

ENVIRONMENTAL AUDITING ON MINING AND MINERALS



GUIDANCE FOR SUPREME AUDIT INSTITUTIONS

This publication was prepared by the INTOSAI Working Group on Environmental Auditing (WGEA). The WGEA aims to encourage the use of audit mandates and audit methods in the field of environmental protection and sustainable development by Supreme Audit Institutions (SAIs). The WGEA has the mandate to

- help SAIs gain a better understanding of the specific environmental auditing issues,
- facilitate exchange of information and experiences among SAIs, and
- publish guidelines and other informative material.

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ACCRONMS AND ABBREVIATION

BLM	Bureau of Land Management
BS	British Standard
CBD	Convention on Biological Diversity
CCD	Convention to Combat Desertification
CSD	Commission on Sustainable Development
CSR	Corporate Social Responsibility
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DSD	Division for Sustainable Development
EA	Environmental Assessment
EIA	Environmental Impact Assessment
EMA	Environmental Management Accounting
EMAS	European Eco-Management and Audit Scheme
FCA	Full Cost Accounting
GAO	General Accounting Office
ICC	International Chamber Of Commerce
ICME	International Council on Metal and Environment
IEAS	International Environmental Agreements
IFAC	International Federation of Accountants
INTOSAI	International Organisation Supreme Audit Institution
ISO	International Organisation for Standardization
JPOI	Johannesburg Plan of Implementation
LVGF	Lake Victoria Gold Field
NGOs	Non Governmental Organisations
NIMD	National Institute for Mina Mata Disease
OAG	Office of Auditor General
OECD	Organisation for Economic Co-Operation and Development
PIT	Pesticide in International Trade
PPP	Police Plans and Programme
RSA	Republic Of South Africa
SAI	Supreme Audit Institution
SAGE	Strategic Advisory Group On Environmental
SEA	Strategic Environmental Impact Assessment
UK	United Kingdom
UN	United Nations
UNCCD	United Nations Convention to Combat Desertification

UNCED	United Nations Conference on Environment and
Development	
UNEP	United Nations Environmental Programme
UNGA	United Nations General Assembly
US	United States
WGEA	Working Group on Environmental Audit
WSSD	World Summit on Sustainable Development
WHO	World Health Organisation

Foreword

The paper, *Auditing mining and minerals: Guidance for Supreme Audit Institutions* is written to be an indispensable resource for audit practitioners, describing

- what mining means, why it is important, what threatens it, and what action governments are taking;
- a suggested process for choosing and designing audits of mining and minerals; and
- practical guidance, information, and case studies related to audits of mineral and mining.

The writing of the paper was led by the SAI of Tanzania. I would like to thank the SAIs of Canada, Estonia, South Africa, Australia, Ethiopia and Kuwait for their inputs, review and comments. Many thanks also go to the other individuals who contributed to this paper

Auditing Minerals and Mining: Guidance for Supreme Audit Institutions is one of four guidance papers developed by the WGEA in the 2008–2010 work plan period. The other four papers are

- *Fisheries*
- Climate change.
- Forests
- Sustainable Energy
- Study on Natural Resources Accounting

INTOSAI WGEA Chair
INTOSAI

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EXECUTIVE SUMMARY

Country's economic development depends ultimately upon the extent and composition of its natural-resource base. All the commercial sources of energy like coal, oil, natural gas, and hydro power are natural resources Among others include the following:-

- The sector is likely to contribute to the development of economy of any country through taxes from large- scale mining companies and contribute to social – economic infrastructural development within the area where the mine is located ; Creation of employment opportunities both direct in the mines and indirectly on services to the mines,
- Improvement of human capital through provision of education and health services,
- Increasing foreign exchange reserves (reducing foreign exchange deficit),
- Improvement of infrastructure like roads and water supply; and
- Creation of other economic activities to support the mine instead of importing all supplies from abroad

Overview of environmental aspects of mining

Environmental impact of mining commences with exploration, extends through extraction and processing of minerals, and may continue to post closure of the operation with the nature and extent of impacts varying throughout the stages of project implementation. This guide is provides an introduction to environmental issues associated with mining activities, the relevant context where a SAI, might be evolved in auditing mining projects and extent to which environmental issues should be addressed by the private or public sector. The guide briefly mentions certain social impacts and primary physical issues. In this executive summary, we will introduce the main central key questions to be answered by the auditor when planning mining change audits

The most central audit criteria conducting audit mining and minerals

Selecting and determining the scope of audits of minerals and mining environmental impacts is a challenging to auditors, this has been the ground for designing a guide which will help Supreme Audit Institutions (SAIs) and auditors as they choose and design audits of minerals and mining environmental impacts. the guide present various ways of describing the scope from initial, ownership and access rights for exploratory purposes through mining and processing, to the use of the end product or disposal of waste materials. On the other hand the guide presents the responses of governments such as laws regulating mining/mineral activities.

For mining, this means focusing not only on the traditional economic concerns, but also on new social, economic and environmental concerns. This includes a wide range of conventions, protocols, declarations, treaties, standards, codes and recommendations relating to environmental social and economy norms. Chapter three is designed to help SAIs and auditors make sense of it all. It includes the following four basic steps.

Step 1: Identify the environmental threats of mining in your country

Step 2: Identify the government's responses to these threats in your country and relevant players

Step 3: Choose audit topics and priorities

Step 4: Decide on audit approaches: scoping the audit.

These steps are only suggestions, and they can be adapted to the situation and needs of a particular SAI. They can be used to define the objectives, scope, and criteria of a single audit of environment on minerals and mining. During the planning stage auditors are advised to understand the environmental problem and governmental responses in mitigating the negative consequences in the respective country.

Further, auditors should prioritise and limit the audit area. Also tips should be obtained and ideas on how to scope the audit. Finally, in Chapter 3, auditors will find information about 10 audit cases that have been conducted in different countries around the world. For each topic, auditors will find

- Sources of potential audit criteria from international conventions, legislation, policies, and programs
- Case studies.

These audits demonstrate that each SAI can play a major role in auditing their government's commitment to protect environmental impacts related to mineral and mining

Audits cases on mining activities

The main objective of having various audit cases which were done in various SAIs on mineral and mining is to give Supreme Audit Institutions (SAIs) information from around the world from these audit. Whenever possible, the examples include information on the audit objectives, scope, findings, and recommendations. Environmental audit on mining and mineral has been very fruitful theme. SAIs which will conduct Audits in this area will be able to raise the consciousness towards the relevance of mining problems and to improve the programmes of governments to solve these problems. To share experiences and audit methods improves the quality of the SAIs' work. Because of the great relevance of mining as a prerequisite for life.

The INTOSAI Working Group on Environmental Auditing recommends that SAIs (continue to) give attention to mining issues in their audit work. The Working Group also recommends SAIs to make use of the experiences on mining audits of their sister organizations within INTOSAI

The Working Group hopes that this paper will be helpful in this respect. The Working Group also hopes that SAIs will find inspiration to approach the audit of mining issues from new angles, to further develop audit skills and methods, and to share these experiences in the near future. In doing so we will further enlarge our shared body of knowledge and contribute to a world that is able to provide fresh mining to all people.

0 INTRODUCTION

Impacts on the environment can occur at most stages of mining, from exploration through to mine closure, and may result from both large- and small-scale mining operations. Impacts may affect natural media - water, soil, air - as well as human health. Public awareness about the environment has evolved considerably in recent years and the mining industry, increasingly responsive to public concern, is keen to demonstrate that mining activity can be compatible with environmental protection

The growing environmental agenda, along with the globalization and liberalization processes, has stimulated the development of new management tools, including instruments for improving decision-making and bringing about changes in behaviour, with the overall aim of improving the environmental performance of the industry. As a general rule, recovery, recycling and adoption of cleaner, low-waste technologies are the means by which waste generation and environmental damage in the mining and mineral processing industry can best be reduced. Solving environmental issues one at a time is usually not cost-effective. A single-medium approach to pollution control often shifts the problem to other sectors, where it exerts a different but equally damaging impact. A comprehensive, integrated and pro-active approach to environmental management is a requirement for progressive mining companies.

Environmental laws and regulations, established to ensure the protection of communities' ecological and social values, provide a stable framework within which investment and operational decisions can be made. Technical change and economic efficiency also contribute to the environmental management of non-renewable resources. The key to improving environmental performance is technology and innovations that reduce both production and environmental costs. The global character of the mining industry means that such technologies will be diffused and used in developing countries where mining and mineral processing operations have been on the increase in recent years

0.1 Importance of minerals and mining resources

The extraction of mineral resources forms the basic foundation on which the modern industrialized economics are built. There cannot be any manufacturing as also processing activity without the extraction activity. A country's economic development depends ultimately upon the extent and composition of its natural-resource base. All the commercial sources of energy like coal, oil, natural gas, and hydro power are natural resources

As such the importance of minerals and mining resources cannot be taken for granted because of the tangible benefits obtained from the mining industry. Among others include the following:-

- The sector is likely to contribute to the development of economy of any country through taxes from large- scale mining companies and contribute to social – economic infrastructural development within the area where the mine is located ; Creation of employment opportunities both direct in the mines and indirectly on services to the mines,
- Improvement of human capital through provision of education and health services,
- Increasing foreign exchange reserves (reducing foreign exchange deficit),
- Improvement of infrastructure like roads and water supply; and
- Creation of other economic activities to support the mine instead of importing all supplies from abroad

0.2 Overview of the expansion of minerals and mining activities over the years in the world

In the past, the governments in most countries were the key players in the minerals sector, few companies licensed to extract minerals and a few recognized traditional groups living in or near mineral reserves. While international organizations and financial institutions were active in aspects of minerals activities, their focus has changed over the past few decades. Other actors, including non-governmental

Organizations (NGOs) and consumers have also become more involved in recent years and focused greater attention on the minerals sector. The number of constituencies and their demands are thus far more diverse today. At every level, from the international to the local, there are constituencies who consider themselves legitimate voices in the minerals sector .At times, their claims of legitimacy can be difficult to evaluate.

Throughout the 1990s, mining companies – both large and small – became more international, driven by changing regulatory structures, falling ore grades in well-established mining countries such as Canada and Australia, and the opening up of several mineral-rich developing countries to foreign investment. But the industry, despite its interdependence – from exploration through mining, metal production, smelting, fabrication, and recycling – remains fragmented, lacking a consolidated

vision. This has significant implications for any collective action towards sustainable development.

0.3 International Awareness regarding environmental impacts of mining and minerals

The United Nations and other international organizations play a role in development of mining and mineral and the associated environmental impacts, the following programme has been directly involved in mining and minerals ;

- United Nations Environment Programme (UNEP)
- United Nations Conference on Trade and Development (UNCTAD)
- United Nations Department of Economic and Social Affairs (DESA)
- United Nations Industrial Development Organization (UNIDO)
- International Labour Organization (ILO)
- World Bank Group

United Nations Environment Programme (UNEP)
Division of Technology, Industry and Economics (DTIE)

The initiatives on mining, minerals and environment within UNEP DTIE are aimed at integrating environmental criteria into mining and mineral development, thus ensuring that the sector contributes to national development in the long term (sustainable development). Activities are focused on enhancing governmental and corporate policies and practices concerning mining operations, and to encourage leadership among key stakeholders concerning scientific, regulatory and technical development of the industry. This should take place in a broad development framework aimed at achieving more sustainable production and consumption patterns at global and national levels.

Work has in recent times focused on information exchange covering best practice mining operation, tailings management, accident prevention and preparedness, regulatory and management practice, and the role of the financing sector in enhancing environmental performance. Extensive training material has been produced to support the above, as well as development of a programme of information exchange on environmental issues generally. [<http://www.uneptie.org/pc/mining>]

International Labour Organization (ILO)

The International Labor Organization (ILO) has been dealing with labour and social problems of the mining industry since its early days, making considerable efforts to improve the working and living conditions of those in the mining industry from the adoption of the Hours of Work (Coal Mines) Convention (No. 31) in 1931 to the Safety and Health in Mines Convention (No. 176), which was adopted by the International Labour Conference in 1995.

Labor and social issues in mining cannot be separated from other considerations, whether they be economic, political, technical or environmental. While there can be no model approach to ensuring that the mining industry develops in a way that benefits all those involved, there is clearly a need that it should do so. The ILO also works closely with other international organizations, bringing the social and labour dimension of mining to their attention and collaborating with them as appropriate. The ILO has been associated with the Mining, Minerals and Sustainable Development (MMSD) project. The ILO's objective is to ensure that all mineworkers have the opportunity for decent working conditions in an industry that contributes to sustainable development.
[<http://www.ilo.org/public/english/dialogue/sector/sectors/mining.htm>]

Other important international agreements deal with mining issues is described in Chapter 3 and also [Appendix 9: Provides](#) links to UN Agencies with specific Internet resources on mining, UN Agencies with activities in the mining sector, Informational, Independent Initiatives, Government, Industry, Non Governmental Organizations (NGO, Commercial / Financial, Academic / Research / Consulting

0.4 Essence for the INTOSAI WGEA to conducting Environmental Audit on mining and minerals

Environmental auditing has been a mainstream activity in many Supreme Audit Institutions (SAIs): many environmental audits ranging from river basin management, pesticide regulation, sustainable development reporting, insecurity, climate change, waste incineration, and international Environmental agreements, etc have been conducted since its establishment —

These audits have been having significant impact on many governments' Management of environment and sustainable development issues around the world,

using the INTOSAI Auditing Standards as a basis, the INTOSAI Working Group on Environmental Auditing decided to develop a guide containing guidelines and methodologies for the conduct of environmental audits of the environmental impacts and mining in order to address to SAls the basis for understanding the nature of environmental auditing in mining sector. This basis is intended to provide a starting point from which each SAI can use this guidance material to conduct various categories of audits of environmental impacts in mining. It is therefore a very important tool for the further development of the practice of environmental auditing by SAls. The major features to consider in audit of mining are:-

- The potential environmental and financial risks and liabilities carried out before a company merger or site acquisition or divestiture (e.g. contaminated land remediation costs);
- Environmental impacts of a product throughout all stages of its design, production, use and disposal, including its reuse and recycling (cradle to grave).
- Mining company's activities relate to an environmental issue or (e.g. global pollution, energy use) or an evaluation of a specific issue (e.g. buildings, supplies);
- Risks and contingency planning (sometimes merged with environmental auditing because of the interconnected impacts of industrial processes and hazards);
- Audit of a particular site to examine actual or potential environmental problems and
- Activities that may cross company departments or units (e.g. energy or waste management)

0.5 Content and structure of the document,

Chapter One	<ul style="list-style-type: none">▪ Background information on mineral and mining sector▪ Nature of mineral.▪ It defines the environmental problem on land ,water and air▪ It describe the main threat of mineral and mining to the environment their causes and consequences
Chapter Two	<ul style="list-style-type: none">▪ national and international responses to the environmental problems▪ explanation on how can environment can be protected e.g. through environmental impact mitigation measures by companies, good regulation and legislation and international conventions and treaties
Chapter Three	<ul style="list-style-type: none">▪ Approach in choosing and designing audit of mineral and mining, four steps are shown in this chapter. The steps will help the auditor to choose and prioritize the audit topics in their countries
Chapter Four	<ul style="list-style-type: none">▪ Contains case studies on the audit of mining activities the case studies were conducted by SAI's around the world.
Chapter five	<ul style="list-style-type: none">▪ Chapter five consist of good auditing practices and finally
Appendices	<ul style="list-style-type: none">▪ Consist of glossary and link to relevant audits and publishes document

1. CHAPTER ONE

Background on mining and mineral

1.1 Definition of mining

Generally mining can be defined as the extraction of valuable minerals or other geological materials from the earth, usually from an ore body, vein or (coal) seam. Materials recovered by mining include base metals, precious metals, iron, uranium, coal, diamonds, limestone, oil shale, rock salt and potash. Any material that cannot be grown through agricultural processes, or created artificially in a laboratory or factory, is usually mined. Mining in a wider sense comprises extraction of any non-renewable resource (e.g., petroleum, natural gas, or even water). <http://en.wikipedia.org/wiki/Mining>

Mining operations are easily recognizable. By nature of what mining means – digging, removing soil and overburden, and separating out ores and non-metal minerals – these operations leave behind environmental “footprints”. Such “footprints” can have a number of different effects – at worst seriously limiting the ability of surrounding communities to earn and sustain their livelihood, particularly in areas where communities rely on their natural environment to provide food, shelter, transport, and other opportunities.

By its inherent nature, mining impacts on land, water and air which are the essential components of the environment. Among the Environmental issues associated with mining can include erosion, formation of sinkholes, loss of biodiversity, and contamination of groundwater and surface water by chemicals from the mining process, contamination of the areas surrounding the mines due to the various chemicals used in the mining process as well as damaging compounds and metal removed from the ground with ores, water produced from mine drainage, mine cooling, aqueous extraction and other mining process increase the potential for these chemicals to contaminate the ground and surface water

1.2 Types of Mines and Nature of Minerals

There are four main types of mining: dredging, surface mining, underground mining and in-situ mining.

Dredging

this is a high-volume mining technique for low-value products near a plentiful source of water. Scoops/buckets are used to extract material from shallow water (often man-made lagoons). A high-tech variation of this is undersea mining, where material is sucked from the seafloor (although the only successful application of this to-date has been for gem diamonds in shallow waters). The mining process is usually combined with the processing (typically drying and concentration) on a floating barge, which is anchored in the middle of the lagoon.

Surface Mining

Surface mining is used when deposits of commercially useful minerals or rock are found near the surface; that is, where the *overburden* (surface material covering the valuable deposit) is relatively thin or the material of interest is structurally unsuitable for tunneling (as would usually be the case for sand, cinder, and gravel). Where minerals occur deep below the surface—where the overburden is thick or the mineral occurs as veins in hard rock—underground mining methods are used to extract the valued material. Surface mines are typically enlarged until either the mineral deposit is exhausted, or the cost of removing larger volumes of overburden makes further mining

Called 'Open-cast' if soft-rock mining (eg coal or limestone) and 'Open-pit' if hard-rock mining (e.g. copper and diamonds). The mining process is fundamentally different between these soft- and hard-rock operations. For further information on surface mining

Underground Mining

Refers to various underground mining techniques used to excavate hard minerals, mainly those minerals containing metals such as gold, copper, zinc, nickel and lead, but also involves using the same techniques for excavating gems such as diamonds. In contrast soft rock mining which refers to excavation of softer minerals such as salt, coal or oil sands.

In underground mining access to mineral is through vertical shafts or inclined roadways (adits). There are usually two access routes (one for men and materials, and one for the ore) for safety and for ease of ventilation (fresh air comes in one and is then exhausted out of the other).

Once at the correct depth, horizontal tunnels are driven to reach the ore deposit. These are permanent structures so require strong roof supports (often including 'bolts' into the rock to tie the layers together for strength). In contrast, tunnels into the ore deposit itself are often temporary, and so the support is less substantial. Transport for men and materials can be by train, truck or man-riding conveyor belts.

In- situ Mining

There are two main types of in-situ mining; solution and thermal. Solution - Involves the injection of water down drill holes into soluble deposits (most commonly salt). The mineral-rich solution is then pumped back to the surface.

Thermal - Although only still at the research stage, it is theoretically possible to burn coal insitu (by creating cracks, then injecting oxygen and a heat source) and recovering the resultant heat (in effect, an underground power station without going to the trouble of extracting the coal). This has happened spontaneously in numerous areas (particularly in India) but the difficulty has always come in controlling the burning process

1.2.1 MINERALS

A mineral is a naturally occurring solid formed through geological processes that has a characteristic chemical composition, a highly ordered atomic structure, and specific physical properties. A rock, by comparison, is an aggregate of minerals and/or mineraloids, and need not have a specific chemical composition. Minerals range in composition from pure elements and simple salts to very complex silicates with thousands of known forms.

To be classified as a true mineral, a substance must be a solid and have a crystalline structure. It must also be a naturally occurring, homogeneous substance with a defined chemical composition.

There are at least 150 identified minerals, most of which are so esoteric as to be unrecognizable to the layman. several dozen are the key building blocks of our society – iron, coal, nickel, aluminum, mineral sands, gold, oil and other hydrocarbons, the more exotic vanadium and tantalum are examples.

Gold

Gold is a chemical element with the symbol Au, is a highly sought-after precious metal in jewelry, in sculpture, and for ornamentation since the beginning of recorded history. The metal occurs as nuggets or grains in rocks, in veins and in alluvial deposits. Gold is dense, soft, shiny and the most malleable and ductile pure metal known. Pure gold has a bright yellow color and luster traditionally considered attractive, which it maintains without rusting in air or water

Production

After initial production, gold is often subsequently refined industrially by the Walkill process or the Miller process. Other methods of assaying and purifying smaller amounts of gold include parting and inquartation as well as cupellation, or refining methods based on the dissolution of gold in aqua regia. Since the 1880s, South Africa has been the source for a large proportion of the world's gold supply, with about 50% of all gold ever produced having come from South Africa. Production in 1970 accounted for 79% of the world supply, producing about 1,000 tonnes. However by 2007 production was just 272 tonnes. This sharp decline was due to the increasing difficulty of extraction, changing economic factors affecting the industry, and tightened safety auditing. In 2007 China (with 276 tonnes) overtook South Africa as the world's largest gold producer, the first time since 1905 that South Africa has not been the largest.

Other major producers are the United States, Australia, Russia and Peru. Mines in South Dakota and Nevada supply two-thirds of gold used in the United States. In South America, the controversial project Pascua Lama aims at exploitation of rich fields in the high mountains of Atacama Desert, at the border between Chile and Argentina. Today about one-quarter of the world gold output is estimated to originate from artisanal or small scale mining. The world's oceans hold a vast amount of gold, but in very low concentrations (perhaps 1–2 parts per 10 billion, e.g. every cubic kilometer of water could contain 10 to 20 kg of gold).

Environmental impacts of gold

Before the health effects of mercury were recognized, miners used it to purify and consolidate their fine gold. Unfortunately, in the process mercury was often released into the streams. It was learned that emissions of mercury into the environment could have serious long term effects on human and animal health. Mercury does not biodegrade very easily, and it accumulates in the tissues of fish, amphibians, and invertebrates over a long period of time. When these animals are consumed, the mercury is absorbed into the body at a higher concentration, which can cause neurological disorders and even death. Post warnings about

fish consumption are kept in many rivers, lakes or other water bodies which are near to the mining; this is often due to the bioaccumulation of heavy metals like mercury and other contaminants. Cyanide, chlorine and similar caustic chemicals which are used to extract gold from ore.

Diamonds

In mineralogy, diamond is the allotrope of carbon where the carbon atoms are arranged in an isometric-hex octahedral crystal lattice. After graphite, diamond is the second most stable form of carbon. Its hardness and high dispersion of light make it useful for industrial applications and jewelry. It is the hardest known naturally occurring mineral. It is possible to treat regular diamonds under a combination of high pressure and high temperature to produce diamonds that are harder than the diamonds used in hardness gauges.^[2]

Diamonds are specifically renowned as a material with superlative physical qualities; they make excellent abrasives because few substances can scratch them. As a result they hold a polish extremely well and retain their lustre. Approximately 130 million carats (26,000 kg (57,000 lb)) are mined annually, with a total value of nearly USD \$9 billion, and about 100,000 kg (220,000 lb) are synthesized annually.

The main producing regions are Africa, Russia, Australia and Canada. About \$US70 billion is spent every year by jeweler buyers. The stones are cut in Mumbai, New York, Johannesburg and Israel; the diamond marketing capital of the world is Antwerp in Belgium. The 90 million pieces of jeweler sold each year contain about 30 million carats of diamonds, only a proportion of the 180 million carats or so mined.

Uranium

Uranium is the most controversial source of energy with deep divisions between those who see it as a way of mitigating greenhouse gas emissions and opponents who argue it is a threat to mankind. Vast energy is released by splitting the atoms of certain elements, notably those in the radioactive mineral uranium.

The technology was first developed in the 1940s, and during the Second World War research initially focused on producing bombs by splitting the atoms of either uranium or plutonium. While the debate over the safety of “peaceful” nuclear energy continues, the world is continuing to embrace its use for generating electricity. One-sixth of the globe’s power now comes from nuclear power stations, and in some countries they are the biggest source of

electricity. At least 30 countries have commercial nuclear reactors, with a third of world capacity in the United States. More than 200 nuclear power stations are in the planning stages or proposed around the world. More than half of the world's mine production of uranium is from Canada, Australia and Kazakhstan. Niger, Namibia, Uzbekistan and the United States are also significant producers. Australia has by far the biggest reserves. Uranium is mined in much the same way as other minerals, in either open cuts or underground mines and sometimes as a by-product to copper or gold mining. The race to build more reactors has been stimulated by the emissions of greenhouse gas from coal and oil-burning power stations

Silver

Silver is a chemical element with the chemical symbol Ag, silver is soft, white, lustrous transition metal, it has the highest electrical conductivity of any element and the highest thermal conductivity of any metal. The metal occurs naturally in its pure, free form (native silver), as an alloy with gold (electrum) and other metals, and in minerals such as argentite and chlorargyrite. Most silver is produced as a by-product of copper, gold, lead, and zinc refining.

Silver has been known since ancient times and has long been valued as a precious metal, used to make ornaments, jewelry, high-value tableware, utensils (hence the term silverware), and currency coins. Today, silver metal is used in electrical contacts and conductors, in mirrors and in catalysis of chemical reactions. Its compounds are used in photographic film and dilute solutions of silver nitrate and other silver compounds are used as disinfectants. Although the antimicrobial uses of silver have largely been supplanted by the use of antibiotics, further research into its clinical potential is in progress.

Coal

Coal is defined as a combustible, sedimentary, organic rock formed from ancient vegetation that has been consolidated between other rock strata and transformed by the combined effects of microbial action, pressure and heat over a considerable time period

There are plentiful deposits of coal around the world, although economics and geography limit the use of many. More than 5 billion tones of coal a year is mined, most of it thermal coal. Despite widespread concern about emissions of carbon dioxide, a significant greenhouse gas, the figure is expected to increase rapidly in the next two decades, particularly in Asia. For example China itself mines about half the world's coal and is also a major importer. The United States produces about a fifth of the world total with India, Australia and South Africa other significant sources.

Environmental impacts of coal

Coal mining can result in a number of adverse effects on the environment. Surface mining of coal completely eliminates existing vegetation, destroys the genetic soil profile, displaces or destroys wildlife and habitat, degrades air quality, alters current land uses, and to some extent permanently changes the general topography of the area mined. This often results in a scarred landscape with no scenic value, though rehabilitation can mitigate some of these concerns.

Mine tailing dumps produce acid mine drainage which can seep into waterways and aquifers, with consequences on ecological and human health. If underground mine tunnels collapse, this can cause subsidence of land surfaces. During actual mining operations, the potent greenhouse gas, methane, may be released into the air. And by the movement, storage, and redistribution of soil, the community of microorganisms and nutrient cycling processes can be disrupted.

Aluminium

Aluminium or aluminum is a silvery white and ductile member of the boron group of chemical elements. It has the symbol Al;. Aluminium is the most abundant metal in the Earth's crust, and the third most abundant element therein, after oxygen and silicon. It makes up about 8% by weight of the Earth's solid surface. Aluminium is too reactive chemically to occur in nature as a free metal. Instead, it is found combined in over 270 different minerals. The chief source of aluminium is bauxite ore.

General use of aluminum metal

Aluminum is the most widely used non-ferrous metal. Global production of aluminum in 2005 was 31.9 million tones. It exceeded that of any other metal except iron (837.5 million tones). The biggest producers are China, Russia, the United States, Canada and Australia.

Some of the many uses for aluminum metal are in:

Household aluminum foil

- Transportation (automobiles, aircraft, trucks, railway cars, marine vessels, bicycles etc.) as sheet, tube, castings etc
- Packaging (cans, foil, etc.)
- Construction (windows, doors, siding, building wire, etc.)
- Cooking utensils

- Street lighting poles, sailing ship masts, Walking poles etc
- Outer shells of consumer electronics, also cases for equipment eg photographic equipment.
- Electrical transmission lines for power distribution
- MKM steel and Alnico magnets
- Super purity aluminum (SPA, 99.980% to 99.999% Al), used in electronics and CDs.
- Heat sinks for electronic appliances such as transistors and CPUs.
- Substrate material of metal-core copper clad laminates used in high brightness LED lighting.
- Powdered aluminum is used in paint, and in pyrotechnics such as solid rocket fuels and termite.
- In the blades of prop swords and knives used in stage combat.
- Aluminum is widely used in watch production as it provides durability and resists tarnishing and corrosion.

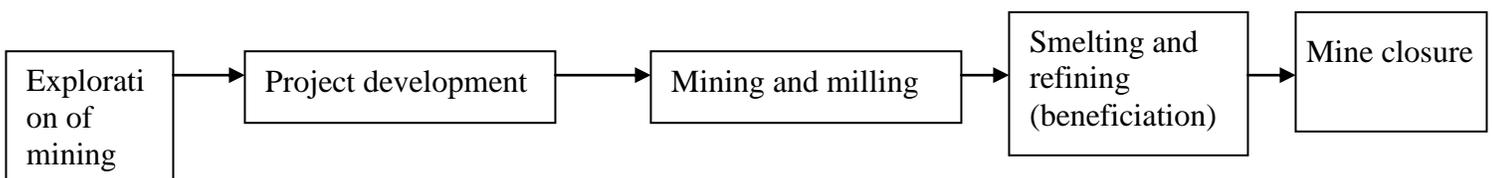
Mineral Sands

Mineral sands are a class of ore deposit which is an important source of zirconium, titanium, thorium, tungsten, rare earth elements, the industrial minerals diamond, sapphire, garnet, and occasionally precious metals or gemstones.

Heavy mineral sands are placer deposits formed most usually in beach environments by concentration due to the specific gravity of the mineral grains. It is equally likely that some concentrations of heavy minerals (aside from the usual gold placers) exist within streambeds, but most are of a low grade and are relatively small

1.3 Life Cycle of Mining (Mining Processes)

In this section the auditor is provided with the logic of mining, various phases of mining are explained and the associated impact in each phase and the suggested good practice of what environment should. To start with the five basic phases to mining are as shown below follows



Activities associated with each phase of mining.

1.3.1 The exploration phase of mining:

Exploration activities encompass all actions in the field which precede feasibility studies. This include initial reconnaissance flights and geophysical surveys, stream sediment studies and other geochemical surveys, construction of access roads, clearing of test drilling sites, installation of drill pads and drilling rigs, benching, trenching/pitting, erection of temporary accommodations, and power generation for exploratory drilling

The potential environmental implications of exploration depend on a number of factors, notably the following:

- Construction of new access routes
- Proximity of surface waters to drill sites (particularly those used for potable water abstraction)
- Ecological significance of affected habitat, and the extent to which access has been improved as a result of exploration
- Proximity to and intrusion upon existing settlements or resources utilized by local or indigenous people
- Extent to which local or indigenous communities are voluntarily isolated, or have been exposed to diseases prevalent among exploration workers.

The potential significance of the environmental and social disruption associated with exploration has often not been recognized, although experience suggests that this is increasingly the first point of conflict on many such issues. Exploration impacts may be controlled by measures such as restricting land clearance to the minimum required, removal or disabling of access infrastructure, use of helicopter access for personnel and equipment wherever practicable, developing plans for managing contact with local communities, and rehabilitation of abandoned exploration sites.

Potential environmental impacts on Exploration phase of mining

1. Land alienation from protection options;
2. Camp garbage
3. Trail/road and trenching erosion
4. Disruption of habitat as well as harvesting and fishing activities;
5. Noise pollution; and
6. Acid mine drainage

1.3.2 The mining development phase

The development phase may include such activities as the following:

- (1) Overburden stripping and placing;
- (2) Drilling and trenching;
- (3) Road/trail, building and/or helicopter transport;
- (4) Erection of treatment plants, preparation of disposal areas, and construction of service, infrastructure such as power line or generating plants, railways, water, supplies and sewerage, laboratories and amenities.

1.3.3 Mining and milling

The mining and milling phase may include such activities as the following:

- Feasibility, engineering design, and environment impact assessment studies;
- Mine construction and pre-production – underground mining, surface mining in open pits or placer deposits and can include hydraulic mining in or near riverbeds.
- Stripping/storing soil and vegetation overburden;
- Ore extraction;
- Crushing or grinding of ore;
- Flotation or chemical concentration of ore;
- Mine and surface water treatment, and
- Storage of waste rock and tailings

Potential environmental impacts on mining and milling phase of mining

- a) Wildlife fisheries habited loss
- b) Changes in local water balance
- c) Increased erosion and sedimentation of lakes and streams
- d) Containment of toxins in tailings ponds or leaching solutions
- e) Tailings ponds or leaching pads stability failure;
- f) Potential acid generation from waste rock and pit walls;
- g) Heavy-metal leaching from acid mine drainage;
- h) Cyanide solution containment at heap leach operations;
- i) Contamination of surface water and ground water from discharge of acid mine drainage including heavy metals originating in ore and tailings, and organic chemicals and cyanide originating from milling processes;

- j) Alienation of land as result of waste rock piles and tailings disposal areas; and Noise and wind-borne – dust

1.3.4 The smelting and refining (Beneficiation)

The smelting and refining phase may include such activities as subjecting minerals concentrate to high heat or electro – chemical process to form ingots or bars of pure metal or alloy. On site processing may include combination to reduce particle size, flotation using selected chemicals, gravity separation or magnetic, electrical or optical sorting, and ore leaching with a variety of chemical solutions. Associated transport storage of ore and concentrates may be a handling risk which can result in localized site contamination.

Potential environmental impacts on smelting and refining (Beneficiation) phase of mining

- Heavy metals, organics and sulphur dioxide emissions to air;
- Discharges of toxic chemicals, such as sulphuric acid and ammonia used during processing;
- Alienation of land as a result of the generation of slag and High energy consumption resulting in indirect environment impacts

1.3.5 Mine Decommissioning

Mine decommissioning usually occurs at a point in the life of an operation where the economic recovery of minerals has ceased. The overall mine decommissioning process is integrated with the overall mine operation planning process. In other words, the mine should be designed and operated with a continual focus on closure outcomes.

Factors contributing to cessation of mining activities include:

1. Depletion of mineable reserves;
2. Changes in market conditions;
3. Financial viability of the company; or even adverse environmental or political conditions

The mine closure phase may include such activities as:

1. Recon touring of pit walls and waste dumps
2. Covering of reactive tailing dumps
3. Decommissioning of roads
4. Dismantling of buildings

5. Re-seeding/planting of disturbed areas
6. Ongoing monitoring
7. Possible treatment for water quality
8. Other mine reclamation activity; and
9. Abandonment

Mine decommissioning ultimately determines what is left behind as a benefit or legacy for future generations. If decommissioning and closure are not undertaken in planned and effective manner, chances are that the site will continue to be hazardous and a source of pollution for many years to come. The overall objective of mine closure is to prevent or minimize adverse long-term environmental (physical, social and economic) impacts, and to create a stable landform suitable for some agreed Mine Decommissioning

Decommissioning and closure plans

Issues to consider in developing a reclamation plan include:

- Long term stability of impoundments, slopes, and surface materials
- Safety issues relating to open pits, shafts, subsidence, toxic, or radiological hazards
- The physical characteristics, nutrient status, and inherent toxicity of tailings or waste rock which may constrain re-vegetation
- The potential for acid drainage from abandoned pits and shafts, tailings, and waste rock dumps (as a consequence of oxidation of sulfides contained in the ore or wastes)
- The potential for methane generation in and emission from coal mines
- The costs of ongoing and post decommissioning rehabilitation.

The socioeconomic aspects of decommissioning are also important, particularly where the existence and economic survival of large communities may depend on a mine. Aside from loss of incomes, the provision of services—such as water, sewerage, electricity, and health care—may be directly linked to the mine. All these issues should be factored into post-closure plans which are adequately costed.

Planning for and progressively implementing effective mine decommissioning can produce significant benefits both during and at the end of operations. These benefits

Include:

1. continually reduces liabilities by optimizing rehabilitation works undertaken during the productive phase of mining operations rather than deferring costs to the end of the project; provides a basis for estimating rehabilitation costs prior to final closure so that sufficient financial and material resources can be set aside; tests rehabilitation designs and/or

processes in a site specific fashion and allows for scrutiny of the outcomes, with feedback during the active mine life; reduces double-handling of waste materials and topsoil;

2. reduces area of land disturbance through use of smaller waste landforms and mining paths, and in some circumstances progressive backfilling; Identifies areas of high risk as priorities for ongoing research and/or remediation;
3. Facilitates the direct involvement of operations personnel in achieving mine rehabilitation outcomes;
4. Facilitates the involvement of key stakeholders (especially local communities) in setting priorities for mine rehabilitation;
5. Reduces ongoing responsibilities for the site and facilitates timely relinquishment of tenements and bond recovery; and
6. Eases impacts on local communities that may be economically reliant on mine operations

Potential environmental impacts on mining decommissioning and closure phase of mining

- Seepage of toxic contaminants, such as heavy metals, into surface and ground water from acid mine drainage;
- Wildlife and fisheries habited loss;
- Alienation of land; re-vegetation failure
- Wind-borne dust; and Slope and tailings impoundment failure causing discharge of contaminants and sediments to water

Below is an exhibit that summarizes the above physical environmental impacts of mining and the time frame of an impact in each phase of mining process and proposed mitigation of the impact,

Exhibit 1: Summarized physical environmental impacts of mining

Phase	Activity	Physical impact	Time frame	Mitigation
general		Energy consumption Climate change Abandoned equipment Loss of cultural or archaeological heritage sites Effects on indigenous populations Loss of biodiversity	Life of mine Permanent Long term Permanent Permanent Can be permanent	Energy conservation measures Adequate dismantling and disposal Evaluate risks prior to operations Public consultation Consultation, community relations Rehabilitation
Exploration	Access road construction	Potential influx of population may lead to increased natural resource use	Potentially long term	Minimize where possible
	Line cutting	Removal of vegetation Soil erosion Possible habitat destruction	Short-term if mitigation	Minimize line width, Re-vegetation where necessary
	Trenching and pitting	Land scars Danger to fauna, livestock	Short term	Infill after sampling, mapping. Re-vegetation
	Drilling	Noise and vibration (impact is dependent on proximity to settlements) Land clearing for drill sites Soil and water contamination by oil spills	During drilling only Short term Rare and minor in General	Discussions with public to minimize nuisance Re-vegetation Good maintenance of machinery.
Mining	In general	Plant and mine noise Blasting vibrations Health and safety related to explosives handling Loss of land Solid waste	Life of mine Life of mine Life of mine Can be permanent Life of mine	Adoption of stringent safety procedures Rehabilitation where possible Implement good disposal practices

Phase	Activity	Physical impact	Time frame	Mitigation
Mining (cont.)	Strip or open-cast	Vegetation removal Increased soil erosion Diversion of water courses Increased sediment load in rivers	Life of mine Life of mine Life of mine to permanent Can continue post-mine	Reclamation by infill of depression with waste rock, replacement of topsoil, revegetation Reclamation as above Reclamation as above
	Open-Pit	Land scar plus potential danger to inhabitants and fauna	Permanent	Stabilization of pit walls Block access to the area - poses long term liability problems Pits may be used for waste disposal or filled with water (reservoir/recreational facility)
	Shallow underground (less than 300 m deep)	Collapse over workings Acid mine drainage (surface and underground water contamination due to acidity and dissolved metal content)	Potentially long term well after mine closure Syn- and post-mine	Stabilise workings with waste rock Seal workings
	Deep underground	Land subsidence Disposal of mine water Acid mine drainage Seismic disturbances	Potentially long term Actual mining Long term, potentially permanent Actual mining and post-mine	Infill with mine waste stabilised with cement; revegetation Discharge into streams if good quality. Use in processing. Treatment of poor quality water prior to discharge Neutralization with lime; use of manmade wetlands (densely planted reed beds to neutralize acidity and precipitate metals) if small volumes are involved. This is a major environmental problem in South Africa.
	Waste rock and Overburden disposal	Visual impact Land alienation Airborne dust Acid drainage Erosion leading to increased sediment loads	Long term to permanent Long term to permanent -mine Actual mining and post-mine	Landscaping and revegetation of dumps. Use of waste as backfill in underground mines Spraying with water. Rehabilitation as for visual

Phase	Activity	Mitigation	Time frame	Physical impact
		Burning discard dumps (coal)	Actual mining Long term	Rehabilitation as for visual Compaction, covering and revegetation to prevent air ingress
Ore processing/plant operation	Roaster plants and smelters	SO ₂ , NO _x , As ₂ O ₃ emissions can lead to air pollution. Fallout can cause soil and water Contamination Disposal of smelter wastes (slag). Dumps may cause visual impact	Emissions are life of mine Potentially long term Post mine-life, potentially permanent	Installation of filters on stacks. Conversion of recovered SO ₂ to sulphuric acid Depends on mitigation of emissions Reclamation of dumps
	Other plants (tailings, the process wastes are dealt with separately)	Process water discharge can lead to soil contamination and water pollution Use of hydrological resources Hazardous chemicals handling and disposal	mine life mine life mine life	Recovery of effluent for recycling as process water. Treatment of process effluent solutions (e.g. cyanide destruction) prior to release into tailings dams. Maximize use of recycled process water. Chemicals handling, storage and disposal procedures
	Heap leach operations	Contamination of surface and underground waters by cyanide bearing solutions	-mine and potentially post-mine life	Line leaches pads. Design of closed circuit to recycle leaching solutions. Treatment of waste solutions to break down cyanide
	Tailings dams	Water pollution from seepage, windblown dust Water logging of adjacent land Wind blown dust Tailings erosion Tailings rupture - release of toxics (e.g. cyanide) Intoxication of wildlife drawn to water	All impacts are Actual mining and post-mine life and may be long-term	Line tailings dam. Seepage trenches. Treatment of process waters prior to damming Line tailings dam. Collect and recycle Water in seepage trenches. Monitor water levels in adjacent land Revegetation Revegetation Emergency situation. Sound Engineering design; continuous Monitoring and verification of dam stability. Prepare emergency plans Block access to tailings dam area

		Land loss Visual effect	Permanent Permanent	Revegetation and rehabilitation in order to allow future use of land Landscaping and re-vegetation
Phase	Activity	Physical impact	Time frame	Mitigation
Access and energy infrastructure	Access roads	Function of proximity to suitable access to infrastructure and energy sources as well as proximity to protected areas, water bodies May cause population influx	Long term	
Mine towns/construction camps	Worker influx	Forest degradation; water supply contamination; destruction of fauna Sewage	Long term, potentially permanent Life of mine town	Construct necessary facilities
Decommissioning post closure Activities		Acid drainage Subsidence Waste dumps	Long term (100's years)	See mining and processing operations Above

1.4 Small-scale and artisanal mining

Most of the activities and associated impacts described above in **section 1.2** relate to industrial/large mining operations. However, in some countries, such as Brazil and the Philippines, small-scale mining is also important and may dominate the sector—for example, in Tanzania less than 3,000¹ people are employed in industrial mining operations compared with more than 500,000 in small-scale mining using artisanal techniques. These typically involve rudimentary methods of ore extraction and processing, normally Small-scale and artisanal mining activities can have a severe impact on the social, physical and ecological environments

The main effects related to small scale and artisanal mining can be summarized as follows: contamination of water, soil and air with mercury; deforestation, destruction of vegetation cover, land degradation, erosion and loss of fertile soils; rapid sedimentation of natural lakes, marshlands and riverbeds; alteration of natural topography and of the structure and dynamics of rivers, with negative effects on navigation and regional waterway communications; land-use conflicts due to the fact that the best available agricultural soils often overlay alluvial gold deposits; alteration of the structure and dynamics of aquatic communities and ecosystems; and instability of the terrain.

The use of mercury in small-scale gold mining affects human and animal populations, even those indirectly involved, including the unborn, through peripheral contamination or introduction into the food chain. It has been estimated that for every gram of gold recovered, two grams of mercury are released into the environment, often resulting in fatalities and in permanently ruined habitat.

For small-scale mining, cooperative bodies or government must assume the environmental management roles normally attributed to enterprises. Safe working methods need to be encouraged through miners' cooperatives. There should be more use of demonstrations of safer, cleaner technologies and practices for small operators. Ecologically damaging technologies and practices (and reagents) should be discouraged by providing suitable alternatives to mercury or cyanide, for example.

¹ *The World Bank, Environment Department March 1998. (environmental assessment source book, Number 22-update)*

Technology is, however, only as effective as its good operation, and an ecologically sound operation remains at the heart of good performance. This is especially valid within small mining activities. In general, the miners have no solid educational background and no management skills to approach the different operations in a systematic way. As general conditions are already difficult, the environment is also the least of their problems.

In order to ensure systematic consideration for the environment, the activities of the small mines will require assistance from the authorities controlling the operation. A detailed plan should be established by them in cooperation with other partners. The objective of such a plan will be to develop a code of practice for environmental management and rehabilitation of disturbed land and river areas within a mine site, area or region, including the setting of appropriate environmental quality objectives and control measures. This plan can be implemented in the context of a regional development plan because of the integrated nature of the associated problems in this sub sector, and should have several phases. It should be observed that these phases must form a continuous process and should be interrelated in scope and time. Government should play a significant role in developing this environmental management approach.

Small-scale projects usually only require a review of environmental factors. Site-specific assessments which will form the basis for the "environmental management agreement" contract (as part of the mining lease) should be carried out. This is equivalent to an environmental impact assessment (EIA). If possible, depending on available resources (both human and financial), an individual environmental review to collect further baseline data should be carried out. This should be done in close consultation with the miners in order for them to understand the mechanism involved.

The environmental review has one drawback: it describes the environmental situation of the area only at the time of the review. Therefore, some form of management system is necessary to ensure regular monitoring and follow-up. For mining leases authorizing small-scale operations, a common rehabilitation fund should be established whereby the lessee pays a prescribed annual fee for the purpose of rehabilitation and to enable the State to take any remedial measures to minimize the destructive effect of mining and revitalize ex-mining lands for beneficial use. Part of the fund may come from the State.

Apart from information in exhibit 1 above which explain physical impact of mining on environmental and their corresponding mitigation, Exhibit 2 below, describes the link between mining threats of on environment, social and economy, their causes and consequences

<ul style="list-style-type: none"> ▪ Social concerned 	<p>waste.</p> <ul style="list-style-type: none"> ▪ Resettlement 	<ul style="list-style-type: none"> ▪ Loss of livelihood and cultural heritage or religious sites ▪ Effects of indigenous people
<p>Potential water problems/pollutants</p> <ul style="list-style-type: none"> ▪ Hydrogeology and water quality 	<ul style="list-style-type: none"> ▪ Suspended solids and sediment from runoff and processing operations; ▪ Acids from various processes; <p>Heavy metals from waste and concentrates around the site; sulphate, thiosulphate, polythionates, etc, from acid drainage; arsenic and other salts from oxidised mine waters;</p> <ul style="list-style-type: none"> ▪ Mercury if used in the process, or from ores; ▪ Cyanide if used in leaching processes; ▪ Oil and fuel from ancillary operations; 	<ul style="list-style-type: none"> ▪ Oxidation of iron content adds de colouration and deoxygenating of waters due to the problems of metal toxicity. ▪ Excessive discharge will damage natural ecosystems and affect local fisheries and may deprive downstream population of a clean water supply. ▪ Wildlife habitat loss ▪ Alienation of land ▪ Re-vegetation failure ▪ Effects on surface and ground water resources
<p>Possible air contaminants</p> <ul style="list-style-type: none"> ▪ Air quality 	<ul style="list-style-type: none"> ▪ Dust from the site or from processing; ▪ Natural gas from underground mines 	<ul style="list-style-type: none"> ▪ Pollutants disease or death. ▪ Increase potential for respiratory disorders

	<ul style="list-style-type: none"> ▪ Heavy metals, organics, 	
<p>Other pollution impacts</p> <ul style="list-style-type: none"> ▪ Occupational and public health concerns 	<ul style="list-style-type: none"> ▪ Drainage from mining sites; ▪ Pollution from mining operations in riverbeds; ▪ Effluent from minerals processing operations; ▪ Sewage effluent from the site; ▪ Oil and fuel spills ▪ Soil contamination from treatment residues and spillage of chemicals; ▪ Leaching of pollutants from tailings, disposal areas and contaminated soils; ▪ Air emissions from minerals processing operations; ▪ Dust emissions from sites close to living areas or habitats, and sulphur dioxide emissions to air discharge of toxic chemicals such as sulphuric acid and ammonia used during processing. 	<ul style="list-style-type: none"> ▪ Hazards from process chemicals or explosive ▪ Severe poisoning – potential increase in disease vectors <p>Alienation of land as a result of the generation of slag.</p>

1.5 Sustainable development and mining

This section provide an over view of the concept of sustainable development and mining, after seeing the phases in mining and their environmental, social and economical threats, the auditor can now compare or have a fully understand on what are the sustainable mining.

Several countries have attempted to define sustainable development more specifically as it relates to the mining and minerals sector. The definitions from Australia and Canada as an example are detailed below.

How Australia define sustainable development for mining ²

In Australia, the Ecologically Sustainable Development Working Group on Mining has defined sustainable development for the mining sector as: "...ensuring that the mineral raw materials needs of society are met, without compromising the ability either of future societies to meet their needs, or of the natural environment to sustain indefinitely the quality of environmental services (such as climate systems), biological diversity and ecological integrity".

How Canada define sustainable development for mining ³

In Canada, Natural Resources Canada (NRCan) has defined sustainable development for the mining sector as:

"finding, extracting, producing, adding-value to, using, re-using, recycling and, when necessary, disposing of mineral and metal products in the most efficient, competitive and environmentally responsible manner possible. NRCan recognises that these activities must be carried out in consultation with, and respecting the needs and values of, other resource users and maintaining or improving environmental quality for present and future generations."

To assist in the implementation of sustainable development practices in the mining sector, NRCan developed six major objectives:

- Integration of the concept of sustainable development in federal decision making affecting the minerals and metals industry.
- Ensuring the international competitiveness of Canada's minerals and metals industry in the context of open and liberal global trade and investment framework.

² Source

³ Source

- Advancement of the concept of sustainable development of minerals and metals at the international level.
- Establishment of Canada as a global leader in promoting the safe use of minerals and metals, and their related products.
- Promotion of Aboriginal involvement in minerals and metals related activities.

Provision of a framework for the development and application of science and technology to enhance the industry's competitiveness and environmental stewardship

Traditionally sustainable development has been described as:

“Development that meets the needs of present generations without compromising the need the ability of future generations to meet their own needs” More specifically, this term refers to a more integrated approach to environmental management and protection that is characterized by three distinct pillars which should interact holistically and in a harmonized manner.

1.5.1 Pillars of sustainable development

Mineral resources are extracted because their sale generates wealth and their use provides a stream of benefits. Mineral resources provide the material basis for a developed society. However, mineral extraction, processing, use, and disposal can entail environmental and social costs therefore sustainable development is build on three main pillars which are:

- Environment
- Social development and
- Economic development

1.5.1.1 environmental aspects

- The location of mineral resource deposits is a result of earth processes
- Extraction and processing change the form of mineral resources, and also generate wastes
- Processes such as recycling and conservation can never be totally effective
- Some minerals are toxic at certain concentrations and in certain chemical forms.

1.5.1.2 Social aspects

- In-migration resulting from mineral development can alter the demographics of an area, which in turn can lead to pressures on local cultures and indigenous populations;
- Mine closure can lead to out-migration that destabilizes communities and reduces the funds available for government services;

- Consumption patterns and social preferences affect the rate of mineral development, use and disposal.
- Social equity necessitates that intra- and inter-generation costs and benefits be fairly balanced

1.5.1.3 Economic aspects

- Countries or regions can become dependent upon extractive industries in ways that limit economic diversity, development and expansion;
- Mineral prices are cyclic leading to industry booms and busts;
- The mineral industry generates jobs, income and foreign exchange earnings that can be invested in other forms of natural, human, human built and social capital. Chapter five gives some details of sustainable auditing

2. CHAPTER TWO

2.1 National and International responses on the environmental problems

2.1.1 National responses on the environmental problems

Laws regulating mining/ mineral activities are increasing in scope and stringency based on the paradigm of “sustainable development” clearly stimulated in chapter 5 of this paper.

However, in comparison to laws at the national level, international laws typically lack the conventional enforcement mechanisms found with command and control regulatory frameworks and instead they rely more on political will and common sense. These laws can apply across the full spectrum of the mining life cycle from initial ownership and access rights for exploratory purposes, through mining and processing, to the use of the end product or disposal of waste materials.

Governments have a variety of legal powers and tools that they can use to address environmental problems and activities. Legal powers include legislation (acts of parliament or congress), regulations, permits, licences bylaws, and ordinances. Governments have different roles and responsibilities over the whole mining process including environmental issues associated with mining operations.

KEY QUESTION: *Are there obligations that will influence national policies? Can they be used as audit criteria?*

2.1.1.1 Environmental policies and regulations

Environmental laws and regulations have the primary goal of ensuring the protection of communities' ecological and social values. They provide a stable framework within which investment and operational decisions can be made and a SAI or an auditor can use them as source of criteria during planning of the audit of mining and mineral.

Environmental regulation alone is unlikely to solve environmental problems especially in countries with endemic production inefficiency. The environmental approach of State-owned enterprises can reflect inefficient operating regimes, excess capacity, breakdowns and shutdowns, and poor management procedures which often contribute to worsening pollution.

At best, environmental regulation comprises one element of a public policy for environmental management of the mining sector. It has therefore been argued that in addition to environmental regulation, public policy to promote technical change and foster economic efficiency is most likely to contribute to sustained and competitive improvement in the long-term environmental management of non-renewable resources. This is true, as environmental degradation is greatest in operations working with obsolete technology, limited capital and poor human resource management. It is also relevant for small-scale mining operations.

Matters covered by environmental regulation may include:

- Environmental impact assessment or other environmental planning;
- Nature conservation, national parks, protection of flora and fauna, endangered species;
- Cultural heritage, indigenous cultures, landscape protection, and scientific sites;
- Water quality protection;
- Clean air laws to limit air emissions and human exposure;
- Control of soil contamination and land protection from weeds and pests; and
- Other issues such as noise, waste disposal and chemicals control sometimes regulated by environmental laws.

Mining legislation may include regulatory provisions relating to:

- Safety of structures and operations, limiting exposure to chemical hazards;
- Wastewater retention and treatment, management of contaminated runoff;
- Soil erosion control and revegetation during and after operation;
- Solid waste disposal; and
- Restoration of sites and disposal of equipment.

Of the matters generally covered by environmental regulation, the major issues for mining companies are emissions (effluent and air emission standards); habitat and wildlife protection; and rehabilitation and mine safety, including tailings dams.

2.1.1.2

Regulatory Controls and Instruments

The instruments available to Governments for influencing environmental practices in the mineral industry can be divided into the following three categories, discussed below:

- I. Environmental regulations (administrative regulations);
- II. Education and training; and
- III. Economic instruments

Environmental regulations

In order to encourage a high level of government accountability and achieve continuous improvements, a regulatory system should advocate a pollution reduction ethos and involve negotiation between the government agency and the mining company on acceptable standards. Prescriptive regulations can be unduly restrictive and quickly become outdated in the face of advances in technology.

"Command and control" policies are representative of the early era of environmental regulation, but they still dominate the approach to environmental regulation in many countries. These policies are characterized by a reliance on predetermined environmental standards which have to be observed by mine operators. The standards are often general in nature, applying to all industries and all parts of the country. The Government's role is to establish the standards

and to enforce them through monitoring operations and levying penalties on operators that do not observe them. Command-and-control mechanisms tend to rely on administrative agencies and judicial systems for enforcement.

the response of the mining industry to command-and-control mechanisms was largely reactive over the past few decades, companies are anxious to improve their reputation and act as "good corporate citizens". In addition, the introduction of international standards setting out guidelines for the development and implementation of EMS has helped many companies to assess their risks and impacts and to establish management systems to minimize them. As a result, Governments can go beyond the traditional incremental and punitive type of environmental regulation and address the real causes of environmental management shortcomings - lack of capital, technology and skills, including the ability to innovate.

Many companies and a number of industry associations have favoured self-regulation, arguing in support of the ability to manage them. Self-regulation is also a way to ensure that agencies/companies are responsible and accountable for the environmental consequences of their choices and actions. Thus, in countries where a system of environmental regulations and standards does not yet exist, the mining company must itself ensure that all likely issues are competently addressed. The disadvantage to this approach is that industry compliance with environmental requirements might not be achieved.

Education and training

Legal provisions must be enforced if they are to be meaningful, and enforcement problems often result from shortages of adequately trained staff and equipment. Hence the importance of education and training programmes, particularly increasingly, proactive programmes of research, information, education and training, incentives and awards for good performance should be undertaken to supplement the regulatory approach. These programmes can be very effective in small operations, such as small-scale mining. The industrial licence and permit fees in many countries are established so as to recoup at least some of the costs of these programmes.

Economic instruments

There has been growing interest in the use of market-based economic instruments, which are preferable to the command and control approach. The internalization of environmental and social externalities helps to reflect the true costs of mineral production and to arrive at the real costs and benefits of development programmes. This process will involve the adoption of a package of policies, including command and control and market-based instruments. It will involve decisions such as timing, how much to internalize, and the use of market-based instruments including taxes and charges. Some confusion arises because of the different regulatory tools used by agencies, such as environmental criteria, ambient standards, discharge standards and site and discharge permits, and as a result economic instruments are often more talked about than applied.

Mining codes

Mining is unique among industrial activities in requiring a set of regulations of its own, usually embodied in a mining law or mining code. A country's mining code is the combination of statute law, regulations and agreements which governs the allocation, tenure and operation of mining rights. Separate legislation usually covers foreign investment, taxation, foreign exchange, labour, environmental and other regulatory matters. Increasingly, environmental protection is being included in mining legislation and so has to be viewed as part of the mining operation, alongside exploration, mining, metallurgical processing and marketing.

2.1.1.3

Institutional issues

It is becoming more common for environmental ministries to focus on the development of environmental protection criteria and standards, approve planning procedures and review EIAs, while mining ministries undertake the implementation work of administering plant permits, regulating discharges and supervising rehabilitation bonds.

Appropriate practices should be identified and required outcomes and objectives should be clearly defined. These practices and objectives then need to be promoted at the different levels of Government to ensure consistency of approach and effective policy coordination between

Government agencies. In addition, the role of the various Ministries concerned, such as Finance, Planning, Environment, Land Resources and Labour, needs to be clearly defined in relation to mining operations, thus avoiding duplication of functions. It is essential to adopt a coordinated approach towards environmental policy and its implementation by the various Government agencies involved.

Strategic Environmental Assessment is a useful way of ensuring that policy-making takes into account sustainability principles in an integrated fashion

2.1.1.4 Industry codes and voluntary agreements

Faced by an ever-growing and ever-widening environmental challenge, the mining industry has tended to promote greater corporate responsibility rather than new regulations or tougher enforcement. Thus, industry associations have been leading promoters of voluntary environmental agreements, codes of conduct and charters and are playing a proactive role, including holding dialogues with stakeholders, and researching and serving new environmental needs of member companies. Companies are increasingly asked to report on their environmental performance, and this reflects the growing attention now also being paid to corporate accountability.

Voluntary agreements generally seek to achieve environmental standards beyond what the law requires - standards which anticipate future regulations becoming more stringent as public opinion evolves

2.2 International Conventions and Treaties

International laws and its relation to mining

The mining sector is increasingly subject to international law, encompassing a wide range of conventions, protocols, declarations, treaties, standards, codes, and recommendations relating to environmental, social and economic norms.

In comparison to laws at the national level, international law typically lacks the conventional enforcement mechanisms found with command and control

regulatory frameworks, instead it relies more on political will. These laws can apply across the full spectrum of the mining life cycle from initial ownership and access rights for exploratory purposes, through mining and processing, to the use of the end product or disposal of waste materials.

Traditionally, international law has taken a "hands-off" approach to mining. It is a general principle of international law that nation-States have sovereignty - that is, supreme, independent political and legal control - over their own natural resources, just as they do over persons, companies and other entities within their borders. Perhaps the most famous expression of this sovereignty doctrine is in Principle 21 of the Stockholm Declaration:

"States have, in accordance with the Charter of the United Nations and the principles of international law, the sovereign right to exploit their own resources pursuant to their own environmental policies, and the responsibility to ensure that activities within their jurisdiction or control do not cause damage to the environment of other States or of areas beyond the limits of national jurisdiction." Individual state sovereignty over resources is no longer an absolute. International constraints have developed and are continuing to develop in three ways:

- The bedrock international environmental law principle that States are responsible for preventing transponder environmental harm to other States
- The undertakings and agreements of specific treaties and
- The emerging principles of sustainable development

These factors have made "international environmental law" grow at amazing speed. There are over 1,000 international treaties and other legal authorities focused on the environment, most developed since. We do not, as yet, have a comprehensive international law of mining. In part, this is because States are naturally reluctant to give up their sovereign control over such an important part of their economies. In part, it is because of the very primitive state of international law, which lacks conventional law-making bodies (having no true legislature, executive or judicial branches). In part, it is because most international law lacks conventional command-control enforcement, leaving compliance largely to the political will of the

individual sovereign States. Finally, in part, it is because all international law is not created equal; some international rules are classed as legally binding or "hard law" (chiefly treaties and litigation), while others are viewed as non-binding, inspirational, or "soft law" (such as United Nations and other international bodies' declarations, resolutions, statements of principles, guidelines, etc.)

International laws of both the "hard" and "soft" nature (and in-between) are increasingly focusing on mining. While the industry does not yet have to deal with anything like uniform, specific international standards applicable worldwide, it does face specific instances of hard law "international standards" and is increasingly being targeted by soft law. Soft law, while not binding per se, cannot be ignored, because it has the tendency to become a hard or binding part of the legal framework given sufficient time and State recognition. The following is an overview of the existing state of international law respecting mining - hard, soft, and in-between.

Binding or "hard" international law

Though there is no comprehensive international law of mining, still a number of treaties or conventions have provisions regulating the industry. Typically, these mining-related treaties use very general language, lack adequate enforcement regimes, and focus on only a small portion of one of the three phases of mineral development and marketing:

- (1) Access,
- (2) Process, and
- (3) Product controls.

Mining process control

There is no comprehensive treaty governing land-based mining activities. Exploration, development, mining, beneficiation, closure, rehabilitation and liability are still primarily under the jurisdiction and laws of the individual States, which of course vary enormously in requirements and enforcement.

Access law carry over

The access laws just discussed can create international law requirements that carry over into the mining process. With respect to deep seabed mining, the Convention on the Law of the Sea sets up the framework for developing a complete regime of

operational law. With respect to terrestrial mining, the nature/biodiversity treaties can also increase the controls on mining. A recent example is the Crown Butte Mines Company New World Mine site adjacent to Yellowstone National Park, a listed site under the World Heritage Convention. Above); had mining been allowed to proceed, the permits would likely have been conditioned with extraordinary environmental requirements because of United States concern over protecting Yellowstone and not jeopardizing its listing under the treaty. Similarly, when EIA laws the findings of the study can reveal the need to condition the permits with special environmental requirements controlling the operation.

Water quality treaties

Other examples of international hard-law standards intruding on the mining process are the various international and regional treaties governing water quality. These include a number of treaties respecting marine pollution from land-based sources, vessels, and dumping and pollution of fresh water resources, Oil and gas production and mining operations whose wastes can reach any of the covered water bodies need to pay especially close attention to the requirements of and future developments in these treaties, as many set relatively concrete international standards.

The Regional Seas Treaties Programme of the United Nations Environment Programme (UNEP), initiated in 1974, is making concrete the requirements of the Law of the Sea Convention through sponsorship of some 13 regional conventions to date which protect regional seas from pollution, including the Baltic, Mediterranean, Persian Gulf, Red Sea, Caribbean, East Africa and South Pacific, involving more than 125 States. The 13 treaties are not homogeneous, but tailored to the priorities of the Governments in each region.

The programme is implemented by UNEP headquarters in Nairobi, Kenya, through its Oceans and Coastal Areas Unit (website: <http://www.unep.org/water/regseas/regseas>). Each treaty develops a one- or two-year Action Plan, approved at regional Intergovernmental Meetings and monitored by regional Bureaus or Monitoring Committees of the parties. Regional secretariats have been established in Athens, Greece; Kingston, Jamaica; and Bangkok, Thailand; and the Unit serves as the secretariat for the Regional Seas Action Plans for regions where financial constraints prevent the establishment of local staff. UNEP's treaties, guidelines and other programmes focusing on prevention of marine pollution merit a

watchful eye by resource-based economies, as they could serve as the springboard for even more rigorous regulation of mineral industry practices in the future.

In addition to UNEP's work, there are other treaties with provisions for development in or affecting oceans (*Armstrong* 3-9), including the 1974 Paris Convention for the Prevention of Marine Pollution from Land-Based Sources (applicable to parts of the North Atlantic, Arctic Ocean and North Sea), the 1972 Oslo Convention for the Prevention of Marine Pollution by Dumping from Ships and Aircraft and the 1973 London International Convention for the Prevention of Pollution from Ships (MARPOL) and its 1978 Protocol.

Air pollution treaties

Air pollution from mining, smelting and related operations is still regulated chiefly by national laws. However, there are several international air laws that have potential implications for the future of the mining industry.

The LRTAP Heavy Metals Protocol is of serious concern to the metal mining/smelting industry, both because of its air quality restrictions and because it could ban certain metal production processes and products when their use or disposal could lead to trans boundary air pollution. At present, it concentrates primarily on emissions of lead, cadmium and mercury; not content with the conventional reliance on reducing lead in petrol, the focus is on industrial sources of heavy metal emissions (iron and steel industry, non-ferrous metal industry) and on combustion processes (power generation, road transport and waste incineration). Also being considered are measures to reduce the heavy metal content in products, such as mercury and cadmium in batteries; mercury in electrical components, measuring instruments and fluorescent light tubes; cadmium and lead stabilizers and pigments in paints and plastics, etc. Some EU countries are urging that it also ban the mercury cell process for production of chlorine and caustic soda (in favour of newer membrane technology) and entry of metal-containing products into municipal waste streams which could result in metals emissions from municipal incinerators).

Even more significantly, the 1992 United Nations Framework Convention on Climate Change and 1997 Kyoto Protocol provide a comprehensive approach for controlling "greenhouse gases" (GHGs), those chemicals which form a heat-trapping layer in the

upper atmosphere and contribute to "global warming", chiefly carbon dioxide and methane. The COP has been struggling for some years to agree on enforceable rollbacks in the rate of increase of these emissions, nominally targeted at a return to or below 1990 levels. However weak or strong the emerging rules become, they will have a profound effect on the mining industry. The mineral industry in general will be affected, to the extent its processes release CO₂, methane and other GHGs, but the fossil fuel sectors of the industry - in particular coal and petroleum - will be profoundly affected by this treaty's developments, as it moves the world away from its dependence on utilizing carbon-based sources for energy (websites: <http://www.unfccc.de>).

Mining product control

A paradigm shift is occurring in the way the global community (and therefore international law) views mining products - a change from the historical view of them as beneficial "commodities" to seeing them as polluting "chemicals". This see-commodities-as-chemicals view is manifesting itself in a movement toward international treaty restrictions on trade in certain mining end-products, even outright bans. The trend is to control waste or pollution by controlling or banning the use of the commodity in trade, recycling and/or products.

Banning actual products

The metals-banning trend, lead by international environmental groups and sympathetic EU countries, has expanded to general consumer products. As examples: In 1996, the EU proposed a ban on use of cadmium, mercury, chrome, PVC and lead (except in batteries) in motor vehicles sold within the Community; in 1997, it proposed a ban on the use of cadmium in products which would outlaw nickel-cadmium batteries; one of its members, Denmark, has proposed a ban on virtually all products containing lead (except batteries); and the World Health Organization (WHO) has raised questions about copper in drinking water which could affect the use of copper in piping, roofing and building materials and other products. The proposed draft LRTAP Heavy Metals Protocol and other developing air, water, and land pollution control laws are also focusing on minerals in a way that can ultimately affect products which use those resources.

Another initiative of relevance is the development by UNEP and FAO of an internationally binding treaty requiring prior informed consent (PIC) procedures for international trade in certain hazardous chemicals (including metals). As conceived, PIC is an information exchange requiring that importing countries be advised of health or environmental bans or restrictions on chemicals and give formal acceptance to their importation. The EU has urged that PIC be expanded into a "global framework agreement" for management of hazardous chemicals, a position the mining industry opposes, making this UNEP/FAO programme an important one to follow, particularly for importing countries.

Litigation and the courts

In the absence of clear cut international standards of liability and effective international dispute-resolution forums, there is a growing potential for *national courts* stepping in and filling the void. Courts of both developed and developing countries are accepting and adjudicating international rights - in discrete personal injury, property damage and/or resource impairment cases, both civil and criminal - and in the process creating international law. The International Court of Justice and other international tribunals take very few cases, so it is accepted that international law can be pronounced by "judicial decisions...of the various nations" (*Statute of the International Court of Justice, Article 38(1)(d)*), and national courts are taking advantage of this power.

New international judicial standards are being created for the mining industry in three venues: (1) by courts in developing countries where mining is occurring, (2) by courts in developed countries where companies are incorporated or headquartered and (3) by courts of some developed countries applying their own national laws extraterritorially.

In the courts of mining States, more and more citizens, environmental organizations, communities and government bodies are suing mining operations at the locus where the mining or processing is occurring. Such suits, long familiar in some developed countries like the United States, are appearing in the courts of developing countries as well. A famous example is the Chañaral case in Chile, in which citizens successfully sued a division of the State-owned Codelco copper company in the late 1980s for remediation of the environmental damage done by years of dumping of its mineral-processing

tailings in the Salado River and Bay of Chañaral. Similarly, in the Huasco case, olive tree farmers and fishermen successfully sued Compañía Mineral del Pacífico for air and water pollution remediation at its pellet plant in Huasco. In another example, a local court in Turkey cancelled the gold mining licence of Eurogold, a multinational French-Australian-Canadian mining company, in a 1997 lawsuit brought by local villagers fearful the company's cyanide process would pollute their region.

Even more ominous for the industry are the criminal prosecutions of Marcopper Mining Corporation managers for that company's 1996 toxic tailings spill on Marinduque Island in the Philippines, which has so far resulted in criminal cases against three of its international managers, civil fines of over US\$2 million, a US\$42 million class action by the local Government, US\$800,000 paid so far in claims from local families, US\$15 million in remediation, and a US\$40 million investment writeoff by 40 per cent owner Placer Dome Inc. of Canada.

Mining companies are not safe at home, either. Citizens of mining States are suing mining operators in the courts in developed countries where they are headquartered. A notorious recent example is the Ok Tedi case, in which Papua New Guinea landowners near the open pit copper-gold mine filed a US\$4 billion suit for tailings dumping against majority owner BHP Minerals at its business residence in Melbourne, Australia in 1997, the mining operation agreed to pay a US\$30 million settlement over 13 years to the landowners and is engaged in a programme of community development projects at over US\$3 million per year which it hopes can be a model for the mining industry worldwide. Similarly, residents of Ecuador and Peru chose United States federal courts to sue Texaco for over US\$1 billion for air, water and soil pollution arising out of its historical oil and gas operations in Ecuador. Likewise, an Indonesian tribal group filed its US\$6 billion lawsuit in the United States against Freeport McMoRan Inc. over environmental damage and human rights violations at its mine in Irian Jaya.

some countries, particularly the United States, have shown both a political and a judicial tendency to attempt to enforce their domestic laws "extraterritorially", on persons and operations in other countries. Most national laws do not apply extraterritorially, except where enacted to support a treaty as this would be

viewed as a violation of the other country's sovereignty. Most United States environmental laws fall into this category, the one partial exception being the EIA requirement of the United States National Environmental Policy Act, which is imposed on some United States Government actions overseas by Executive Order and in territories without a sovereign, like Antarctica

International financial institutions and their environmental requirements

The "greening" of international financial institutions (IFIs) is one of the major new trends spurring the development of international environmental standards for mining. Increasingly, multilateral development banks (MDBs), multilateral and bilateral development assistance agencies, and other public and private finance and insurance institutions are conditioning their loans, aid, underwriting and other involvement on the target project's (and host country's) environmental acceptability, particularly with regard to mining projects.

This "green conditionality" comes in two forms:

- (1) The use of EIAs to screen projects in advance of approval and, to a lesser extent so far,
- (2) Actual operating conditions and requirements imposed on projects to promote sustainable development.

This greening is not simply altruism. The international financial institutions have been the targets of "extensive criticism" for supporting environmentally destructive and unsustainable projects and have been embarrassed by several recent disasters at mines financed by them in developing countries. In addition, the institutions' new sustainable development requirements are also influencing progressive changes in the national law requirements of resource-based economies

Multilateral development banks

MDB imposes environmental/sustainable development criteria on loan assessments, The World Bank Group has been in the forefront of developments, although its four legally and financially independent component entities are at

somewhat different stages of progressiveness in promoting sustainability in the projects the support

The International Bank for Reconstruction and Development (IBRD, or World Bank) is the Group's chief lending arm for loans and guarantees to member Governments. While not the Group's most active arm in resource development, it participates in some mining projects (US\$14 million in 1994). Responding to international criticisms in the 1980s it created an Environment Department and began developing operational directives and rules addressing its supported projects' environmental impacts, involuntary resettlements, concerns of indigenous peoples, and NGO involvement (website: <http://www.worldbank.org>). Its environmental-sustainability rules are fast becoming an international standard. Primarily, they require EIAs for projects with potentially substantial environmental, social or other impacts, and these EIAs are typically prepared by the borrower. The World Bank has also developed environmental standards for mining, although these remain "guidance" and are rarely included as explicit loan conditions.

The International Finance Corporation (IFC) is the largest multilateral source of loan and equity financing for private sector projects in the developing world. Its particular focus is to promote economic development by encouraging the growth of productive enterprises and efficient capital markets in its member countries (website: <http://www.ifc.org>). IFC has extensive experience in financing mineral resource projects in the developing world, through its Oil, Gas & Mining Department. IFC has been involved in over 50 mineral projects in 30 countries, to the extent of US\$352 million in 1994 alone. While it generally follows the World Bank rules for EIAs and technical standards, its standards are viewed as "lower" by critics

Very active in the minerals sector, the Multilateral Investment Guarantee Agency (MIGA) is the chief insurance entity within the World Bank Group. It insures private investors against non-commercial risks, including political instability, government defaults, currency liquidity, etc. (website: <http://www.miga.org>). Its lack of an environmental staff and its failure to do EIAs has embroiled the Bank in disasters at two MIGA-insured gold mines in Guyana

The United Nations Revolving Fund for Natural Resources Exploration (UNRFNRE), headquartered in New York City, is the branch within the United Nations Development Programme (UNDP) that has promoted mineral exploration in the developing world. While its funds have been much more limited than other international governmental lenders, its 25 donor Governments have funded 29 exploration projects leading to the discovery of 16 economically viable mineral deposits since its inception in 1973 (*UNDP/UNRFNRE 2*). It adopted Environmental Protection Guidelines in 1994 similar to the World Bank's; in 1995 initiated a "Revitalization Plan which gives greater impetus to environmental regeneration and to the promotion of sound mining activities

UNCED: The Rio Declaration

In 1992, the United Nations convened the "Earth Summit," A very ambitious Agenda 21 was adopted by consensus,. Framework treaties on biodiversity and climate change were signed, but left all substantive regulations to be developed later. Instead of a forestry treaty, UNCED parties could agree only on a "Non-legally Binding Authoritative Statement of Principles".

of great significance to resource-based economies dealing with mineral development is Rio Principle 10, which calls for increased public participation in environmental issues: citizen access to environmental information from their Governments, opportunity to participate in environmental decision-making, and effective access to courts and agencies for redress and remedies. Principles 11 and 13 call on States to enact "effective environmental legislation" and laws of "liability and compensation" for victims of environmental damage. "Indigenous people" and "local communities" are positively singled out; States should support their "identity, culture and interests" and enable their effective participation in sustainable development (22). Rio Principle 14 urges an end to the "export" of toxic substances and harmful activities from one State to another. Principle 17 makes EIAs generally accepted procedure for all activities likely to have a significant adverse environmental impact. And Principles 18 and 19 restate the longstanding international environmental laws of "timely notification" and "good faith consultation" for environmental emergencies and transponder impacts.

Developing nations were accorded special treatment in Rio, as they were in Stockholm, with priority to be given their "special situation and needs" with

acknowledgement of the "common and differentiated responsibilities" among States (thus placing greater responsibility on developed nations because of their greater financial and technical resources and greater consumption and pollution) and with recognition that developed-country standards may be economically and socially unwarranted for developing countries

UNCED: Agenda 21

To implement the Rio Declaration, UNCED also produced an extremely detailed and ambitious action plan for accomplishing the Rio principles in the 21st century, Agenda 21. Agenda 21 has countries around the world developing "national action plans," with the new United Nations Commission on Sustainable Development (UNCSD) and other international agencies promoting implementation. Overlooked by many, the development and implementation of these Agenda 21 action plans at the country level should stimulate considerable interest and involvement on the part of resource-based economies and others interested in mineral resources, given their potential to be the vehicle for greater planning requirements and restrictions on mineral resource development.

Agenda 21 provide a programme for integrated planning and management of land resources. Its "broad objective is to facilitate allocation of land to the uses that provide the greatest sustainable benefits. Its specific objectives are "to review and develop policies to support the best possible use of the land and the sustainable management of land resources", "to improve and strengthen planning, management and evaluation systems", "to strengthen institutions and coordinating systems" and "to create mechanisms to facilitate the active involvement and participation of all concerned, particularly communities and people at the local level, in decision-making on land use and management". For most countries, implementing even a portion of the suggestions would radically change the resource planning and allocation process.

Also it include Changing Consumption Patterns, which urges reduction in unsustainable demand for natural resources, greater efficiency in the use of energy and resources, minimizing generation of wastes and environmentally sound pricing , Protecting and Promoting Human Health, which calls for extensive health protections in the industry and energy sectors;

In Chapter 13 of agenda 21 Mountain Development, suggesting alternatives to minerals development to prevent soil erosion, landslides, and loss of habitat and genetic diversity; Agenda 21 also proposes two programmes relevant to the mining sector, one on inter firm cooperation with government support to transfer technologies to minimize waste and increase recycling, and a second on responsible entrepreneurship encouraging self-regulation, environmental research and development, worldwide corporate standards and partnerships in clean

In summary, Agenda 21 proposes a stunningly diverse array of global, national and local reforms - some 2,500 projects in all - which if even a fraction were implemented could transform the way resource-based economies and the world deal with mineral development. The Economic and Social Council notes: "Agenda 21...sets the priorities under which mineral resource management and technical assistance are to be carried out. Further general guidance for these priorities is given by the Capacity 21 programme of Agenda 21. The goals of this programme are to (a) assist countries in incorporating the principles of sustainable development into their development plans and programmes, (b) assist countries in involving all stakeholders in developing planning and environmental management and (c) create a body of experience and expertise in sustainable development and capacity-building that will be of continued material value to, and influence the operation of, developing countries, UNDP, the specialized agencies, non-governmental organizations and other donors".

Soft law-making by the United Nations and its agencies

I. Mining industry guidelines

In 1991, the United Nations convened an important roundtable of international mining experts in Berlin to address environmentally sustainable mineral development. From that emerged the Berlin Guidelines, which set out important mining-environment principles both for the industry and for the cooperating multilateral and bilateral financing institutions. The Berlin Guidelines proclaim that "Sustainable mining activities require good environmental stewardship in all activities, from exploration and processing to decommissioning and reclamation

To achieve this, Governments, companies and the mining industry "should as a *minimum*" make environmental management a high priority:

"notably during the licensing process and through the development and implementation of environmental management systems include early and comprehensive environmental impact assessments, pollution control and other preventive and mitigative measures, monitoring and auditing activities, and emergency response procedures

In addition, the Berlin Guidelines call for environmental participation of affected communities, best practices even "in the absence of specific environmental regulations, environmentally-sound technology, technology transfer, additional environmental funding at existing operations, risk analysis and management, reduced trade and investment and transparent environmental regulation, Significantly, the document also produces guidelines for multilateral and bilateral DAAs, urging financial institutions to similar high and detailed standards of sustainable development protection.

II. International Council on Metals and the Environment (ICME)

The International Council on Metals and the Environment (ICME) is an "environmental NGO" of major non-ferrous and precious metals mining and primary metal companies worldwide, organized in 1991 to promote "sound environmental and health policies and practices" in the production, use, recovery and disposal of metals (website: <http://www.icme.com>). ICME has adopted an ICME Environmental Charter, which is somewhat less detailed than the Berlin Guidelines and has co-published a series of studies with UNEP (*ICME & UNEP-IE*). Similarly, the World Mining Environment Congress issued its New Delhi Guidelines. In addition, most international mining companies working in developing countries have adopted detailed internal environmental management guidelines and systems

III. International Chamber of Commerce (ICC)

Apart from mining industry guidelines, a number of general industry guidelines have emerged, with relevance to the mining sector. Key among these is the International Chamber of Commerce (ICC) Business Charter for Sustainable Development, which it is promoting in cooperation with UNEP (website: <http://iccwbo.org>; then click on "Environment"). Other general industry groups producing guidance for the mineral

resource industry include the World Business Council for Sustainable Development (WBCSD), which includes a number of major mining and oil and gas companies and issues guidelines and case studies on environmental/resource management (website: <http://www.wbcds.ch>), and the World Industry Council on the Environment, since 1995 part of the WBCSD, which focuses on improved environmental reporting and communication

IV. Environmental non-governmental organizations and their contribution

International (and even some national) environmental NGOs are active participants and influential observers in the formulation and development of international law. The preeminent example is the World Conservation Union (International Union for Conservation of Nature, or IUCN), a very respected expert organization which assists countries throughout the world to conserve the integrity and diversity of nature and ensure that use of natural resources is equitable and ecologically sustainable (website: <http://www.iucn.org>). The IUCN has a reputation that makes it a greater player than many Governments in developing conservation treaties and guidelines. It helped formulate (and assists in the implementation of) the World Heritage Convention, Ramsar, CITES, biodiversity treaty and other international authorities protective of nature and natural resources.

Other NGOs with influence in the international law-developing and -enforcing arenas affecting mining include, to name a few of the more prominent and active in the minerals area, the Sierra Club (website: <http://www.sierraclub.org>), Greenpeace (website: <http://www.greenpeace.org>), Environmental Defence Fund (EDF) (website: <http://www.edf.org>), Natural Resources Defence Council (NRDC) (website: <http://www.nrdc.org>), World Wildlife Federation (website: <http://www.wwf.org>) and, for a particularly anti-mining group, Basel Action Network (BAN) (website: <http://www.ban.org>).

V. roles of indigenous peoples and local communities

Indigenous people and their communities and other local communities have a vital role in environmental management and development because of their knowledge and traditional practices. States should recognize and duly support their identity, culture

and interests and enable their effective participation in the achievement of sustainable development."

In 1989, the ILO adopted a Convention Concerning Indigenous and Tribal Peoples in Independent Countries (No. 169). While adopted by few countries as of this writing, it is the most detailed and protective international authority to date. The ILO Convention so firmly promotes the principle of self-determination that it may well violate principles of sustainable development and environmental protection. The Economic and Social Council has also been active on indigenous protection issues and mining. It has created a Working Group on Indigenous Populations, and in 1993 it produced a Draft Declaration on the Rights of Indigenous Peoples, with many provisions affecting natural resources development.

Indigenous/tribal peoples and local native communities have increasingly broadly recognized rights to protect their concerns and to participate in the decision-making on and implementation of mineral resources development projects. A company or Government that neglects to involve these interests faces the prospect of project opposition, mine site protests and violence, reputational damage and potentially successful court attacks. On the other hand, for companies and Governments that includes indigenous and local community interests early and fairly in the negotiation of mining agreements, "the benefits will outweigh the costs"

World Summit on Sustainable Development (WSSD)

The World Summit on Sustainable Development (WSSD), held in Johannesburg, South Africa, from the 26 August to the 4 September 2002, marked the ten year anniversary of the 1992 United Nations Conference on Environment and Development (UNCED), otherwise known as the Earth Summit. The WSSD reviewed progress towards sustainable development since that time, and made recommendations and identified quantifiable targets for future action to achieve the goals outlined within Agenda 21.

Plan of implementation for the world summit on sustainable development

A number of sections from the Plan of Implementation are of specific relevance to the mining, minerals and metals sector. These sections are presented below; in each

case the entire subsection has been extracted to place the reference in context. The following sections of the Plan of Implementation contain direct references to the activities of the minerals, metals and mining sector:

Poverty eradication

Strengthen the contribution of industrial development to poverty eradication and sustainable natural resource management. This would include actions at all levels to:

- (a) Provide assistance and mobilize resources to enhance industrial productivity and competitiveness as well as industrial development in developing countries, including the transfer of environmentally sound technologies on preferential terms, as mutually agreed;
- (b) Provide assistance to increase income-generating employment opportunities, taking into account the Declaration on Fundamental Principles and Rights at Work of the International Labor Organization;
- (c) Promote the development of micro, small and medium-sized enterprises, including by means of training, education and skill enhancement, with a special focus on agro-industry as a provider of livelihoods for rural communities;
- (d) Provide financial and technological support, as appropriate, to rural communities of developing countries to enable them to benefit from safe and sustainable livelihood opportunities in small-scale mining ventures;
- (e) Provide support to developing countries for the development of safe low-cost technologies that provide or conserve fuel for cooking and water heating;
- f) Provide support for natural resource management for creating sustainable livelihoods for the poor.

Protecting and managing the natural resource base of economic and social development

Mining, minerals and metals are important to the economic and social development of many countries. Minerals are essential for modern living. Enhancing the contribution of mining, minerals and metals to sustainable development includes actions at all levels to:

- (a) Support efforts to address the environmental, economic, health and social impacts and benefits of mining, minerals and metals throughout their life cycle, including workers' health and safety, and use a range of partnerships, furthering existing activities at the national and international levels among interested Governments, intergovernmental organizations, mining companies and workers and other stakeholders to promote transparency and accountability for sustainable mining and minerals development;
- (b) Enhance the participation of stakeholders, including local and indigenous communities and women, to play an active role in minerals, metals and mining development throughout the life cycles of mining operations, including after closure for rehabilitation purposes, in accordance with national regulations and taking into account significant trans-boundary impacts;
- (c) Foster sustainable mining practices through the provision of financial, technical and capacity-building support to developing countries and countries with economies in transition for the mining and processing of minerals, including small-scale mining, and, where possible and appropriate, improve value-added processing, upgrade scientific and technological information and reclaim and rehabilitate degraded sites

3.0 CHAPTER THREE

3.1 Choosing, designing and conducting audits of minerals and mining

The purpose of this chapter is to guide Supreme Audit Institutions (SAIs) and auditors as they choose and design audits of minerals and mining environmental impacts. Selecting and determining the scope of audits of minerals and mining environmental impacts can be challenging to SAIs. There are so many ways of describing the scope from initial, ownership and access rights for exploratory purposes through mining and processing, to the use of the end product or disposal of waste materials. The responses of governments include laws regulating mining/mineral activities based on the paradigm of “sustainable development” – development that meets the needs of the present without compromising the ability of the future generations to meet their own needs.

For mining, this means focusing not only on the traditional economic concerns, but also on new social, economic and environmental concerns, particularly in developing nations with resource based economies. This includes a wide range of conventions, protocols, declarations, treaties, standards, codes and recommendations relating to environmental social and economy norms.

This chapter is designed to help SAIs and auditors make sense of all impacts that may arise due to mining activities. The chapter mainly includes the following four basic steps as shown in the exhibit 4- 1 below

- Step 1: Identify the environmental threats of mining in your country
- Step 2: Identify the government's responses to these threats in your country and relevant players
- Step 3: Choose audit topics and priorities
- Step 4: Decide on audit approaches: scoping the audit

EXHIBIT-2: Basic steps for choosing a topic and approach for an environmental audit on minerals and mining

Step 1: What are the main threats to environment caused by minerals and mining

- General environmental impacts
- Potential water problems/pollutants
- Possible air contaminants
- Other pollution impacts

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Step 2: What are the government responses and who are players (adequate stakeholder analysis should be done)

What	Who	How
<ul style="list-style-type: none"> • Environmental policy design and regulations 	<ul style="list-style-type: none"> Environmental agencies 	<ul style="list-style-type: none"> regulation By enforcing and monitoring the compliance with the regulations
<ul style="list-style-type: none"> • Dealing with Acid drainage 	<ul style="list-style-type: none"> Research initiatives and programmes e.g. Mine Environmental Drainage 	<ul style="list-style-type: none"> • Installing a water treatment plant. • Passing the water Through an artificial wetland in which organic matter, bacteria and algae work together to filter, absorb, and precipitate out the heavy metal ions and reduce acidity

<ul style="list-style-type: none"> • Tailings storage facilities 	<p>The mining company</p>	<ul style="list-style-type: none"> - Good design, close consistent routine attention over a long period. - Ensure that all designs are based on the highest design standards possible. <p>Have an international system certification for designers or at least some formal pronouncement by</p>
		<p>Engineering bodies as to the minimum qualifications for undertaking such task.</p>
<p>Monitoring air pollution by mercury</p>	<p>Non-government organisation, Professional association e.g. International Atomic Energy Agency.</p>	<p>Using lichens in air pollution assessment and air pollution monitoring</p> <ul style="list-style-type: none"> - Lichens obtain their nutrients directly from the atmosphere, are good accumulators of metals, and show good tolerance to high metal concentrations in their tissues. They are good for national and international air pollution assessment for programmes
		
<p>Step 3: Choose audit topics and prioritise</p> <ul style="list-style-type: none"> ○ Potential water problems pollutants ○ General environmental impacts ○ Possible air contaminants ○ Other pollution impacts <hr style="border: 2px solid cyan;"/> <p>Step 4: What audit approach to use</p>		

- Financial management and regularity
- Compliance with agreements, laws and policies
- Policy coherence
- Performance measurement and results
- Accountability, coordinator and capacity
- Scientific research and monitoring
- Public education
- Reporting to client and public

These steps are only suggestions, and they can be adapted to the situation and needs of a particular SAI. They can be used to define the objectives, scope, and criteria of a single audit of environment on minerals and mining. During the planning stage auditors are advised to understand the environmental problem and governmental responses in mitigating the negative consequences in the respective country.

Further, auditors should prioritise and limit the audit area. Also tips should be obtained and ideas on how to scope the audit of environmental mining and minerals.

The above four steps have been further elaborated as shown below:-

STEP: 1 IDENTIFY THE MINING STAGES AND THREATS TO IT

Chapter 1 gives a good background on minerals and mining life cycle and some of the common global threats and concerns. However, to develop domestic approaches for auditing minerals and mining environmental impacts, SAIs must understand the situation in the country and the main threats associated to the mining life cycle.

Key Questions: Why environmental problem arisen?

Auditors could consider the activities involved at every stage of the mining process, this could be:

- Exploration – Drilling and exploration excavations.
- Project Development – Construction of roads and buildings, erection of treatment plants, overburden stripping and placing.

- Mine operation - Heap – leaching of tailing dumps, Bio-leaching of surface heaps or deposits and solution mining of buried deposits.
- Beneficiation - On- site processing may include combination to reduce particle size, flotation using selected chemicals.
- Mine closure - incompatible landscape features.

Key Questions: What are the effects on the environment, economy and society?

Economy

- Environmental pressures are forcing up corporate spending – and especially investment spending. The International Chamber Of Commerce (ICC) estimated that corporate environmental spending was around 2.1 per cent of sales in 1991 and was expected to rise to 3.3 per cent by the year 2000 an increase of around 50 per cents

STEP 2: Identify the government’s response in your country:

Understand the response to environmental threats due mining and mineral processing and the relevant players

Governments play an important role in protecting the environment in many ways one being mainstreaming environment into the economy, i.e. integrating the environmental issues in the development planning process. Essentially, also the government makes the environment feature in decision- making, and in the formulation, implementation and evaluation of policies, strategies, programme and projects. Since SAIs do not audit the environment, they audit the government policy, programs, they need, therefore, to understand what is doing to mitigate or prevent environment threats through programs and policy tools.

KEY QUESTION: What is government doing about environmental threats of mining and minerals?

- **Policies and programs**

Governments can formulate environmental policies. Policies tend to set directions, but are usually not prescriptive or enforceable. A policy might be a statement of intent or of a desired outcome. In some cases policies can be supported by specific procedures (action plans) and (funded) programs.

For instance, governments can have a number of enacted policies, strategies, programme and legislations to address environmental concerns. However, successful implementation of programs requires that they have enough monetary resources, skilled people, goals and authorities. Government should set performance measurements regarding the implementation of their policies or programs.

Environmental Policy Instruments

There are a number of tools that ensure integration of environmental concerns in the planning process:

The National Budget

Perhaps the greatest tool available to the government in order for it to implement policy is the budget. How effectively the environment is mainstreamed into various budgetary provisions implicitly or explicitly is ultimately the measure of how effectively or otherwise the government can effect environmental conservation.

Environment Assessment

Another such policy instrument, which facilitates the balancing, imperatives of the economic development and environmental conservation is Environmental Assessment (EA). EA is observed at two levels; the Strategic Environmental Impact Assessment (SEA) and the Environmental Impact Assessment (EIA).

Strategic Environmental Assessment (SEA)

Strategic Environmental Assessment is a formalized systematic and comprehensive process of evaluating the environmental impacts of a policy, plan or programme and its alternatives.

It includes the preparation of a written report on the findings of that evaluation, and using the findings in publicly accountable decision – making.

It is in other words, and put simply, the EIA of policies plans and programme (PPP). It should, however, be born in mind that the process of evaluating environmental impacts at a strategic and project level are not necessarily the same.

Environmental Impact Assessment

EIA as a national instrument shall be undertaken for proposed activities that are likely to have a significant adverse impact on the environment and are subject to a decision of a competent national authority.

EIA is a formal study to predict environmental consequences of proposed undertakings before their implementation. It is a planning tool or a methodology through which possible ill effects of development interventions (projects, policies, and programmes) can be ascertained and mitigated or prevented before the intervention is undertaken. It aims at ensuring that potential environmental problems and related conflicts are foreseen and addressed at an early stage in project planning and design.

EIA is therefore an important environment management tool for improving long-term viability of projects and for achieving sustainable development. Projects which incorporate EIA at an early stage tend to be more effective and cheaper when compared with long term costs of not undertaking EIA which can lead to significant environmental degradation, damage to human health, and economic costs. In some governments, such EIAs are legislated. In others, they are part of the policy tools.

Challenges on Environmental Assessment,

The challenges posed to environmental assessments of mining projects are twofold.

Firstly, to ensure that environmental, social and health cost afforded adequate consideration in determining the economic viability and acceptability of alternative project scenarios

Secondly, to ensure that adequate control, mitigation or protection measures are incorporated in project design, implementation and decommissioning plans. This requires both effective environmental legislation and enforcement by

regulatory institutions, and sound environmental management practices by private and public sector mine operators

- **Environmental Management Accounting**

After the Earth Summit in Rio de Janeiro – Brazil in 1992. There was a belief that existing management accounting approaches did not adequately deal with environmental issues such as waste. Environmental Management Accounting or EMA was developed to address these shortcomings; however, use of EMA was limited. One early user of EMA was the United States Environmental Protection Agency which was keen to share the benefits more widely.

The limited use of EMA was discussed at a meeting of the United Nations Commission on Sustainable Development (CSD) in 1998. This led to the Division for Sustainable Development (DSD) establishing an expert working group in 1999, known as the United Nations Expert Working Group on Environmental Management Accounting.

The working group comprised of representatives from various countries as well as from the European Union and the United Nations. The working group met nine times and its main objective was to promote EMA.

It also published the principles and procedures for EMA. In 2005, the International Federation of Accountants Published a Guidance Document on EMA. This document was a collaborative effort involving representatives from several countries as well as representatives from the DSS.

Division for Sustainable Development Expert Working Group on Environmental Management Accounting

Environmental Management Accounting has no single, universally accepted definition. According to IFAC's statement Management Accounting concepts, EMA is "the management of environmental and economic performance through the development and implementation of appropriate environmental related accounting systems and practices. While this may include reporting and auditing in some companies, environmental management accounting typically involves life-cycle costing, full-cost accounting, benefits assessment, and strategic planning for environmental management.

A key element of EMA is that it requires organization to collect monetary and non-monetary data on inputs such as material used, employee hours and electricity consumed. The IFAC Guide on EMA says, ‘EMA places a particular emphasis on materials and material-driven costs because:

- 1) Use of energy, water and materials, as well as the generation of waste and emissions, are directly related to many of the impacts organizations have on their environments and
- 2) Materials purchases costs are a major cost driver in many organizations.

The Guide illustrate on effectively management and reduction of the potential environmental impacts of waste and emissions, as well as of any physical products, an organization must have accurate data on the amounts and destinies of all the energy, water and materials used to support its activities.

It needs to know which and how much energy, water and materials are brought in, which become physical products and which become waste and emissions”.

Environmental Accounting (EA) is a broad term used in a number of different contexts. First use of the term seems to have been in the 1970s.

Some of the elements of environmental accounting:

- Measurement and disclosure of environment- related financial information in the context of financial accounting and reporting.
- Measurement and use of environment-related physical and monetary information in the context of Environmental Management Accounting (EMA).
- Estimation of external environmental impacts and costs often referred to as Full Costs Accounting (FCA).
- Accounting for stocks and flows of natural resources in both physical and monetary terms, that is Natural Resource Accounting (NRA).
- Aggregation and reporting of organization – level accounting information, natural resource accounting information and other information for national accounting purposes.
- Consideration of environment-related physical and monetary information in the broader context of sustainability accounting.

KEY QUESTION: What are the National Targets and objectives in this Field?

The national targets and objectives in this field may include:

- Protection and Management of the environment for sustainable development.
- Integration of environmental Management and economic decisions of minerals and mining at an early stage to ensure that potential problem are avoided.
- Prediction of the consequences of a proposed minerals and mining undertaking from the environment, social, economic and cultural perspectives and to develop plans to mitigate any adverse impact, resolve conflicts and enhance positive ones;
- Provision of avenues for involvement of the public, proponents, private and government agencies; interested as well as affected people in, the assessment and review of the proposed minerals and mining undertaking in an open, transparent and participatory approach.

KEY QUESTION: Who are the main players that have an impact on the environment problem? What are their roles and responsibilities? Outlines some major key players

The auditor needs to identify the major players involved in any environmental related activity. Players can be a good number of them emanating with both converging and diverging interests. Nevertheless, the auditor is supposed to define each player's role, activities and scope of influence.

Players may include government departments and agencies at central government and local government levels. Government control on minerals and mining environmental pollutions vary from country to country.

For instance, the U.S mining policy is quite different from that in Sweden and other Scandinavian countries, where dynamic mining and mineral industry coexists with a strong national environmental commitment and with relatively simple laws. In Canada, for most cases, management of mining is delegated to the provinces and strong emphasizes are set on decentralized management.

Australia has 14 Commonwealth Laws regarding the environment, with states having some additional 5 to 15 Laws. In 1999, Sweden consolidated 15

existing environmental Laws into a single Environmental Code. Permit requests for mining activity are given an administrative level corresponding to the level of hazardous materials involved in the activity.

Thus, bulk mineral mining permits are category C, handled by municipal boards. Normal mining exploration (except uranium) is in category B, corresponding to country boards. Full-scale metal mining requests are in category A, handled by regional environmental courts. This is a good example of how relatively simple laws and high public environmental awareness can contribute to sustainable development in this economic sector.

Therefore, it is important for auditors to understand where an issue fits into the hierarchy, which level of government is involved, and how that level is involved.

Non-government organizations, such as civil institutions, members of social movements, professional associations, local communities, non-governmental organizations, business sectors, academic institutions, and scientific institutes, may have a role to play. In some countries, it is also important to highlight the key role played by indigenous communities. Many countries have established knowledge resource centers, databases, and networks to preserve and disseminate traditional ecological knowledge.

STEP 3: CHOOSE AUDIT TOPICS AND PRIORITIES

The auditor is now ready to identify possible audit topics. The important thing is to define the focus the audit examination. Chapter 4 includes detailed information (including possible audit criteria, players, and researchable questions) on the following possible audit topics:-

- General environmental impact
- Potential water problem pollutants
- Possible air contaminants
- Other pollution impacts.

It is up to the SAI to choose audit topic and set priorities, which would answer the following questions:

KEY QUESTION:

What are the risks relating to environment and government's commitment?

The SAI will need to carry out a risk analysis in order to determine whether its action will be appropriate and useful. When assessing threats to environment caused by minerals and mining, the auditor should consider the quantum of the actual and potential impact on the environment, society, and the economy. When ascertaining the damage to the environment, the auditor should question how reversible that damage is- irreversible damage is especially risky. Furthermore, the auditor should consider how intensive the damage is, since it is a priority to address and prevent acute threats. Generally, auditors rely on their government's assessments. Nevertheless, if needs arise, they may ask assistance from experts in the field.

It is also important for the auditor to examine the government's response regarding the identified environmental threats and its capacity to meet targets. The auditor should also determine the government behavior in terms of abiding by the principles.

KEY QUESTION: How will the audit contribute to good governance?

The recommendation of environmental audit report of mining and environment is expected to influence a good government on the basis that it wills Promote Transparency on Environmental Issues by addressing question such as

Transparency: Government needs to maintain openness to its citizens.

Probity: Government officials will act with honesty and integrity.

Equity: Government officials must exercise the power entrusted to them fairly. Government must avoid the misuse of power, and corruption

Setting direction: establishing organizational policy; the budget is a major tool

Ethics: instilling values in the organization; setting the tone at the top, with clear lines of accountability that hold people responsible for doing the right thing

Overseeing results: oversight to ensure policies are implemented; monitoring that performance meets expectations

Accountability reporting: good financial and performance reports, preferably subject to independent audit

Correcting course: identifying problems; responding and taking corrective action - for instance, implementing auditors' recommendations.

An effective audit function is a basic requirement of sound governance and strong accountability.

KEY QUESTION: How will the Institutional audit framework influence possible audit topics?

A SAI will also need to ascertain where it will be most effective in improving the way the government protects the environment in terms of minerals and mining. The auditor may consider the following questions:

- What are the interests of the users of the audit report, particularly the primary users (e.g. parliament)?
- What is the importance of the topics to the overall government activities?
- What is the impact of the audit likely to be? Is the audit likely to make a significant difference?
- Has the topic been audited before?
- What is the relevance of this topic to protect basic human needs?

KEY QUESTION: Does the SAI have the required mandate and authority?

After identifying the players, the SAI should determine which one it has jurisdiction over. Even the government sphere, it may be able to act only at the mentioned level let us say (federal), state, provincial or local (municipal) level. Private players (for instance), the private sector, state – run enterprises, or non – governmental organizations) that are financed by public resources may also fall under the SAI's jurisdiction. In spite of the lack of jurisdiction over some players, the auditor must know who they are and what role they play, since the government can regulate or influence their behavior through public policy tools and instruments. If the most influential players are not subject to the SAI's jurisdiction, auditing the issue may have little value.

KEY QUESTION: Are the topics auditable?

First and foremost, the auditor should consider and decide whether there are suitable sources of criteria against which to conduct the audit.

- Has the government signed international agreements relating to minerals and mining?
- Has the government enacted laws and regulations?
- Has the government made policy statements on the issue?
- Are environmental threats caused by minerals and mining included in national budgets?
- Does the government receive external funding from international organizations?

After determining where their action will be most useful and choosing the topic, auditors can start planning the audit.

STEP 4: DECIDE ON AUDIT APPROACHES (SCOPING THE AUDIT)

For this last step, the auditor needs to select an audit approach and choose audit objectives, audit criteria, lines of enquiry and methodology for the audit.

Following are some possible lines of enquiry and associated researchable questions. See Exhibit 5 for more information on how auditors can combine various topics and approaches.

Financial Management and Regularity

Using traditional financial audit techniques, auditors can investigate the use of public funds in projects and programs that focus on environment conservation in relation to minerals and mining.

- Are the funds spent on environmental conservation in relation to minerals and mining programs correctly administered, according to spending authorities and regulations?
- Are adequate financial resources allocated to protection programs?
- Is the disbursement of funds monitored?
- Against what criteria is the disbursement of funds measured?
- Do official trade – offs exist in policies? If so, how do the estimated benefits balance against the losses in environmental conservations caused by minerals and mining?

Compliance with Agreements, Laws, and Policies

An audit of environmental conservation in relation to minerals and mining can address the consistency of government strategies, actions, and programs with laws and regulations, or with the international conventions, to which the country is a signatory. It may answer the question: Is the government meeting commitments it made in treaties, Laws policies and programs? The following are some of the lines of enquiry:

- Are there international agreements that protect the environment against the environmental threats caused by minerals and mining within the country?
- Is the country following the rules and agreements determined by the international conventions that it is a signatory to?
- Has the government enacted laws and regulations to implement its international commitments and domestic policies?

- Are there any conflicts or gaps between national policies on environmental conservation against minerals and mining and the country's environmental laws?
- Are environmental laws and regulations being adequately enforced?
- Is there any conflict between national policies and the international conventions that the country is a signatory to?

Policy

- Auditing policies and programs on environmental conservations against minerals and mining environment threats can be valuable .Interesting lines of enquiry include the following :
- Are government policies being complied with?
- Has the government developed policies that address the environmental pollutions caused by mining sector in the country?
- Do the policies deal with the most important threats?
- Have general policies on minerals and mining environmental conservations been addressed, specified and executed in laws and other legal instruments such as plans and budgets?
- What kinds of changes can be suggested that would make national policies achieve better results?

- Are government programme efficient?

Performance measurement and results

Audits of minerals and mining environmental conservation can assess the performance of government program's actions to deal with threats to the environment and ensure the conservation of the environment. SAIs may wish to evaluate the traditional three E's-effectiveness, efficiency, and economy-of the programs. They may also wish to assess the processes used to define and measure success and the results of these processes; such assessment can be achieved by answering the following questions

- Have the relevant agencies defined expected results for their programs?
- Have they developed indicators and measures for the results and are they being monitored and tracked?
- Is the data used to measure performance reliable?
- Are the policies and programs on minerals and mining environmental conservations achieving their objectives and intended results?
- Why are policies and programs not achieving their objectives and intended results and how can the causes be encountered?

Accountability, Coordination and capacity.

Since minerals and mining environmental conservation topics cut across many government entities and other players, SAIs could assess how departments and agencies have demonstrated good governance, for instance, whether they can meet their responsibilities for environmental programs and actions, and whether they have mechanisms to coordinate those actions. The assessment can be achieved through answering the following questions

- Are the roles, responsibilities, and accountability of relevant entities (for example, ministries and departments) clearly defined?
- Are any necessary mechanisms to coordinate action in place?
- Do the entities have adequate financial and human resources to carry out their roles and responsibilities?
- Have the entities developed robust internal management system?

Scientific research and monitoring

The government's capacity to undertake research and monitor the level of pollution in the air; water; land degradation and human health effects from minerals and mining activities ought to be examined. In many countries this responsibility is legally defined. The following are suggested lines of enquiry:

- Does the government have the scientific knowledge (in-house or consultant-based) to prioritize its action on the threats to the environment resulting from minerals and mining?
- Are there adequate systems in place to monitor the status of levels of pollutants in the air, water, land and human health as a result of minerals and mining?
- Is the government developing and maintaining databases on minerals and mining environmental effects either in house or with research Institutions?
- Is information being shared between the national and international monitoring system?
- Does the public have access to information on monitoring activities?

Public Education

National and International environmental protection programs often have a public education component. Large sums of money can be spent even though the success of these programs has not been measured. SAIs includes, among others, the following lines of enquiry:

- Is the government allocating appropriate funds for public outreach and education at each phase (formulation, planning implementation, and evaluation) of a policy?
- Is the government encouraging the public and private sector to protect the environment against unmanageable minerals and mining in terms of polluting the environment?
- Has the government integrated the minerals and mining environmental concerns into its public outreach strategies?
- Is the government measuring its public outreach results?

Reporting to clients and the public

The reporting requirements of public policies can be an important source of audit evidence. For example, many international environmental agreements require that national governments report to United Nations agencies or other International agencies (e.g. donor agencies). In addition, regulated entities within a country may be required to report to regulatory agencies that in turn, may report to their Parliament or equivalent.

Proper monitoring, reporting and accountability processes – which include collecting data, performing analysis and reporting findings – should be in place. SAIs can ensure that such reports and performance comply with appropriate standards, rules, and regulations. SAIs may consider:

- How are departments and agencies reporting their results?

Are departments and agencies meeting international and national reporting obligations?

Conducting environmental audit of mineral and mining

*Environmental audit of mineral and mining will require the usual four phases of any audit - **planning, field work, reporting and follow up***

The standards applied to the conduct of audits looking on Environmental issues for mineral and mining activities should be no different than any other audit. Audit of Environmental on mineral and mining will require the usual four phases of any audit - planning, field work, reporting and follow up. The essential objectives - making differences, promoting accountability and use of best practices - remain unchanged.

A successful audit will often revolve around some basic questions of management

- Is any body in charge
- Is there adequate planning that include mile stones, performance measures, goals and expected results
- Does the organization have sufficient expertise at hand to discharge the responsibilities it's charged with?
- How well are the various organizations working together
- Is accountability clearly defined? Is reporting clear, relevant, understandable and timely, does it include results

- Is there adequate measurement of results against goals and target?
- Is the relevant information being used to make sound decision
- Does the organization have adequate arrangement in place to assess how effective their actions are, and if so, what the results have been?

SUMMARY OF AUDIT APPROACHES

Exhibit five Summarizes the many possible ways auditors can combine minerals and mining environmental topics and audit approaches. An audit of environment on minerals and mining may cover more than one of the listed topics and more than one audit approach can be used for each audit topic. Nevertheless, as with any audit, auditors need to be careful when they decide what scope will be? In particular those who are new to auditing minerals and mining environmental audit need to try and choose an audit scope that will be

EXHIBIT 3: MINERALS AND MINING ENVIROMENTAL AUDIT TOPICS AND APPROACHES

MINING & MINERAL ENVIROMENTAL TOPICS	AUDIT APPROACHES (LINES OF EQUITY)							
	FINANCIAL MANAGEMENT AND REGULARITY	COMPLIANCE: A GREEN ENTS, LAWS AND POLICIE S	POLICY	PERFOMANCE MEASUREMENT AND RESULTS	ACCOUNTABI LITY, COORDI NATION AND CAPACITY	SCIENCE RESEARCH, AND MONITORING	SCIENCE PUBLICRESE ARCH AND MONITORING	REPORTIN G RESULTS
General environmental impacts								
Possible air contaminants								
Potential water problems /pollutants								

4 CHAPTER FOUR

4.1 Audits on Mining activities

To facilitate the planning of your mineral and mining audit, it may be useful to see how other SAIs have approached the field, so as to profit from what they have learned. We will therefore present a set of examples of audits that reveal the most pressing problems related to mining that have confronted a number of SAIs. The examples are grouped under the nine previously presented audit topics. The emphasis in the audits as they are presented here is on the findings

The topics constitute typical problem areas that audits reveal. Under each topic general considerations when using the approach will be presented. Some of the examples may address more than one of the topics, but are only presented less than one topic

Compliance with national and international obligations

International agreements and conventions on mining are important instruments when it comes to preventing damage to the environment: It is therefore imperative that the SAIs keeps parliaments informed of how well executive governments fulfil their international obligations in this respect.

In its most basic form, the audit of compliance with international obligations can address the issue of ensuring that the international obligations signed by a country are fully implemented in national laws and regulations.

Furthermore, it is important to evaluate how effectively the obligations are fulfilled and whether required measurement and reporting systems are in place and providing correct and timely information.

The audit of international obligations is an area in which it is especially useful for SAIs to co-operate. Such co-operation might yield economies of scale because SAIs can help each other in the formulation of good audit questions and the collection of background information. It might also be useful for countries – and for the environment – to get an unbiased view of how well a participant is performing relative to other participants or to a group of such countries.

AUDIT ON SPECIFIC MINING OF MINERAL

GHU

An Indonesian experience

Audit Case study: COAL MINING

Audit Objectives:

To assess whether:

1. Internal control system of coal mining management is adequate;
2. Government institutions and mining companies comply with rules and laws regarding in following aspects namely legal mining licenses, non-tax state income (PNBP), fund sharing (DBH), and local government income (PAD).
3. Mining companies comply with mining and environment laws and regulations.

Audit Criteria:

Following acts or laws regarding

- (1) Fundamental Rules of Mining;
- (2) State Finance;
- (3) State Treasury;
- (4) Non-tax state income;
- (5) Local Government ;
- (6) Financial Balance of Central and Local Government;
- (7) Settlement of Regions;
- (8) Environmental Management;

- (9) Forestry; and
- (10) Conservation of Natural Resources and Ecosystem.

The audit applied also several government regulations related to:

- (1) Fundamental Rules of Mining;
- (2) Financial balance;
- (3) Non-tax incomes in Ministry of Energy and Natural Resources;
- (4) Division of Works between Central and Local Governments;
- (5) Analysis of Environmental Impacts;
- (6) Quality of Water and Control of Water Contamination;
- (7) Management of Toxic and Dangerous Waste Materials;
- (8) The Control of Air Contamination; and
- (9) Presidential Decree regarding Permit or Agreement in Mining Area inside the Forest Area;

Audit Methods:

The audit applied following approaches:

1. Risk-based audit focusing on high-risk aspects, such as coal mining policy, compliance to mining licenses, management of PNPB, DBH, and PAD, and also environmental management in coal mining sector. Risks identified are then evaluated by reviewing the effectiveness of management including system effectiveness internal control of governments and mining companies. Residual risks will be used in determining samples of business unit and mine location.
2. Review of regulation and policy related to coal mining management. The regulations include policy and regulation of Central Government, Provincial Government and Regional Government. Examination is conducted on payment documents and/or endorsement of PNPB and evidence endorsement of guarantee, and also document supporting of production, selling expenses and sales.
3. Physical observations to mine companies and locations.
4. Confirmations to related government institutions.

Audit entities:

1. Ministry of Energy and Mineral Resources;
2. Provincial Government of South Kalimantan, East Kalimantan, Central Kalimantan, and South Sumatra;
3. 28 regions, that consists of five regions in South Sumatra, eight regions in East Kalimantan, seven regions in Central Kalimantan, and eight regions in South Kalimantan.
4. 40 coal companies that held the Coal Mining Agreement (PKP2B) with Ministry of Energy and Mineral Resources;
5. 1,358 companies that held the Mining License (KP) from Regional Governments, that consist of 171 KPs in South Sumatra, 646 KPs in East Kalimantan, 229 KPs in Central Kalimantan and 312 KPs in South Kalimantan;
6. Other related government institutions that include Ministry of Finance, Ministry of Forestry, and Ministry of Internal Affairs.

Audit Findings & Recommendations:

1. Weakness on Policy

- a. Policy determination of estimated general mining income in State Budget Law and in Budget Realization Report for Minister of Energy and Mineral Resources of FY 2007 was not appropriate. BPK recommended the Minister of Finance to review the Regulation of Minister of Finance regarding central government accounting and financial reporting system, especially about the Cash Flow Reports from PNPB Natural Resources.
- b. DBH allocation from PKP2B companies was poorly distributed, disregarding the justice principles in distributing income for regional government. BPK recommended the President of the Republic of Indonesia to review Presidential Decree No. 75 year 1996, and further instructs the Minister of Finance and Minister of Energy and Mineral Resources in DBH Natural Resources allocation.
- c. Duplication of fees charged to KPs at the amount of Rp40.2 billions and US\$3.7 millions. BPK recommended the Minister of Energy and Mineral Resources to coordinate with Minister of Internal Affairs and Minister of

Finance to review or withdraw regional regulations contradicted with central government's rules, and order the regional governments to review the agreements that set such levies on coal mining objects that have become the object of PNBP.

- d. PNBP from coal mining revenues as of Rp1.4 billions was paid to regional accounts instead of to the Central Government account, and an amount of Rp569 millions of it have been used improperly by Regional Governments. BPK recommended the Minister of Energy and Mineral Resources to coordinate with the Ministry of Internal Affairs to written notice the regional governments to comply with central government rules regarding coal mining royalty payment to the Central Government Account Number of 501.000.000 in Bank of Indonesia.
- e. Regional Governments approved KP permissions without considering the Commitment Assurance Deposit fulfillment. BPK recommended the Minister of Energy and Mineral Resources to coordinate with Ministry of Internal Affairs to order Regional Governments to comply with rules and regulations especially in fulfillment of commitment assurance deposits, and to collect Commitment assurance that have not deposited by the KP holder.
- f. The policy of Minister of Energy and Mineral Resources and Regional Governments to grant PKP2B and KP companies land concessions in conservation forest and protected forest areas did not support forest prevention efforts and environmental damage mitigation efforts. BPK recommended the Minister of Energy and Mineral Resources:
 - a. In approving a concession area have to take fully attention to forest prevention and environmental damage mitigation efforts, and have to accurately review the preserve locations.
 - b. To improve coordination with the Ministry of Forestry prior to coal mining area allocation to comply with laws and regulations.
 - c. To coordinate with Minister of Internal Affairs to order Regional Governments:
 - 1) To order KP companies in the forest area to immediately complete the borrow-use permit from the Minister of Forestry prior to mining activities.
 - 2) To review KP permits in conservation forest areas, by reducing the mining concession area.
 - 3) To improve coordination among regional government institutions in approving KP permits.

2. Incompliance of laws and regulations

- a. Mining companies have made activities in forest area without borrow-use permits from the Ministry of Forestry. BPK recommended:
 - 1) the case to the law enforcement agency.
 - 2) the Minister of Internal Affairs to coordinate with Ministry of Forestry and Regional Governments to order such companies to immediately complete the obligations and responsibilities, especially related to provide compensations for standing timber and land.
- b. Regional Governments have issued KP permits with violating the rules and laws. BPK recommended the Ministry of Energy and Mineral Resource to coordinate with Minister of Internal Affairs in order to instruct the regional governments to consistently publish the permit in their jurisdiction area, to solve the problem of overlapping mining permits, and to review the permits published outside their jurisdiction authority.
- c. Forgery indications of coal mining permits. BPK recommended the Minister of Energy and Mineral Resource to coordinate with Minister of Internal Affairs to order the Regional Government to investigate the problem according with rules and regulations.

3. Incompliance with Non-Tax Revenue Income Laws

- a. KP mining companies paid Fixed Fee less than required as of Rp22.5 billions and Coal Royalty as of Rp225 billions and US\$6.95 millions. BPK recommended the Minister of Energy and Mineral Resource to coordinate with Minister of Internal Affairs in order to instruct Governors and Majors in related areas to obtain such payments from the companies and deposit them to the State Account, and to strengthen control and supervision to mining companies.
- b. Six PKP2B contractors arrested DHPB payments as equal to Rp2.3 trillions and USD728.7 millions. BPK recommended Minister of Finance and Minister of Energy and Mineral Resources mutually to resolve and

improve the tax reimbursement mechanism according to rules and agreement contract.

- c. DBH Revenue of FY 2006 and 2007 equals to Rp9.7 billions and US\$2,8 thousands have not been distributed to local governments. BPK recommended the Minister of Energy and Mineral Resources to reconcile the revenue with accurate and complete data, and to improve coordination with Minister of Finance in distributing the DBH revenue.
- d. Mining companies have not fulfilled their obligations to submit reclamation guarantees or deposits that equal to USD3.2 millions and Rp127.25 billions. BPK recommended the Minister of Energy and Mineral Resources to:
 - 1) Coordinate with Ministry of Internal Affairs to instruct the Local Governments to request such deposits from mining companies and improve internal control.
 - 2) To improve the internal control and inspections regarding the obligation of PKP2B companies to submit such deposits.

4. Incompliance to Environmental Laws

- a. Inappropriate management of top soils, sub-soils, toxic wastes and acid water waste. BPK recommended the Minister of ERM to coordinate with Minister of Internal Affairs, and improve internal control and inspection of coal mining companies in managing environmental issues according to environmental laws and rules as well as to operating standards.
- b. Inappropriate management of reclamation and re-vegetation of ex-mining areas. BPK recommended the Minister of ERM to:
 - 1) coordinate with Ministry of Internal Affairs to instruct Regional Governments to improve control and observation of mining reclamation in ex-mine areas and to direct mining companies to immediately conducting reclamation and re-vegetation;

direct Director General of Minerals, Coal, and Geothermal to improve internal control and supervision regarding reclamation and re-vegetation activities done by PKP2B contractors according to environmental management standards.

TIN MINING

Audit Objectives:

To ensure that:

- 1. Government and mining companies maintain adequate control system to minimize environment damage impacts
- 2. Mining companies—PT. Timah Tbk and PT. Kobatin—obey the mining rules under the supervision of Government of Indonesia according with the contract of work or mining rules
- 3. The companies have carried out their obligations related to Non-Tax State Revenues (PNBP).

Audit Criteria:

Law Number 11 of 1967 regarding of Mining Rules, Law Number 20 of 1997 regarding PNBP and Law Number 23 of 1997 regarding Environmental Management, and others concerned with mining and standard operational procedures as well.

Audit Method:

The audit assessed budget expenditures and intern control system, as well as disclosure of financial and environment process, conducted with following methods:

- 1. Risk method

The implementation method based on review and examination of effectiveness of the internal control system. The result influences the reliability of intern control system level according with the laws, and finally guides in determining audit object.

2. Materiality

The audit applies low level of materiality considering that user will give attention on legality and lawfulness on mining's rules. Besides that, materiality on environment management refers to important effects resulted from mine business according with the Environmental Impact Assessment.

3. Audit sampling

The three methods in collecting audit evidences are:

- Interview and observation
- Testing sampling
- Document review

However, BPK limited the audit analysis, especially on substantive test with no further technical testing concerned with criteria

Audit Scope:

1. Ministry of Energy and mineral resources;
2. Two tin mining companies, PT. Timah Tbk and PT. Koba Tin;
3. Other related institutions

Audit Findings & Recommendations:

1. Both companies failed to conduct appropriate reclamation efforts on some mining areas/sites. BPK recommended:
 - a. The companies to immediately design a comprehensive strategic planning that includes solutions for illegal mining practices, and engage public community, Government and local authority;
 - b. PT Timah, Tbk to collect data of all its ex-mining sites and to conduct reclamation;
 - c. The companies to realize their environment commitments in conformity with the environmental laws, public society and government interest;
2. PT. Timah Tbk failed to fulfill its rent payment responsibility to government. BPK recommended the Minister of ESDM to give PT Timah Tbk sanctions according to the Law and to revise the over time schedule of landrent payment method;

The companies failed to pay their responsibility, royalty and land rent. The audit recommended both managements to realize the payment immediately.

Compliance with national mining and environmental related law

When dealing with environmental issues, the focus is usually on compliance with laws and regulations specific to this domain. However, one should bear in mind that environmental fields need to be considering red from other angles as well, such as the perspectives of health and safety and of accounting laws and regulations. Therefore, when dealing with environmental matters, it is important that all of the relevant laws and regulations be considered.

Requirements often associated with financial audits have a natural place here. SAIs that do not have a mandate for performance auditing often use compliance with legislation and general quality requirements as a justification for environmental auditing

PERFORMANCE OF THE MINERALS AND MINING MANAGEMENT SYSTEM EXPERIENCE FROM CHINA

Case Study 1 for “Guidelines for Auditing Mineral Resources” Project: Performance Audit Investigation upon the Control and Comprehensive Utilization of Gangue in “X” City

Describe the main audit objectives.

1. Assessing the performance of control and comprehensive utilization work for gangue in “X” city;
2. Promoting the effective implementation of national comprehensive utilization policy for gangue;
3. Boosting local governments to intensify the efforts of utilizing gangue in a comprehensive way;
4. Urging local governments to strengthen environmental protection, and advancing the sustainable development of local economy and ecosystem

Scope of the audit

“Y” Coal Industry Group, time period covered 2004-2008 ,

Main Findings

1. Relatively low utilization ratio of Gangue, only for limited purposes and low level of comprehensive utilization;
2. Wall materials are mainly composed of clay bricks which are not conducive to the effective protection of arable land, energy conservation and eco-system improvement;
3. Relevant basic information is not complete, statistic data is yet to be integrated and the profundity of comprehensive utilization should be further improved.

Main Conclusions

1. “Y” Coal Industry Group has altogether provided financial support of 84.23 million RMB for controlling gangue-piled hills ever since 2004 and made obvious effects;
2. Up to now, there are no spontaneous combustion by gangue-piled hills of “Y” Coal Industry Group, new-generated gangue have been fully discharged according to the new discharge rules, and most of old gangue-piled hills have been rectified;
3. Gangue-fired power-generating and brick-making projects have been put into operation and initial benefits have been shown.

Recommendations

1. Clearly-defined laws, rules and standards for discharging and controlling gangue should be promulgated so that enterprises could be promoted to strictly abide by the relevant regulations for controlling the piling of gangue and control the environmental impacts of gangue-piled hills to the maximum.
2. Government input for controlling the gangue-caused disaster should be increased. Otherwise the rectification of gangue-piled hills is mainly relying on the financial resources of coal industry and the relevant enterprises are heavily burdened. The increase of government input shall further mobilize the enterprises to control and comprehensively utilize gangue.
3. Support policies and measures should be put into place in order to solve the problems such as low level of comprehensive utilization of gangue, backward technical facilities, small-scale production, poor competitive power and limited potential for further development.
4. The national preferential policies should be fully implemented in order to mobilize the initiatives of various parties to control and rectify gangue-piled hills. For example, various policy limits with regard to approving and giving loans to the projects of gangue-fired power plant, giving the right to be combined to the grid, price of electricity and peak load regulating operation should be lifted. More preferential policies should be given. Moreover, the policy support to the technology and industry in the field of cyclic operation of gangue should be increased. The development and promotion of gangue-utilization projects

should be quickened.

Performance of the mining system

It is the responsibility of a country's SAI to audit the mining and determine how well the system is performing. There are a large number of issues that naturally arise here, as to whether the system meets the challenges that mining entails. One important task is to map out the relevant actors and their responsibilities to determine whether all of the necessary functions are managed and the lines of responsibility are clear.

For example, there may be a ministry of environment that has the overall responsibility to ensure compliance regarding mining. If such a ministry does not exist, it may be necessary to map out the partial responsibility held by different government bodies. If there is more than one body in the central administration that has some kind of responsibility, a natural audit question is whether this entails any risk. Concretely, does the scattering of responsibility fragment accountability? This question was raised by the Canadian SAI in an audit presented below, which focuses on the management of abandoned mining.

This audit also specifies the criteria that must be fulfilled in order to have sound management.

A focus on the performance of the system also implies the scrutiny of whether the responsible agencies possess the necessary instruments for meeting their obligations and whether these are the most effective and efficient means of so doing.

Within mining there may be programmers or actions that are one of a kind. Although the audit of such activities may have no impact on future practices, it is nevertheless important to consider them as well.

Several SAIs have performed full-scale audits of their mining , and the audits are presented in the following pages.

Audit Case study: Audit of minerals and mining

Abandoned mines in the North

Hundreds of thousands of tons of highly toxic chemicals such as arsenic and cyanide are found at northern abandoned mine sites. These chemicals, the result of past mining operations, have accumulated to hazardous levels. Indian and Northern Affairs Canada estimates that the clean up and closure of these complex contaminated sites will cost the Canadian taxpayers at least Canadian 4,555 million. In many cases. Long term site management will be needed because complex and definite clean up will not be possible. Every year, Indian and Northern Affairs Canada spend millions of dollars in an effort to stop contaminants from escaping these sites. The year (2002) alone, the Department budgeted up to \$ 26 millions to prevent water contamination and protect human health and the environment.

This current care and maintenance approach is a band – aid approach that does little to solve the problems in the long term. Further, considering the rapidly growing costs associated with delaying decisive action, it is not an optimal use of public funds. With insufficient financial resources, the Department was scrambling to keep up with the demands. Long – term stable funding and long- term solutions are required.

In the past, the Department did not collect sufficient financial security from mining companies operating in the North to cover the costs for the eventual clean up and closure of the mines sites. Prior to 1993, there were legislative limits to the amount of financial security that could be collected. Those restrictions were removed in 1993. Since then, Indian and Northern Affairs Canada has progressively increased the amount of financial

security required from owners of operating mines in the North. Its objectives is the obtain full financial security for all mining projects.

The Department reported that full financial security is being achieved for the two new diamond mines. However, it may not be possible for some older mines still in operation. If these older mines are abandoned, Canadian taxpayers will end up paying the difference for their clean up and closure.

The Department's challenge of addressing the problems of northern abandoned mines is two fold:

- Cleaning up the environmental mess it has inherited from the past; and
- Ensuring that mining companies operating in the North pay for the clean up of the environmental problem they create now and in the future.

FOCUS OF THE AUDIT

The audit focused on examining the progress that Indian and Northern Affairs Canada has achieved in managing northern abandoned mines over the last several years through its Northern Affairs Program. The audit covers hard – rock mining only, which is mining that, extracts the mineral from solid rock by drilling or blasting.

The following questions were asked:

- Does the Department have a program in place to identify, assess, and manage abandoned mines, and determine priorities and costs?
- Does the Department have the necessary systems, policies, procedures, and standards to deal with abandoned mines?
- Is the Department doing enough to ensure that currently operating and future mines in the northern mines in the northern territories do not become a financial burden on Canadian taxpayers?
- Is the Department collecting sufficient financial security from mining companies to cover all costs associated with care and maintenance, clean up and closure if they abandoned their mines?
- Is the department conducting the necessary inspections to ensure that it can enforce water license terms and conditions adequately?

OBJECTIVES

The objective of the audit was:-

- To determine the progress the federal government has made in the last several years in managing contaminated sites resulting from abandoned mines in northern Canada including the Yukon, the Northern West Territories, and Nunavut.

Two Subs – Objectives

The main audit objective was broken down into two sub objective as follows

- Determine the extent to which the federal government has identified abandoned mines, completed site assessments, set priorities for funding, selected and implemented site remediation options, and contained the risks posed by these sites.
- Determine whether the federal government has the necessary structures, resources, safeguards, and policies to effectively manage these sites and any future sites that it might inherit.

SCOPE AND APPROACH

The audit used the following scope and approach in realizing audit objective:-

- Examined the management by Indian and Northern Affairs Canada of abandoned hard – rock mines in northern Canada. Chose four mines to examine in detail. These four mines represent a significant portion of environmental liabilities in the region.
- Interviewed department officials, took detailed notes and photographs during the visits.

CRITERIA

In conducting the audit the following criteria was used

- Consistent principles, practices, and standards for conducting environmental liability assessments for its abandoned mines.
- Estimated environmental costs, liabilities, and risk associated with these sites and set priorities for further assessment or remediation.
 - A system for establishing priorities.
 - Contaminated sites management program.
 - Inspections to ensure that water license terms and conditions are adequately enforced.
 - Comprehensive plans for the reclamation of disturbed areas are developed, including the provision of satisfactory financial assurance to cover the costs of reclamation and where necessary long – term Maintenance.

Finding means for reclaiming old mine sites where responsibility can not be assigned and initiated reclamation at those sites posing the greatest risks. e recommendation?

Main Findings

1. Hundreds of thousands of tons of highly toxic chemicals such as arsenic and cyanide are found at northern abandoned mine sites. These chemicals, the result of past mining operations, have accumulated to hazardous levels. Indian and Northern Affairs Canada estimate that the cleanup and closure of these complex contaminated sites will cost Canadian taxpayers at least \$555 million. In many cases, long-term site management will be needed because complete and definitive cleanup will not be possible.
2. Every year, Indian and Northern Affairs Canada spends millions of dollars in an effort to stop contaminants from escaping these sites. This year alone, the Department has budgeted up to \$26 million to prevent water contamination and protect human health and the environment.
3. This current care and maintenance approach is a band-aid approach that does little to solve the problems in the long term. Further, considering the rapidly growing costs associated with delaying decisive action, it is not an optimal use of public funds. With insufficient financial resources, the Department is scrambling to keep up with the demands. Long-term stable funding and long-term solutions are required.
4. In the past, the Department did not collect sufficient financial security from mining companies operating in the North to cover the costs for the eventual cleanup and closure of mine sites. Prior to 1993, there were legislated limits to the amount of financial security that could be collected. These restrictions were removed in 1993. Since then, Indian and Northern Affairs Canada has progressively increased the amount of financial security required from owners of operating mines in the North. Its objective is to obtain full financial security for all mining projects.
5. The Department reported that full financial security is being achieved for the two new diamond mines. However, it may not be possible for some older mines still in operation. If these older mines are abandoned, Canadian taxpayers will end up paying the difference for their cleanup and closure.
6. The Department's challenge of addressing the problems of northern abandoned mines is two-fold:
 - cleaning up the environmental mess it has inherited from the past; and
 - ensuring that mining companies operating in the North pay for the cleanup of the environmental problems they create now and in the future.

Main Conclusions

1. The current situation of abandoned mines in the North demonstrates the importance of integrating the social, economic, and environmental dimensions of development. Indian and Northern Affairs Canada is now tasked with managing serious environmental problems but

lacks the necessary long-term, stable funding. The handling of this situation is far from a good example of "environmental excellence," a goal that the federal government set for itself in the 1999 Speech from the Throne.

2. The Department now has a good grasp of the size and the complexity of the problems and has set priorities for further site assessments and cleanup work. However, its information base on northern abandoned mines needs regular updating. For example, the current cleanup costs it has provided to the Treasury Board are only estimates, with the level of detail varying from site to site.
3. Over recent years, the Department has made progress toward establishing a comprehensive program to deal with contaminated sites in the North, including abandoned mines. Officials of the Department indicated that full implementation of the related draft management framework will depend on available human and financial resources. No annual inspection plans related to water legislation enforcement are prepared; however, the Department has conducted inspections and occasionally identified compliance issues at the four mines we visited.
4. At the time of our audit, the Department had just approved the mine site closure policies for the Northwest Territories and Nunavut, although it had been working on these policies since the late 1980s. The Department has made notable improvement over recent years in setting financial security for mining companies. Its objective is to attain full financial security for all mining projects. It reported that full financial security will be achieved for the two new diamond mines, but this will not likely be possible for some older mines still in operation. Therefore, Canadian taxpayers are not fully protected should some of these mines be abandoned.
5. Overall, Indian and Northern Affairs Canada is making progress in dealing with the problems of abandoned mines in the North. So far, it has successfully contained the contaminants from these mines and avoided serious impacts to human health and the environment. However, the current band-aid approach, covering care and maintenance only, is not sustainable in the long term. The existing containment structures are deteriorating and reaching their capacity. Decisions on whether to do a major retrofit of these structures and/or clean up the accumulated toxic chemicals will be required. Long-term, stable funding and long-term solutions are needed.
6. The Department says its message to the mining industry is now loud and clear: 100 percent financial security is part of the cost of doing business in the North. An inadequate security deposit means no mine. On behalf of all Canadian taxpayers, Indian and Northern Affairs Canada needs to continue its efforts to resolve the current situation and ensure that it does not happen again.

Recommendations

1. **Recommendation.** Indian and Northern Affairs Canada should secure adequate resources to implement long-term solutions.

Department's response. Indian and Northern Affairs Canada agrees with this recommendation. The Department has established a dialogue with central agencies to address the resource shortages and is working with them to secure long-term funding to address contaminated sites and abandoned mines.

2. **Recommendation.** Indian and Northern Affairs Canada should conduct the cleanup, containment, and closure of abandoned mines, based on priorities.

Department's response. Indian and Northern Affairs Canada accepts this recommendation. Priorities have been established for all our contaminated sites, including

abandoned mines, by using the Canadian Council of Ministers of the Environment National Classification System. Workplans are in place for the Department's priority sites, and the Department annually allocates available resources to sites that are deemed to pose the most risk to human health and the environment. The Department cannot determine the completion date for cleanup, containment, and closure of abandoned mines as this will depend on the availability of resources and the technical constraints on each individual site.

- 3. Recommendation.** As soon as possible, Indian and Northern Affairs Canada should put in place its management framework and long-term management plan for contaminated sites and abandoned mines in the North.

Department's response. Indian and Northern Affairs Canada accepts this recommendation. The Northern Affairs Program's Contaminated Sites Management Framework, which includes a long-term management plan, is being finalized in the fall of 2002 and will be updated on an annual basis.

- 4. Recommendation.** Indian and Northern Affairs Canada should make public its water compliance and enforcement policies and report annually on its water compliance and enforcement actions.

Department's response. Indian and Northern Affairs Canada accepts this recommendation. Water compliance and enforcement policies will be made more readily available to the public and an annual summary of compliance and enforcement actions will be prepared by the Northwest Territories and Nunavut regional offices.

- 5. Recommendation.** Indian and Northern Affairs Canada should complete the Yukon Mine Production and Reclamation Regulations.

Department's response. Indian and Northern Affairs Canada agrees with this recommendation; however, the Government of Yukon (GY) now has the lead on this issue due to Yukon Devolution, 1 April 2003. The Department will continue to work with GY to ensure the completion of the regulations, but ultimately the timing will be determined by GY, and the regulations will be promulgated under Yukon legislation after devolution.

- 6. Recommendation.** Indian and Northern Affairs Canada should update the guidelines on the preparation of proper mine site closure plans.

Department's response. Indian and Northern Affairs Canada accepts this recommendation. The Department will work with the Northwest Territories and Nunavut regulatory boards to update and improve the guidelines on the preparation of mine closure plans within two years.

- 7. Recommendation.** Indian and Northern Affairs Canada should provide clear policy directions to water boards on the setting of appropriate security deposit requirements.

Department's response. Indian and Northern Affairs Canada accepts this recommendation. The Department has recently provided the Northwest Territories and Nunavut mine site reclamation policies to the boards responsible for issuing water licences. It will follow up on the ongoing application of these policies

through submissions to the boards on specific applications and ministerial review of major licences issued by the boards.

8. **Recommendation.** For all mining projects, Indian and Northern Affairs Canada should continue to

- establish cleanup cost estimates,
- ensure sufficient financial security deposits are set,
- review the cleanup cost estimates regularly, and
- apply adjustments to financial security deposit requirements as needed

Department's response. Indian and Northern Affairs Canada agrees with this recommendation. The Department will continue to prepare mine closure and reclamation cost estimates for new mines. When appropriate, the Department will update estimates for existing mines. Provisions in the environmental agreements for the two diamond mines, which allow for adjusting the amount of security periodically throughout the life of the mine, will continue to be implemented. Departmental decisions on security requirements, as well as submissions to regulatory licensing boards, will be guided by the principles and objectives of the new Northwest Territories and Nunavut mine site reclamation policies.

the full report is available electronically in website
http://www.oagbvg.gc.ca/internet/English/parl_cesd_200210_03_e_12409.html

Quality of the implementation of mining process

This topic covers the initial phase of a mining. Time and resources should be well spent and the goals that underlie the initiative or action should be accomplished. A good selection of instruments is also important.

One obvious goal for a mining initiative is the implementation of existing legislation. Thus, the construction of a new mining that does not comply with the appropriate legislation can be regarded as inadequate in the implementation process.

Before the establishment of a mining activity that may have a negative impact on the environment, an impact assessment should be conducted. Principle 17 of the Rio Declaration states:

"Environmental impact assessment, as a national instrument, shall be undertaken for proposed activities that are likely to have a significant adverse impact on the environment and are subject to a decision of a competent national authority."

Assessing the impact on the environment before intervening is easy to acknowledge as an ideal. It is also in keeping with the precautionary approach. The following examples from Israel and Paraguay focused on the lack of prior assessment of the environmental impact of mining activities.

Below an experience from GAO on examining and assess whether the government and the mining company maintain adequate internal control system according to rules and laws. The audit also examined whether governments and companies comply with laws, contract of work and impact control documents.

OIL & GAS

Audit objectives

To examine and assess whether the government and the mining company maintain adequate internal control system

according to rules and laws. The audit also examined whether governments and companies comply with laws, contract of work and impact control documents.

Audit criteria

Law Number 11 of 1967 regarding of Mining Rules and Law Number 23 of 1997 regarding Environmental Management, impact analysis and others concerned with mining and standard operational procedures as well.

Audit Method:

The audit assesses budget expenditures and intern control system, as well as disclosure of financial and environment process, conducted with following methods:

4. Risk method

The implementation method based on review and examination of effectiveness of the internal control system. The result influences the reliability of intern control system level according with the laws, and finally guides in determining audit object.

5. Materiality

The audit applies low level of materiality considering that user will give attention on legality and lawfulness on mining's rules. Besides that, materiality on environment management refers to important effects resulted from mine business according with the Environmental Impact Assessment.

6. Audit sampling

The three methods in collecting audit evidences are:

- Interview and observation
- Testing sampling
- Document review

Audit Scope:

4. Oil and Gas Regulatory Agency (BP Migas);
5. PT. Chevron Pacific Indonesia;
6. Other related institutions

Audit Findings:

The audit found weaknesses in controlling the environmental impacts and incompliance to applicable rules as follows.

1. No further decision regarding long-term management of Darling mixing cells and stockpiles.
2. Inadequate handling of hydrocarbon-contaminated soils.
3. Inadequate facilities in the toxic waste temporary storage.
4. Inadequate monitoring and maintenance efforts of hot water pipeline network and hydrocarbon transport shipping line.
5. Gas emissions above tolerable limit.
6. Incompliance of liquid waste and gas emission management in CGS-5 Duri facility with government's rules.
7. Water waste in Duri Canal is above tolerable limit.
8. Emergency waste management is incompliance with SOPs.

9. The company fails to conduct reclamation in its plug and abandoned sites.

Existence of mining policy

It can be argued that the existence of a national mining policy is a prerequisite to any SAI's examination of mineral management, and that without such a policy the SAI lacks a foundation for an audit. At the same time, the existence of a national mining policy is also an issue that a SAI may raise. Some international conventions oblige national governments to take measures that may necessitate the formulation of some sort of national policy. The existence of a mining policy may therefore be audited using an international convention or agreement to derive audit criteria.

In considering the phases of mining and the types of mining may provide good starting points for investigating the existence of a mining policy in a country. Such an audit might reveal an absence of or gaps in the mining policy for one or more of the stages in the mining stream or for one of the types of mining.

It is also important to expose inconsistencies between the mining policy at the different stages in the Mining stream and the general environmental policy. No examples of audits that set out to analyze the existence of a mining policy or the consistency between. General environmental policy and mining policy have been found. The experience of GAO: Mine Safety: Better Oversight and Coordination by MSHA⁴ and Other Federal Agencies Could Improve Safety for Underground Coal Miners

Describe the main audit objectives.

1. Examine the challenges underground coal mines face in preparing for emergencies.,
2. Examine how well MSHA oversees mine operators' training efforts.,
3. Examine how well MSHA and NIOSH coordinate to enhance the development and approval of mine safety technology,
4. Examine how civil penalties are assessed

Scope of the audit

Auditee(s), The Mine Safety and Health Administration (MSHA), the National Institute for Occupational Safety and Health (NIOSH), the Federal Mine Safety and Health Review Commission, the Department of Labor's Office of the Solicitor, the states, and the mining industry share responsibility for ensuring mine safety.

Time period covered The present situation at the time of the report. (2007)

Geographical locations (Regions/districts/provinces covered) All United States locations within the jurisdiction of the Auditee.

Main Findings

1. Mine operators have limited access to special training facilities, and limited capacity to pay for training.
2. MSHA has materials for providing specific hands-on training for mine emergencies

⁴ The Mine Safety and Health Administration

3. MSHA has materials for providing specific hands-on training for mine emergencies, but it does not provide all mine operators with information and tools for training under simulated emergency conditions.
4. MSHA has materials for providing specific hands-on training for mine emergencies, but it does not provide all mine operators with information and tools for training under simulated emergency conditions.
5. MSHA has general guidelines for items to be considered when approving new instructors.
6. MSHA does not have current information on its instructors and does not ensure that they keep their knowledge and skills up to date
7. MSHA does not adequately monitor instructors or evaluate training sessions, and does not assess how well miners are learning the skills being taught.
8. Between 1996 and 2006, MSHA proposed assessing mine operators 506,707 penalties for violations of underground coal mine safety and health standards Mine operators have limited access to special training facilities, and limited capacity to pay for training.
9. MSHA has materials for providing specific hands-on training for mine emergencies
10. MSHA has materials for providing specific hands-on training for mine emergencies, but it does not provide all mine operators with information and tools for training under simulated emergency conditions.
11. MSHA has materials for providing specific hands-on training for mine emergencies, but it does not provide all mine operators with information and tools for training under simulated emergency conditions.
12. MSHA has general guidelines for items to be considered when approving new instructors.
13. MSHA does not have current information on its instructors and does not ensure that they keep their knowledge and skills up to date
14. MSHA does not adequately monitor instructors or evaluate training sessions, and does not assess how well miners are learning the skills being taught.

Between 1996 and 2006, MSHA proposed assessing mine operators 506,707 penalties for violations of underground coal mine safety and health standards

MAIN CONCLUSIONS

1. Underground coal mine operators face significant challenges preparing for emergencies, including ensuring that miners receive realistic training and organizing mine rescue teams that satisfy new requirements.
2. MSHA oversight of miner training is hampered by several factors.
3. Coordination between MSHA and NIOSH⁵ is largely informal and inconsistent
4. Without adequate training, including practice using safety devices in simulated emergency conditions,

⁵ National Institute for Occupational Safety and Health

minors may be unable to safely and confidently escape a mine.

5. Without adequate monitoring of instructors who provide this training, MSHA cannot determine whether all of its instructors are properly qualified or whether it has enough instructors to meet its needs.
6. MSHA is unable to determine whether miners receive timely and appropriate training.
7. Without a more structured method of coordination, MSHA and NIOSH cannot use their shared knowledge base and research to effectively speed the implementation of new safety technology in mines.

It is important that when penalties are issued, penalty decisions are transparent and contain information to understand how final penalty amounts are set.

Recommendations

1. To help mines train their workers under simulated emergency conditions, the Secretary of Labor should direct MSHA to publicize information and available tools for training mine workers under such conditions. In addition, MSHA should periodically review and update this information, as appropriate.
2. To help ensure that mine workers are adequately prepared for emergencies, MSHA should strengthen its monitoring of training. This monitoring should include
 - reviewing and standardizing districts' procedures for approving new instructors;
 - establishing continuing education requirements for instructors to help instructors maintain or improve their knowledge and skills;
 - improving the data in its records on approved instructors; and
 - developing a process for monitoring miner training that includes regularly evaluating training sessions, assessing how well learning objectives are being met, and providing feedback to instructors.
3. To improve the effectiveness of information sharing between MSHA and NIOSH, we recommend that the Secretaries of Labor and Health and Human Services direct their respective agencies to work together to establish a formal memorandum of understanding to guide their coordination. In addition, the agencies should periodically review and update the memorandum, as appropriate.
4. In order to ensure that there is transparency in penalty determinations, we recommend that the Department of Labor's Office of the Solicitor, MSHA, and the Commission take steps to ensure that the specific rationale for all final penalty amounts, including reductions from MSHA's proposed penalties, are adequately documented.

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Monitoring

The term monitoring covers the activities of governments to oversee practices related to mining handling at different stages and the different instruments that governments use to ensure compliance with legislation, concessions and goals related to mining.

First, there is need for information. There has to be a system that provides the government with relevant, reliable, valid information about the different activities related to management of mining activities

This may imply the existence of a system that ensures a satisfactory flow of information, such as reporting procedures. Furthermore, the information needs to be of sufficient quality with reference to the purpose. If the information is statistical, the quality of the procedures for collecting the basic material and punching and processing the data must be satisfactory.

Monitoring may involve checking systems of internal control. These systems require good procedures and must be put to use in a proper manner. They can be subject to supervision by relevant government bodies. If the monitoring agency does not have the capacity to inspect all agencies and activities, the decisions on what to inspect must be based on a calculation of the risks entailed for the population's health and the environment.

These can be information or recommendations, but can also be coercive measures such as fining, closing a mining site, withdrawal of a license or permit or instructions for further practices. Agencies may have the authority to enforce licensee terms and to prosecute those who are handling mining illegally.

The experience from GAO on mineral revenues and data management problems and reliance on self-reported data for compliance efforts put mms royalty collections at risk

Main audit objectives.

Whether Interior has adequate assurance that federal oil and gas are measured accurately

Whether MMS's royalty IT system and royalty collection and verification processes provide sufficient assurance that all royalties are being collected

The extent to which MMS's compliance efforts provide an adequate check on industry's self-reported data

Scope of the audit

Time period covered : April 2007 to July 2008 and the geographical locations was (Regions/districts/provinces covered)

Main Findings

- 1) Neither BLM nor OEMM is meeting statutory obligations or agency targets for conducting inspections of certain leases and metering equipment used to measure oil and gas production, raising uncertainty about the accuracy of oil and gas measurement. Moreover, when these inspections have been conducted, BLM and OEMM have at times recorded inspections inaccurately in their databases. Accurate data are necessary not only to monitor progress throughout the year to determine whether annual goals are achieved, but also to assist MMS in its royalty compliance activities.
- 2) MMS's royalty IT system and processes for collecting and verifying royalty data have improved, but they continue to lack several capabilities that would provide greater assurance that royalties are being accurately collected. For example, MMS's royalty IT system cannot monitor adjustments made to production and royalty data by companies. While MMS is working to address this issue, companies may continue to adjust their previously self-reported production and royalty data without prior MMS approval or review. Furthermore, MMS is unable to identify, in a timely manner, instances in which a royalty report has not been submitted by a company, and, as a result, MMS cannot be entirely confident it is receiving all of the royalties when they are due. Finally, MMS lacks a clear process to determine that royalties are accurately paid in instances when OEMM or BLM identify volume discrepancies during their production inspections and verification work.
- 3) While MMS continues to strengthen its compliance efforts, MMS's use of compliance reviews, which are more limited in scope than audits, has led to an inconsistent use of third-party documents to verify that self-reported industry production and payment data are correct, thereby placing royalty collections at risk. MMS has historically relied on audits to determine whether a company accurately paid its royalties by examining third-party documents that contained information on prices, volumes, and deductions. More recently, MMS has transitioned to relying heavily on compliance reviews that assess whether the royalties paid by a company are reasonable, and do not always include an examination of third-party documents. The absence of a consistent check on self-reported data—such as comparing the data with third-party documents—when conducting onshore compliance reviews raises questions about the accuracy of royalty payments.

Main Conclusions

- 1) However, given high oil and gas prices and the increased interest on the part of oil and gas companies in the nation's oil and gas resources, it is important that we have a royalty collection system going forward that can assure the American public that the government is receiving accurate and timely royalty payments.
- 2) Critical to this is that both BLM and OEMM complete and accurately document their production inspection and verification work. Furthermore, collections of accurate royalties will remain at risk as long as companies may make unverified adjustments to royalty and production data after MMS completes its compliance activities. Increasing this risk is uncertainty regarding the statutory time frames for MMS to collect unpaid royalties, which under one interpretation may leave just 1 year for MMS to identify an improper adjustment.
- 3) Ultimately, Interior's royalty IT system and policies should provide adequate assurance that the federal government receives appropriate value for oil and gas produced from federal lands and waters.
- 4) This royalty collection process should also rely less on companies providing accurate information

on production and royalties owed, and more on a system with the ability to conduct thorough and independent verification of what is owed to the government, using third-party data where available at reasonable cost, and more systematically examining company source documentation.

Recommendations

- 1) To help provide greater assurance that federal oil and gas is being measured accurately, we recommend the Secretary of the Interior take the following three actions:
 - Report to Congress any year in which OEMM and BLM have not met their legal and agency requirements for completing production inspections, along with the cause and a plan for achieving compliance.
 - Define the terms “lease sites producing or expected to produce significant quantities of oil or gas in any year” and “lease sites which have a history of noncompliance with applicable provisions of law or regulations” for offshore oil and natural gas leases.
 - Direct BLM and OEMM to evaluate both the accuracy and completeness of production inspection data in their databases, including the timeliness of data entry, and amend relevant policies and procedures as necessary.

- 2) In addition, we recommend that the Secretary of the Interior direct MMS to take the following three actions to improve its royalty IT system and royalty collection and verification processes:
 - Conduct a study on the Federal Oil and Gas Royalty Simplification and Fairness Act’s effect on MMS’s capacity to efficiently and accurately collect federal royalties due by analyzing both the (1) 6-year timeframe for allowing companies to make adjustments to their federal royalty data and (2) MMS’s 7-year time frame for issuing monetary demands for additional royalties. This study should identify an appropriate time period cutoff for allowing companies to make adjustments without MMS’s prior approval to their royalty and production data and related payments, address the need for clarification on when the 7-year time period begins for issuing a monetary demand, and report the findings to Congress.
 - Finalize the adjustment line monitoring specifications for modifying its royalty IT system and fully implement the IT system so that MMS can monitor adjustments made outside the legal 6-year time frame, and ensure that any adjustments made to production and royalty data after compliance work has been completed are reviewed by appropriate staff.
 - Develop processes and procedures by which MMS can automatically identify when an expected royalty report has not been filed in a timely manner, and contact the company to ensure it is complying with both applicable laws and agency policies.

- 3) Finally, to improve its compliance program, we recommend that the Secretary of the Interior direct MMS to require that the onshore compliance review process include the review of a sample of third-party documentation in instances when BLM has not already collected this information to provide additional assurance that self-reported data are correct.

Full report is available electronically in website address
<http://www.gao.gov/new.items/d08893r.pdf>

The experience of GAO: Mine Safety: Better Oversight and Coordination by MSHA⁶ and Other Federal Agencies Could Improve Safety for Underground Coal Miners

Describe the main audit objectives.

5. Examine the challenges underground coal mines face in preparing for emergencies.,
6. Examine how well MSHA oversees mine operators' training efforts.,
7. Examine how well MSHA and NIOSH coordinate to enhance the development and approval of mine safety technology,
8. Examine how civil penalties are assessed

Scope of the audit

Auditee(s), The Mine Safety and Health Administration (MSHA), the National Institute for Occupational Safety and Health (NIOSH), the Federal Mine Safety and Health Review Commission, the Department of Labor's Office of the Solicitor, the states, and the mining industry share responsibility for ensuring mine safety.

Time period covered The present situation at the time of the report. (2007)

Geographical locations (Regions/districts/provinces covered) All United States locations within the jurisdiction of the Auditee.

Main Findings

15. Mine operators have limited access to special training facilities, and limited capacity to pay for training.
16. MSHA has materials for providing specific hands-on training for mine emergencies
17. MSHA has materials for providing specific hands-on training for mine emergencies, but it does not provide all mine operators with information and tools for training under simulated emergency conditions.
18. MSHA has materials for providing specific hands-on training for mine emergencies, but it does not provide all mine operators with information and tools for training under simulated emergency conditions.
19. MSHA has general guidelines for items to be considered when approving new instructors.
20. MSHA does not have current information on its instructors and does not ensure that they keep their knowledge and skills up to date
21. MSHA does not adequately monitor instructors or evaluate training sessions, and does not assess how well miners are learning the skills being taught.
22. Between 1996 and 2006, MSHA proposed assessing mine operators 506,707 penalties for violations of underground coal mine safety and health standards Mine operators have limited access to special training facilities, and limited capacity to pay for training.
23. MSHA has materials for providing specific hands-on training for mine emergencies
24. MSHA has materials for providing specific hands-on training for mine emergencies, but it does not provide all mine operators with information and tools for training under simulated emergency conditions.
25. MSHA has materials for providing specific hands-on training for mine emergencies, but it does not provide all mine operators with information and tools for training under simulated emergency conditions.
26. MSHA has general guidelines for items to be considered when approving new instructors.
27. MSHA does not have current information on its instructors and does not ensure that they keep their knowledge and skills up to date

⁶ The Mine Safety and Health Administration

28. MSHA does not adequately monitor instructors or evaluate training sessions, and does not assess how well miners are learning the skills being taught.

Between 1996 and 2006, MSHA proposed assessing mine operators 506,707 penalties for violations of underground coal mine safety and health standards

MAIN CONCLUSIONS

8. Underground coal mine operators face significant challenges preparing for emergencies, including ensuring that miners receive realistic training and organizing mine rescue teams that satisfy new requirements.
9. MSHA oversight of miner training is hampered by several factors.
10. Coordination between MSHA and NIOSH⁷ is largely informal and inconsistent
11. Without adequate training, including practice using safety devices in simulated emergency conditions, miners may be unable to safely and confidently escape a mine.
12. Without adequate monitoring of instructors who provide this training, MSHA cannot determine whether all of its instructors are properly qualified or whether it has enough instructors to meet its needs.
13. MSHA is unable to determine whether miners receive timely and appropriate training.
14. Without a more structured method of coordination, MSHA and NIOSH cannot use their shared knowledge base and research to effectively speed the implementation of new safety technology in mines.

It is important that when penalties are issued, penalty decisions are transparent and contain information to understand how final penalty amounts are set.

Recommendations

5. To help mines train their workers under simulated emergency conditions, the Secretary of Labor should direct MSHA to publicize information and available tools for training mine workers under such conditions. In addition, MSHA should periodically review and update this information, as appropriate.
6. To help ensure that mine workers are adequately prepared for emergencies, MSHA should strengthen its monitoring of training. This monitoring should include
 - reviewing and standardizing districts' procedures for approving new instructors;
 - establishing continuing education requirements for instructors to help instructors maintain or improve their knowledge and skills;
 - improving the data in its records on approved instructors; and
 - developing a process for monitoring miner training that includes regularly evaluating training sessions, assessing how well learning objectives are being met, and providing feedback to instructors.
7. To improve the effectiveness of information sharing between MSHA and NIOSH, we recommend that the Secretaries of Labor and Health and Human Services direct their respective agencies to work together to establish a formal memorandum of understanding to guide their coordination. In addition, the agencies should periodically review and update the memorandum, as appropriate.
8. In order to ensure that there is transparency in penalty determinations, we recommend that the Department of Labor's Office of the Solicitor, MSHA, and the Commission take steps to ensure that the specific rationale for all final penalty amounts, including reductions from MSHA's proposed penalties, are adequately documented.

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⁷ National Institute for Occupational Safety and Health

A CASE STUDY: MONITORING OF FISH AND HUMAN EXPOSURE TO MERCURY DUE TO GOLD MINING IN THE LAKE VICTORIA GOLDFIELDS, TANZANIA

UNIVERSITY OF DAR ES SALAAM, TANZANIA

Increased use of mercury in gold recovery in mining operations in many developing countries in recent year has raised world concern over the release of this toxic metal into the environment. Previous experiences of human mercury poisoning in Minamata Bay (1956) in Japan and in Iraq (1970s) indicate the dangers associated with mercury contamination. Little work, however, has been undertaken to study environmental mercury contamination in African countries where an increasing number of people are engaged in so called "artisan" small scale gold mining using mercury amalgamation technique. In Tanzania, for example, it is estimated that about 250,000 people are involved in small scale gold mining in three principal gold fields namely the Lake Victoria goldfields around Lake Victoria.

RISK

There is potential risk of human exposure to inorganic mercury because of the extensive use of mercury in gold recovery in the Tanzanian goldfields.

Furthermore, inorganic mercury released into river systems during gold ore processing is likely to be gradually transformed into the highly toxic form of methyl mercury and become concentrated through biomagnifications in aquatic food chains, particularly in fish consumed by local populations.

STUDY OBJECTIVE

To determine mercury levels in fish and human hair and urine in order to assess environmental and human exposure to mercury in the Lake Victoria gold fields.

SCOPE

The Lake Victoria Gold Field (LVGF) refer to a number of goldfields located to the east and south of Lake Victoria in northern Tanzania. About 4.5 tonnes of mercury are released annually in the LVGF alone by gold mining activities

Two study areas, Mugusu and Nungwe Bay were chosen for biological monitoring of mercury contamination. Mugusu has been an active small scale gold mining area since 1988. Inhabitants of the Mugusu mine were chosen for monitoring of inorganic

Hg exposure from amalgam burning. Nungwe Bay on the south western part of Lake Victoria is located about 10 Km from the Mugusu gold mine. The bay is essentially a drainage area for the Mugusu (Mabubi) river and other rivers contaminated with Hg due to gold mining activities. The bay is surrounded by a village (Nyamwilolelwa) whose inhabitants are engaged both in fishing and farming, and fish is a major item in their diet. Those inhabitants were thought to be suited for monitoring of organic mercury exposure through fish consumption. Fish from Nungwe Bay was considered to be ideal for monitoring of environmental mercury contamination in that area as fish could not be obtained from the contaminated rivers.

METHODOLOGY

Sampling was conducted during the first week of November 1995. Hair and urine samples were collected mainly from inhabitants of the Mugusu goldmine and Nungwe Bay fishing village. Hair samples were collected by cutting about 30 – 50 mg of hair close to the scalp. Each sample was preserved in a labelled paper envelope and kept in air tight plastic bags. Spot urine samples were collected in clean glass bottles with tight plastic caps.

Both hair and urine samples were kept at room temperature (25 °C) for 4 days before the samples were transported from the field to the Geochemical Laboratory at the University of Dar es Salaam where they were kept in a freezer until the time of shipment to Japan for analysis.

Fish samples were collected from different types of fish caught from Nungwe Bay by fishermen during the day of sampling. Each fish sample consisted a rectangular piece (2 x 4 CM) of fish muscle. The samples were collected in thick polyethylene bottles with tight caps and kept in a cooler box until brought to the nearby town where the samples were frozen. All fish samples were transported and kept frozen until analyzed. Mercury analysis: Samples were analyzed for total mercury (T – Hg) and methylmercury (MeHg) at the National Institute for Minamata Disease (NIMD) in Japan.

CRITERIA

In conducting the study the University Of Dar e salaam used the following criteria:-

1. According to WHO environmental health criteria Hg concentrations in fresh-water fish from non-polluted areas are commonly in the range of 100 – 200 ppb (0.1 – 0.2 Mg/g).

2. The reference value for total mercury in hair is considered to be about 2000 ppb (2 ug/g; WHO).
3. The urinary Hg level that increases the incidence of Hg toxic affects is considered to be above 50ng/ml.

RESULTS/FINDINGS

Monitoring of environmental and human exposure to mercury in the Nungwe Bay area of the Lake Victoria goldfields, Tanzania revealed the following:-

- Low mercury concentration in fish (range: 1.8 – 16.9 ppb, mean : 7.0 ppb);
- Human hair (range : 156 – 442 ppb, mean: 304 ppb)
- Urinary mercury levels in gold mine workers frequently exposed to Hg vapour in amalgamation and burning of amalgam were significantly higher (mean : 241 mg/ml) than in the general mine population not occupational exposed to Hg (Mean : 2.6 hg/ml.)

RECOMMENDATION

Rotation of mine duties (e.g. amalgamation or amalgam burning VS mining) reduced urinary Hg levels in the mine workers and hence the risk of mercury intoxication.

5.0 CHAPTER FIVE

5.1 GOOD AUDITING PRACTICE

This chapter introduces the development of environmental management, sustainable development, and the need for conducting sustainable audits as well as certain linkages shared between these concepts.

5.1.1 SUSTAINABILITY AUDITING

Sustainability auditing can be seen as measuring a corporate entity's performance and accountability through a process of examination and investigation of the audited organization's record, statements, systems and procedures in accordance with the three pillars (environment, economic and social) of sustainable development – the so called “triple bottom line”. In order to achieve sustainability the three pillars should be measured holistically (integrated approach) in order to achieve an appropriate balance. Balancing the three pillars is by no means an easy task nor is finding the appropriate balance.

The basics of environmental management system auditing

Successfully auditing any environmental management system relies on a few critical factors, namely:

- Knowledge of the principles and general issues regarding environmental management;
- Basic knowledge of natural science (e.g. chemistry, ecology etc);
- Basic knowledge of business principles and procedures;
- Knowledge of environmentally related legislation and legal principles;

- Knowledge of the standard (ISO 14001: 2004) and its interpretation.

The process to be followed in order to audit an environmental management system is very similar to that employed in the auditing of any formalized management system, and involves the following basic process:

- Collection of evidence through review of policies, procedures, work instructions, records, interviews and physical observations;
- Evaluating the evidence for compliance against set criteria contained within standard (ISO 14001);
- Legislation and other requirements such as industry or company specific requirements;
- Testing conformance to policies, procedures and work instructions through interviews, evaluation of records and physical observation.

5.1.1.1 Environmental Management Tools And Systems

Since sustainable development requires the integration of environment and development issues at the outset of the decision-making process, policy/decision makers are increasingly obliged to attempt strategic environmental impact assessment (SEA), so as to align core macroeconomic, energy, transportation, forestry, fisheries, fiscal and other economic strategies with environmental goals.

Another tool being promoted is environmental technology assessment (EnTA), which is used to assess the implications of technologies and to analyse and express their environmental impacts. Policy/decision makers can use EnTA to evaluate the impacts of industrial process options on environment and sustainable development generally. This assessment methodology is rapidly maturing, and a variety of international groups are studying how technology assessment can best be carried out in their sectors. The United Nations Environmental Programme (UNEP) is testing the methodology in regional workshops, using specific examples of mining technologies as case studies for further evaluation. For example, the cyanide leaching techniques used in gold mining were extensively analysed and assessed in a sub regional workshop in Potchefstroom, South Africa, in November 1996.

Below are the environmental management tools for mining:

Tools for analysis:

- Corporate environmental benchmarking
- Cost-benefit analysis
- Environmental auditing
- Environmental impact assessment
- Full-cost accounting/total-cost assessment
- Initial environmental assessment
- Life-cycle assessment
- Risk assessment
- Environmental technology assessment
- Strategic impact assessment
- Sustainable development indicators

Tools for action:

- Environmental management systems
- Environmental policy
- Total quality environmental management
- Eco-labelling

Tools for reporting:

- Corporate environmental reporting (companies)
- Sector-wide reports (associations)
- State-of-the-environment reports (Governments)

Full-cost accounting (FCA) is a tool used to identify, quantify and allocate the direct and indirect environmental costs of ongoing operations. It helps identify and quantify three types of cost for a product, process or project: direct costs (e.g., capital, raw materials), hidden costs (e.g., monitoring, compliance reporting), and contingent liability costs (e.g., public relations, good will).

Audits are coming into increasing use⁸. An environmental audit provides a retrospective look at an existing mining operation to see how successfully environmental issues are being addressed. It helps in assuring the accuracy and relevance of environmental monitoring. It also measures an organization's environmental performance and can encourage continual improvement. There are many types of environmental audits, including audits of sites or facilities, of regulatory compliance or management systems, or of technical aspects such as energy use or pollution releases.

Communication is becoming an increasingly interactive management tool in addition to its traditional function of one-way delivery of information. Thus, company environmental reporting can involve the publication of verifiable information on corporate environmental performance, contained in either annual or one-off reports. Reporting can play a valuable role in improving the company's overall management. Internal and external reporting have essentially the same requirements: understanding and balancing stakeholder needs, assessing problems and identifying opportunities for improvements, and establishing goals and plans.

The range of environmental tools available has resulted in some confusion as to their value and application, and who should use them. A project manager cannot be an expert in all techniques; the challenge is to manage the applications in a rational way. Moreover, when tools are incorporated into national standards and regulations, there arises the misconception that these are "government" tools, rather than an aid in corporate decision-making. Environmental auditing, life-cycle assessment, risk assessment, EIA and more recently SEA, and standards for environmental management systems have therefore been slow to be adopted as regular procedures by the industry.

Some management tools have progressed to the point of international standardization. The recent adoption of ISO 14001 has brought with it the sudden need to train large numbers of senior

⁸ The rising cost of environmental liabilities has led companies in North America and Europe to develop environmental auditing as a management tool to identify environmental problems and to monitor their environmental performance similar to the way a financial audit is used to measure financial performance. The first goal was to ensure compliance with environmental laws and regulations. The scope has since been extended to cover the monitoring of "best management practices" for environmental vulnerabilities.

managers in its implications and applications. A recent survey by KPMG in Canada showed a surprising degree of reluctance to incorporate this standard into operating procedures. This is particularly worrying, as several countries are already considering requiring ISO 14001 certification as a pre-condition for project approval.

Many mining companies pursue specific programmes with more limited but environmentally important objectives, including:

- Occupational health and safety programmes for employees;
- Responsible care programmes on safety, risk reduction, and public communication;
- Cleaner production, eco-efficiency or waste minimization programmes to achieve greater efficiency of resource use and less polluting discharges; and
- Longer-term product stewardship principles, including eco-labelling, product safety, and disposal.

Such programmes, sometimes of impressive scope, are developed independently by responsible companies in order to achieve specific environmental policy objectives. Ideally, however, these programmes should find their place within a broader environmental management system with a wider but integrated approach.

5.1.2 Pollution prevention/cleaner production

Cleaner production (CP) is the continuous application to processes, products and services of an integrated preventive environmental strategy in order to increase efficiency and reduce risks to humans and the environment.

- For production processes this means conserving raw materials and energy, eliminating toxic raw materials, and reducing the quantity and toxicity of all emissions and wastes; and
- For products this means reducing negative impacts throughout a product's life cycle, from raw materials extraction to its ultimate disposal.

In spite of widespread international efforts and the obvious benefits, CP has not been incorporated into facility operations. As a concept it has failed to attract a spontaneous client base and remains driven by CP service suppliers, donors and international agencies. The barriers inhibiting uptake include: inappropriate or contradictory signals; weak support for information dissemination strategies; lack of company senior management interest in, or commitment to CP concepts; and limited availability of finance for CP investments.

Current environmental legislation and regulatory systems often stipulate or require investments in end-of-pipe or waste management technology rather than promoting pollution prevention investments.

With the trend towards the worldwide development of free market economies, privatization and deregulation, there is also a demand for government action to promote proper market development under acceptable social and environmental conditions. This is expected to have an impact on international trade. Increasingly the concept of pollution prevention is seriously looked on as a way of avoiding waste production altogether.

Cleaner production is especially important for developing countries, many of which are expanding industrial production quickly. That pace will make it imperative for developing countries to seize the opportunity to invest relatively cheaply in CP rather than pay heavily later for clean-up operations, as the industrialized nations have had to do. Doing so will also provide developing countries with a competitive edge.

Cleaner Production in mining

Cleaner production has not been adequately developed in the mining sector. There are also discrepancies within the industry itself, with cleaner production of metal extraction not adequately addressed. The following points and comments (Reeve, 1997) briefly describe the situation in the mining sector and provide a general insight into why it has evolved in this way:

- Most of the environmental efforts to date involve site remediation and clean-up after making the mess rather than preventing the pollution and AMD in the first place.
- Media reports of massive mine site pollution appear to be on the increase.
- There is some effort being dedicated to reuse of metals already in the industrial system, and metal recycling plants are enjoying a growth period (zinc, aluminium, etc).
- Insufficient effort is placed (towards zero emission) on developing non-toxic, closed-loop extraction chemistry in the mining industry.
- In relation to gold extraction, the use of cyanide and mercury still dominates. Industry in the meanwhile maintains that well-managed operations pose little risk.

5.1.3 Environmental management system

It is generally accepted that with effective planning, modern technology and careful management, much of the degradation historically associated with mining can be avoided and mining can be pursued at an acceptable environmental cost.

Environmental management is a systematic approach to environmental care in all aspects of business. Mining and other companies are increasingly assessing the benefits of adopting environmental management as well as the risks of not adequately addressing environmental issues such as accidents, inability to obtain bank credits and other investment money and loss of markets. The concept of the environmental management system (EMS), first introduced in the Netherlands, is firmly established in Europe and receiving increasing attention in other parts of the world. Together with environmental auditing it is becoming an integral part of business strategy and is also being adopted by government.

ISO 14001 defines an EMS as part of the enterprise overall management system. It includes the organisational structure, planning activities, responsibilities, practices, procedures, processes, and resources for implementing and maintaining environmental management. It includes those aspects of management that plan, develop, implement, achieve, review, maintain and improve the enterprise's environmental policy, objectives and targets.

A formal environmental policy is an important first element in a management system, as this affects both the environmental and production personnel in their day-to-day responsibilities. Company policies can be based on models already developed by national or international industry associations, or the company may develop its own. This self-development process often results in a better understanding and subsequent commitment by staff.

The "Deming model" of quality management⁹, set out in ISO 9000, provides the framework for most EMS. It divides the enterprise's actions into four phases:

1. A planning phase where the overall objectives and goals of the enterprise are established and the methodologies for achieving them developed (initial environmental review, environmental policy and an environmental action plan).
2. An action phase where the plan is implemented and agreed measures are taken in pursuit of the enterprise's goals (responsibilities and procedures).
3. An evaluation phase where the actions taken under the plan are checked for effectiveness and efficiency and the results compared to the plan (monitoring and control, records, corrective and preventive actions, environmental audit).
4. A corrective action phase where any deficiencies or shortcomings identified are repaired, the plan revised and adapted to changed circumstances, and procedures reinforced or reoriented as necessary (management review).

⁹ "Total quality management" (TQM) concepts, although originally aimed at reducing and eventually eliminating defects (non-compliance with specifications) in manufacturing and at improving the efficiency of business processes, have increasingly been applied to managing environmental issues.

Some companies have already realized the advantages of applying and developing EMS. In Australia, for example, the CRS mining company started applying EMS with two objectives: to decrease the impact of its operations on the community and the environment; and to ensure that the company was taking a due diligence approach. The following objectives have since been added: to increase job satisfaction and pride; and to improve corporate relations with shareholders, who see the EMS as a responsible initiative (Australian Environmental Protection Agency, 1995).

The environment has moved rapidly up the corporate agenda. Corporations and companies have realized that in order to stay in business, they will increasingly have to integrate environmental considerations into their business strategy and long-term planning. Environmental planning has to be a key component of project planning, and environmental management has to be a central part of project management. The process of environmental management is a complex matter in its own right, but needs to be fully integrated with other planning and management systems in an organization.

The integration of environmental management into business operations includes procedures for incorporating environmental measures into other aspects of an enterprise's operations, such as the protection of workers, purchasing, R&D, product development, mergers and acquisitions, marketing, finance, and so on. This includes the development of specific environmental procedures, usually detailed in operating manuals and other operating instructions describing measures and actions to take on the implementation of the environmental programme or action plan.

Interest in EMS generally, and ISO 14001 in particular, is very strong. Industry and Governments need to be informed about the system and its implications. The recently prepared EMS training resource kit assists companies, associations and agencies in this process.

5.1.4 Environmental monitoring and auditing

I. Monitoring

Monitoring provides the information for periodic review and alteration of the environmental management plan as necessary, ensuring that environmental protection is optimized at all stages of the mining project.

It informs management of what is going on, what the state of the environment is, and how operations are proceeding within the site. Monitoring is required to obtain baseline information about environmental quality before operations begin, and to examine periodically the impact of the operation on water quality (surface and groundwater), native species, chemical contamination of soils, and human health (both at the workplace and outside it, if necessary).

Plant monitoring measures the actual operating and discharge parameters of the plant on an ongoing basis. Monitoring must be done according to a formal schedule, using standard sampling and analytical

procedures, and carried out by trained personnel. Without such protocols, the considerable expense of monitoring programmes may be rendered completely futile by invalid results.

The protocols must clearly state the basis for subsequent interpretation, especially if statistical analysis is to be used, or if the results are likely to be used to demonstrate compliance in a court of law. Monitoring results should be interpreted by an appropriate expert and passed on to higher management for information.

Where compliance with regulations is one of the objects of monitoring, the analytical requirements may be laid down in detail by the authorities.

Through proper monitoring, undesirable environmental impacts can be detected at an early stage and remedial measures taken. Monitoring also serves to identify economic loss of raw or refined material, and general operating inefficiencies.

A proper environmental monitoring programme in the mining industry would have the following key components:

- Water monitoring;
- Land monitoring;
- Air and noise monitoring;
- Process and waste monitoring;
- People and community monitoring; and
- Biological monitoring.

Monitoring programmes will differ from site to site given the diversity of climates, ecosystems, land uses, topographies and social factors. The monitoring programme should identify which actions need to be taken to ensure acceptable environmental performance at each site.

II. Auditing

An audit is a retrospective look at an existing mining operation to see how successfully the environmental issues are being addressed. It helps to safeguard the environment, by assisting with and substantiating compliance with local, regional and national laws and regulations, and with company policy and standards.

The audit procedure involves gathering relevant background and environmental data, reports and programme details. An inspection checklist is generally used during the site inspection by the audit team. This team may be either internal or external, depending on the objectives of the exercise.

A company environmental audit gives an overall view of the company's mechanisms and their effectiveness in environmental control, as well as regulatory compliance. Management systems auditing (full environmental auditing) cover such issues as:

The growing environmental agenda, along with the globalization and liberalization processes, has stimulated the development of new management tools, instruments for improving decision-making or bringing about changes in behaviour, with the overall aim of improving the environmental performance of the industry.

- Lines of responsibility for environmental controls;
- Resources allocated; and
- Effectiveness of security and protection measures.

In addition to regulatory compliance and management system auditing, specific technical audits of energy consumption, waste and pollution sources, and site contamination are possible. Each technique has its own application and the methodology is described in operations manuals. Regulatory compliance covers issues such as establishing the actual level of environmental discharges; site contamination; and accidents, etc.

Waste and pollution audits can pinpoint exactly where in a process most of the wastes originate and why they are allowed to be released. Energy audits seek to investigate the pattern of energy consumption within a company and to propose cost-effective conservation measures. Both waste and energy audits often lead to substantial cost savings within a company by identifying where excessive wastage occurs.

Site audits try to document the state of soil contamination, and perhaps also groundwater contamination. This may have an economic payback in identifying the practices that led to the contamination. Remedial clean-up measures being notoriously expensive, such audits may result in improved operating procedures, thereby avoiding further expenditure during the eventual site closure phase.

The auditing process should ensure that the monitoring programme adequately measures the true nature and extent of all contaminated discharges to water and air, whether chemical or physical.

III. Environmental reporting

Reporting closes the management loop by giving the company an overview of how it is performing, outlining areas for improvement and searching for ways to do so. Public reporting is becoming an important management instrument in some countries, even for smaller recycling facilities.

In the past, most companies regarded auditing as an internal management tool, with the results remaining confidential. More recently, auditing information has often been reported in the annual environmental reports of different companies. A 1994-95 audit of the WMC Australian mining company revealed deficiencies in document

control, oil and fuel management, saline water management, compliance with dangerous goods regulations, species diversity on rehabilitated lands and tailings management.

Company environment reports cover policy, practice and performance. They disclose internal targets, usually beyond compliance, and discuss shortfalls as well as achievements. Reports can encourage better performance and offer benchmarks across the industry. Company environmental reporting is considered a major tool for improving environmental performance.

Appendixes

Appendix 1—WGEA resources for SAIs

All the documents referred to in this appendix are available at: <http://www.environmental-auditing.org>

WGEA meetings and compendia themes

For the past several WGEA meetings, a call for papers has been issued to all SAIs prior to the meeting. From these papers, a compendium is compiled to facilitate information sharing. This list provides the themes of the papers for each year.

11th Meeting of the WGEA—Arusha, Tanzania (25 to 29 June 2007)

- Audits of Global and Regional Environmental Issues
- Audits of Domestic Environmental Issues
- Emerging Topics in Environmental Auditing
- Supreme Audit Institutions' Approaches to Building and Managing Environmental Auditing

10th Meeting of the WGEA—Moscow, Russian Federation (27 October to 1 November 2005)

- Auditing Biological Diversity
 - Auditing Climate Change
 - Increasing the Impact of Environmental Audits
 - Environmental Auditing: Facing the Challenges

9th Meeting of the WGEA—Brasilia, Brazil (30 May to 2 June 2004)

- Environmental Auditing and Biological Diversity
- Concurrent, Joint or Co-ordinated Audits
- Environmental Audit and Regularity Auditing
- Environmental Auditing: Facing New Challenges
- Supreme Audit Institution Approaches to the World Summit on Sustainable Development

8th Meeting of the WGEA—Warsaw, Poland (24 to 27 June 2003)

- Environmental Audit and Regulatory Auditing
- Sustainable Development: The Role of Supreme Audit Institutions
- Water Issues, Policies, and the Role of Supreme Audit Institutions
- Towards Auditing Waste Management **WGEA studies and guidelines**

WGEA studies and guidelines

- Auditing Water Issues: Experiences of Supreme Audit Institutions (2004)
 - Cooperation Between Supreme Audit Institutions: Tips and Examples for Cooperative Audits (2007)—English
 - *The Audit of International Environmental Accords* (2001)—English, Spanish
 - *Towards Auditing Waste Management* (2004)—English, French, German, Arabic

Audits related to environment

Audits and audit summaries from SAIs are available on the WGEA website (in the section “Environmental Audits worldwide”), listed by environmental issue and by country. Many are available only in their national language.

WGEA / IDI environmental auditing training program

- In partnership with the INTOSAI Development Initiative, a two-week training course was created for SAIs. The course was designed by IDI training specialists, has a learner-centred participatory approach, and reflects regional needs. It includes a standardized design for course materials and detailed instructor manuals.

2005–2007

WGEA work plan summaries

Activities and projects focussed on providing guidance, facilitating information exchange and building relationships, and were organized under the following six goals

To expand the number and breadth of environmental auditing tools available to SAIs.

2. To increase information exchange among SAIs and to expand their training in the techniques of environmental auditing.
3. To increase the number of concurrent, joint, or coordinated audits by SAIs.

4. To increase communication of WGEA activities.
5. To increase cooperation between the WGEA and other international organizations.
6. To explore the potential for external funding for the WGEA activities

Appendix 2—List of Audits of Biodiversity Conducted by SAIs

Most of the audits listed in this appendix were provided to the authors of this paper, through a questionnaire that was sent to the SAIs. All the case studies in the Chapter 3 are listed in the following table, along with any available Web links to these audits or their summaries

Please note that the links to these audits are only listed if they are available in English. Other audits may be available, in other languages, on each SAI's individual website. For a more comprehensive list of audits of biodiversity produced by SAIs, go to the WGEA website at: <http://www.environmental-auditing.org/>.

Country	year	Audit title	Weblink where available
Canada		Annual Report on Environmental Petitions	http://www.environmental-auditing.org/Portals/0/AuditFiles/Canada_f_eng_cesd_200812_05_e.pdf
Indonesia		Audit on the Implementation of Environmental Impact Assessment in PT Chevron Pacific Indonesia	
Colombia	2008	Environmental management of mining activities: carbon and gravel carment de carupa,cucunuba,guacheta and sutatausa municipalities	
Paraguay	2008	Exploitation of mineral resources handling by the vice ministry of mine and energies	
United states	2008	Natural resources management, opportunities exist enhance federal participation in collaborative effort to reduce comfit and improve natural resources condition	

Appendix 1: links to UN Agencies with specific Internet resources on mining, UN Agencies with activities in the mining sector, Informational, Independent Initiatives, Government, Industry, Non Governmental Organizations (NGO, Commercial / Financial, Academic / Research / Consulting

<p>United Nations Environment Programme (UNEP) http://www.uneptie.org/pc/mining</p> <p>The World Bank Group http://www.worldbank.org/mining</p>	<p>International Labor Organization (ILO) http://www.ilo.org/public/english/dialogue/sector/sectors/mining.htm</p> <p>United Nations Industrial Development Organisation (UNIDO) http://www.unido.org</p>	<p>Mining Association of Canada (MAC) http://www.mining.ca</p> <p>Prospectors and Developers Association of Canada (PDAC) http://www.pdac.ca</p>	<p>NGOS</p> <p>Mining Watch Canada http://www.miningwatch.ca</p> <p>Project Underground http://www.moles.org</p> <p>Infomine http://www.infomine.com</p> <p>Mine Web http://www.mineweb.com/</p>	<p>The Centre for Energy, Petroleum and Mineral Law and Policy (CEPMLP) http://www.cepmlp.org</p>
<p>United Nations University (UNU) http://www.unu.edu</p> <p>Mineral Resources Forum (MRF) http://www.natural-resources.org/minerals</p>	<p>Extractive Industries Review (EIR) http://www.eireview.org</p> <p>Socially Sustainable Development Strategy (SSDS) http://www.ssds.info</p>	<p>Mineral Policy Center (MPC) http://www.mineralpolicy.org</p> <p>Mineral Policy Institute (MPI) http://www.mpi.org.au</p>	<p>United Nations Economic Commission for Europe (ECE) http://www.unece.org</p> <p>United Nations Economic and Social Commission for Asia and the Pacific (ESCAP) http://www.unescap.org</p>	<p>Congo Online http://www.congo-online.com/</p>

Appendix 2

Glossary

- <http://www.cyanidecode.org/>
- [<http://www.unep.org/Documents/Default.asp?Document/D-97>]
- [<http://www.unep.org/Documents/Default.asp?Document/D-97>]
- (Website: [<http://www.unglobalcompact.org/>])
- (Website: [<http://www.un.org/Overview/rights.html>])
- (Website: [<http://www.pic.int>])
- (Website: [<http://www.unccd.int>])
- <http://www.un.org/sustdev/sdissues/technology/techmapub.htm>
- <http://www.un.org/esa/sustdev/sdissues/technology/ertema1.htm>
- <HTTP://WWW.ITAC.ORG/STORE/DETAILS.TMPL?SID=11235959318284>
- <http://www.itac.org/store/Details.tmpt?SID=11235959318284>
- www.gao.gov/cgi-bin/getrpt?GAO-05-418
- <HTTP://WWW.IFU.ORG/STORE/DETAILS.IMPL?SID=112359318284> – PAGE 20
- <http://www.ifu.org/store/details.tpl?SID=112359318284>
- http://www.hc-sc.gc.ca/ewh-semt/pubs/eval/handbook-guide/vol_4/mining-miniere-2-eng.php
- http://www.fnehin.ca/site.php/sitenews/profile_on_mining_and_environmental_health/
- *World Business Councils for sustainable Development. From challenge to opportunity: The role of business in tomorrow's society. (2006)*
- *Carrol and Buchholtz, p36 – Business and Society and Stakeholders Management – 5th ed. Australia: (3) Thomson South – Western, 2003.*
- *Corporate Social Responsibility: Meeting changing Expectations;*
-
- http://www.ret.gov.au/resources/mining/leading_practice_sustainable_development_program_for_the_mining_industry/Pages/bpem_mining_industry.aspx
-
- More references will be added on the next draft.....
- <http://www.cambrianmining.com/!Images/Home/Home1.jpg>, cover images