

Mining in Zambia: Challenges to Effective Regulation

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Abstract

The nationalized mining sector in Zambia has undergone virtually complete privatization since January 2000. Prior to this, Zambian mines, while blessed with substantial copper and cobalt deposits, had received little upgrading or funding for environmental protection. As well, paramount concerns related to copper requirements during the Second World War and post war reconstruction efforts resulted in legislation (in the then Northern Rhodesia) that exempted mining companies from prosecution related to air quality issues. This legislation persisted to the mid-1990s however there has been insufficient capital available to build the air treatment infrastructure. Currently, air quality in areas of the Copperbelt Province and the aquatic habitat in the Kafue River, a tributary to the Zambezi River, are two significant mining environment issues in Zambia. A third environmental risk relates to the stability of tailings dams constructed to design standards consistent with the time of construction. These designs result in perpetually high maintenance costs, with the funds and infrastructure to provide necessary maintenance not always readily available. With the onset of privatization, new investors in the form of multinational mining companies, have adopted their corporate environmental policies in Zambia, which has placed increased pressure on the Environmental Program of the Zambian Mines Safety Department (MSD) of the Ministry of Mines and Minerals Development to review development plans as well as monitor and enforce environmental regulations related to mining. The Mining and Mineral Sciences Laboratories (MMSL-CANMET) of Natural Resources Canada under contract with the Canadian International Development Agency (CIDA), are working with MSD to accelerate the development of an increasingly functional environmental inspection program for mining, using Canadian experience and consulting expertise to facilitate this process. With a considerable Canadian mining presence already established in Zambia, it is anticipated that the project will help to establish a regulatory regime that will benefit new and existing Canadian mining companies in Zambia.

Project Location

Zambia (formerly Northern Rhodesia) is located on the vast central plateau in Africa. It consists of nine provinces covering approximately 750,000 square kilometres with a population of 9.3 million people (Figure 1). In contrast to some of its neighbours, Zambia is a stable and peaceful democratic republic. Most of the current mining activity is concentrated in the Copperbelt Province of Zambia (Figure 2). This part of Zambia is 12° south of the equator at an elevation of 1200 m and borders on the Southeastern portion of the Democratic Republic of Congo (Zaire).

The Copperbelt Province is almost entirely within the drainage basin of the Kafue River, which joins the Zambezi River below Mosi-o-tunya (Victoria Falls) and the Kariba Hydroelectric reservoir. The Zambezi River forms a significant part of the border with Zimbabwe (formerly Southern Rhodesia) and

ultimately drains to the Indian Ocean. The Kafue River and its aquifer supplies all mine water and receives all effluent from the Copperbelt. It also supplies domestic-potable water to the majority of the population of Zambia. The release of substantial levels of metal rich suspended solids over a period of decades has resulted in severe siltation and loss of aquatic habitat in sections of the Kafue River as well as significant economic loss for the mines. Pollution control facilities (settling ponds) are historically non-existent or underdesigned for the task of retaining heavy metals as solids on the mine properties and to control pH, sulphate and metals levels in discharged water.

Mineral Resources and Exploitation

Zambia has very substantial mineral resources with deposits grading over 6 % copper plus substantial levels of cobalt and by-products of gold, silver, antimony and selenium. The older tailings deposits often have high

residual grades of copper, usually around 1%. A number of the tailings deposits are being re-mined and are now producing a substantial amount of low cost copper product. The Copperbelt geological formation extends across the border into the Democratic Republic of the Congo and it is believed that this formation turns back to Zambia into the Northern Province. The extension of the Zambian mineral resources has not received exploration attention for over 30 years and remains largely unexplored for its mineral potential.

Zambia hosts the second largest emerald deposit in the world but this is substantially underdeveloped and does not contribute significantly to the Zambian economy. There are also large deposits of amethyst and other semi-precious stones in several areas of the country and a number of kimberlite and alluvial diamond areas are currently being explored. The Kabwe lead-zinc mine, in Central Province just south of the Copperbelt, was commissioned in 1902 and operated until 1994. A tailings reprocessing operation (tailings grade above 9% zinc) started in 2001 providing economic relief to some of the thousands of unemployed miners that remain in the area. There are thermal-coal mines located in the southern part of Zambia. The Country also has substantial hydroelectric generation facilities.

Though the mining industry has a questionable environmental past, it contributes significantly to Zambia's economy and the well being of the Zambian people. It remains the largest industry in Zambia, producing approximately 80% of Zambia's foreign exchange and 10-12% of its Gross Domestic Product.

There has been a substantial decline in production from a peak in the mid-1970s to the mid-1990's (Table 1). In addition, there has been a substantial decline in commodity prices over this same period, which has had a very significant effect on the Zambian economy. Copper production results from ten underground and five open pit copper mines. The Nchanga Mine is the biggest producer in the commonwealth and began production in 1939. It is anticipated that the revitalisation of this industry can return production levels to near historical levels within a few years.

The new private sector owners are responsible for recapitalizing infrastructure and introducing environmentally sound technologies and practices to their acquired operations. A grace period, referred to as the 'Stabilization Period', has been granted to allow the new owners to complete this, although the

time frames have been individually negotiated, as the issues are very site specific. The Zambian government, through its wholly owned ZCCM Investment Holdings Plc, has retained responsibility for all environmental and safety issues associated with abandoned and defunct facilities as well as for the facilities not yet privatized.

While financing of the recapitalisation for infrastructure and the introduction of environmentally sound technologies are the responsibility of private sector owners, environmental protection is regulated by government legislated standards with which companies must comply by the end of the negotiated stabilization periods. It is therefore important for the government institutions having responsibility for permitting and monitoring of mining operations in Zambia to be familiar with international environmental management capabilities and practices in order to provide a positive investment climate.

Project Description

Given the socio-economic importance of the mining sector in Zambia and the effect that it has had on the Zambian environment, it is expected that Canadian assistance in addressing environmental mining-management issues in Zambia will result in far-reaching benefits for all of Zambia.

The Mining and Mineral Sciences Laboratories (CANMET-MMSL) of Natural Resources Canada is the executing agency for a capacity development project entitled *Environmental Management in the Mining Sector of Zambia (EMMS)*. The project has been developed in partnership with CIDA and the Government of the Republic of Zambia (through the Ministry of Mines and Minerals Development).

The project was developed over a number of years and initiated in March of 2001 with an operational time frame of four years. The goal of the project is to improve environmental management practices and performance in the mining sector in Zambia. The project purpose is to strengthen the technical and managerial capacity of the Mines Safety Department of the Ministry of Mines and Minerals Development (MMMD) and other key mining sector institutions in Zambia to execute statutory mandates to regulate, monitor, enforce and/or implement appropriate environmental management practices in the mining sector. The partners in the project are: the Mines Safety Department (MSD); the Environmental Council of Zambia (ECZ); ZCCM Investment Holdings Plc (ZCCM-IH); the two Universities of Zambia, and representatives of the mining industry.

The MSD was created in 1957 to ensure that the then private mining companies complied with national health and safety requirements. The mines were subsequently nationalized after independence. More recently, MSD has also been tasked with providing environmental expertise related to mining as a sectoral expert to the national level expertise of the ECZ. This is a new field for the department, and MSD has established its Environmental Unit to review Environmental Impact Assessments, environmental plans and audit reports submitted by the industry. As this was a new function for the agency and modern environmental practices with regard to mining were unfamiliar during the period of nationalized mine operation, a need for a substantial increase in expertise was identified.

The ECZ was created in 1990 and is responsible for implementing environmental policy and ensuring the country's compliance with environmental regulations, standards, and guidelines as per the 1990 *Environmental Protection and Pollution Control Act*. The Council was set up to co-ordinate the environmental management activities of all government organizations and agencies and plays a co-ordinating role in the preparation and implementation of cross-sectoral programs of consequence to the environment. The ECZ is also responsible for final approval of environmental impact statements/plans at a national level, the issuance of discharge permits and licenses and enforcement and prosecution. ECZ relies on competent sectoral authorities to implement and enforce regulations in the field, such as MSD as the competent authority for the mining sector.

ZCCM Investment Holdings Plc, majority owned by the government of Zambia, is charged with managing the residual holdings left after privatization of the Mines, all of which it had operated during the period of nationalization. A large portion of their activity is directed at the rehabilitation of defunct sites and facilities. As part of this mandate, the company will need to develop environmental plans related to decommissioning and rehabilitation of the sites. A World Bank project is providing significant funding for this initiative.

There are two universities in Zambia. The School of Mines of the University of Zambia was established in 1973. It offers a five-year program in geology, mining engineering and metallurgy/ore processing, with graduates receiving a Bachelor Degree in Mineral Sciences. While some environmental management courses are already included in the various programs, in order to ensure that graduates

enter the workforce with the environmental management skills required by the minerals and metals industry, the project will attempt to expand and strengthen the existing student curriculum with regard to environmental management in mining. The Copperbelt University delivers Technical Diplomas and is expected to benefit from this program in a similar fashion to the University of Zambia.

The First Two Years:

The project has provided the information and training required to develop new expertise within the partner agencies, but the prevailing economic and life expectancy conditions have thwarted a significant portion of the initial effort.

Very high inflation levels have eroded government agencies' salary levels over the past several years and government workers are largely unable to sustain themselves and their families without alternative sources of income or food. Conditions of service for many government workers includes the employer paying rent for employees but economic conditions have resulted in frequent non-payment of rents and a reluctance on the part of landlords to invest in housing maintenance and to accept government workers as tenants due to the poor payment track history. As staff leave to seek more sustaining sources of income it becomes difficult to attract and retain new employees. Currently, a mining inspector working for government (MSD) receives several times less than industry employees with similar education and experience. This disparity makes recruitment and retention of trained, experienced staff very difficult.

In addition, whereas the working period in the first world is in the order of 35 to 40 years, that period is substantially less in Zambia, due to high mortality rates in working age groups. The resulting employee turnover rates are such that larger staffing levels are generally required to ensure a continuing availability of suitably trained and experienced personnel.

At the inception of the project it was identified that it would be very important that MSD in particular, find a means of generating and retaining sufficient operating funds to effectively fulfil its mandate. An analysis of resource requirements and potential for revenue generation is currently underway in an effort to develop a stabilized and sustainable agency to receive the training program.

Environmental Conditions:

The National Environmental Action Plan of Zambia (NEAP) is the guiding document for the Zambian government, international development agencies and other stakeholder activity in Zambia's environmental sector. The NEAP identifies five principal environmental problems facing the country: air pollution; water pollution and sanitation; land degradation; deforestation; and wildlife depletion.

The strategic and global importance of copper production during the Second World War and post war reconstruction period resulted in an exemption of mining companies from prosecution for air emissions under the terms of the *Smoke Damage Prohibition Act*. This legislation was repealed in the mid-1990s. Although progressive environmental regulations related to mining were passed in the mid-1990s, environmental concerns, particularly air and water quality could not be addressed due to the financial constraints prior to and during the 5-year privatization process from 1995 to 2000. New mine owners are now faced with the daunting task of reducing costs, while simultaneously spending significant money on modernization.

Another environmental risk relates to the stability of tailings dams constructed to design standards consistent with the time of construction. These designs result in perpetually high maintenance costs, due largely to extensive erosion during the rainy season and disturbance by the local population. The funds and infrastructure to provide the necessary maintenance are not always available. New investors obviously were unwilling to take over the liabilities left by historical mining practices of previous operators and these very substantial liabilities remain with the Zambian Government, under the control of ZCCM-IH.

The Zambian mining industry has undergone privatization and is in a period where conditions are appropriate for wholesale adoption of modern environmental practices. A modern *Mines and Minerals Act* was passed in 1995, which reflects current environmental management requirements. International mining companies are returning to Zambia either to acquire brownfield sites or to take up new exploration licenses. For example, a Canadian company, First Quantum Minerals Ltd., has 100% ownership of the Bwana Mkubwa SX/EW operation, and has interests in the Nkana underground copper mine and cobalt refinery, and the Mufulira underground copper mine, smelter and copper refinery. In addition, it is currently

developing the Kansanshi open pit copper deposit, and is operating the first trans-border operation, with ore mined from the Lonshi deposit in the Congo being processed at the Bwana Mkubwa SX/EW facility in Zambia.

With the privatization of mining properties, multinational investors are entering or have entered the Zambian mining industry. This has resulted in the introduction of new mining and environmental technologies and practices consistent with individual corporate commitments to environmental protection. Knowledge of modern environmental management practices in mining has been improved over the past two years, however it remains weak within the various statutory institutions making it difficult for those institutions to effectively assess environmental effects, monitor industry performance and enforce regulatory compliance. The Government of Zambia and the industry are both aware of this and the need to raise the level of knowledge of the statutory agencies in order to promote a meaningful dialogue between industry and government. An informed dialogue will ensure responsible environmental management practices are implemented within the mining sector of Zambia in a timely fashion.

Mining and processing methods, in conjunction with an old and inefficient infrastructure and relatively uncontrolled smaller scale mining activities including stone crushers, have resulted in degraded air and water quality and localized land surface degradation through soil loss to wind and water erosion. These effects however, should be considered secondary to the human suffering that has resulted from the overall economic decline of the mines in spite of the vast untapped mineral potential in the country.

Sulphur dioxide and particulate emissions from smelting and refining activity in the Copperbelt region of Zambia are the leading air quality issues, while effluent from various aspects of mining activity is the country's primary non-urban water quality issue. Significant, and potentially larger effects, although unmeasured, occur as a result of vehicle emissions, uncontrolled burning and disposal of waste and garbage in urban areas and of bush and grasslands throughout the country. The lack of economic opportunity has forced many people to turn to subsistence activities for survival. This includes burning areas in preparation for agriculture activity and cutting of trees in all areas near human habitation to provide fuel for cooking and warmth.

Sulphur dioxide and particulate emissions from smelting and roasting operations result in increased ground level concentrations during overcast or rainy conditions with resultant respiratory distress however surprising little apparent vegetation damage. These issues are being

addressed through more stringent legislation, including the introduction of sulphur dioxide emission penalties. Environmental Impact Assessments are underway in order to formulate environmental management plans to redress this matter. Environmental inspection, follow up and enforcement has not been consistently implemented or sustained. This results in two negative circumstances, the industry remains uncertain of what is expected of it and what it must do to actually comply, and unequal and uncertain application of the legislation causing economic disadvantage, or an uneven playing field, increasing the risk, cost and therefore reluctance of new investors who are needed for the economic recovery of the country and to alleviate human and environmental suffering.

The Government of Zambia has expressed the will to implement and enforce the Environmental Protection and Pollution Control Act and to promote and adopt internationally accepted standards and practices of environmental management in mining. Canada is well positioned to provide development assistance in this regard, since it is recognized as a world leader in the development and application of environmentally sustainable and clean technologies in the minerals and metals sector.

Activities for the current year include: a major initiative to review the core critical functions, organizational structure and funding options of the Mines Safety Department, in an effort to enhance the longer term sustainability of this key organization; reciprocal visits for Zambian and Canadian mining sector regulators, to exchange information on approaches to various issues; working sessions on the review of Environmental Impact Assessments; a needs assessment related to the requirements for effective air quality monitoring; and, a feasibility study on the installation of an industry wide (including regulators) competency based training system. The project is expected to strengthen the capacity of Zambia to perform its environmental management roles and functions in an effective fashion and to manage the sustainable development of its very substantial mineral resources, to the benefit of the country and its people.

In summary, the project is very timely, with events taking place in Zambia that will provide a fertile ground in which to introduce and/or improve environmental management practices in the mining sector, including:

- 1) Enactment of a modern, progressive *Mines and Minerals Act* (1995) and *Environment Protection and Pollution Control Act* (1990);
- 2) Recent privatization of ZCCM's mining assets;
- 3) Increasing foreign interest and investment in the largely unexplored mining potential in Zambia;
- 4) Public sector reform, with increased emphasis on efficiency, capacity building and client orientation;
- 5) Pressure for continuing improvement in environmental performance from the international community.

MSD and the other stakeholder agencies are enthusiastic and committed to increasing their specialized environmental management knowledge, techniques and expertise through additional training, in order to effectively perform their duties.

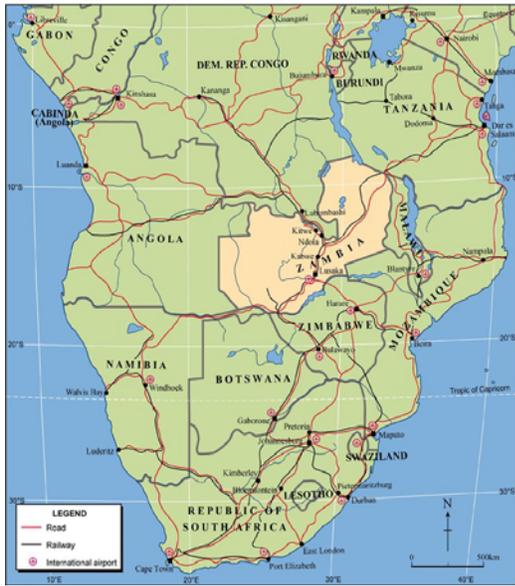


Figure 1: General Map of Southern Africa.



Figure 2: Map showing Zambian Provinces.

Table 1. Annual Production Levels of Major Commodities from Zambian Mines.

Commodity	Mid-1970s (metric tonnes)	Mid-1990s (metric tonnes)
Copper	700,000	200,000
Cobalt	5,000	3,000
Lead/Zinc	7,600	0