Mining and Metals

Introduction

This Environmental and Social Risk Briefing covers Mining and Metals (including Quarrying). Mining is the extraction and development of sub-surface solid resources. Core mining and quarrying products are metals and minerals, precious and semi-precious gemstones, building and road materials and industrial non-metal products.

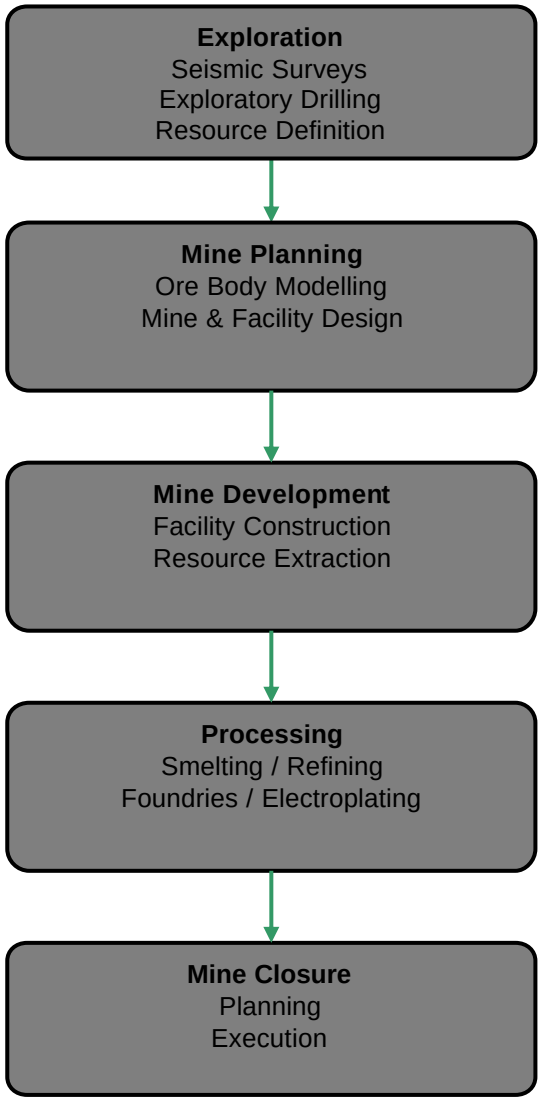
Mining and Metals

Mining (and quarrying) includes many different activities but these can be logically grouped into key phases within the "life cycle" of a mine (or quarry) as illustrated in the following schematic.

Exploration

Exploration typically employs a number of different techniques and technologies. In the very first instance, large tracts of land are geologically surveyed and mapped to identify areas of potential mineralisation. Airborne magnetic surveys are often used to cover large tracts of land quickly to help identify anomalies that can indicate a mineralised zone. Once a target area is identified, a more detailed ground survey is completed using techniques such as seismic surveys, direct sampling and drilling

Mining / Quarrying Life-Cycle



Mine Planning

For mine planning, data from exploration of a mineralised zone is entered into sophisticated software applications where the ore reserve is modelled. The output from the model is a 3-dimensional image of the subsurface ore body.

Understanding the spatial distribution of the reserve allows the geologist and mining engineers to identify and design the best method and approach to mine development taking into consideration both technical and economic issues pertaining to ore extraction. The depth and geological lie of the deposit will also be a key factor in determining whether the mine will be developed as an open pit / open cast or underground (shaft or decline) operation.

A mine plan will address mine layout design and timing / scheduling of high and low grade ore extraction to strike the best balance between mine capitalisation costs and mining revenue. Development planning should also consider mine closure.

Mine Development and Operation

Mine development includes the construction of mining infrastructure and the commencement of ore extraction. It is not uncommon for a new mine to be several years under development before ore is actually extracted.

Mining and Metals

In open pit / open cast mining, over-burden material (soil and surface rock) is stripped and stockpiled. The mineralised zone is then mined preferentially although ongoing removal of waste rock will typically continue to some extent throughout the life of mine.

Open pit / open cast mining employs relatively straight forward excavation techniques - rock is drilled and blasted and the broken material is loaded onto haul trucks and transferred to stockpiles (ore or waste rock) or directly to a surface processing plant (ore).

Where open pit / open cast mining is prohibitively expensive or results in the disturbance of too greater a surface area, underground mining is considered. Shaft underground mining involves sinking an access shaft (or shafts) through or adjacent to the ore body. Horizontal shafts or "adits" are cut from the shaft into the ore body "seams". Ore material is retrieved and transported to the surface for processing.

Declines are underground mines where access to the ore body is gained by driving a near horizontal adit (as opposed to a vertical shaft) from the surface to the mineralised zone. Declines can cater for direct vehicular access from the surface to the underground workings.

Surface and underground mining are the most common techniques for extracting ore, although there are others including solution mining - mineral is brought into a liquid solution by some chemical or bacteria and the resultant liquid is pumped to the surface where the mineral or metal is taken out of solution; glory-hole mining - a steep-sided, funnel-shaped surface excavation is connected to tunnels below it and rock blasted from the sides of the excavation fall into the tunnels, from which they are then removed; gopher mining - narrow, small holes are driven in order to extract the ore as cheaply as possible; placer mining - no excavation is involved but instead, gravel, sand or talus is removed from deposits by hand, hydraulic nozzles or by dredging and the ore is separated from the waste by panning or sluicing.

Tailings Waste

Tailings are a slurry residue waste product generated as from ore milling and processing operations in mining. They are typically physically and / or chemically treated before being passed by pipeline to a Tailings Management Facility (TMF). TMF are containment facilities and are most commonly either a dammed and backfilled natural valley or "dry stack" stockpiles. In some locations where the landscape is flat tailings are stored within constructed earth bunds.

Tailings dams may impact the environment through leaching of acids and / or heavy metals into surface and / or groundwater resources and /or through dust blowing off them. Tailings dams are often unsightly features in the landscape. From a social perspective, if not appropriately sited, TMF can require the displacement and resettlement of communites resulting in associated socio-economic disruption, community upheaval and breakdown of social fabric. Failure of a TMF due to earthquakes or floods results in disastrous impacts on humans and the natural environment.

Processing

The type of processing method employed depends on the nature of the ore. Even where there is a standard metallurgical approach for a given mineral type (e.g. carbon-in-leach (cyanide treatment) for gold extraction), all processes are likely to be customised to some extent for the specific ore being treated. The detail of the smelting process varies with the nature of the ore and the metal involved but a blast furnace is always used.

Smelting

Smelting is the chemical reduction process whereby metal is extracted from its ore by melting or fusion. Crushed / pre-treated ore is fed into the smelter along with a chemical reducing agent, often carbon (coke). The carbon, or resulting carbon monoxide removes oxygen from the molten metal oxide to leave the metal. Carbon

dioxide and carbon monoxide are by-products of the process. As most ores are impure, it is often also necessary to use a flux, such as limestone, to remove the accompanying waste rock as slag.

Refining

Refining is the process by which impurities are separated from crude or semi finished materials. The nature of the refining process depends the type of material involved, the value of the end product and the degree of purity required.

Foundries

In foundries, molten metals are cast into objects of desired shapes. Castings of iron, steel, light metals (e.g. aluminium) and heavy metals (e.g. copper and zinc) are made in units that may be independent or part of a production line. The main production steps include preparation of raw materials, metal melting, preparation of moulds, casting and finishing (which includes “fettling” and “tumbling”).

Electroplating

Electroplating involves the deposition of a thin protective layer (usually metallic) onto a prepared metal surface using electrochemical processes. The process involves pre-treatment (cleaning, and degreasing), plating, rinsing, passivating (i.e. protect metal with a corrosion resistant surface) and drying. Cleaning and pre-treatment includes the use of a variety of solvents and surface stripping agents depending on the metal surface to be plated.

Plating solutions are acid or alkaline and may contain cyanides.

Mine Closure

Mine closure is the process of decommissioning and dismantling mine infrastructure once extraction activities have ceased.

A variety of approaches are used to rehabilitate l mines depending on the nature of the mine itself. Open pit / open cast mines are quite often allowed to fill with water to form pit lakes. Pit walls are battered back to angles that make them safe and stable and the pit void is left to in-fill via inflow of surface and / or groundwater. Some treatment of the pit lake water (e.g. lime addition) may be required where acid-generating material is exposed in the pit wall. Where there is more than one open pit in a mine development, some voids may be partially or fully backfilled with waste rock during mine operations.

Underground mines are typically simply sealed off to prohibit access. In some cases partial backfilling may be undertaken where this can be achieved during mine operations.

Waste rock dumps are typically reshaped and covered with a topsoil layer in order to promote vegetation growth. It is important to ensure that rehabilitation of waste rock dumps also addresses any long-term acid mine drainage potential. This is usually achieved through application of appropriate cover and / or surface water drainage collection and treatment system. Long-term maintenance liabilities may exist where the potential for acid mine drainage is significant.

Decommissioning of mine processing plant can be a lengthy and involved process where plant and equipment is progressively cleaned / decontaminated using solvents and other chemicals. By-products from such cleaning processes can be highly toxic and require careful management and disposal.

Following decommissioning, plant and equipment can be partially dismantled and on-sold for re-use at another mine site or completely dismantled and on-sold as scrap metal. Where decommissioned plant cannot be sold for re-use or as scrap, it is sometimes buried on-site.

Mining and Metals

Key Sector Risks and Headline Issues

In large-scale mining and metals operations some critical issues of particular public concern may result in reputation or credit risk to a lender or an investor, these include:

- Irreversible land degradation and instability – geotechnical stability / major landslips and subsidence;
- Tailings dams – health risk from major pollution events to drinking water supplies from toxic leachate and significant long-term ground water contamination post closure (e.g. cyanide in gold mining tailings);
- Tailings dams – major environmental and social impacts following dam wall failure;
- Security of operations and human rights violations of workers and communities - child labour, terrorism and sabotage, social conflict and unrest;
- Supply chain and revenue transparency / bribery and corruption particularly in developing economies and states with weak governance structures;
- Climate change - long term impact from ozone depletion and global warming from greenhouse gas emissions from refining and processing; and
- Sustainable community development - economic dependency of project affected communities at mine closure.

The following tables detail potential Environmental and Social risks associated with industry processes and appropriate control measures. These may include **Environmental and Social Management Plans** and may form part of a wider **Environmental Social Management System**.

Mining and Metals

Environmental Risks

Life Cycle Phase and Activity	Environmental	
	Risks	**Controls**
Exploration		
Seismic Surveys	♦ **Habitat depletion, fragmentation and degradation -** - Vegetation clearance (seismic surveys, access roads) - Land disturbance (seismic surveys access roads) - Ecology and biodiversity impacts (seismic surveys access roads) ♦ **Atmospheric emissions:** - Pollutants (VOC, NOX, SOX, PM10, CO, CO2, etc) - Greenhouse gas production - Dust and noise (vehicles and seismic shots)	♦ **Habitat protection plans** - - Restoration/rehabilitation and Transport Management - Limit disturbance to vegetation and landforms - Use "thumpers" in preference to explosives - Limit the use of vehicles - airlift equipment to remote greenfield sites if possible - Protect / avoid water resources ♦ **Emissions and dust management** - through minimization of use / movement of vehicles, plant and machinery and dust suppression techniques
Drilling and Resource Definition	♦ **Habitat depletion, fragmentation and degradation** - - Vegetation clearance (drill pad construction, access roads) - Land disturbance (drill pad construction, access roads) - Ecology and biodiversity impacts (drill pad construction, access roads, drill mud disposal ponds) ♦ **Atmospheric emissions:** - Pollutants (VOC, NOX, SOX, PM10, CO, CO2, etc) - Greenhouse gas production - Dust and noise (vehicles and seismic shots)) ♦ **Disruption and pollution to surface water (hydrological) and groundwater (hydrogeological) systems and flows** - Surface / groundwater contamination (drilling fluids and muds use and disposal; hydrocarbon / chemical spills)	♦ **Habitat protection plans** - - Restoration/rehabilitation and Transport Management - Limit disturbance to vegetation and landforms - Use "thumpers" in preference to explosives - Limit the use of vehicles - airlift equipment to remote greenfield sites if possible - Protect / avoid water resources ♦ **Waste management** - Prepare and implement methods for disposal of drill cuttings and mud cuttings ♦ **Emissions and dust management** - through minimization of use / movement of vehicles, plant and machinery and dust suppression techniques
Mine Planning		
Ore Body Modelling	♦ **No specific risks**	♦ **No specific controls**
Mine and Facility Design	♦ **No specific risks** - assuming design optimisation from environmental perspective (see Facility Construction and	♦ **Employee health and safety** - standards are integrated into design contracts

Mining and Metals

Life Cycle Phase and Activity	Environmental	
	Risks	**Controls**
	Resource Extraction below)	♦ **Minimise facility footprint** - wherever possible in environmental design
Mine Development		
Facility Construction	♦ **Habitat depletion, fragmentation and degradation -** - Vegetation clearance - Land disturbance - Ecology and biodiversity impacts ♦ **Atmospheric emissions** (i.e. of harvesting and plant vehicles): - Pollutants (VOC, NOX, SOX, PM10, CO, CO2, etc) - Greenhouse gas production - Dust and noise ♦ **Disruption and pollution to surface water (hydrological) and groundwater (hydrogeological) systems and flows** - e.g. hydrocarbon / chemical spills	♦ **Environmental management plans** - for construction activities e.g. erosion control, water quality, spill prevention and response, etc. to ensure that compliance is monitored by third party ♦ **Emissions management** - through minimization of use / movement of vehicles, plant and machinery ♦ **Hazardous waste, storage and disposal plans** - employ appropriate health and safety measures for containment of chemicals ♦ **Waste management** - responsible waste vegetation management ♦ **Water management** - protect / avoid water resources - spill prevention and response planning
Resource Extraction	♦ **Habitat depletion, fragmentation and degradation** - - Vegetation clearance - Land disturbance and subsidence/settlement - Habitat loss, fragmentation and / or degradation Ecology and biodiversity impacts ♦ **Atmospheric emissions** (i.e. of harvesting and plant vehicles): - Pollutants (VOC, NOX, SOX, PM10, CO, CO2, etc) - Greenhouse gas production - Dust and noise - (vehicles, plant, machinery, blasting) ♦ **Disruption and pollution to surface water (hydrological) and groundwater (hydrogeological) systems and flows** - Surface water quality (sedimentation, acid mine drainage, wastewater disposal, hydrocarbon spills) and groundwater quality (acid mine drainage, hydrocarbon / chemical	♦ **Environmental management plans** - for construction activities e.g. erosion control, water quality, spill prevention and response, especially a **Tailings management plan** - ensure that compliance is monitored by third party ♦ **Emissions and dust management** - through minimization of use / movement of vehicles, plant and machinery and use of dust suppression techniques ♦ **Hazardous waste, storage and disposal plans** - employ appropriate health and safety measures for containment of chemicals ♦ **Sustainable resources management** - esp. water management plans ♦ **Waste management plans** - especially for tailings and overburden

Mining and Metals

Life Cycle Phase and Activity	Environmental	
	Risks	**Controls**
	spills) ♦ **Pressure on natural resources** - high water resource consumption ♦ **Liquid and solid waste (production and disposal)** - overburden disposal, tailings disposal	
Processing		
Smelting / Refining / Foundries / Electroplating	♦ **Atmospheric emissions** - (i.e. of harvesting and plant vehicles): - Pollutants (VOC, NOX, SOX, PM10, CO, CO2, etc) - Greenhouse gas production - Dust and noise - (vehicles, plant, machinery, blasting) ♦ **Disruption and pollution to surface water (hydrological) and groundwater (hydrogeological) systems and flows** - wastewater disposal, hydrocarbon / chemical spills ♦ **Disruption and pollution to surface water (hydrological) and groundwater (hydrogeological) systems and flows -** water quality (hydrocarbon / chemical spills) ♦ **Pressure on natural resources** - high water consumption	♦ **Sustainable resources management** - optimise efficiency of processes to minimise energy (emissions) and water usage ♦ **Use Best Available Technique Not Entailing Excessive Cost (BATNEEC)** - in emission stack design and wastewater treatment design ♦ **Emissions management** - greenhouse gas / climate change offset programmes ♦ **Water management –** protect/avoid resources – spill prevention and response planning
Mine Closure		
Planning and Execution	♦ **Site decommissioning and remediation** - failure to establish closure objectives e.g. rehabilitation / reinstatement ♦ **Disruption and pollution to surface water (hydrological) and groundwater (hydrogeological) systems and flows** - protection from potential acid mine drainage	♦ **Closure and decommissioning plan** - ensure closure plan seeks to establish environmental conditions that as near as possible reflect pre-mining conditions or that support alternative land use

Mining and Metals

Social Risks

Life Cycle Phase and Activity	Social	
	Risks	**Controls**
Exploration		
Seismic Survey	♦ **Community health and safety** - transport routes / vehicle accidents, emissions/discharges (aqueous and gaseous), noise and dust ♦ **Strain on infrastructure and public nuisance** - strain on transport networks and local infrastructure, community disruption and disturbance from noise, vibration and vehicle movements ♦ **Communicable diseases** - spread of diseases to local/foreign populations ♦ **Cultural / archaeological heritage** – damage to / destruction of cultural / archaeological sites / features	♦ **Community/stakeholder relations management -** - Management of interface between local communities and outsiders/foreign workers through stakeholder identification and consultation (including governmental/national/regional/local stakeholders). - Management of community tensions, grievances and concerns through transparent formal grievance mechanism ♦ **Community health and safety plans-** instigation of safety buffer zone around seismic operations ♦ **Cultural heritage / archaeology management -** - Identification, classification and protection of cultural / archaeological sites in accordance with the country's laws/international standards and conventions - Implement site / feature "watching brief" " (continuous visual monitoring)
Drilling and Resource Definition	♦ **Community health and safety** - transport routes / vehicle accidents, emissions/discharges (aqueous and gaseous), noise and dust ♦ **Strain on infrastructure and public nuisance** – strain on transport networks and local infrastructure, community disruption and disturbance from noise, vibration and vehicle movements ♦ **Land acquisition** - **displacement**- socio-cultural tensions/conflict ♦ **Cultural / archaeological heritage** - damage to / destruction of cultural / archaeological sites / features	♦ **Community/stakeholder relations management -** - Management of interface between local communities and outsiders/foreign workers through stakeholder identification and consultation (including governmental/national/regional/local stakeholders). - Management of community tensions, grievances and concerns through transparent formal grievance mechanism ♦ **Community health and safety plans-** instigation of safety buffer zone around seismic operations ♦ **Cultural heritage / archaeology management -** - Identification, classification and protection of cultural / archaeological sites in accordance with the country's

Mining and Metals

Life Cycle Phase and Activity	Social	
	Risks	**Controls**
		laws/international standards and conventions - Implement site / feature "watching brief" " (continuous visual monitoring)
Mine Planning		
Ore Body Modelling	♦ **No specific issues/risks**	♦ **No specific controls**
Mine and Facility Design	♦ **No specific risks -** assuming design optimisation from social perspective (see Facility Construction and Resource Extraction below)	♦ **Community/stakeholder relations management -** Ensure that appropriate consultation is completed during design process ♦ **Minimise facility footprint** - wherever possible environmental design should avoid sensitive social areas / features
Mine Development		
Facility Construction	♦ **Significant engineering works** - construction interference with populations ♦ **Loss of livelihood** - **economic displacement -** job competition, conflict between local and foreign workers ♦ **Communicable diseases** - spread of diseases to local/foreign populations ♦ **Land acquisition** - **displacement** ♦ **Land acquisition - loss of access-** (temporary and/or permanent) resettlement - disruption to family/community hierarchy/assets ♦ **Employee health and safety** - poor employment and labour standards, child labour ♦ **Disruption of social / community cohesion and exclusion of vulnerable groups -** - Breakdown of social networks and structures - Socio-economic exclusion of ethnic minorities and indigenous peoples - Socio-cultural tensions between local and foreign workforce from influx and outflow of migrants/ temporary workers and attraction of seasonal residents to project	♦ **Community/stakeholder relations management -** - Management of interface between local communities and outsiders/foreign workers through stakeholder identification and consultation and disclosure (including governmental/national/regional/local stakeholders). - Management of community tensions, grievances and concerns through transparent formal grievance mechanism - Employee skills training in community relations management and cultural awareness - Management of relations with NGOs and national advocacy groups (through consultation and project disclosure) ♦ **Social / community baseline assessment** - establish community profiles (e.g. social hierarchy, ethnic groups, socio-cultural and religious practices, skills profile and public services/resources) in the project area, through detailed social baseline assessments to inform mitigation measures and the development of long term agreed community investment/development ♦ **Community development and investment (both long and short term)** - e.g. health care facilities, micro-finance initiatives

Mining and Metals

Life Cycle Phase and Activity	Social	
	Risks	**Controls**
	area ♦ **Cultural / archaeological heritage -** - Damage to/destruction of cultural/ historical/ archaeological/ religious sites - Disturbance of family/community hierarchy/assets ♦ **Stakeholder/public consultation and disclosure -** local and national NGOs, local and national advocacy groups, badly managed social and community relations, negative exposure, compensation claims ♦ **Host country governance, national economy and revenue transparency** - impacts on local procurement and businesses e.g. 'boom and bust' effect, unregulated trade, sustainable growth and inflation, bribery, corruption and extortion ♦ **Strain on infrastructure and public nuisance** - strain on transport networks and local infrastructure including capacity of social infrastructure to absorb new/foreign populations (supply and demand) e.g. water resources, power, health, education, housing	♦ **Resettlement and relocation management** - including development proper compensation schemes, restoration of livelihoods and living standards ♦ **Site security plans** ♦ **Community health and safety plans** - vaccinations and awareness raising on communicable diseases ♦ **Resettlement and relocation plan** - community compensation strategy for land acquisition ♦ **Human resource policies** - maximization of local employment ♦ **Cultural / archaeological heritage plans** - including site / feature "watching brief" " (continuous visual monitoring) ♦ **Supply chain sustainability** - local procurement and supply chain management ♦ **Partnering with and supporting host governments -** - Encourage revenue transparency and good governance - Compliance with national / regional / local regulations
Resource Extraction	♦ **Community health and safety** - transport routes / vehicle accidents noise, dust and vibrations, emissions and air quality, 'fly rock' safety hazard ♦ **Social / community cohesion and exclusion of vulnerable groups** - Socio-cultural tensions between local and foreign workforce including possible social conflict and unrest - Economic and social exclusion of vulnerable groups ♦ **Loss of livelihood - economic displacement**- job competition and conflict between local and foreign workers	♦ **Community/stakeholder relations management -** - Management of interface between local communities and outsiders/foreign workers through stakeholder identification and consultation and disclosure (including governmental/national/regional/local stakeholders). - Management of community tensions, grievances and concerns through transparent formal grievance mechanism - Employee skills training in community relations management and cultural awareness - Management of relations with NGOs and national advocacy groups (through consultation and project disclosure) ♦ **Social / community baseline assessment** - establish

Mining and Metals

Life Cycle Phase and Activity	Social	
	Risks	**Controls**
	♦ **Communicable diseases** - spread of diseases to local/foreign populations ♦ **Land acquisition**- **displacement** -temporary and/or permanent resettlement - disruption to family/community hierarchy/assets ♦ **Employee health and safety** - employment and labour standards, child labour and employee health and safety ♦ **Cultural /archaeological heritage** - disruption to family/community hierarchy/assets ♦ **Stakeholder/public consultation and disclosure** - local and national NGOs, local and national advocacy groups, badly managed social and community relations, negative exposure, compensation claims ♦ **Host country governance, national economy and revenue transparency –** impacts on local procurement and businesses, unregulated trade, sustainable growth and inflation, bribery, corruption and extortion ♦ **Community health and safety and public nuisance** - strain on local networks and local infrastructure - Infrastructure and social services, capacity to absorb new/foreign populations (supply and demand) e.g. water resources, power, health, education, housing	community profiles (e.g. social hierarchy, ethnic groups, socio-cultural and religious practices, skills profile and public services/resources) in the project area, through detailed social baseline assessments to inform mitigation measures and the development of long term agreed community investment/development ♦ **Community development and investment (both long and short term)** - e.g. health care facilities, micro-finance initiatives ♦ **Resettlement and relocation management** - including development proper compensation schemes, restoration of livelihoods and living standards ♦ **Site security plans** ♦ **Community health and safety plans** - vaccinations and awareness raising on communicable diseases ♦ **Resettlement and relocation plan** - community compensation strategy for land acquisition ♦ **Human resource policies** **-** maximization of local employment ♦ **Cultural / archaeological heritage plans** - including site / feature “watching brief” ” (continuous visual monitoring) ♦ **Supply chain sustainability –** local procurement and supply chain management ♦ **Partnering with and supporting host governments** - Encourage revenue transparency and good governance - Compliance with national / regional / local regulations
Processing		
Smelting, Refining, Foundries, Electroplating (new build and existing opeartions)	♦ **As Mine Development** - Facility Construction	♦ **As Mine development** - Facility Construction

Mining and Metals

Life Cycle Phase and Activity	Social	
	Risks	**Controls**
Mine Closure		
Planning and Execution	♦ **Loss of livelihood** - **economic displacement** - loss of community financial support ♦ **Social / community cohesion and exclusion of vulnerable groups** - Socio-cultural tensions including possible social conflict and unrest - Economic and social exclusion of vulnerable groups ♦ **Loss of livelihood** - **economic displacement** - loss of income and employment - dependency on project related jobs ♦ **Land acquisition -loss of access** - inadequate land rehabilitation and restoration ♦ **Employee health and safety** - poor employment and labour standards, child labour and employee health and safety ♦ **Stakeholder / public consultation and disclosure** - local and national NGOs, local and national advocacy groups, badly managed social and community relations, negative exposure, compensation claims	♦ **Community development and investment (both long and short term)** - e.g. health care facilities, micro-finance initiatives ♦ **Rehabilitation and remediation management plan**

Mining and Metals

Key Considerations

1. Does the company process the mineral either at the mine or at ancillary sites?
2. What is the environmental compliance track record of the company? (Association with a company with a poor compliance record can give rise to potential reputation risk).
3. What procedures and/or resources exist to manage environmental risks (e.g. an environmental management system or personnel with specific responsibilities for risk mitigation)? Are these considered adequate?
4. What materials have been used to infill old workings and are there hazardous gas control systems in place?
5. Are there any onerous conditions attached to the consents and authorisations? Has the company made the necessary provisions to meet these conditions?
6. How does the company deal with biodiversity protection?
7. Has the customer planned for all the necessary provisions to restore and rehabilitate the site or to treat mine water?
8. How does the company deal with biodiversity protection?
9. How does the company tackle the issue of acid leaching from tailings dams/lagoons?
10. What wastes are produced and how are they disposed of?

Mining and Metals

Regulation and Best Practice

Permits, consents and licences are likely to be required for mining and metals operations, the specifics of which will depend on the relevant regulatory framework in the location of the facility/operation. In developing regions, weaker governance structures may mean that there is less stringent implementation of local controls and regulations or indeed there may be no controls at all. In such cases, the project proponent as a demonstration of Best Practice should ideally adopt international environmental and social standards and industry best practice.

In the case of almost all large-scale new build, expansion and development projects an Environmental and Social Impact Assessment (ESIA) will be required particularly where project debt financing is being sought. A comprehensive ESIA undertaken to international standards allows both the project sponsor and the investors to assess the full range of potential environmental and social impacts related to a project development, operation and decommissioning. Part of the ESIA process is to design appropriate mitigation measures and to set a framework for the monitoring the performance of these measures on a long-term basis. This limits and controls compliance and remediation costs as well as long term credit and reputation risks.

For smaller scale projects and operations a full ESIA may not be required. Focused studies on particular issues of concern may however, be helpful in identifying potential environmental and social risks associated with certain project activities.

The table below lists key international standards and publicly available best practice reference materials relevant to the mining and metals industry:

Mining and Metals

Source	Agency / Body
Multilateral	IFC Performance Standards http://www.ifc.org/ifcext/enviro.nsf/Content/PerformanceStandards World Bank Group Pollution Prevention and Abatement Handbook http://lnweb18.worldbank.org/ESSD/envext.nsf/51ByDocName/PollutionPreventionandAbatementHandbook World Bank Group: Energy Sector Management Assistance Program http://wbln0018.worldbank.org/esmap/site.nsf Greenhouse gas Protocol Initiative (a tool that can be used to determine the emissions of your specific project/industry) from the World Business Council for Sustainable Development http://www.ghgprotocol.org/templates/GHG5/layout.asp?type=p&MenuId=OTAx&doOpen=1&ClickMenu=No Intergovernmental Panel on Climate Change 'IPCC Special Report on Carbon dioxide Capture and Storage' http://arch.rivm.nl/env/int/ipcc/pages_media/SRCCS-final/IPCCSpecialReportonCarbondioxideCaptureandStorage.htm Stockholm Convention on Persistent Organic Pollutants http://www.pops.int/ UNESCO Conference on Indigenous People and http://portal.unesco.org/sc_nat/ev.php?URL_ID=3854&URL_DO=DO_TOPIC&URL_SECTION=201&reload=1092045126 EU Directive for Waste Management http://www.wbcsd.org/Plugins/DocSearch/details.asp?ObjectId=MTg4OTE The International Finance Corporation has a fund GEF grants support projects related to biodiversity, climate change, international waters, land degradation, the ozone layer, and persistent organic pollutants. http://www.ifc.org/ifcext/enviro.nsf/Content/GEF EU Policies: Integrated Pollution prevention and control. http://europa.eu/scadplus/leg/en/lvb/l28045.htm International Labour Organization: Mandate http://www.ilo.org/public/english/about/index.htm ILO's Lists of Subjects Standards have been decided upon- http://www.ilo.org/ilolex/english/subjectE.htm Security Issues and Human Rights - Voluntary Principles http://www.voluntaryprinciples.org/principles/private.php

Mining and Metals

Source	Agency / Body
Government	Environment Agency UK Monitoring Guidance notes for emission levels http://www.environment-agency.gov.uk/business/444217/444661/444671/466158/monitoring/?version=1&lang=_e Health and Safety Executive Noise Regulations (complete) http://www.hse.gov.uk/noise/regulations.htm Health and Safety Executive Guidance for Employers for the Control of Noise at Work Regulations 2005 http://www.hse.gov.uk/pubns/indg362.pdf Air Quality Criteria for Particulate Matter Environmental Protection Agency United States Government http://cfpub2.epa.gov/ncea/cfm/recordisplay.cfm?deid=87903 Environment Canada Convention on Biological Diversity http://www.ec.gc.ca/international/multilat/biodiv_e.htm - act Health Canada Guidelines on Noise in the Workplace http://www.hc-sc.gc.ca/ewh-semt/pubs/noise-bruit/insider7/index_e.html Traffic Noise Information and Recommendations http://www.hc-sc.gc.ca/ewh-semt/pubs/noise-bruit/insider8/index_e.html Canada Labour Code Federal Law and Regulations http://www.hrsdc.gc.ca/asp/gateway.asp?hr=/en/lp/lo/fll/part2/index-fll.shtml&hs=oxs
Industry Association	Extractive Industries Transparency Initiative http://www.eitransparency.org/ International Council on Mining and Metals http://www.icmm.com/ Mining Association of Canada An Action Plan for Reducing Greenhouse Gases http://www.mining.ca/www/media_lib/Energy/vcr2004.pdf Mining Association of Canada Tailings Assessment Protocol http://www.mining.ca/www/media_lib/TSM_Documents/TAILINGS_PROTOCOL_170306.pdf The Mining, Minerals and Sustainable Development (MMSD) Project funded International Institute for Environment and Development Room to Manoeuvre? Mining, biodiversity and protected areas http://www.iied.org/mmsd/mmsd_pdfs/manoeuvre.pdf