ✓ Errors in conception & design
  - ✓ Poor operating conditions
  - ✓ Spills of cyanide & heavy metals by means of breach & overflow
  - ✓ Acid Rock Drainage
- The real level of sustainability commitment of the mining industry is under increasing vigilance
- Prevention is better than Cure

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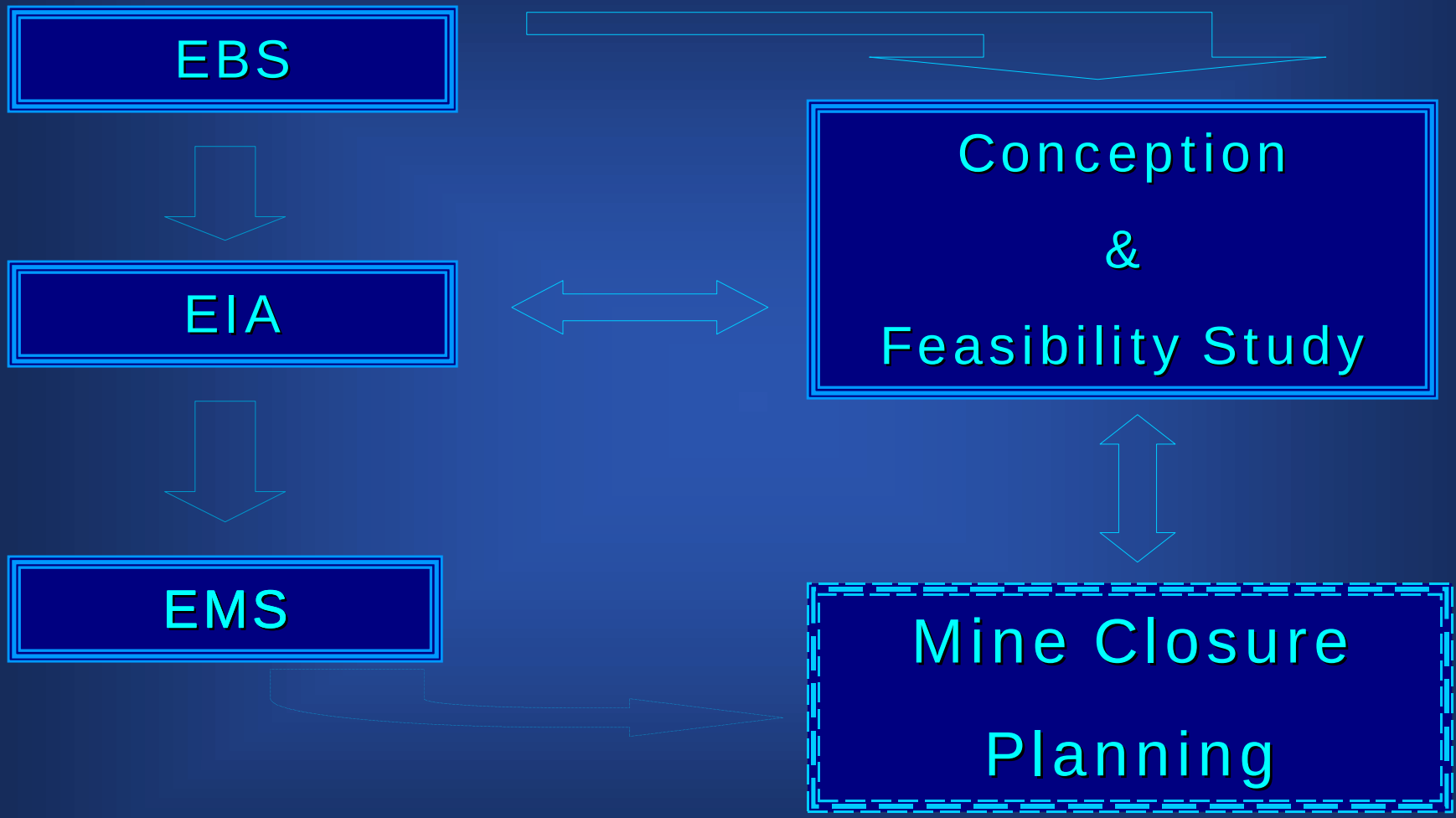
Mine Closure System



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Conception & Feasibility Interface

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

Source: VALE, Eduardo. (1998)

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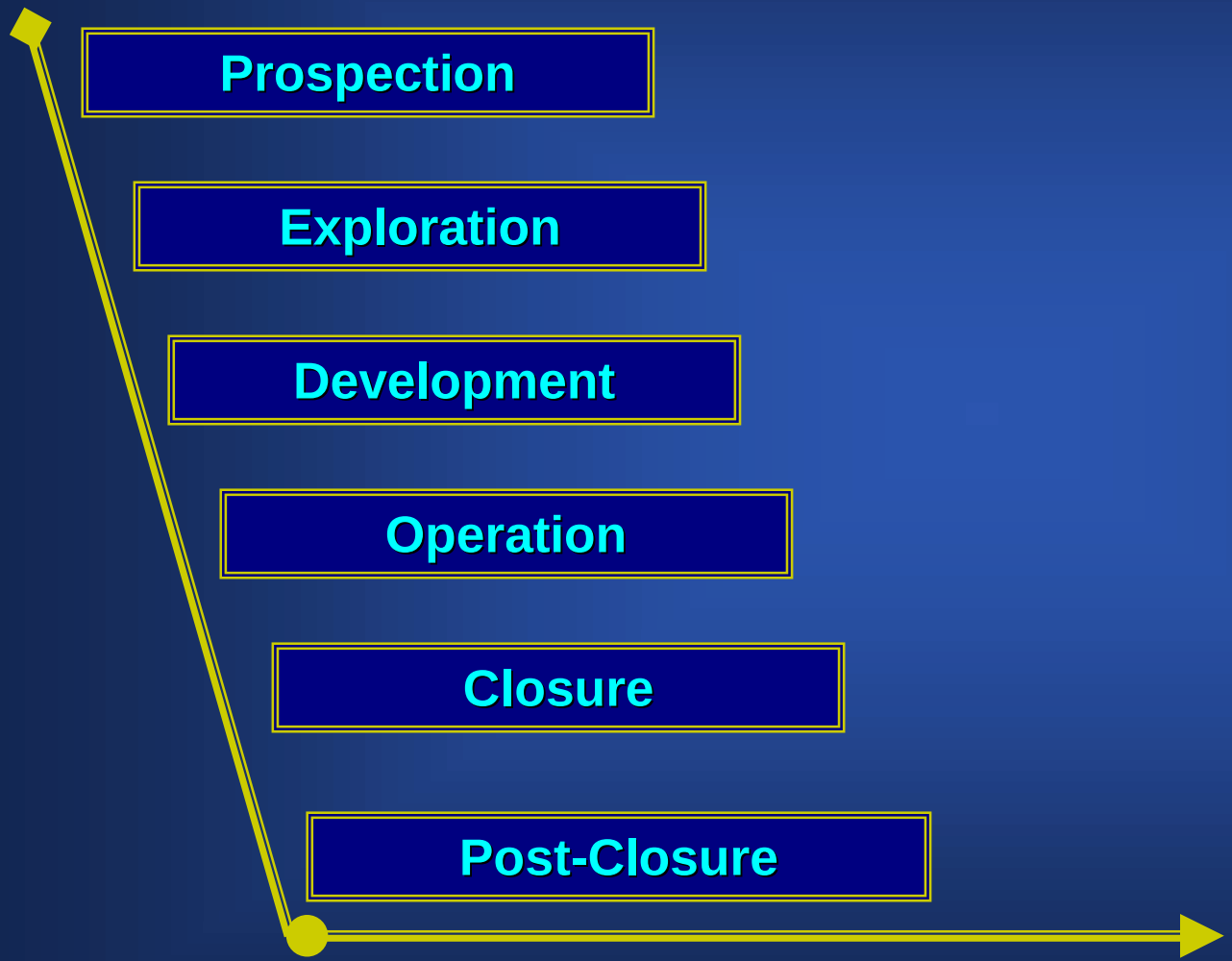
Mine Closure Planning



Rehabilitation

- Physical & Chemical Stability
- Public Health & Security
- Mine Dewatering Ponds
- Permanent Impoundments
- Excavations *versus* Backfill
- Visual Restoring
- Revegetation
- Demolition of Structures
- Safety of Surface Openings
- Hazardous Waste
- Acid Mine Drainage

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Closure Plan Budgeting

Source: USGS

- **Demolition & Dismantle**
- **Remotion of Infrastructure & Superstructure**
- **Assets Recovery**
- **Landscape Reclaiming**
- **Acid Mine Drainage**

Source: National Association of Abandoned Mine Land Programs

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Closure Plan Budgeting

- Restoration
- Close of Openings & Underground Access
- Maintenance & Monitoring
- Management
- Training & Realocation
- Socio-Economics

Source: National Association of Abandoned Mine Land Programs

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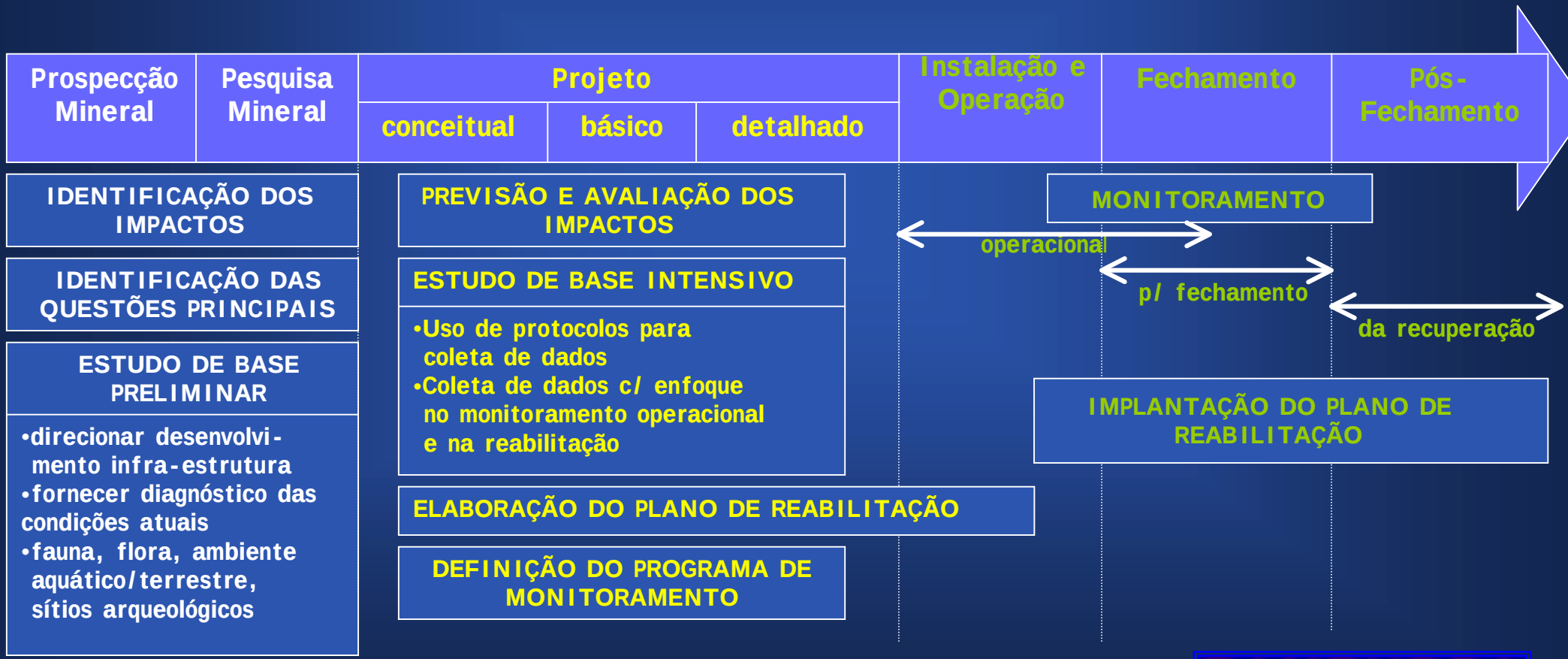
Mine Life Cycle & EIA



Source: CETEM / CANMET

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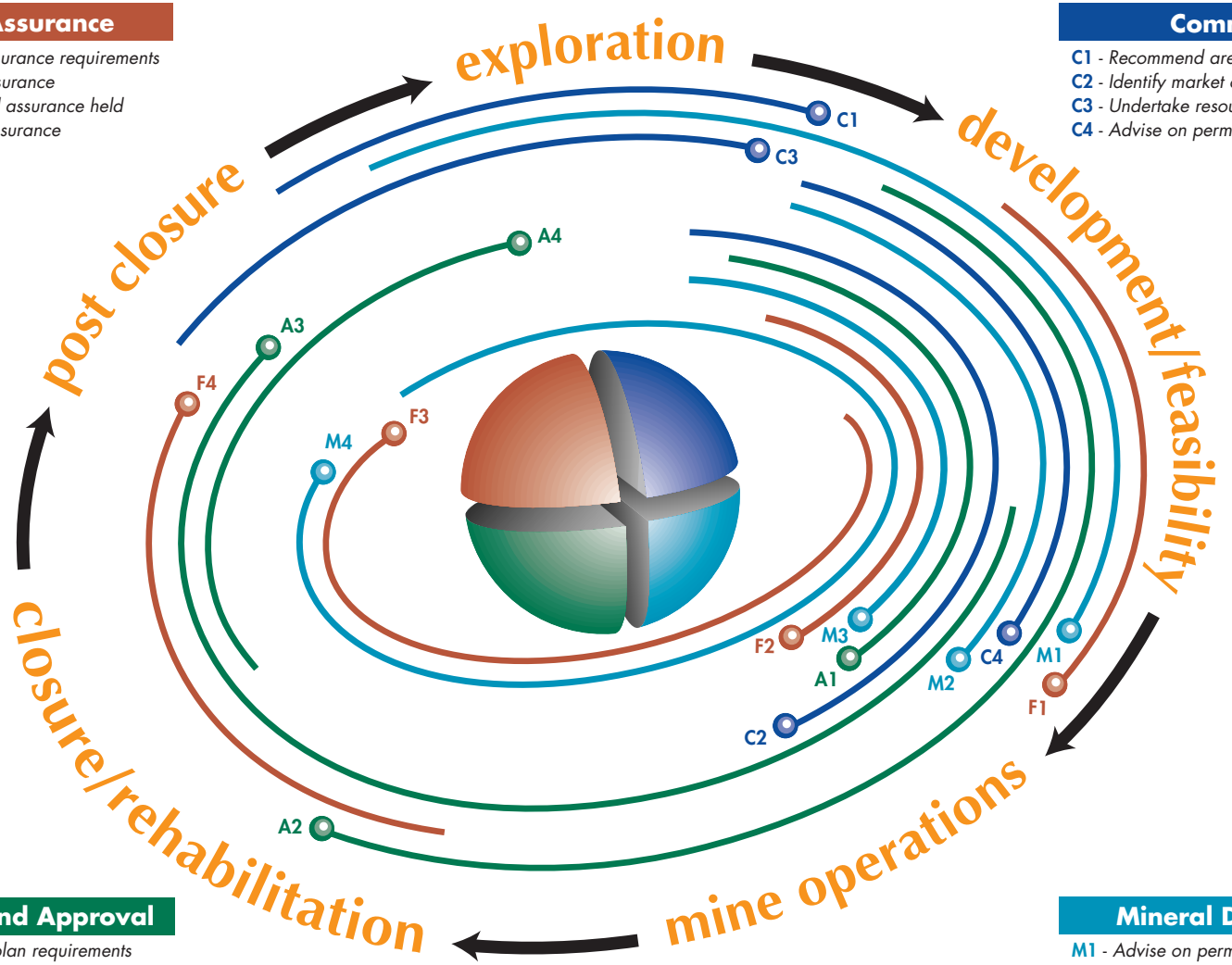
Mines Group Activities through the Mine Life Cycle



Financial Assurance

- **F1** - *Advise financial assurance requirements*
- **F2** - *Collect financial assurance*
- **F3** - *Administer financial assurance held*
- **F4** - *Release financial assurance*

Commodities

- **C1** - *Recommend areas for exploration*
- **C2** - *Identify market opportunities*
- **C3** - *Undertake resource studies*
- **C4** - *Advise on permitting*

Compliance and Approval

- **A1** - *Advise on closure plan requirements*
- **A2** - *Audit closure plans*
- **A3** - *Monitor closure activities and compliance*
- **A4** - *Rehabilitate mine hazards*

Mineral Development

- **M1** - *Advise on permitting*
- **M2** - *Facilitate regulatory process*
- **M3** - *Advise on public notification*
- **M4** - *Facilitate consultations with Aboriginal communities*

Ontario

www.gov.on.ca/mndm/mines/mg/minrehab.htm
1-888-415-9845 (ext. 5787)

Ministry of
Northern Development
and Mines

Coal in USA

Highlights of Surface Mining Law

- **Environmental Protection Program**
  - ✓ Surface Mining Control and Reclamation Act of 1977
  - ✓ Standards & procedures for permits and inspecting active coal mining
  - ✓ Standards & procedures for reclamation operations
  - ✓ Performance Bond to cover cost of reclaiming
  - ✓ Bond can be partially released in accordance with phase completed
- **The Abandoned Mine Land (AML) Program**
  - ✓ To reclaim land & water resources affected by pre-1977 coal mining
  - ✓ In 1990 SML included reclamation of mines abandoned after 1977
  - ✓ Funded by fees pai by mine operators on each ton of coal mined
  - ✓ Fees of 35 cents/t of surface mined coal and 15 cents/t if underground
  - ✓ Fees of 10 cents per ton of lignite mined

Source: Office of Surface Mining. (1997).

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Coal in USA

Highlights of Surface Mining Law

1977 - 1997

- Accumulated Production: 17.8 billion t
- Number of Active Mines: 4,129 (1997)
- Total Acreage Permitted: 4.9 million acres
- Total Acreage of Bonds Released: 1.6 million acres
- Abandoned Mine Lands
  - ✓ Total Cost of Reclaiming Works: US$ 1.5 billion
  - ✓ Cost of Reclaiming Remaining Problems: US$ 2.7 billion

Source: Office of Surface Mining. (1997).

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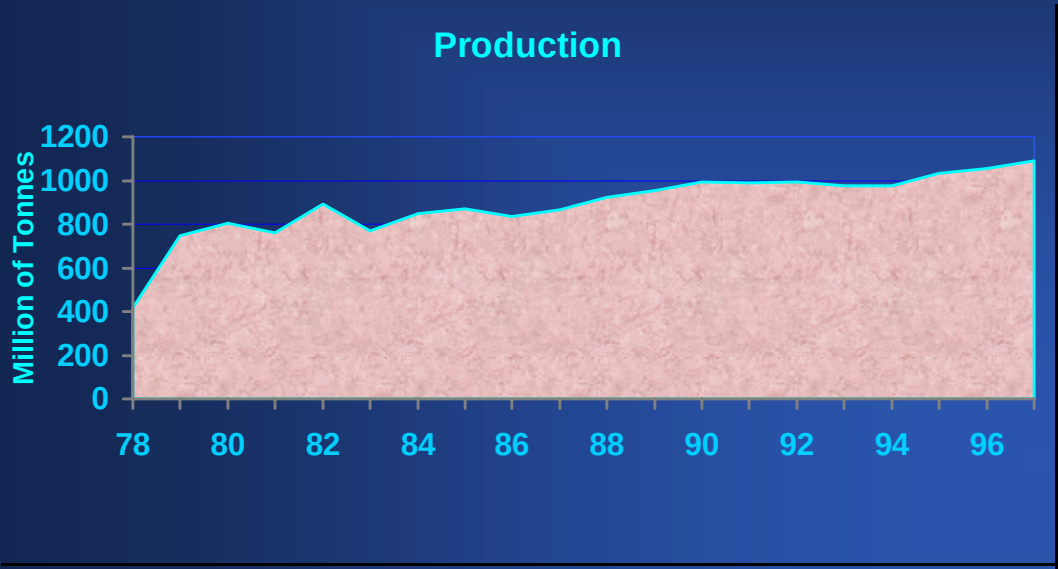
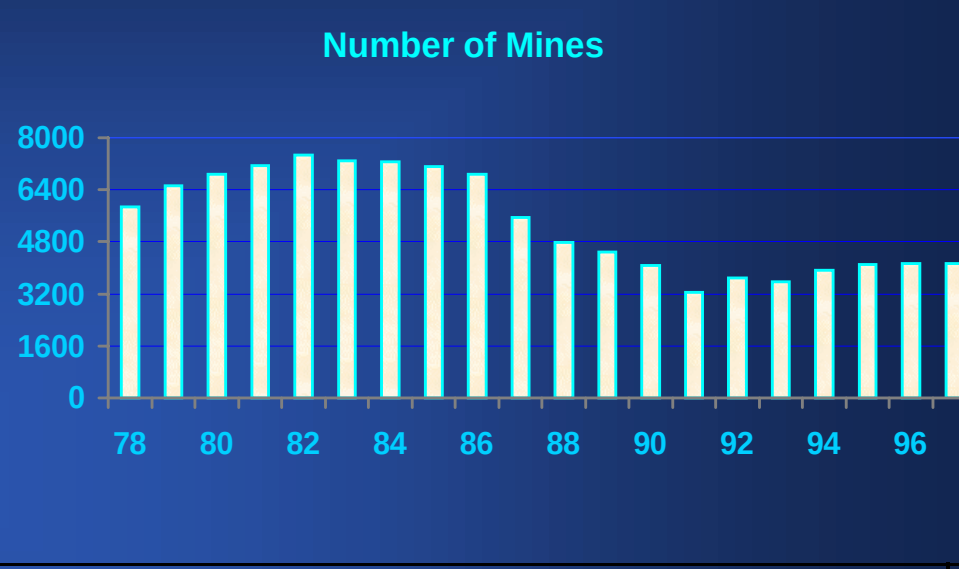
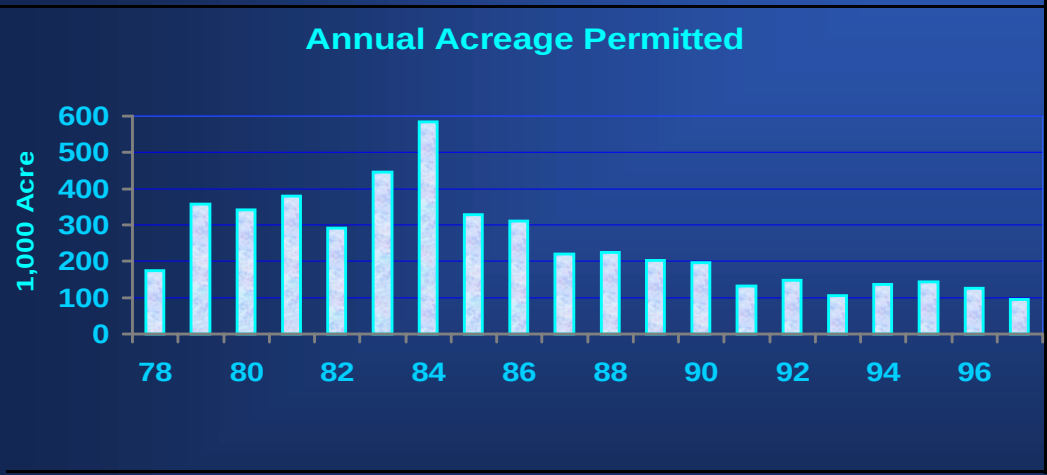
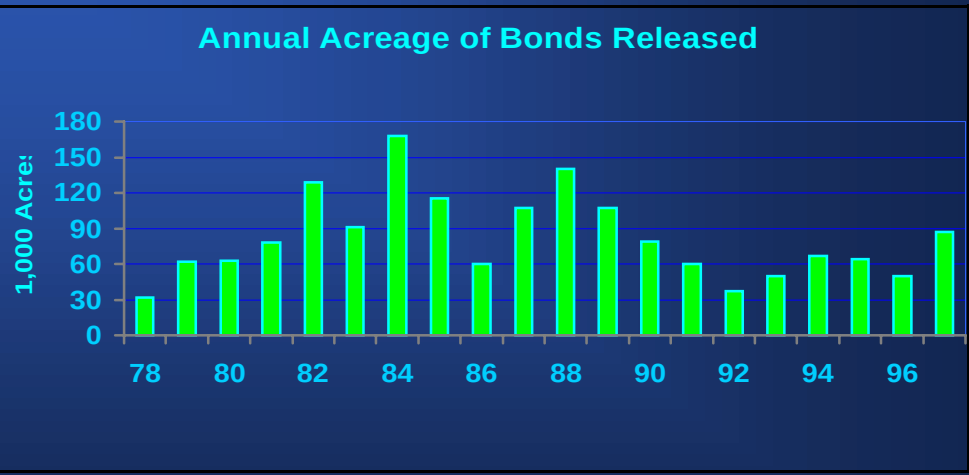
Coal in USA









Source: Office of Surface Mining. (1997).

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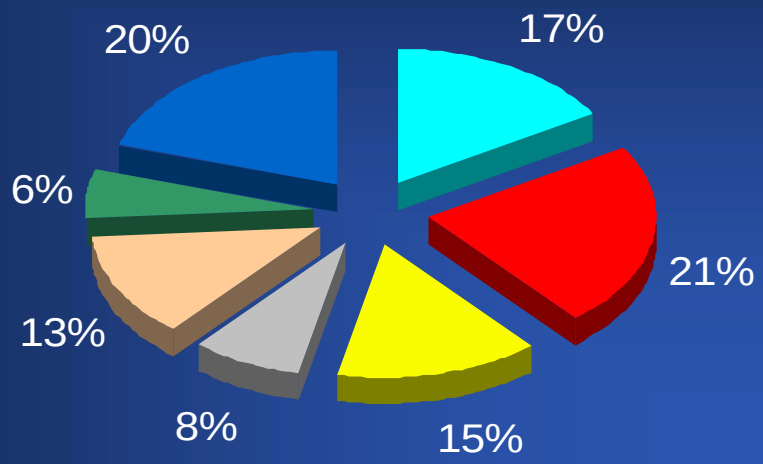
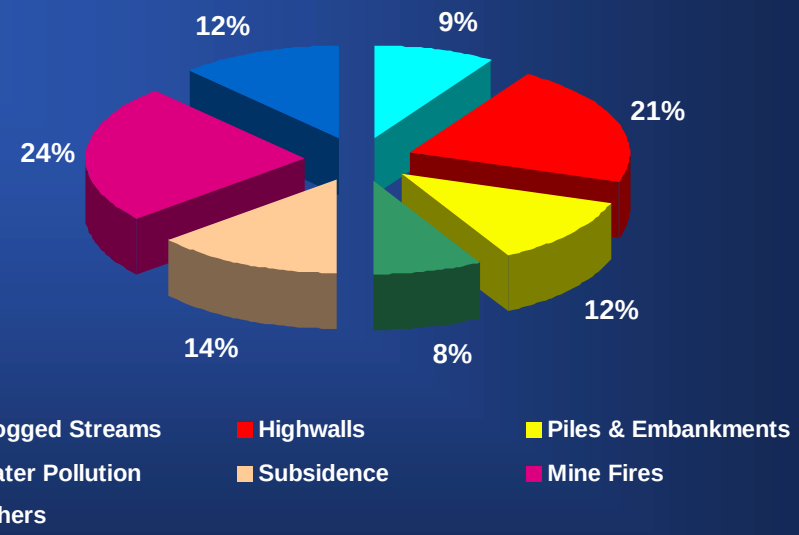
Coal in USA

Cost of Reclamation - 1977-1997



Remaining Cost of Reclamation



Source: Office of Surface Mining. (1997).

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Financial Assurance Features

- **Monitoring & Compliance**
- **Bond Review Period**
- **Noncompliance Status**
- **Bond Release Criteria**
  - ✓ **Project Bond Release**
  - ✓ **Phased Bond Release**

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Financial Assurance Options

- Cash
- Certificate of Deposit
- Saving Accounts
- Surety Bond
- Self-Bond
- Performance Bond

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Financial Assurance Options

- Third Party Guarantee
- Irrevocable Letter of Credit
- Trust Funds
- Property & Assets
- Government Bonds
- Insurance

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Self Financial Assurance

Ontario's Corporate Financial Test Proposal

Mines & Mills

- "Single AA rating (Standard Poor's) or equivalent for at least two agencies will be able to fully self-assure for the life of the mine
- A rating of BBB (Standard and Poor's) or equivalent from at least two rating agencies will be able to fully self-assure for the first half life of a mine provided that the life of the mine is equal to or greater than eight years.
- Life of a mine is based on the proponent's proven and probable reserves against planned schedules of production".

Source: Ontario Ministry of Northern Development and Mines

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Self Financial Assurance

Ontario's Corporate Financial Test Proposal

Smelters, Refineries & Mills (more than one project)

- "Single AA rating (Standard Poor's) or equivalent for at least two agencies will be able to fully self-assure for the life of the mine.
- A rating of BBB (Standard and Poor's) or equivalent from at least two rating agencies will be able to fully self-assure for the first half life of a mine provided that the life of the mine is equal to or greater than eight years.
- Life of a mine is calculated by prorating the proponent's portion of proven and probable reserves and the planned production schedules for all projects providing material to that operation".

Source: Ontario Ministry of Northern Development and Mines

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Self Financial Assurance

Ontario's Corporate Financial Test Proposal

Smelters, Refineries & Mills (more than one project)

➲ **Allowed to be self-assured under the following conditions:**

- ✓ "Provided that the "life of the mine" is equal to or greater than eight years.
- ✓ At least 67 % of the operation's total feed is from the company's mines but only in proportion to its ownership interest in those mines.
- ✓ At least 33 % of the operation's total feed is from the company's Ontario mines but only in proportion to its ownership interest in those mines".

Source: Ontario Ministry of Northern Development and Mines

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Perpetual Impacts:
Risks & Challenges

- **Estimate of Investments**
- **Estimate of Operational Costs**
- **Financial Costs & Risks**
- **Escalation**
- **Prompt Availability of Funds**
- **Legal Chain of Liability Owners**
- **Legal Disputes & Costs**
- **Risks to Society**

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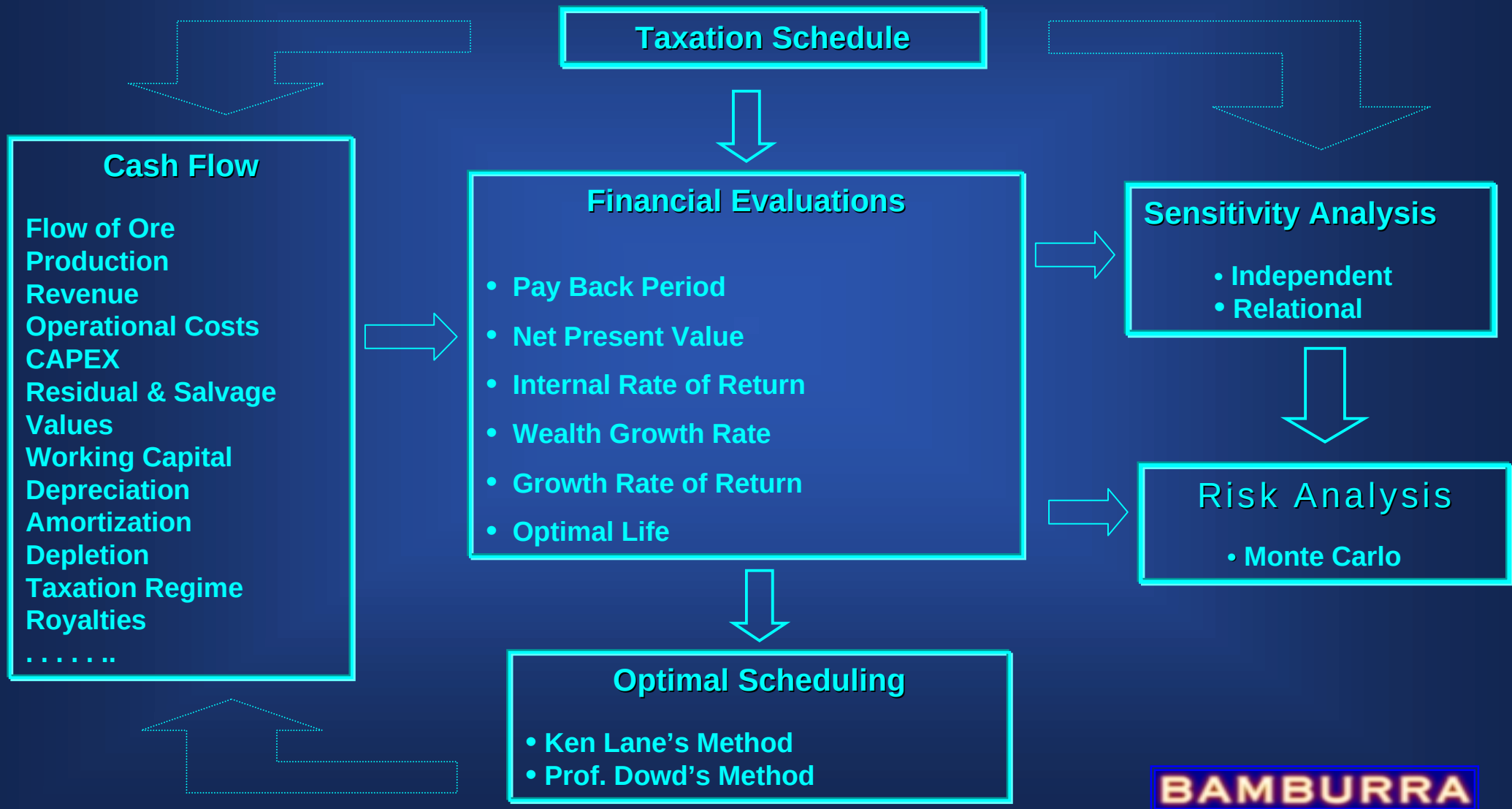
Financial Evaluation System



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Risk Analysis:
Classical Mining Project Issues

- ✓ Reserves
- ✓ Grade
- ✓ Dilution
- ✓ Stripping Ratio
- ✓ Mining Recovery
- ✓ Metal Recovery
- ✓ CAPEX
- ✓ Working Capital
- ✓ Operating Costs
- ✓ Cost of Capital
- ✓ Demand
- ✓ Development Period
- ✓ Prices
- ✓ Taxation
- ✓ Exchange Rate
- ✓ Sovereign
- ✓ Political
- ✓ Technological Route
- ✓ Force Majeure
- ✓ Funding
- ✓ Infrastructure
- ✓ Competition

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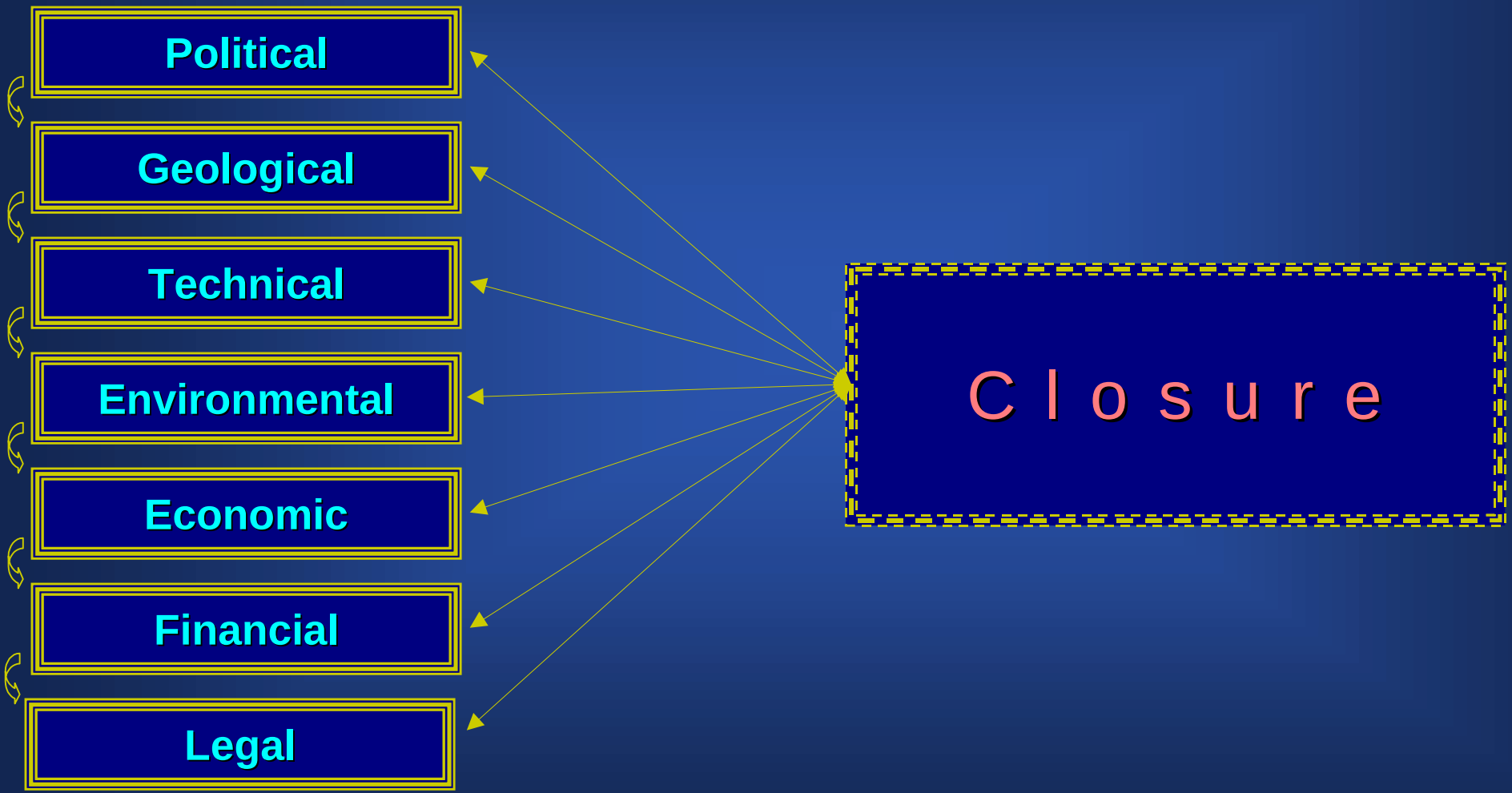
Risk Analysis:

Classical Mining Project Modules



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Risk Analysis:
Closure Components of Risk

Public Sector

Private Sector

Legal Framework

Geological Assessment

Engineering Pipeline

- ✓ Conception & Design
- ✓ Construction
- ✓ Operation

Environmental Assessment

- ✓ EBS
- ✓ EIA

Environmental Management

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Risk Analysis:
Closure Components of Risk

Public Sector

Private Sector

Financial

- ✓ Investments
- ✓ Operating Costs
- ✓ Performance Bonds

Economic

- ✓ Future Alternatives of Use
- ✓ Oportunity Costs

Social

- ✓ Changes in Community Demands

Technology

Natural Disasters

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TRAC - **Transfer Risk & Accelerate Closure**

- **Innovative risk based fixed price contract**
- **Project - Alaska-June Mine**
- **Players - Echo Bay and Kvaerner Environmental**
- **Objective - Reclaim & Closure of A-J Mine**
- **Critical vectors of A-J Mine closure process:**
  - **Long-term health & safety of Juneau residents**
  - **Integrity of the environment in the area of influence**

Source: PETRILLO, Joseph L.; HILBELINK, Paul A. (1999).

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TRAC - **Transfer Risk & Accelerate Closure**

Kvaerner's Mandate:

- **Negotiate, prepare and implement closure plan**
- **Excel regulatory requirements**
- **Improve and maintain a proactive public and community relations**
- **Priority to hire Echo Bay personnel**
- **Provision of adequate performance guarantees**

Source: PETRILLO, Joseph L.; HILBELINK, Paul A. (1999).

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Stimulus to Reflection:
Selected Critical Interfaces

- Resources & Reserves
- Mine Design
- Sequence of Mining
- Scale & Mix of Production
- Technological Route
- Feasibility Study

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Stimulus to Reflection:
Selected Critical Interfaces

- **Flow of Funds**
- **Project Finance**
- **Impact on Transactions:**
  - ✓ Buying & Selling
  - ✓ Mergers & Acquisitions
  - ✓ Joint Ventures & Mining Agreements
  - ✓ Leasing & Contracting
  - ✓ Collaterals
- **Integration of Risk Analysis**

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Stimulus to Reflection:
Selected Critical Interfaces

- **Impact on Competitiveness**
  - ✓ Project
  - ✓ Company
  - ✓ Industry
  - ✓ Region & Country
- **Taxation Regime**
- **Environmental Due Diligence**
- **Social Due Diligence**

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Stimulus to Reflection:
Selected Critical Interfaces

- Cost & Benefit Analysis
- Contingent Valuation
- Cost Efficacy Analysis
- Transferring Costs
- As a Matter of Fact, Who Pays The Bill ?

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