AN ASSESSMENT OF THE ENVIRONMENTAL COMPLIANCE MONITORING CAPACITY OF THE DEPARTMENT OF MINERALS AND ENERGY, EASTERN CAPE

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ABSTRACT

One of the greatest challenges facing the world today is integrating industrial activities such as mining with environmental integrity and social concerns. Monitoring is fundamental to environmental management, both to assess the adherence to standards and to allow environmental managers to learn from practical experiences. However, a problem arises when the regulatory authorities cannot keep up with their mandate of enforcement and compliance monitoring. This research examined how the Department of Minerals and Energy (DME) implements the concept of sustainable development in the mining sector of the Eastern Cape (EC) and, more specifically, the extent to which the Mine Environmental Management (MEM) section is able to effectively monitor compliance of mining operations with environmental legislation. This was the first systematic compilation of statistical data for the DME, and presents the first study in the EC regional office in terms of environmental sustainability.

Results indicate that there has been a sustained increase in mining activity over the past three years, possibly as a result of the boom in the construction industry and the accelerated road maintenance and improvement programmes in the Eastern Cape. Mining applications received by the DME have increased by 47% from 2006 to 2007 (January-May) and by a further 100% from 2007 to 2008. In addition to the increasing number of mining concerns being established, 98 mining concerns will need to apply for the conversion of their old order rights to new order rights by the 1st May 2009. Mining in the province is predominantly small scale with mining permits (mined areas less than 1.5Ha) making up 52.3% of all applications, with larger mining concerns contributing 29.3% and prospecting contributing the remaining 18.4%.

In terms of compliance inspections, the EC regional office is required to conduct 120 environmental compliance inspections annually in terms of contributing to sustainable development. The MEM section exceeded this target since 2003. However, when the number of operational mines is considered, 120 inspections per year equates to one mine being visited, on average once every four years (based on 2008 data). Based on projected figures (number of compliance audits and number of operational mines) for 2009, the DME's target of 150 inspections for 2009/10 combined with the limited staff

capacity will, at best, mean that mines would be inspected once in seven years. However, the target of 150 inspections will not actually even cover the expected number of EMP evaluation inspections. This has serious implications in terms of regulating the compliance of the mining concerns with their EMPR's. The low level of compliance monitoring can be directly related to staff capacity and logistics problems at the regional office as well as provincial targets being based on staff capacity rather than the number of operational mines. Thus, considering potential environmental damage associated with mining operations and the capacity constraints of the MEM to conduct frequent compliance audits, it is likely that mining operations will have negative implications for sustainable development in the region. Currently there are many challenges facing the DME in terms of contributing positively to sustainability in the mining sector and there is a need to base future actions on the idea of continuous improvement and ultimately progress.

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LIST OF ACRONYMNS

AMICEM	Australia's Minerals Industry Code of Practice for Environmental Management
ANS	Net Adjusted Savings
CARC	Canadian Arctic Resources Committee
CEAA	Canadian Environmental Assessment Act
DA	Department of Agriculture
DDT	Dichloro-Diphenyl-Trichoroethane
DEAT	Department of Environmental Affairs
DLA	Department of Land Affairs
DME	Department of Minerals and Energy
DRT	Department of Roads and Transport
DWA	Department of Water Affairs
EIA	Environmental Impact Assessment
EKC	Environmental Kuznet Curve
EMP	Environmental Management Plan
EMPR	Environmental Management Programme Report
EPA	Environmental Protection Agency (USA)
GDP	Gross Domestic Product
IAIA	International Association for Impact Assessment
IIED	International Institute for Environment and Development
MEM	Mine Environmental Management
MPRDA	Mineral and Petroleum Resources Development Act
NMA	National Mining Association
OECD	Organisation for Economic Co-operation and Development
SAMI	South African Mining Industry
SEA	Strategic Environmental Assessment
SRI	Socially Responsible Investment Index
UNEP	United Nations Environment Programme
UNCED	United Nations Conference on Environment and Development
UNESCAP	United Nations Economic and Social Commission for Asia and the Pacific
WCED	World Commission on Environment and Development

CHAPTER 1: INTRODUCTION

1.1 INTRODUCTION

Economic growth is an explicit economic goal in every nation. Neoclassical theory of economic growth argues that there are no environmental limits to growth, and all forms of capital are completely substitutable. However, while most manufactured and human capital can be replaced, the destruction of natural capital is often irreversible within generational timeframes (IIED, 2002a,b). Often the services provided by the environment cannot be substituted, since the loss of some forms of 'critical' natural capital, for example, the ozone layer or biological diversity, could threaten our very existence on earth.

In 1987, the Brundtland Commission passed the resolution of sustainable development, defining sustainable development as '*development that meets the needs of the present without compromising the ability of future generations to meet their own needs*' (WCED, 1987; Rogers *et. al*., 2005). The report presents a powerful argument that the environment and development should be addressed together because they are interdependent – both as problems and solutions (Hilson and Basu, 2003) and the emphasis must be placed on the achievement of more equitable but sustainable growth within the biophysical limits (UNCED, 1992). As an outcome of the Brundtland Report, many countries have incorporated 'sustainable development' into their planning and criteria for decision-making (Franceschi and Kahn, 2003; Gibson *et. al*., 2005).

The mining industry produces minerals and energy that are essential to economic prosperity and a better quality of life (NMA, 2006). Worldwide, until the 1970's, environmental issues associated with past mining practices were not a major consideration and environmental degradation was accepted as the price that had to be paid for the production of essential mineral commodities. The new challenge associated with the application of a sustainable development framework in mining, is to make sure that the minerals sector as a whole, contributes to human welfare and well-being today without reducing the potential for future generations to do the same. Thus, efforts must increasingly concentrate on environmental and social responsibility.

Widespread criticisms of mining centre on the externalization of the environmental and social costs of the industry, which inevitably leads to the inequitable and unsustainable distribution of mining costs and benefits (Fields, 2003; King and Mori, 2007). Taking these criticisms into account, one may question whether the mining industry is actually taking the necessary steps towards sustainability that goes beyond what is legally required.

The key issue in South Africa is that the route to sustainable development is directed by government policy and legislation and the regulatory authorities play the vital role of ensuring that development, including mining and related operations, adhere to policies and the law. Compliance monitoring by regulatory authorities is thus fundamental to environmental management in South Africa and aims to assess the adherence to environmental standards. Without it, the process remains incomplete (Linder, 1986; Burby and Paterson, 1993; Ramos, *et. al*., 2004; Ross, *et. al*., 2006; Stephenson, 2006). Although the enforcement of regulation and government control is complex, it determines to a large extent, the effectiveness of the law.

In South Africa, the Department of Minerals and Energy (DME) is the responsible authority concerning the regulation and promotion of the minerals and energy sectors. More specifically, the Mineral Regulation Branch is responsible for the regulation of all mining and prospecting activities and enforces the requirements of the Mineral and Petroleum Resources Development Act (Act 28 of 2002) and related regulations that make provision for the equitable access to and sustainable development of the nation's mineral and petroleum resources. The main compliance tool of the mineral industry is the Environmental Management Programme Report (EMPR), which provides information on the mining activity, emphasizing how the mining activity may impact on relevant environmental factors and how these impacts may be mitigated and managed over the life of the mine so as to be environmentally acceptable. It includes a description of the environmental objectives and specific goals related to the management of the identified environmental impacts emanating from the proposed mining operation, and outlines the environmental implementation programme, planned monitoring and mitigation, ultimately leading to successful mine closure. Part of this regulation therefore includes checking compliance of mining operations with the conditions of their EMPR.

In terms of staff compliment, the Eastern Cape (EC) Office is the smallest regional office of the DME. It is, however, responsible for environmental compliance in a region that is experiencing increased growth in terms of the number of mining operations. With limited capacity, it is predicted that monitoring of compliance of mining operations in the Eastern Cape with the condition of their EMPR's would also be limited, and this could have significant negative implications for the impact of mining on the environment and overall sustainability of the mining sector.

1.2 RESEARCH OBJECTIVES AND KEY QUESTIONS

Considering the above, the overall objective of the current project was therefore to ascertain the current and future capacity of the DME to effectively evaluate EMP/EMPR's and EIA's and monitor compliance of mining operations with the conditions of their EMPR's, in the pursuance of the sustainable development of mining within the Eastern Cape.

The key questions to be addressed by the current study were :

- Historically (13 years), how effective have the DME been in monitoring environmental compliance of mining operations in the EC?
- What is the predicted growth of the mining sector within the EC over the next five years?
- Based on existing resources, what is the DME's likely ability, to monitor environmental compliancy within the EC in the future?
- What are the challenges facing the DME and how does this reflect on capacity and what are the main problems facing authorities?

1.3 STRUCTURE OF THE DISSERTATION

The major theoretical concepts discussed in the literature review (Chapter 2) include the concept of sustainable development, sustainability related to mining, and the regulatory frameworks relevant to mining. Chapter 3 summarizes the research goals and key questions and Chapter 4 outlines the results and discussion. The data analysis reports on the current economic growth in the mining sector and the character of mining in the Eastern Cape.

The foundation of any sustainable development policy is environmental legislation. The policies and indicators that the DME use to indicate sustainability are outlined and the tools used to measure sustainability (EMP evaluations, financial provision for rehabilitation, compliance monitoring and enforcement), and the implementation thereof, are assessed. Finally, the Chapter 5 provides a synthesis of the findings and assesses implications for the management of environmental impacts of mining within the EC Province in the near future. The report is concluded by suggesting some recommendations that could contribute to the goal of environmental sustainability in the mining sector within the Province.

This is the first systematic compilation of statistical data for the Eastern Cape and presents the first study in the DME Regional Office in terms of environmental sustainability.

CHAPTER 2
LITERATURE REVIEW : SEEKING SUSTAINABILITY WITHIN THE MINERALS SECTOR

2.1 INTRODUCTION

Past development has advanced economic growth, but at a growing environmental cost. Over the past two hundred years, the combination of industrialisation and capitalism has resulted in unprecedented pressure on the physical and biological systems that support life on earth. The world's resources "are being battered on all fronts" (Ulhoi and Madsen, 1999 :1). The Stern Report (Stern, 2006) provides evidence that dramatic changes are taking place – the climate system is becoming more unstable, global warming, shrinking forests, melting icecaps, depleted fisheries, dying coral reefs, droughts and encroaching deserts and greater demands on diminishing water supplies. These are all early warning signs that the world is approaching its carrying capacity. "Environmental limits are being reached and breached – with uncertain outcomes for the future well-being of people and nature" (Burgess, *et. al*., 2003 : 261). The current-day economic practices are not sustainable and the consequences of infinite human demands on a finite world cannot be avoided (Lamm, 2003; Glenn and Gordon, 2006). We cannot be growth maximizes and ecological realists at the same time.

This chapter begins with a review of the literature on the origin of sustainable development, concentrating on the three pillars of sustainable development (environmental, economic, social) and why an integrated approach is required. A discussion of the concept of sustainability within the mining sector is then followed by a review of the international regulatory frameworks relevant to mining. Since Canada and Australia are major players in the mineral exploration industry (ranked first and second in the world rankings, respectively), it is relevant to consider their mining regulatory frameworks in comparison with the South African mining legislative framework. Internationally, there are a number of challenges and constraints facing governments in terms of the environmental compliance monitoring of mining operations and these challenges are highlighted in this chapter.

2.2 THE ORIGINS OF SUSTAINABLE DEVELOPMENT

Many credit Rachel Carson's book, The Silent Spring (1962), as the catalyst for the acknowledgement of worldwide environmental problems (Cafaro, 2006; Kroll, 2006). Carson defined the impact of DDT (Dichloro-Diphenyl-Trichoroethane) and other pesticides, due to unrestrained and indiscriminate use and spraying, on the contamination of the food chain, genetic damage and the death of entire species. For the first time, the need to regulate development in order to protect the environment became widely accepted. Other publications such as Paul Ehrlich's Population Bomb (1968) and the Club of Rome's Limits to Growth (1972) also drew attention to global developmental issues. Ehrlich predicted famine and disaster on an unprecedented scale and 'Limits to Growth' warned that if the world's consumption patterns and population growth continued unabated, then the earth will run out of non-renewable resources within a century (by 2072). But they also stated that it was possible to alter these growth trends, in order to establish ecological and economic stability that can sustain the future. The authors described their stance as 'not blind opposition to progress, but opposition to blind progress' (Meadows, *et. al*., 1972).

In 1987, the Brundtland Commission passed the resolution of sustainable development, defining sustainable development as 'development that meets the needs of the present without compromising the ability of future generations to meet their own needs' (WCED, 1987; Rogers *et. al*., 2005). This definition introduced the concepts of intra- and inter-generational equity. Intra-generational equity states that all people within the current generation have a right to fair access to the earth's natural resources while inter-generational equity covers the concept that future generations should not be deprived of resources as a result of the current generation consuming them at unsustainable levels (Weiss, 1993; Goodland, 1995; Cawood, *et. al*., 2001; Hanley and Atkinson, 2003). Thus, the Brundtland report presents a powerful argument that the environment and development should be addressed together because they are interdependent – both as problems and solutions (Ulhoi and Madsen, 1999; Hilson and Basu, 2003) and that the emphasis must be placed on the achievement of more equitable but sustainable growth within the biophysical limits (UNCED, 1992). The environment is held in 'commons' for all generations and must be viewed from a long-term perspective. But what is a 'commons' and can it really work?

2.3 TRAGEDY OF THE COMMONS

Hardin's 'tragedy of the commons' (Hardin, 1968) has proven to be a useful concept for understanding how we have come to be on the brink of numerous environmental disasters. Tragedy of the commons is a social trap that involves a conflict over resources between individual interests and the common good. Hardin's parable demonstrates how free access and unrestricted demand for a finite resource, ultimately dooms the resource through over-exploitation. This occurs because the benefits of exploitation accrue to individuals, each of which is motivated to maximize his/her own use of the resource, while the costs of exploitation are shared amongst all who use the resource. This is the tragedy – the actions of self-interested individuals do not promote the public good. Unfortunately, knowing the conditions that lead to a tragedy does not always ensure one can easily avoid it.

The 'social contract' is the basis of morality – it is the set of rules that rational people will agree to obey, for their mutual benefit, provided that other people will obey them as well. We benefit directly from the ethical conduct of others and our own compliance is the price we pay to secure their compliance. Thus, sustainable development must be a cultural adaptation made by society. The only way to protect 'the commons' is to be cooperative and to act responsibly (Krol, 2001).

With the evidence of climatic change mounting, the Johannesburg Summit on Sustainable Development (2002) was dominated by debate about how best to manage the accelerating impacts of human activities on destabilizing and degrading environmental systems. On a global scale, the pressures on the earth have increased dramatically - between 1950 and 1990, the world's population increased two-fold from 2.6 to 5.3 billion, water use increased three-fold, fish consumption grew 4.4-fold, use of chemical fertilisers increased 10-fold, world production of organic chemicals (major sources of air and water pollution) rose 20-fold, and global air travel (which causes significant atmospheric pollution) soared 70-fold (Corson, 1994 : 206). The evidence is overwhelming - yesterday's solutions have become today's problems (Coté, 2007). Global warming is not just an ideological or political issue, but the biggest moral challenge facing us today. The only way to cope with these issues is to deal with the environment and development issues together in a balanced manner (Hugo, 2004), recognizing the synergistic interaction of the economic, environmental and social systems.

2.4 THE THREE PILLARS OF SUSTAINABLE DEVELOPMENT

Sustainable development is comprised of three components – environmental, economic, and social (Pearce, 1988; Westley, *et. al*., 2002) and this is frequently referred to as the triple bottom line (Elkington, 2005).

2.4.1 THE ENVIRONMENTAL COMPONENT

Ecosystem services refer to a wide range of conditions and processes through which natural ecosystems and the species that are part of them, help to sustain and fulfil human life. Ecosystems provide 'services' that moderate extreme weather conditions and their impacts, disperse seeds, protect people from the sun's harmful ultraviolet rays, recycle nutrients, detoxify and decompose waste, maintain biodiversity, and generally contributes to climate stability. These services (Table 2.1) are so fundamental to life, that they cannot be taken for granted, yet they tend to be severely threatened through population growth and increasing world consumption (Millennium Ecosystem Assessment, 2005).

Table 2.1 : Ecosystem functions and services (adapted, Hindmarch *et. al*, 2006 : 138).

Ecosystem functions	**Ecosystem services**
Regulation functions	Providing maintenance of ecological processes and life support systems
Habitat functions	Providing suitable living space for 'wild' plant and animal species
Production functions	Providing natural resources from which to make goods (consumables and structural)

Depletion and degradation of many ecosystem services represents a loss of capital assets that is poorly reflected in conventional economic indicators, such as Gross Domestic Product (GDP). For example, a country could engage in extensive deforestation or depletion of its fisheries, and this would show only as a positive gain to

GDP, despite the loss of natural assets. As a result, ecosystem services are generally greatly undervalued, for a number of reasons – they are not traded or valued in the marketplace; they serve the public good rather than provide direct benefits to individual landowners; those who disrupt ecosystem service often do not pay for the consequences; and society does not compensate landowners who do safeguard ecosystem services for the economic benefits they lose by doing so. Thus there is a need for the ‘natural capital’ of ecosystems to be properly valued, and the value embedded in decision-making frameworks (Burton, 1987; Lapalme, 2003; Hugo, 2004; Sassen, 2005; Johnson, 2005; Common and Staaf, 2005).

Environmental management is not only about management of the environment; it is also about management of developmental activities within the limits of the assimilative capacity of the environment (Rogers *et. al*., 2005). For a renewable resource (soil, water, forest, fish) the sustainable rate of use can be no greater than the rate of regeneration. For a non-renewable resource (fossil fuel, high grade mineral ore, fossil groundwater) the sustainable rate of use can be no greater than the rate at which a renewable resource, used sustainably, can be substituted for it. For example, treated sewage can be discharged into a stream sustainably at the rate at which the natural ecosystem in the water can absorb its nutrients. However, the maintenance of ecological integrity should be a fundamental constraint on all economic activity. “Biodiversity is the basis for evolution and adaptation to changing environments, making it essential for survival of life” (IAIAc, 2003 : 2). It plays a significant role in sustaining the resilience of ecosystems, which tend to be more resilient when there are many species performing essential functions (photosynthesis, decomposition). Each responds in different ways to outside disturbances so that species can replace or compensate for one another in times of severe disturbance (Gunderson and Holling, 2002).

There is increasing evidence that human induced loss of resilience can lead to sudden switches to alternative, less desirable states (Holling and Gunderson, 2002; Holling, *et. al*., 2002). For example, if not properly managed, water seepage from salt mining pans or slimes dams can infiltrate the groundwater systems and this can ultimately lead to salinization or toxification of the soils as a result of the evaporation processes. However, this problem may only manifest itself years later, when the productivity of the soil becomes threatened and the established plants die from high toxicity levels. "This heightens the possibility that in ignorance we may cross a seemingly minor environmental threshold that may precipitate a cascade of unpredictable, deleterious and potentially irreversible effects" (Hindmarch, *et. al*., 2006 : 138). Figure 2.1 illustrates that simple causes (A) can have complex and unfavourable outcomes (B) that can degrade the wider environment, requiring remedial measures (C), and may even push the ecosystem to the point of collapse (D). The simple sustainable response would be to first identify any problems that could arise through risk assessment and ensure that processes are put in place to avoid any such incidences. Rather identify possible causes of problems than just relying on trying to ameliorate the symptoms.

As ecosystem resilience is lost, the system becomes more vulnerable to external shocks that could previously be absorbed. Unfortunately, we have eroded resilience in many natural systems to the extent that their ability to protect us from the impact of disturbances has diminished, irreversibly, ultimately leading to the loss of options (Goodland, 1995 ; Folke, *et. al*., 2002; Holling and Gunderson, 2002).

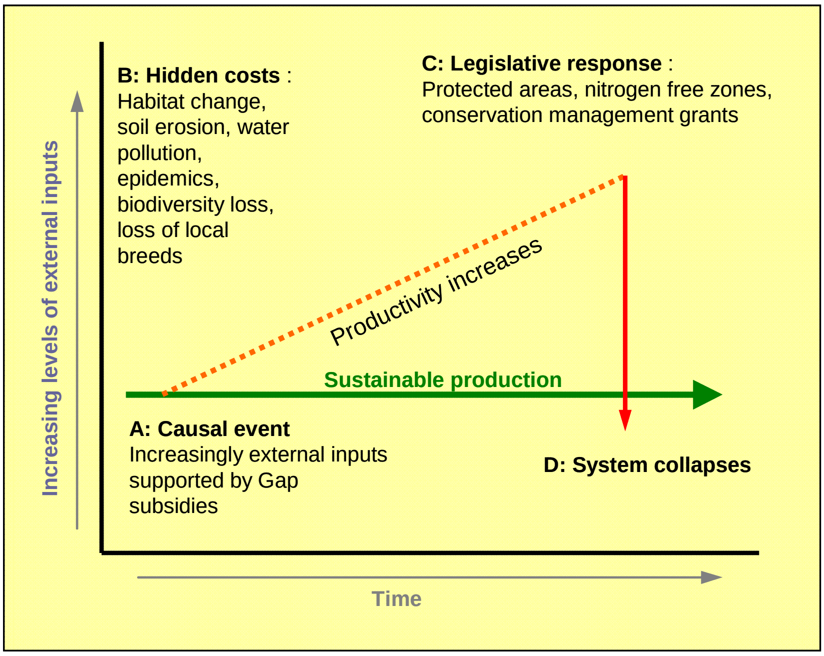

Figure 2.1 : Environmental thresholds and productivity (adapted after Hindmarch *et. al*., 2006 : 138).

2.4.2 THE ECONOMIC COMPONENT

Economic growth is an explicit economic goal in every nation (Asheim, 1994; Pearce, 1998; Ayres *et. al*., 1997). Capitalists think of the market as a mechanism that operates on objective signals like price and rates of return on investment. This means that environmental problems are mainly studied in the context of externalities and market equilibrium. In fact, neoclassical theory of economic growth argues that there are no environmental limits to growth, and all forms of capital are completely substitutable. However, while most manufactured and human capital can be replaced, the destruction of natural capital is often irreversible within generational timeframes (Page, 1997; IIED, 2002; Goffman, 2007; Spangenberg, 2007). Often the services provided by the environment cannot be substituted, since the loss of some forms of 'critical' natural capital, for example, the ozone layer or biological diversity, could threaten our very existence on earth.

Kuznet's curve is a graphical representation of the hypothesis that economic inequality increases over time, and then, after a critical income is attained, inequality begins to decrease. The environmental Kuznet curve (EKC) (Figure 2.2) is a hypothesized relationship between various indicators of environmental degradation and per capita income, representing an inverted U-shaped function (Stern, 2003). This implies that in the early stages of economic development, little attention is given to environmental concerns, but as the per capita income rises, this economic growth leads to environmental improvement Beckerman (1992). However, it has never been shown that the EKC applies to all pollutants or environmental impacts (Dasgupta, *et. al*., 2002, Stern, 2003). Evidence suggests that the theory is true for some pollutants such as sulphur dioxide and nitrogen oxide, but that the hypothesis does not hold true for other indicators such as global warming, ecosystem services and biodiversity. For example, the 'ecological footprint' does not fall, but rather increases with rising income, and even with the increase in prosperity, ecosystem services have continued to decline in developed countries.

Arrow, *et. al*., (1995) argue that the EKC relationship is influenced by the effects of trade on the distribution of polluting industries. For example, under free trade, developing countries specialize in the production of goods that are based on labour and natural resources, in contrast to developed countries that specialize in human capital and manufacturing activities. Therefore, part of the reduction in environmental degradation levels in developed countries is a result of the gravitation of polluting activities towards developing countries, and the poorer countries are faced with the more difficult task of abating these activities rather than having the option of outsourcing them (Arrow *et. al*., 2005). Consequently, the World Bank (2007) uses the concept of adjusted net savings (ANS) as a sustainability indicator in an attempt to incorporate 'green accounting' into national accounts. ANS "measures the true rate of savings in an economy after taking into account investment in human capital, depletion of natural resources and damage caused by pollution" (World Bank, 2007). Table 2.2 gives an indication of the ANS for various countries. Negative ANS rates indicate that total wealth is declining and policies that lead to persistently negative ANS are policies for unsustainability – indicative of those countries planning to grow today, and only think about protecting the environment in the future. Positive ANS values indicate countries that are proactively pursuing the goal of sustainability along with economic growth.

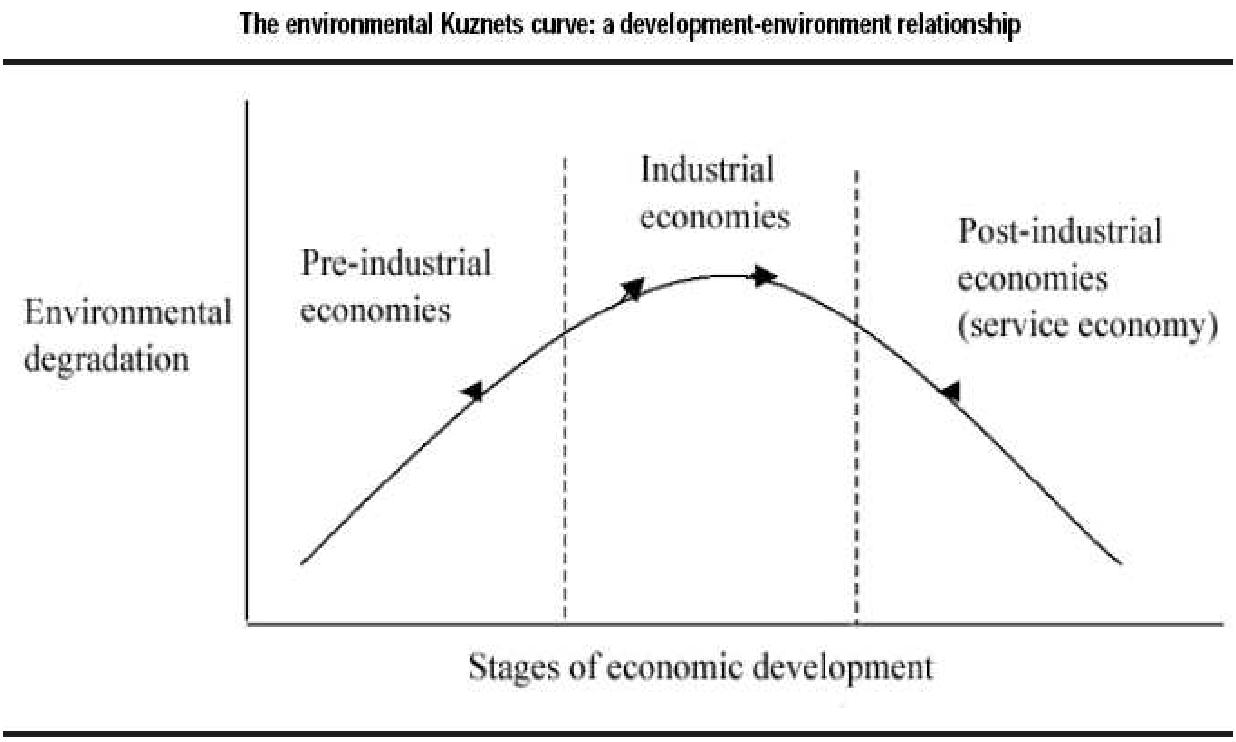

Figure 2.2 : Environmental Kuznets Curve (EKC) (after : Panayotou, 2003 : 46).

Table 2.2: Adjusted bet savings for various countries in 2004 (Edited list from : World Bank, 2007).

Country Name	Gross National Saving (various methods used)	Consumption of Fixed Capital	Net National Saving	Education Expenditure	Energy Depletion	Mineral Depletion	Net Forest Depletion	CO2 damage	Adjusted Net Saving
Angola	18.43	11.49	6.95	3.14	44.96	0.00	0.00	0.34	**-35.22**
Argentina	22.22	12.43	9.79	4.27	8.16	0.32	0.00	0.65	**4.94**
Australia	19.46	14.96	4.50	4.79	1.48	1.35	0.00	0.41	**6.06**
Austria	24.30	14.42	9.88	5.57	0.13	0.00	0.00	0.15	**15.17**
Canada	20.67	14.66	6.01	5.22	5.06	0.29	0.00	0.36	**5.53**
Chad	9.96	13.74	-3.78	1.44	79.12	0.00	0.00	0.05	**-81.51**
China	42.30	10.41	31.89	1.97	2.99	0.21	0.02	1.37	**29.27**
Congo, Rep.	35.98	13.25	22.72	3.79	54.06	0.00	0.00	0.25	**-27.81**
Denmark	22.74	15.42	7.32	8.09	1.27	0.00	0.00	0.13	**14.01**
Finland	23.70	16.17	7.52	5.92	0.00	0.03	0.00	0.22	**13.20**
France	18.97	12.58	6.39	5.16	0.13	0.00	0.00	0.12	**11.29**
Ireland	29.91	11.00	18.91	4.78	0.04	0.04	0.00	0.21	**23.40**
Kazakhstan	27.04	12.01	15.03	4.41	39.92	1.62	0.00	2.97	**-25.07**
Kenya	13.66	8.96	4.70	6.56	0.00	0.00	0.18	0.39	**10.69**
Nigeria	32.56	10.86	21.70	0.85	49.09	0.02	0.09	0.62	**-27.27**
South Africa	14.74	12.12	2.63	5.33	0.00	0.63	0.27	1.15	**5.91**
Sweden	23.64	12.08	11.56	8.04	0.00	0.07	0.00	0.10	**19.44**
Uzbekistan	30.16	8.85	21.30	9.37	59.35	0.00	0.00	7.64	**-36.31**

This may just mean that the scale of the Kuznet's curve is different for environmental impacts and that these may still be positioned on the 'upward' side of the curve, and that the economy may need to prosper further before that critical threshold is reached. However, since it may take decades for a low-income country to progress from the upward to the downward slope of the inverted u-curve, the accumulated environmental "damage in the meantime may far exceed the present value of higher future growth" and so "current prevention may be more cost effective than a future cure" (Panayotou, 2003 : 54). For example, the safe disposal of hazardous waste as it is generated may be less costly than future clean ups at a number of scattered sites. In fact, Domfeh (2003) found that the environmental degradation associated with mining costs in Ghana is estimated to be 4% of Ghana's GDP – which in turn is "almost equivalent to Ghana's annual economic growth rate" (Domfeh, 2003 : 155).

Another aspect to consider is the height of the EKC – the steeper the upward curve, the more environmental damage the country will suffer with each increment of per capita income generated. Thus, the critical issue here is, how rich do we have to get and how long will it take. The simple fact is that in meeting our needs, we are reducing the possibility of future generations to meet their needs. Furthermore, for decades, economic growth has exceeded the renewable ecosystem service capacity (Figure 2.3) (Daly 1990; Mulder and Van Den Bergh, 2001). This has reduced ecosystem resilience as a consequence of over-exploitation and pollution (Hindmarch *et. al*., 2006).

But, growth is not something we can easily give up – the economic dimension is incredibly important: poor countries need economic growth. The sad consequence is that they will resort to desperate measures to attain this growth. For example, after dumping 58 million tons of tailings per annum into the Ok Tedi river (Henry, 2007), BHP-Billiton severed all ties with the Ok Tedi copper mine in Papua New Guinea (PNG) once the company was faced with the possible legal liabilities of environmental rehabilitation. However, the cash-strapped government, who was desperate to attract new investment by proving that it will protect mining interests, was determined to extend the life of the mine in order to retain its share of $A30 million in royalty taxes each year. Thus, BHP-Billiton secured a deal with the PNG government that indemnified the company against all future compensation claims (Marshall, 2002) and the environmental and social problems have been left for the local people and an impoverished government to fix up. The mining company has simply walked away from the problem. Although the mine provided 20% of PNG's foreign exchange (Henry, 2007), the way the mining company has treated the people and the environment raises questions as to the real costs of the project. The World Bank has advised the PNG government to close the mine, based on environmental considerations.

A similar example is Ghana, a country relying on mining to boost the economy. Yet the mining boom is leading to the loss of approximately two million hectares of tropical forest per annum (Standing, 2007). In the Wassa West District of Ghana, in 2001, thousands of metres cubed of mine wastewater contaminated with cyanide and heavy metals, spilled into the Asuman river after a tailings dam burst at a mine operated by Goldfields (SA) (Anane, 2001). The result was that people's livelihoods were endangered and the effects of the spill will remain for decades, posing health and environmental problems. Another example is Romania - in 2000, a tailings dam at Aurul Mine in Romania overflowed, releasing 100000m^3 of cyanide-tainted effluent into the Tisza river (Balkau, 2004). By the time the accident was detected, heavily contaminated wastewaters had already infiltrated the Danube river, affecting water supplies to thousands of people in seven countries, and killing over 1000 tons of fish – a major source of livelihood for the affected people.

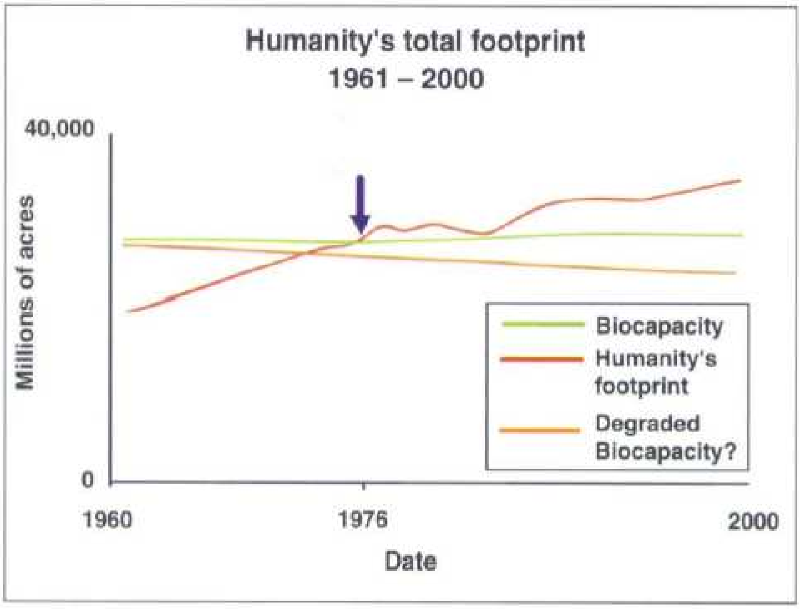

Figure 2.3: Ecological footprint and ecosystem resilience (after : Hindmarch *et. al*., 2006 : 137).

The above examples indicate the close relationship between economic, environmental and social elements of sustainable development. One component cannot take preference in favour of the others and it is essential that an integrated approach is followed.

2.4.3 THE SOCIAL COMPONENT

Communities not only need to be environmentally sustainable, but they must also be socially sustainable, and both require a system of economic growth that is not destructive to either the ecological or social web of life. There is now a growing awareness that, to a large extent, environmental problems also arise from social and behavioural maladjustments. The people who bear most of the cost of environmental harm, especially pollution, are frequently not the same people who will benefit most from the development and the poor often bear a disproportionate share of environmental costs, especially where there is little social mobility (Hanley and Atkinson, 2003; Schultze, 2007).

The use of migrant labour has caused major social disturbances in labour sending areas, irreversibly disrupting family units. When a mine closes, it is often more dramatic than it would be for other types of industry, as mines usually constitute a larger proportion of the local economy. Mines are dependent on the geographical locations of the ores and are often located in remote areas. Mining towns develop around these mines and when the mine closes down, it essentially equates to closing down the town and “can leave communities that have not found other means of generating income, with few options” (Guerin, 2006: 32). It is clear that social responsibility is about managing risk and should become a dynamic ongoing process of integrating knowledge on potential social impacts, into decision-making and compliance monitoring.

Thus, in South Africa, it is critical and a legislative requirement, that for every mining concern, interested and affected parties are consulted and for all mining rights, social and labour plans must be submitted and approved before mining authorisations are granted. The necessity for consulting with interested and affected parties was recently highlighted when the Minister of the Department of Minerals and Energy admitted and apologized for the fact that the processes that the DME followed in the Xolobeni Project (Transkei) were flawed in that the communities and the interested and affected parties were not adequately consulted (Kockott, 2008). It is critical that the social component of sustainability is taken into account when assessing any mining proposals.

Fortunately, there has been some progress - the Johannesburg Stock Exchange (JSE) Limited in South Africa is the first bourse in an emerging market to develop a sustainability index for its top 160 listed companies, called the JSE Socially Responsible Investment (SRI) Index (launched in May 2004). It provides an opportunity for companies “to demonstrate more socially responsible behaviour and hence for companies to truly embrace the triple bottom lines of environmental, economic and social sustainability” (Sonnenberg and Hamann, 2006: 305). The Index has provided a framework for companies to assess their existing approach and systems for sustainability management. More and more of the larger mining companies are buying into the concept of the SRI in order to align their business plans to reflect the triple bottom line.

2.4.4 THE INTEGRATED APPROACH

In terms of the sustainability concept, decision-makers face considerable challenges not only in understanding what they have committed themselves to but also in constructing credible policy responses and analytical frameworks to monitor policies. Sustainability is open ended – it is a set of principles to apply and processes to follow and must be pursued in a dynamic and complex world where there will always be uncertainty (Ekbom, 2003; Gibson, *et. al*., 2005). As an outcome of the Brundtland Report, many countries have incorporated the terms 'sustainability' and 'sustainable development' into their planning and criteria for decision-making (Franceschi and Kahn, 2003). Yet, environmental concerns will never be widely enough embraced so long as they are treated as an 'alternative' to economic priorities. We cannot depend solely on growth - economic practices cannot be at variance with ecological reality (Bartelmus, 1999; Lamm, 2003). For example, Stern (2006) reports that a 5-6^{o}C warming of temperatures can lead to an average 5-10% loss in global GDP, with poor countries suffering greater costs (Stern, 2006 : ix). Further, the cost of climate change for India and SE Asia could be as high as 9-13% loss of GDP by 2100 (Stern, 2006: 92). The imbalance with regards to the importance given to each of the components of sustainability (ecological, social, and economic) is a major cause of unsustainability (Castrilli, 1999). There is no need for a country "to adopt weak environmental standards, or to be lax in the enforcement of the standards that are in place, in order to protect its international economic competitiveness" (Weiss, 1993: 2125). The orientor theory (Figure 2.4) states that a 'sustainable economy', must not undermine the sustainability of the systems it interacts with in order to defend its own viability (Hindmarch *et. al*., 2006, Spangenberg, 2007). Rather, all the components of sustainability should be considered within an integrated approach.

The essential fact is that without environmental sustainability, it will not be possible to have true long-term social or economic sustainability. A number of tools have been developed to assist in predicting impacts associated with development, with a view to minimising negative impacts and maximising positive ones. One such tool is the environmental impact assessment (EIA) process, which is widely used in large scale developments such as mines.

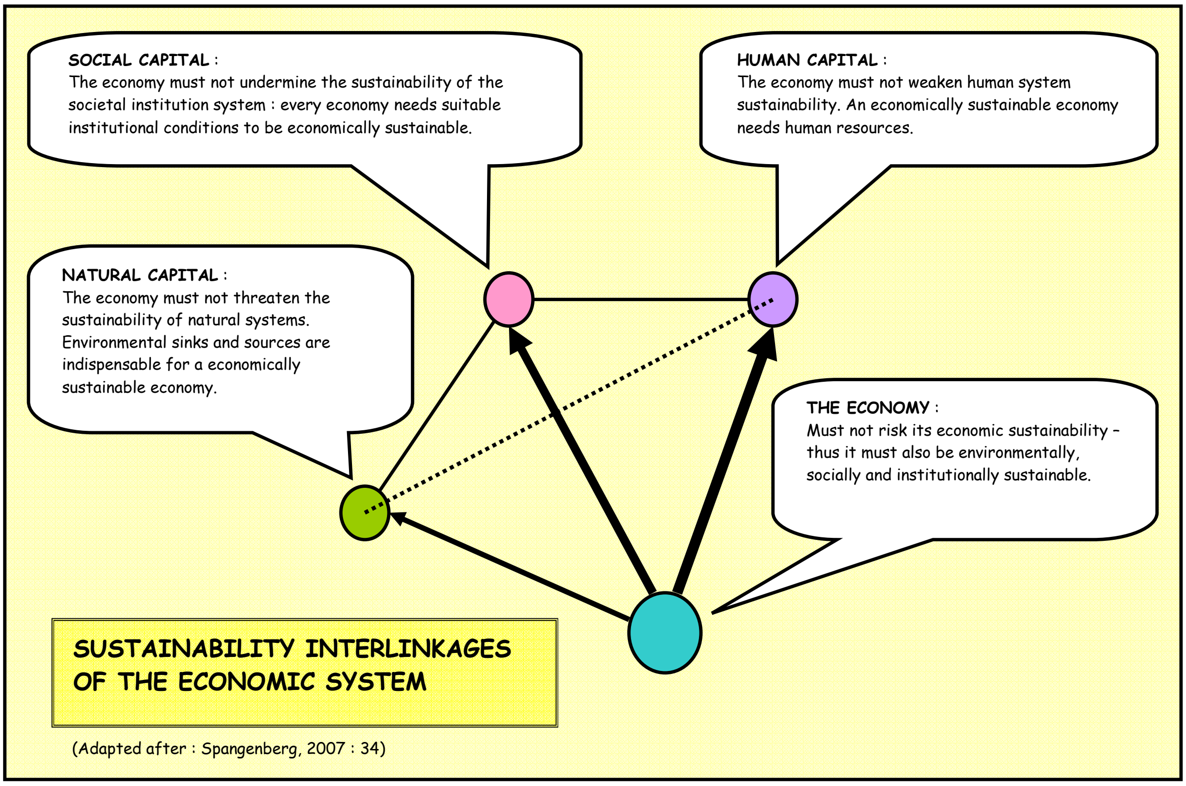

Figure 2.4 : Sustainability interlinkages (adapted after Spangenberg, 2007: 34).

2.5 THE MINING SECTOR AND SUSTAINABLE DEVELOPMENT

One of the greatest challenges facing the world today is integrating mining activities with environmental integrity and social concerns. The practical implication of sustainable development is that it must allow for greater utility of resources while simultaneously conserving the natural resource base (Von Below, 1993; James, 2001; Minnitt, 2001). Thus, the concept of sustainability in mining is particularly problematic since here one is dealing with an exhaustible resource. Mining is an extractive industry, – dig it up and it is gone for good. Worldwide, until the 1970's, environmental issues within past mining practices were not a major consideration and environmental degradation was accepted as the price that had to be paid for the production of essential mineral commodities. The 'E' word was efficiency not environment. But the resultant environmental problems associated with historic mining sites and abandoned and orphaned mines, seriously questions the concept of sustainability within the mining sector. Widespread criticisms of mining centre on the externalisation of the environmental and social costs of the industry, its negative impacts on sustainable development and the inequitable and unsustainable distribution of its costs and benefits.

Some researchers have argued that mining is intrinsically unsustainable since minerals are a non-renewable resource and so by exploiting mineral resources, we are reducing the ability of future generations to supply that particular mineral (Cowell, *et. al*., 1999; Bartlett, 2006; Whitmore, 2006). Mine life is limited by ore availability and market fluctuations. Depleting a mineral deposit will lead to the increase in production costs due to the mining of lower grade and less accessible mineral deposits. In turn the mining of progressively lower grade material can lead to increasing environmental degradation as larger volumes of material need to be mined and processed in order to extract the same quantity of mineral commodity. The degradation of the environment caused by the low grade operation in terms of the volumes that will need to be disturbed, will be ten times that of the higher grade operations (Von Below, 1993). Thus, the mining sector is one of the biggest generators of waste and has significant potential to impact negatively on the environment (Cawood *et. al*., 2001).

Other researchers have argued that economic mineral resources are not a stationary, solitary figure, but rather a function of prevailing economic, social and environmental constraints (Tilton, 1996; Yua, *et. al*., 2005). Before a resource is depleted, it will be the mining and environmental costs that will become too high to sustain profitable extraction, and practical experience has shown that in terms of sustainability, mining has an economic limit. It is the environment that provides the physical limit.

The challenge of a sustainable development framework in mining, then, is to ensure that the minerals sector as a whole, contributes to human welfare and well-being today without reducing the potential for future generations to do the same. Disparities in the distribution of costs and benefits are very real, and often the situation occurs where companies from developed countries are exploiting the mineral reserves of developing countries, relying on the developing country's desperate need for economic growth, their lax attitude towards environmental conservation and their lack of legislation or poor regulation in this regard. The PNG case (section 2.3.2) clearly illustrates this point.

As long as the economic component to mining is viewed as a priority, to the detriment of the environmental and social components, sustainable development will remain a good concept, but illusive in reality. Efforts must increasingly concentrate on environmental and social responsibility (Hilson and Basu, 2003).

Thus the concept of sustainability in mining must be a function of environmental management with effective regulation, through the rehabilitation of mined areas and the avoidance of mining in environmentally sensitive areas. There are no longer any excuses for mining concerns to leave uncorrected impacts on the environment – if it does then it means that the project has not been properly managed, nor properly regulated. In fact, the MMSD project articulated the change of approach to sustainability in mining by instead of concentrating on individual mines alone, rather determining what the sector as a whole could contribute to sustainable development (IIED, 2002a,b). This allows for a broader consideration of a balance of social, economic and environmental for the industry as a whole (Hilson, 2001; Horowitz, 2006). So, while the performance of individual mines remains critical, a focus on the sector as a whole is necessary to assess sustainability in a proper manner.

Mining must be conducted in such a way that the company makes money, but at the same time the community is consulted in order to ensure sufficient attention to social responsibility and that environmental rehabilitation is ensured (Markley, 2005). Verifiable measures are required to evaluate progress and foster continuous improvements in terms of sustainability indicators. Since relying on the good ethics of society and business does not work (typically resulting in the 'tragedy of the commons'), government departments need to develop and regulate mining through policy and legislation.

2.6 CURRENT ECONOMIC GROWTH IN THE SOUTH AFRICAN MINING SECTOR

South Africa's wealth has been built on a rich abundance of mineral resources and mining is the largest industry in the primary economic sector. The country is a leading supplier of a number of minerals and has nearly 90% of the global platinum reserves, 80% of manganese, 73% chrome, 45% vanadium and 41% gold (SAMI, 2007). Mineral wealth is found in the Witwatersrand Basin which yields 98% of SA's gold output; the Bushveld Complex which is famous for its platinum group minerals, chromium, vanadium, titanium and fluorspar; the Transvaal subgroup which contains manganese and iron ore reserves; the Karoo Basin hosts bituminous coal and anthracite, the Kimberlite pipes host diamond deposits, significant deposits of lead-zinc ores in the Northern Cape and heavy mineral coastal deposits containing ilmenite, rutile and zircon. The diamond industry is the fourth largest in the world and SA is one of the leading producers of base metals and coal (SAMI, 2007).

South Africa's mineral resources have been exploited for many decades, but, as in Canada and Australia, there remains considerable potential for the discovery of new deposits. In 2006, South Africa ranked seventh in the world's exploration spending, accounting for 4% of the total world exploration budget in comparison to Canada (19%) and Australia (11%) who are ranked first and second respectively (SAMI, 2007 : 8). Exploration expenditure is primarily driven by demand for commodities and since the inception of the MPRDA, exploration expenditure has increased substantially (Table 2.3).

Table 2.3: Exploration expenditure for South Africa (billion rands), 2003 – 2006.

Year	2003	2004	2005	2006
Expenditure	R 1218.4 bn	R 1265bn Increase 3.8%	R 1239bn Decrease 2.06%	R 1936bn Increase 56.3%
(Source : SAMI, 2007 : 8)				

Although mining is sensitive to exchange rate movements and international commodity cycles, mining remains an important foreign-exchange earner for South Africa. In 2006, mining contributed R120.2bn or 7.9% to the Gross Domestic Product, an increase of R19.7bn over 2005. In addition, the contribution of mining and quarrying to Government revenues via mining taxation has increased significantly (Table 2.4 and Figure 2.5).

The strong macro-economic performance of the country, along with the increasing construction activity, is expected to continue and the economy is expected to grow at 5.1% in 2008 and 5.4% in 2009 (SAMI, 2007 : 148). The boom in the construction industry (Figure 2.5) can be attributed to various projects around South Africa especially the building of 2010 soccer world cup stadiums, airport upgrades, railway infrastructure upgrades, Coega Industrial Development Zone and the Richard's Bay – Durban corridor. This record expansion in the construction sector has helped South Africa's gross domestic product (GDP) to grow by 4.7% in 2007 (Figure 2.5).

Table 2.4: Contribution of mining and quarrying to gross domestic product (million rands).

Year	**GDP (R'million)**	**From Mining (R'million)**	**%**
1997	627167	40524	6.5
1998	674874	45879	6.8
1999	738873	52173	7.1
2000	838218	63391	7.6
2001	928215	77214	8.3
2002	1063880	92113	8.7
2003	1141132	84258	7.4
2004	1242864	89290	7.1
2005	1352952	100515	7.3
2006	1529413	120221	7.9
South African Reserve Bank, Quarterly Bulletin, March 2007 : S105.			

Figure 2.6 indicates how the number of mining and prospecting applications received by the DME is increasing from 2004 – 2008 as a result of the boom in the economy. The general upward trend may well have implications for the ability of DME to monitor the environmental performance of mines – something that needs to be assessed.

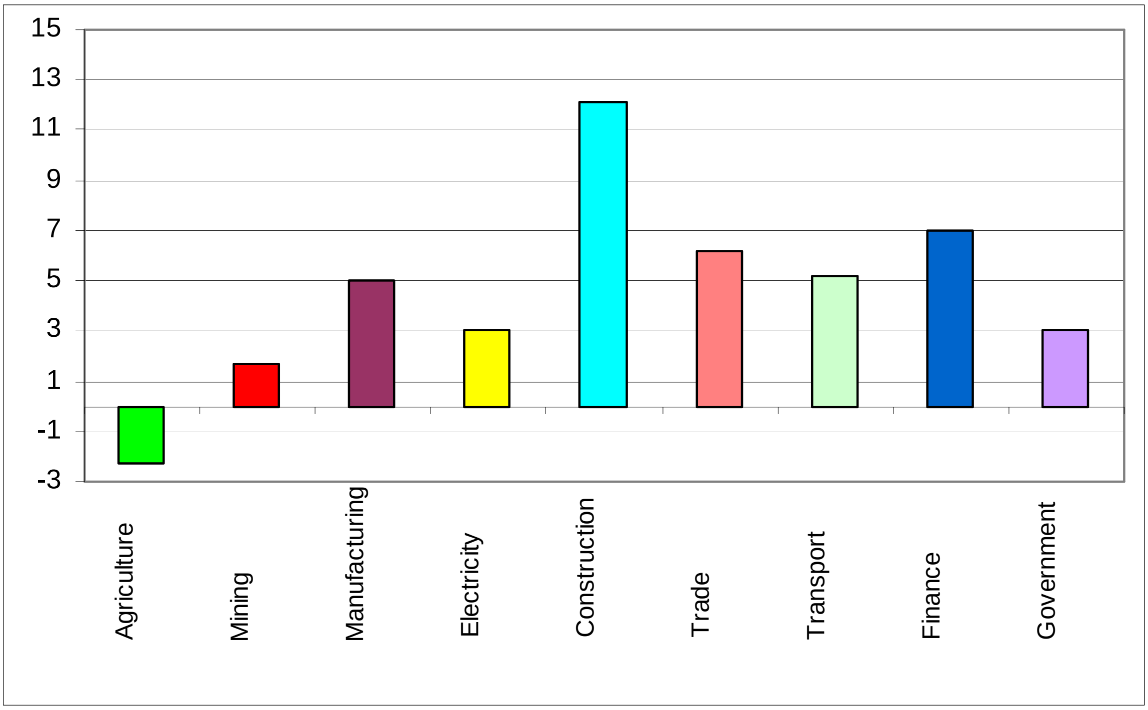

Figure 2.5: Percentage change in the contribution by sectors to the average annual real GDP growth 2004 to 2007.

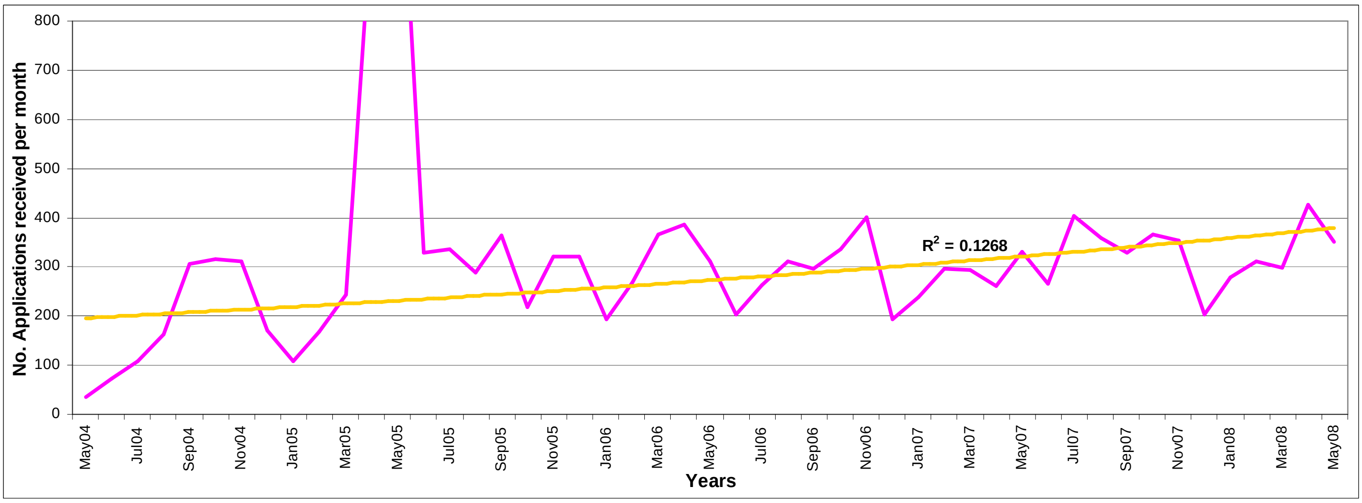

Figure 2.6: Combined total number of mining applications received per month, for all Regional Offices of the DME (2004-2008).

2.7 REGULATORY FRAMEWORKS RELEVANT TO MINING

Since Canada and Australia are major players in the mineral exploration industry, it is relevant to consider their regulatory frameworks in relation to mining, in comparison with the South African legislative framework. This enables one to observe whether the major mining countries have identified common legislative controls for mining, in terms of environmental sustainability.

2.7.1 Mining regulation in Canada

There is no constitutional right to a clean environment in Canada (Castrilli, 1999). The types of legislation governing environmental protection from mining activities include environmental planning and impact assessment legislation, and regulatory legislation controlling emissions and discharges of contaminants to the environment (Canadian Minerals and metals industry, 2000). In 1995 the Canadian Environmental Assessment Act (CEAA) came into force. Concerns with CEAA include the fact that:

- proponents review the environmental effects of their own projects (which amounts to self-assessment);
- it is not mandatory for proponents to assess the need for their project nor to assess alternatives;
- principles of fairness and due process are not guaranteed at review panel hearings;
- it is not an offence for proponents to ignore or violate CEAA or its regulations;
- the public cannot seek injunctions to restrain violations of ministerial orders.

Mining project proposals under CEAA have recently generated considerable controversy regarding the adequacy of the review panel process and resulting recommendations. For example, a case of an open pit and underground diamond mining project in the North-Western territories was recommended for approval, yet the review panel failed to make any recommendations in relation to sustainable development and cumulative effects, mine closure and reclamation, alternatives to the project or to consider wilderness and protected areas (Castrilli, 1999). These gaps resulted in an environmental review that was fundamentally flawed – one that was neither comprehensive, rigorous nor fair. This raises questions as to whether the environmental assessment process is a failure and it is clear that much remains to be done to improve the process. Thus, in its current form, CEAA is definitely not a model to emulate as it is too narrowly focussed, based on self-assessments with panel review recommendations being ignored without any consequences. It also lacks public participation and the enforcement process.

2.7.2 Mining regulation in Australia

Under the Mining Act of 1978, all minerals in Australia belong to the Crown. An application for a licence must include a work program, setting out details of the proposed exploration methods and expected expenditure. This work program must satisfy the relevant Minister who grants the licence and who also has the right to impose title-specific conditions. Public notification of the application is a requirement. The applicant is also required to pay compensation to the landowner for land surface damage. All mining proposals are subject to environmental assessments.

Central elements of mining approvals in Australia include environmental impact assessment (EIA), community consultation, polluter pays principle and the promotion of ‘best practice’ principles. Under best practice, government sets the general conditions for mining, including those based on the EIA process and companies have flexibility as to how they meet these conditions or guidelines. In cases where companies have demonstrated prolonged good performance, there is an approach to self-regulation. With self-regulation, authorities receive regular reports from mining companies and inspectors conduct audits and inspections (Lambert and McKay, 1998). This promotes the situation where government can concentrate on dealing with cases where performance is not satisfactory. Actions can range from financial penalties to closure, with company directors being held accountable and liable. Mine rehabilitation is also a tax deductible expenditure, thus creating further incentives for improved performance and compliance, and under the ‘Greenhouse Challenge Program’ many mining companies have volunteered to reduce their greenhouse emissions. Australia’s Minerals Industry Code of Practice for Environmental Management (AMICEM, 2000) commits the industry to excellence through sustainable development, continual improvement, risk management, rehabilitation, the setting environmental targets and reporting to government and the community (Lambert and McKay, 1998).

Unfortunately, once mining companies from developed countries move abroad and take on mining ventures in a foreign developing country, standards tend to slip in favour of the more relaxed mining and environmental standards and legislation of the developing countries. The companies make use of the lax laws, corrupt officials and cash-strapped governments to get operation 'go-aheads' without conducting the necessary EIA, or considering the environmental and social implications, and the appropriate rehabilitation (such as Ok Tedi- Papua New Guinea; Wessa District – Ghana; Tisza River – Romania (section 2.3.2)).

2.7.3 Mining legislation and regulation in South Africa

Mining and prospecting in South Africa is regulated by the Department of Minerals and Energy, and a number of Acts have been promulgated over the years (Table 2.5) to facilitate and ensure that mining is regulated. This section is divided into three subsections dealing with mining legislation before 1990, between 1990 – 2002, and after 2002, to indicate more clearly the progressive nature of the legislation that has been promulgated. Before 1990, mining legislation was mainly concerned with water pollution issues and no rehabilitation was required for mine closure. Mining legislation after 1990 introduced the concept of environmental management and provided for the rehabilitation of the mines according to the EMPR. However, it is the mining legislation after 2002 that has been the most effective in providing for a more comprehensive management of environmental rehabilitation and conditions for mine closure.

Table 2.5: Legislation pertaining to mining in South Africa.

Mines and Works Act, 27 of 1956	Mineral Technology Act, 30 of 1989
Minerals Act, 50 of 1991	Geoscience Act, 100 of 1993
Mine Health and Safety Act, 29 of 1996	Mineral and Petroleum Resources Development Act, 28 of 2002
Mining Titles Registration Amendment Act, 24 0f 2003	Diamond Amendment Act, 29 of 2005
Precious Metal Act, 37 of 2005	Mineral and Petroleum Resources Development Bill (19th April 2007)

Mining legislation in South Africa pre-1990

The first act to regulate the control of mining and prospecting in South Africa was the Mines and Works Act (Act 12 of 1911), which was subsequently replaced by the Mines and Works Act (Act 27 of 1956). It provided for the State President to make regulations with regards to the prevention of waste, pollution, fouling or distributing of any water on or underneath any proclaimed land or land held under mining title or in any public stream and also provided for the prevention or the abatement of nuisances. It was mainly concerned with water pollution issues.

Mine closures before 1956 were not subject to rehabilitation and closure requirements, and consequently mines were usually simply boarded-up or abandoned. These mines are now the responsibility of the State and a few examples are presented below to indicate the significance of problems arising from mining activities where there was no compliance, proper rehabilitation or mine closure.

- Sink holes associated with *in situ* combustion of coal are evident at the abandoned Transvaal and Delagoa Bay colliery in Witbank. Here bare patches are present around the sinkholes and gases continue to escape, often resulting in underground fires (Figure 2.7). In addition, acid water decants into the nearby Brugspruit river, and a R30 million treatment plant has been established to treat this water. The colliery was closed before closure legislation was enacted and the former owners are no longer traceable. The result – the State is now responsible for rehabilitation – which has been estimated to be around R100 million (Limpitlaw, *et. al*., 2005: 3).

- For underground mines, over time, underground excavation pillars can collapse. If these excavations are near the earth’s surface, this can lead to extensive land subsidence. Even where these mines are not too shallow, subsidence can still occur as is evident at Springs, East Rand (Figure 2.8), where sinkholes have propagated 65m up to surface (Stacey and Page, 1983).

- Mine hydrology and geochemistry is complex and water impacts can be severe over the long term, if not managed appropriately. For example, mines that closed 20 years ago may still be filling up and may not yet have reached a steady state where water starts to decant. Once this happens it will pose considerable environmental problems for future generations to deal with. For example, in the Brugspruit catchment, acid or saline drainage from abandoned coal mines, is estimated to contribute 35% of the salt load of the Loskop dam (Limpitlaw *et. al*., 2005).

- All coal contains methane, a greenhouse gas that is 21 times more potent in its greenhouse effect than CO_2. During the coalification process, plant material is progressively converted to coal and generates large quantities of methane rich gas which is then stored within the coal. During mining, this methane gas is released. The deeper the mine, the higher the concentrations of methane and it is estimated that "South Africa currently emits nearly seven million tons per annum of CO_2 equivalent from the underground coal mines" (Lloyd, 2002: 2).

- In the 1970's, Richards Bay Minerals started mining forested dunes along the north-east coast of KwaZulu-Natal. The natural environment of pristine forest has been replaced with experimental efforts to restore vegetation on the sand dumps left by the mining activities. The mining operation failed to abide to the conditions of the lease that the sea-facing dunes were not to be mined (Figures 2.9 and 2.10) (Menne, 2003). The resulting dune slumping has created serious erosion problems.

Figure 2.7: Water pollution arising from the abandoned Transvaal and Delagoa Bay Colliery, Witbank (after : Limpitlaw, *et., al*., 2005: 3).

Figure 2.8: Surface subsidence, Witbank (after : Limpitlaw, *et. al*., 2005: 3).

- In terms of social and health issues, a typical example of how environmental law has failed in SA in the past is the detrimental health effects of mining that have surfaced years after mining has ceased, within communities such as those near asbestos mines, who have registered higher incidences of lung diseases for example, the Bareki tribe – Hondeklip community (Cullinan, 2002; Gunn, 2005; Bareki, 2006).

- In the Eastern Cape, a number of opencast mines have been left unrehabilitated and although these mine sites do not represent as large an environmental threat in terms of environmental pollution, as the above examples, they have still left significant scars on the landscape and pose significant environmental problems in terms of soil erosion and land degradation (Figures 2.11 to 2.14).

Figure 2.9: General dune mining – Richards Bay Minerals, KwaZulu-Natal (after, Menne, 2003).

Figure 2.10: Frontal dune damage – Richards Bay Minerals, KwaZulu-Natal (after, Menne, 2003).

Figure 2.11: Access road to a Department of Roads and Transport quarry showing the development of significant rill erosion – Eastern cape (DME archives).

Figure 2.12: Hard rock quarry showing rock face slumping – Eastern Cape (DME archives).

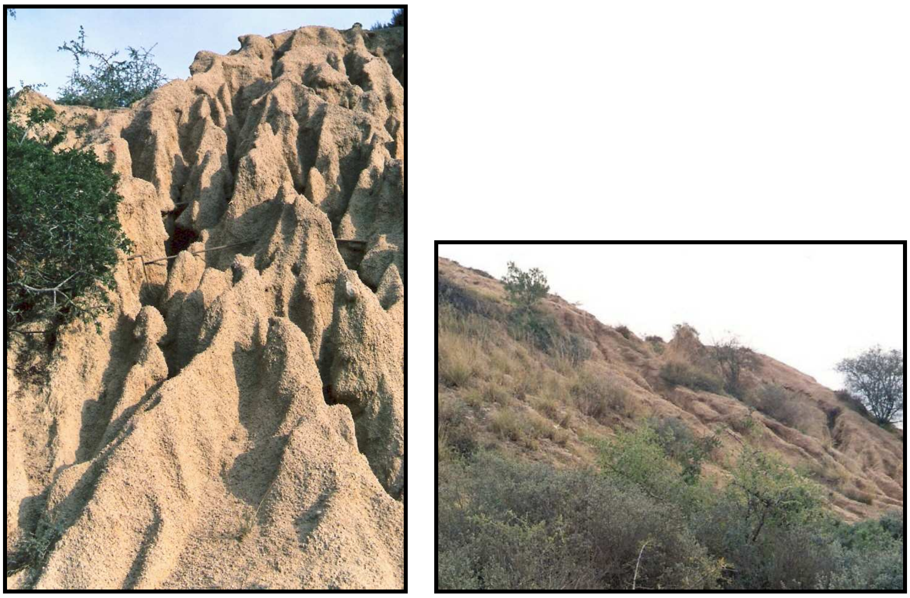

Figure 2.13: Unrehabilitated opencast mine showing significant gully erosion – Eastern Cape (DME archives).

Figure 2.14: Opencast mine left unrehabilitated – Eastern Cape (DME archives).

Although companies are becoming increasingly aware of the implications of their actions, many are yet to take reasonable measures to prevent or remedy the effects of environmental degradation. Past environmental law has not guaranteed the protection of the environment. In addition, mining companies are hesitant to become involved in the rehabilitation of abandoned mines, as they are concerned that they may end up with a liability that is not theirs, or their actions can be construed as an admission of guilt. A case in mind is the Wonderfonteinspruit debacle. The sediments within the water at Wonderfonteinspruit have been contaminated by potentially dangerous chemicals as a result of decades of acid mine drainage. Vegetables and fish collected in Wonderfonteinspruit have been contaminated with radioactive uranium and the National Nuclear Regulator (NNR) is testing milk and meat from cows grazing in the area (Wade, 2003; Lieferink, 2007; Swanepoel, 2007; DWAF, 2008; Opperman, 2008).

Mining legislation in South Africa 1990-2004

The Minerals Act (Act 50 of 1991) was the first South African governing legislation to provide a basis for environmental management within the minerals industry. Chapter VI provided for the rehabilitation of the surface of land and indicated that rehabilitation will occur in accordance with the environmental management programme (s38(a)). As per section 39 of the Act, a holder of a prospecting or mining authorization was required to submit an environmental management programme in respect of the land concerned. Section 39(2) also provided the Regional Director with the authority to exempt the holder of a prospecting or mining authorization or grant an extension of time to comply with the provision of the environmental management programme. Often rehabilitation did not occur concurrently with the mining activities and as a result, section 38(2a) denoted that within five years of a mine closing, the Director: Mineral Development was to officially give notice to the owner of the mine to take the necessary steps or provide adequate provision for rehabilitation. This in fact provided the mine owners with the opportunity to leave all rehabilitation activities until the closure of the mine, often resulting in mines being abandoned before closure was issued. Mining authorizations were granted before the mines submitted mine environmental plan (EMP's). This simply meant that once an applicant received authorization, the MEM subsection struggled for years to obtain an EMP from the mining concern because they already had authorization to mine, and rehabilitation was simply viewed as an additional cost.

However, the outcomes of the Save the Vaal case (1999) changed this (Director : Mineral Development, Gauteng Region and another v Save the Vaal Environment and others, 1999). Thereafter, all mining authorizations had to have an approved EMP before mining authorisation was granted and mining could commence. This was a very significant development in terms of legislative interpretation in that this is when the whole concept of environmental management became a serious entity in the DME. The 'Save the Vaal' appeal case raised the question of whether interested and affected parties that wished to oppose an application for a mining licence in terms of section 9 of the Minerals Act 50 of 1991 are entitled to raise environmental objections. In the deliberation, the Judge stated that "*what has to be ensured when application is made for the issuing of a mining licence is that development which meets present needs will take place without compromising the ability of future generations to meet their needs. … Our Constitution, by including environmental rights as fundamental, justiciable human rights, by necessary implication requires that environmental considerations be accorded appropriate recognition and respect in the administrative processes in our country. Together with the change in the ideological climate must also come a change in our legal and administrative approach to environmental concerns*" (Director:Mineral Ddevelopment Gauteng Region and another v Save the Vaal Environment and others, 1999). Thus, from that point onwards (1999) all mining authorizations had to have an approved EMP before a mining permit or licence could be issued and mining commence.

Mining legislation in South Africa post 2004

Today, environmental issues in South Africa are largely regulated by statute. The inclusion of a clause in the Bill of Rights (s24) of the Constitution (1996), which gives everybody the right to an environment that's not harmful to their health or well-being – a right enforceable by law - resulted in fundamental changes in South Africa's environmental statutes. Although the National Environmental Management Act (NEMA - 1998) is the overarching piece of environmental legislation in South Africa, it is predominantly a policy setting Act and in many instances, the principles laid down in NEMA need further enabling legislation in order to be totally effective (Gunn, 2005). This is provided by the conservation, water and pollution laws (Environment

Conservation Act (1989); National Water Act (1998); White Paper on Integrated Pollution and Waste Management for South Africa (2000); Air Quality Bill (2003)) and minerals legislation (Mineral and Petroleum Resources Development Act (2002)).

In recognition of the fact that our knowledge of the environmental processes is incomplete and will vary from place to place and over time, SA environmental legislation recognizes the *precautionary principle*. Under the precautionary principle, where there are threats or potential threats of serious impact, the lack of full certainty of those impacts should not be used as a reason for approving development or mining. This principle must be applied in any situation where important biodiversity may be threatened and where there is insufficient knowledge to either quantify risks or implement effective mitigation (Wikipedia, 2007). Anticipating and preventing problems is better than trying to react and fix them after they occur, and policy decisions must err on the side of caution, placing the burden of proof on the mining company to demonstrate that the impacts are ecologically sustainable. Thus, there is a need to enforce formal controls on the use of the environment as both a resource and a sink and the precautionary principle has become an inclusive element in environmental risk assessment (Stirling, 2003).

Mining legislation also supports the *'polluter pays' principle* - that the full costs of avoiding or compensating for environmental and social impacts must be borne by the proponents of the developmental activity. With regards to mining, financial guarantees are required, upfront, to cover all rehabilitation and remedial costs that could be imposed, should a mining activity be approved.

The MPRDA (Act 28 of 2002) was promulgated in 2004 and stipulates rigorous mitigation of both biophysical and socio-economic impacts and provides for a more comprehensive management of environmental issues and rehabilitation conditions. It is the principle regulatory instrument governing prospecting and mining in South Africa. The MPRDA defines the entire regulatory environment of the minerals industry, includes safety and health issues and controls the rehabilitation of land disturbed by mining. Relevant sections of the Act related to environmental management and compliance are indicated in Table 2.6.

Table 2.6: Relevant sections of the Mineral and Petroleum Resources Development Act (28 of 2002), related to environmental management and compliance.

Section	**Description**
s2(h)	Gives effect to s24 of the Constitution by ensuring that the nation's mineral and petroleum resources are developed in an orderly and ecologically sustainable manner while promoting justifiable social and economic development.
s37(2)	The Act stipulates that prospecting and mining must be conducted in accordance with generally accepted principles of sustainable development.
s38	Gives effect to the general principles of integrated environmental management (as laid down in chapter 5 of NEMA (Act 107 of 1998)) with the responsibility of the right holder to rehabilitate the environment to its natural or predetermined state or to a land use which conforms to the generally accepted principle of sustainable development.
Part III of the MPRDA regulations	Deals specifically with environmental regulation. Regulation 49 requires a scoping report for any mining operation that includes a description of the methodology, identifies environmental, social and cultural impacts (including cumulative effects); describes the process of public participation and the extent of the EIA that will be required. Once the scoping report is submitted, the DME is required to submit it to other Government Departments (usually the Department of Economic Development and Environmental Affairs and - DEDEA; Department of Water Affairs and Forestry - DWAF; Department of Land Affairs - DLA; Department of Agriculture - DA) for comment and input. If the DME is satisfied that all aspects are covered within the scoping report, the applicant can go ahead and prepare either an environmental management plan (EMP) or an environmental management programme (EMPR) depending on the size of the mining concern. The EMP/EMPR and EIA must provide a framework within which the DME environmental officers can consider the environmental aspects of the proposed mining activity in parallel with social, economic, technical and other factors.
s41 and	Deals with financial provision for remediation of environmental damage

regulation 53	in that the holder of a mining or prospecting right must make financial provision for rehabilitation and must assess annually his/her environmental liability and increase it to the satisfaction of the Minister.
Regulation 55	Requires that a monitoring and performance assessment of the EMPR be conducted by the right holder in order to ensure compliance with the EMPR and to assess the continued appropriateness, adequacy and effectiveness thereof, during the life of the mine until closure is granted.
s43 and regulations 56-62	Provides the mine closure procedures.
Regulation 52(e)	Provides for planned monitoring and performance assessment of the environmental management plan.
S92(a)	Relates to the carrying out of routine inspections and enables any authorized DME official to enter without a warrant, any prospecting or mining operation “in order to inspect any activity, process or operation carried out in or apon the area”.
S93(1)	Deals with orders, suspensions and instructions. If an authorised person finds that a contravention or suspected contravention of, or failure to comply with “(a) any provision of this Act”, then the authorised DME official can (b)(i) order the holder of the relevant right, permit or permission, or the person in charge to take immediate rectifying steps, and can (b)(ii) order that the prospecting or mining be suspended and give such instructions.

However, the latest development is that mining is now (2007) a listed activity under the newly revised environmental impact assessment regulations of DEAT. Thus, the issue of who has final authority to regulate environmental issues related to mining is still under debate, with the DME and DEAT at loggerheads and so far, no final decisions have been made. This already has an impact on the legality of current procedures regarding EMPR evaluation, pending the outcome of the issue.

It is clear that the MPRDA compares favourably with the mining legislation of Australia. The DME have made certain that a mining legislative framework is in place to ensure the minimization of the negative impacts of mining through the concept of ensuring sustainable development by means of EMP/EMPR evaluation and approval and compliance monitoring. Regulation 52(e) provides for planned monitoring and performance assessments, section 92 provides for routine inspections and section 93 provides for the suspension of prospecting or mining operations in the event of non-compliance (Table 2.6).

The objectives of these requirements are to anticipate and avoid, minimize or offset the adverse significant biophysical, social and other relevant effects of mining proposals (Miranda *et. al*., 2005). Yet, in mining, the EIA is often viewed as simply the obligatory provision of 'environmental background' to the Department with little commitment on behalf of the mining concern. This has a significant impact in terms of compliance monitoring and enforcement. What tends to be lacking in the EMPR's is not the raw data, but the interpretation – EMPRs are usually a basic collection of a lot of 'unconnected data' that needs to be consolidated into what the data means collectively and the identification of the potential risks and actions that can be taken to ameliorate these risks (Benson, 2003). The current situation may create a false sense that EMPR is achieving more than it really does, or that it promises much whilst it delivers less (Weston, 2002). The EMPR must rather be viewed as a dynamic tool for environmental management and compliance (George, 1999; Yorque, *et. al*., 2002; Cashmore, 2004; Cashmore *et. al*., 2004; Makuluma, 2005). Either way, the DME plays a vital role in ensuring that mine operators comply with the plans set out in the document and this must involve regular compliance audits over the life of the mine.

2.8 DME PROCESSES IN EVALUATING AND MONITORING THE LIFE-CYCLE OF A MINE

The process followed by the DME in evaluating and monitoring the life-cycle of a mine is indicated in Figure 2.15. The application phase involves either accepting or rejecting the mining application. Only once an application is accepted, does the MEM section manage that application. The authorisation phase includes the consultation with interested and affected parties (including other Government Departments), evaluation of the EMP and initial site inspection, and the issuing of the Record of Decision (ROD) to either authorise or refuse the mining application. The operational phase should, ideally, involve regular inspections and compliance audits by MEM. The closure phase incorporates the receipt of a closure notification application form together with a performance assessment report, the evaluation of the closure document, a closure site inspection and, if all is in order, the issuing of the closure certificate.

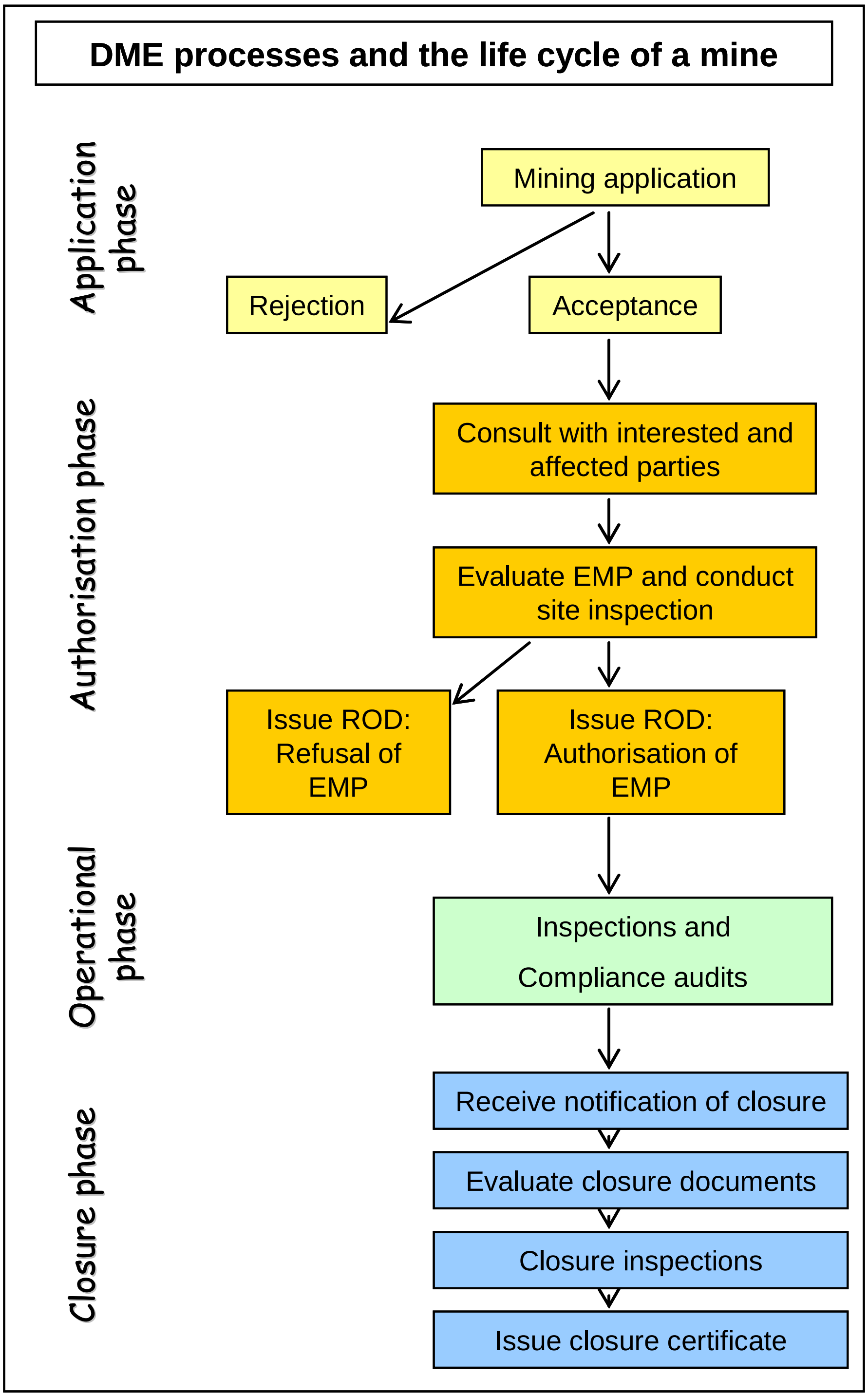

Figure 2.15: DME's involvement in the life cycle of a mine.

2.8.1 EMP evaluations

The basic principles of environmental impact assessment (EIA) for projects are well established in an extensive body of literature (Canter and Canty, 1993; McDonald and Brown, 1995; IAIAa,b, 1999; Nitz and Holland, 2000; Morrison-Saunders *et. al*., 2001; Abuodha, 2002; Benson, 2003; Fraser *et. al*., 2003; IAIA, 2003; Cashmore, *et. al*., 2004; Ramos *et. al*., 2004; Tinker *et. al*., 2005; Ross *et. al*., 2006; Tennoy, *et. al*., 2006). It is a procedure and management technique which ensures that the likely environmental, economic and social effects of new development are fully appraised and taken into account before mining is allowed to go ahead. It includes identifying potential impacts and predicting, evaluating and developing strategies to mitigate their outcomes (IAIAa, 2003; Gunasekera, 2004; Marshall, 2005; Marshall, *et. al*., 2005). The core assumption behind impact assessment is that we can exert some intentional positive influence over the direction and character of environmental change (Castrilli, 1999; Gibson, *et. al*., 2005; Sanchez, 2006).

Environmental impact reports are prepared to aid sound decision-making, to inform those who have a stake in the decision, to provide an opportunity for interested and affected parties to express their concerns, and to meet the requirements of environmental and mineral laws and regulations (Veiga *et. al*., 2001; Wang and Chen, 2006; Page, 2006). In order to make informed decisions, the DME environmental officials need to understand the design, operation, decommissioning of the proposed mining concerns and the environment and the environmental trade-offs of the alternatives. The DME’s assessment process must ensure that projects have the least possible impacts on the environment. In addition, the MPRDA requires that heritage reports be provided with all applications for potential mining sites that may be of historic and cultural value. It is essential to focus on a ‘holistic approach’ when assessing the EIA. The evaluation of the EMP, which describes the necessary mitigation measures, and initial site inspection forms part of MEM’s involvement in the authorisation phase of the mine.

2.8.2 Compliance monitoring

Compliance monitoring refers to the monitoring of mining operations that have been granted authorization to determine whether they are undertaking activities in compliance with the conditions of their approved EMP. This monitoring forms part of DME's involvement in the operational phase of the life cycle of the mine. The DME's environmental compliance monitoring program must be conducted in a fair and consistent manner to achieve compliance with environmental regulations and to ensure protection of our environmental resources. It is the foundation for the application of environmental laws and ultimately the achievement of sustainable development (Figure 16). Generally, the failure to strengthen environmental compliance and enforcement programs is a key reason for the continuing degradation of environmental quality (OECD, 2005).

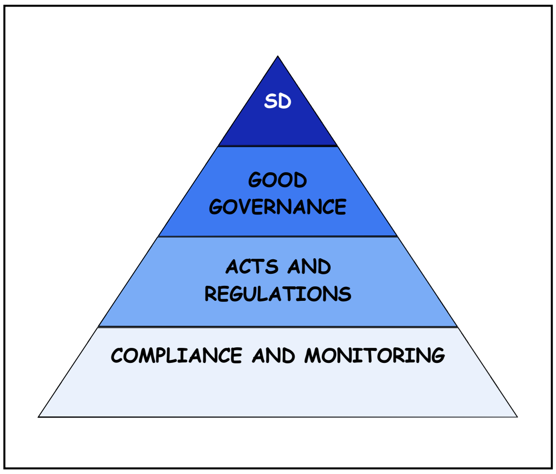

Figure 2.16: Environmental compliance monitoring foundation

There are many reasons for EIA systems failing to perform (Morgan, 2006), and despite the availability of good guidance on how to undertake effective EIA's, many elements of practice still remain sub-standard, and consequently requires regular compliance monitoring, especially in the mining sector where environmental impact is of a high magnitude and environmental degradation can occur rapidly if not managed effectively.

A stronger focus on environmental policy implementation has increased pressures on environmental inspectorates for additional activities to ensure higher compliance and environmental laws and regulations. Authorities are responsible for routine and reactive inspections, post-inspection reporting, administrative responses to non-compliance and also need to provide information about legislation and permitting requirements. However, these pressures have not always been accompanied by allocation of adequate resources. With the same, or sometimes fewer resources, inspectors are required to maintain and even increase their performance (OECD, 2005).

Environmental inspection rates for mining are not commonly available, however, those for Botswana, India and the Environmental Protection Agency (EPA) were obtained. In terms of inspections, the Department of Mines in Botswana has indicated that a total of 314 inspections were made to mines in 2002, an increase of 77% in man-hours compared to the 160 inspections made in 2001 (Republic of Botswana, 2002). Taking into account that the report reveals that there are 185 authorised mining operations, this means that, effectively, each mine was inspected 1.7 times per year.

In India, an audit report (Mallick and Kaul, 2006) indicated that for the period 2001 to 2006, 329 mines out of 795 mines were inspected (Table 2.7). Statistics indicate that for the five year period (2001-2006), 40% of the mines had been inspected, yet mining inspectors are required to inspect mines once every six months (Mallick and Kaul, 2006).

Table 2.7: Number of mines inspected, 2001 – 2006, India.

Year	**No. of mines**	**No. of mines inspected**	**Shortfall**	**Percentage of non inspection**
2001-2002	150	51	99	66
2002-2003	152	64	88	58
2003-2004	166	70	96	58
2004-2005	167	69	98	59
2005-2006	160	75	85	53
Total	*795*	*329*	*466*	
(After: Mallick and Kaul, 2006 : 40)				

The EPA (United States) inspection rates for mining are presented in Table 2.8 (EPA, 1995 : 66-67). Combining both metal and non-metal mining, a total of 48% of all mining operations were inspected over a five-year period. The number of inspections made to these operations was 4941, and on average there is was a 27 month gap between inspections . The total number of enforcement actions resulting from these inspections was 347, representing an enforcement-to-inspection ratio of 7%. Based on the one-year period, the number of mining operations inspected was 367 or 18% of the total number of mining operations (EPA, 1995 : 66-67). The number of inspections conducted was 619 and the average number of months between inspections was 19 months. However, this data dates back to 1995. Although no other international

Table 2.8: Environmental Protection Agency's (EPA) inspection rates for mining.

INSPECTIONS FOR MINING OVER A FIVE-YEAR PERIOD	
Mining : Non-metals	
Facilities inspected : 631 (55%)	(Total number of facilities : 1143)
Number of inspections : 3422	
Average number of months between inspections : 20	
Total number of enforcement actions taken : 192	
Enforcement-to-inspection rate : 0.06 (6%)	
Mining : Metals	
Facilities inspected : 339 (39%)	(Total number of facilities : 873)
Number of inspections : 1519	
Average number of months between inspections : 34	
Total number of enforcement actions taken : 155	
Enforcement-to-inspection rate : 0.10 (10%)	
Mining : All minerals	
Facilities inspected : 970 (48%)	(Total number of facilities : 2016)
Number of inspections : 4941	
Average number of months between inspections : 27	
Total number of enforcement actions taken : 347	
Enforcement-to-inspection rate : 0.07 (7%)	
INSPECTIONS FOR MINING OVER A ONE-YEAR PERIOD	
Mining : Non-metals	
Facilities inspected : 253 (22%)	(Total number of facilities : 1143)
Number of inspections : 425	
Average number of months between inspections : 20	
Mining : Metals	
Facilities inspected : 114 (13%)	(Total number of facilities : 873)
Number of inspections : 194	
Average number of months between inspections : 6	
Mining : All minerals	
Facilities inspected : 367 (18%)	(Total number of facilities : 2016)
Number of inspections : 691	
Average number of months between inspections : 19	

benchmarks for the frequency of compliance inspections could be located, based on the above examples it would appear that the international norm is in the region of an inspection at least every two years. Considering the magnitude of environmental impacts that can result from mining operations within a relatively short time, this is probably less than the ideal and suggests that there are a number of challenges and constraints facing governments in terms of the environmental compliance monitoring of mining operations.

Some of these international challenges and constraints that countries have identified in terms of compliance monitoring include:

- Environmental management systems and policy implementation has been ineffective due to lack of coherence among environmental regulations, insufficient technical capacity and limited resources. The policy framework favours development over the environment, and in this way compromises the work of enforcement bodies resulting in widespread non-compliance. Although there has been a fundamental change in perception, recognizing the need to incorporate the principles of sustainable development, the corresponding changes in institutional structures in order to accommodate these changes, has not occurred. Some countries have tried to change their structures, but these changes have not been incorporated into the actual policy. For example, the Phillippine Council for Sustainable Development was set up to assist the official government policy-making body and the Nepal's Environmental Protection Council was established to advise the National Planning Commission, but there have been no formal procedures established to facilitate the incorporation of the recommendations that these councils make, into the actual main policy formulating body (UNESCAP, 1990). In the long run, this may prove counterproductive since it may give the impression of progress without actually putting any pressure on those that are in a position to make the policy decisions.

- Internationally, there is an institutional and financial subordination of environmental protection Bureau's to provincial and local governments, who tend to favour development over environmental considerations (OECD, 2006). In China, the only evidence of environmental performance compliance is fines and these fines are lower than the costs to reduce pollution (OECD, 2006). In addition local officials sign mining permits without the approval of the environmental authorities. The local authorities also prohibit environmental authorities to inspect and impose fines on operations which are significant polluters, but are considered important to the local economy in terms of providing tax revenue and employment.

- The capacity of the government for monitoring compliance is generally inadequate. As fast as environmental officers are trained in environmental matters, they are hired away by the better paying mining industry. This often means that junior officers are employed who lack the experience to provide informed judgement (EPA, 2005). This leads to challenges in building and maintaining appropriate skills, expertise and resources to enhance regulatory capacity (UNEP, 2000). There is a requirement to provide continuous training for staff.

- Sometimes there is also a conflict of interest within the governing department, as the department is responsible for enforcing compliance with environmental regulations, but is also charged with promoting the activities that they are supposed to regulate. This poses a potential conflict of interest in carrying out their mandates. This leads to environmental officers lacking adequate environmental enforcement powers. There is a need to ensure that there is an alignment between the responsibility to implement policies and the authority to do so.

- There is a need to strengthen the capacity of environmental administrators in order to facilitate better public participation. An informed public opinion, where the public becomes environmentally conscious, can play a powerful role in assisting with identifying illegal mining and non-compliance.

- Fines are low and are not acting as a deterrent and departments rarely bring any offenders to court, preferring to work with the offender to remedy the problem rather than to charge them. Governments face challenges in determining the right mix of command and control measures with voluntary compliance. In Western Australia, prosecution is regarded as the ‘last tactic’ and reserved to incidents that involve serious injury or death, and generally the lower level of enforcement is used (Gunningham, 2005).

- Many developing countries have extensive small scale mining activities which are difficult if not impossible to monitor and regulate.

- Many environmental agencies suffer from inadequate funding (Otto and Barberis, 1994), and a need has been identified to prioritize compliance monitoring and develop approaches to better allocate resources available for compliance assurance.

2.8.3 Financial provision

In terms of mining, the submittal, evaluation, and acceptance of the financial guarantee for rehabilitation is critical, because it ensures that if environmental management is not conducted in an acceptable manner, then the DME has the financial means to take over and rehabilitate these concerns. Prior to 1991, financial provision for rehabilitation was not a requirement and the consequence was that mines were overexploited and once the mines were mined out, then they were simply abandoned, sans rehabilitation. The result is the legacy of derelict and abandoned mines scattered all over South Africa.

With the implementation of the Minerals Act (1991), mining concerns were now required to provide financial provision for rehabilitation. However, mining authorizations were granted before the financial provision for rehabilitation was provided, which in effect meant that once the mining concerns had obtained approval to mine, they simply did not bother to submit their financial provision as indicated by the DME archives. In addition, since rehabilitation was only started once the mining was completed, there was still a serious threat that the mining concerns could be abandoned without rehabilitation.

With the promulgation of the MPRDA, section 41 and regulation 53 requires that a holder of a mining or prospecting right must make financial provision for rehabilitation and the mining concern must assess annually their environmental liability and increase the financial rehabilitation monies accordingly. This is a significant improvement in the legislation, as financial guarantees must now be submitted and approved *before* any authorisations for mining are granted.

The level of compliance with regards to the submission of the financial guarantees is important, because, it means that if the DME fails to keep up with compliance inspections and the mine operators fail to mine in accordance with their EMP's, then at least the DME has the financial funds in retention in order to enable the amelioration of the site.

2.9 THE WAY FORWARD

The key issue in South Africa is that the route to sustainable development is directed by government policy and legislation and the regulatory authorities play an extremely important role in ensuring that development adheres to the policies and law. This is particularly important in South Africa as the economy is heavily reliant on mining, in addition to the fact that we generate a significant proportion of all our power from a mined resource, coal. Monitoring is fundamental to EIA both to assess the adherence to standards and also to support management options because, without it, the process remains incomplete (Linder, 1986; Burby and Paterson, 1993; Ramos *et. al*., 2004; Morrison-Saunders and Arts, 2005; Stephenson, 2006). Although the enforcement of regulation and government controls is complex, it determines to a large extent, the effectiveness of the law (Fenn and Veljanovski, 1988).

Feiock and Stream (2001) argue that industry regulation may deter economic growth in some contexts. For example, there may be a window of opportunity for a mining concern to develop a certain resource i.e. when the market demand and price is right. But the DME requirement for an EIA and the long process of obtaining a mining authorisation (maximum of 6 months for a mining permit and 12 months for a mining or prospecting right under the MPRDA (2002)) may result in the window of opportunity not being available anymore. However, the question here is whether this mining venture is truly sustainable? One can sympathise with companies frustrated by bureaucratic delays in granting environmental approvals, but the EIA and EMP/EMPR approval is of paramount importance if mining is to be conducted in a sustainable manner.

Overcoming the trade-offs between the social, economic and environmental consequences of mining has never been easy in practice, and the environmental administrators are often confronted with choices between protecting citizens and the environment through regulatory actions on the one hand, and promoting economic growth and development on the other (King and Mori, 2007).

Even though legislation has been enacted to regulate rehabilitation and closure of mines, serious challenges still exist such as the abandoned mine legacies of the past and the fact that often, land is not returned to the pre-mining condition. There is a need for effective environmental management stewardship by DME and the Department and the mining concerns need to work in partnership to address these legacies of the past.
The question is whether the DME has up until now, paid only lip service in their response to the challenges that they are trying to articulate with regards to mining and the concept of sustainable development? Does the Department have the resources and the legislative powers to bring about changes in collective behaviour with regards to mining and sustainable development, in order to enforce compliance and provide adequate protection for the environment? Is the mining industry taking steps towards sustainability that goes beyond what is legally required? Can we expect mining operations to 'do the right thing' outside the threat of regulation and public pressure? There is a need to ensure that the minimum standards of compliance are met. Verifiable measures or indicators are required to evaluate progress and foster continuous improvement. In terms of the sustainability concept, the DME faces considerable challenges not only in understanding what the Department has committed itself to, but also in developing credible policy responses and analytical frameworks to monitor policies and progress.

Currently the DME has very limited means for assessing sustainability. This project focuses primarily on environmental management and compliance monitoring with regard to the approved EMPR's of the mining concerns, and the capacity of the Department to fulfil its vision of "world-class minerals and energy sectors through sustainable development".

CHAPTER 3 : RESEARCH METHODOLOGY

3.1 INTRODUCTION

The methodology involved was a conceptual review, analysis and synthesis of data. This chapter details the research paradigm, data collection methods and data analysis methods. The data collection methods include a review of the data sources and population sampling and the dataset validity, reliability and completeness. The data analysis methods include an assessment of the resource requirements, mining application assessment and trends in mining and scenario planning.

3.2 RESEARCH PARADIGM

The research paradigm is an inductive approach that is data-driven and the ontological assumption is positivist in that the real world is assumed. The epistemological stance is an objectivist approach based on true findings from document analysis and the researcher's views did not interfere with the outcome of the research (Babbie and Mouton, 2006). Both quantitative and qualitative data is used to describe and understand events, given the specific contextual background. This objective procedure will maximize data validity.

3.3 DATA COLLECTION

It is critical to understand the nature of the dataset being analyzed. In terms of quality and completeness, the prospecting and mining data held by the DME differs significantly in relation to the content and consistency of data within the application files. Prior to 1995, data on the mine environmental management files was inconsistent and incomplete since the inspections and environmental monitoring was controlled from the Cape Town office. However, for the period 1995 to 2003, the data on file is more consistent, and the reports are more comprehensive, although not always complete. Since the implementation of the MPRDA (2004-2008), data on file is accurate and reliable, with comprehensive reporting. These files are also audited for correctness by the internal auditors on a yearly basis.

3.3.1 Data collection methods

A number of data collection methods were used in this study and included:

- an audit of the DME's National Mining Promotion System (NMPS) to determine the growth in mining activities both for South Africa as a whole, and for the Eastern Cape regions;
- an audit of the DME's NMPS and the EC internal System Development and Maintenance (SDM) database to determine the nature and type of minerals mined in the Eastern Cape and the spatial concentration of mining concerns;
- analysis of application records held by the DME to determine the number of mining and prospecting applications that have been authorized over the past 15 years (1992-2008);
- a review of EC human resources records in order to determine staffing trends. This was important because staff component is directly proportional to the number of person hours available per month, to accomplish all tasks;
- targeted open-ended interviews with MEM staff on the challenges related to compliance monitoring and staff capacity.

3.3.2 Data sources and population sampling

Before 1991, mining activities were controlled by the Mines and Works Act (1956) and mining concerns did not require rehabilitation plans or closure certificates. However, with the promulgation of the Minerals Act, 50 of 1991, all mining concerns were required to become legalized and owners of the mining concerns were required to apply for authorization via a mining permit, mining license or a prospecting permit that was issued by the DME. In addition, all mining concerns were required to submit an environmental management plan and financial provision for rehabilitation. This necessitated the opening of a regional office in the Eastern Cape (Port Elizabeth) in 1992. However, the establishment of the Mine Environment Management (MEM) sub-section only occurred in July 1995, which meant that the MEM section started off with a backlog of applications that were received between 1992-1994. Before 1995, the environmental component was handled by the Inspector of Mines, who was stationed in Cape Town. This resulted in a very limited degree of monitoring and from a preliminary survey of the data records, it became clear that data before 1995 was unreliable and that records were generally incomplete. The sample size for the analysis of trends in the mining activity was the total population (all mines) for the Eastern Cape region and the reason for this is because the longer the time period, the more information and therefore the more likely it was that trends or patterns of change could be identified. This sample included both regular and borrow pit mining concerns. However, a smaller sample size for the analysis of compliance monitoring was used as explained later in this section.

Under the Minerals Act (50 of 1991), a total number of 941 applications were lodged within the timeframe 1992 - March 2004. Of this total number, 60% (562 applications) have since been closed. Closure certificates have thus not yet been issued (as of 31st May 2008) for the remaining 40% of the applications (379 mining concerns). This is significant in that, although the applications were received in past years, they are still impacting on the present workloads of staff in terms of compliance monitoring and auditing, as environmental compliance monitoring only concludes with the issuing of a closure certificate. For the analysis of the inspection patterns, the timeframes of this project did not permit the analysis of all 941 application files. A cursory random sample of 120 closed files (20%) indicated that there was no apparent difference in the inspection frequency in comparison to the remaining operative files and so all mines that have been closed, were excluded from the subsequent data.

Under the MPRDA, compliance monitoring comes into effect once the authorization for the mining activity has been granted. Thus compliance monitoring will include commissioning, operation and closure of the mining concerns. So, although 535 applications have been lodged in the Eastern Cape under the MPRDA (April 2004 – May 2008), 167 (32%) have been granted authorization (includes both regular and borrow pit applications), which means that these mining concerns have approved EMPR's. Of the remaining applications, 51% were closed (applications that have been rejected or refused due to non-compliance of the requirements of the MPRDA, or have been withdrawn by the applicant) and 17% are still being processed.

Thus, the final data sampling included:

- 379 mines (245 regular applications and 134 borrow pit applications) lodged under the Minerals Act (1991), that have not yet been issued with closure certificates i.e. are still in operation

- 167 mines (106 regular applications and 61 borrow pit applications) lodged under the MPRDA (April 2004 – May 2008)

Thus, for the compliance monitoring analysis, a total of 546 mines were included in the study and represents all the active mines within the jurisdiction of the DME's Regional Office. Mines that have been issued with closure certificates or where authorisation was rejected or refused have not been used in the study.

3.3.3 Dataset validity, reliability and completeness

The Eastern Cape Registry office is the data repository for the DME and the registry system is governed by the National Archives and Records Service of South Africa Act (Act 43 of 1996). Records management is a process of ensuring the proper creation, maintenance, use and disposal of records throughout their life cycle to achieve efficient, transparent and accountable governance (DAC, 2004). Section 13 of this Act, provides specific provisions for efficient records management and part V of the regulations contains the parameters within which the Department should operate regarding the management of records.

All mining application records and associated correspondence and reports are stored in a filing system to ensure their usability, reliability, authenticity and preservation. Access to these files is controlled. Internal audits are conducted on a yearly basis to ensure that the record systems and Registry procedures are properly implemented (Tolwana, 2008).

In terms of completeness, the dataset is fairly extensive and complete. However, there is a degree of difference in terms of the content of the files and it is clear that the files opened after 1996 (after the implementation of the National Archives and Records Service of South Africa Act), are more comprehensive. This indicates that there exists reliable and valid, comprehensive dataset expanding over 13 years, that has been well maintained.

All environmental data collated was obtained from the environmental management files of the mining operations, the EIA sub-files and the financial guarantee sub-files. Thus, if inspections were conducted and no inspection report was submitted or the inspection was not recorded on file, then it was assumed that the inspection did not take place. There are common instances, for example, where the environmental officer is on inspection and he/she is passing another mine, so he/she may simply look in on the mine and assess whether the environmental management is occurring according to plan. If everything is deemed in order, then it is likely that the environmental officer would not have completed an inspection report. This is more the case when the inspection reports were not as comprehensively written up as required. However, there is no way that these *ad hoc* inspections can be reliably taken into account and thus the project is based on the true number of written inspections as contained on file. Fortunately, the DME started auditing the MEM files from 2000 and this is really when inspection reports were filed more consistently. Under the MPRDA (2002) the content of the data files is more comprehensive, accurate and reliable.

Data trails have been maintained in order to preserve the credibility, transferability and dependability of the dataset. Data verification audits have been used to ensure quality control in terms of the accuracy of the databases compiled (McQuisten and Gebhardt, 1983; Avenhaus, *et. al*., 1991; Babbie and Mouton, 2006). Application status (open or closed mines) has been verified against files in the DME archives and the application type (regular or borrow pit applications) have been spot-checked against the application files in the DME Registry office. These quality measures have been used to ensure that the dataset is valid.

Data verification and quality control measures were ensured and confirmed via data audits and file cross-referencing. The quality of the data was dependant on the contents of the application files and since all data on file are official documents and correspondence with the mining concerns, the data quality has been deemed to represent a true reflection of reality. Thus, the data set from 1992 to 2008 was deemed valid and reliable and all data was analyzed in an objective manner.

3.4 DATA ANALYSIS METHODS

Qualitative analysis of the application records included descriptive statistics and trend analysis, frequency distributions of the inspections undertaken, and preliminary scenario planning in relation to inspections required versus capacity.

3.4.1 Assessment of resource requirements

The staff of the MEM section was interviewed in relation to their perception of regulation, sustainable development, the compliancy of the mining concerns, the procedures used by the DME, the status of the backlog, and perceptions in terms of capacity and job satisfaction.

The intention was to identify whether the environmental officers were more comfortable with formal regulation or if they are in favour of voluntary compliance, or a combination of both. They were also asked to identify the key obstacles in ensuring compliance monitoring and the greatest challenges that DME will face in the future. The environmental officers were also asked to comment on the status of abandoned mines and illegal mining in relation to the human resources capacity of the DME (EC). Particular attention was paid to their perception of capacity in relation to compliance monitoring.

3.4.2 Application Assessment

Trend or scenario analysis can give an indication of what could happen if certain circumstances arise and are useful to identify the points of transformation (Ducot and Lubben, 1980; Coates, 2000; Masini and Vasquez, 2000; Roubelat, 2000) and can assist management to identify the influence of critical factors. Trend analysis was used to identify growth patterns in the number of mining concerns over the years in relation to the frequency of compliance inspections and staff capacity.

Future trends in mining

The aim of the application assessment was to ascertain likely future trends in mining, based on historical trends and the current economic outlook for mining in the EC. The data was split into two periods – 1995-2003 and 2004-2008, based on the prevailing legislation during those periods (namely the Minerals Act (50 of 1991) and the MPRDA (28 of 2002). The number of applications received by the DME was ascertained for the periods 1995-2003 and 2004-2008, as well as the percent of these mines that were successful in receiving authorization and thus became active mining concerns. The current growth rate in the mining industry in the EC was determined by looking at the number of new mining applications over the past 15 years (under the MPRDA) as well as the number of mines that have actually started operations over the same period. A statistically-based linear trend analysis (using the MS Excel transformed regression model) (Table 3.1) was used to determine the likely trend of mine development within the EC over the next five years, based on past growth patterns. A linear regression trend line was fitted to the number of applications received by the Eastern Cape regional office using the least squares fit method. The slope indicated how the number of applications received is expected to change per unit of time. Linear trend line assumes that the change over time occurs uniformly, so if mining is increasing by a certain percent per annum, it was assumed that it would continue to do so.

Although it was based on objective linear extrapolation of historical data, it also relied on subjective judgement in that there was a need to identify the drivers causing the past trend and whether the same or different drivers would be at play in the future.

Table 3.1: Linear regression model

Linear :	Regression :
$Y = mX + b$	$R^2 = 1 – SSE \backslash SST$
Where:	Where:
m = slope	$SSE = \sum (\hat{Y_i} – Y_j)^2$
b = intercept	$SST = (\sum Y_i^2) – (\sum Y_j)^2$

Percentage of successful applications

The number of applications received by the DME was compared to the number of applications that were successful in becoming operational mines. In addition, the number of prospecting rights was investigated to determine the percentage of prospecting rights that were successfully converted into mining operations. The extent of the mining conversions was ascertained as these mining operations will need to convert to new order rights by April 2009, and will have a significant impact on the workload of environmental officers.

3.4.3 Existing mines

Trends

The goal of trend analysis was to use the historical data to ascertain the level of prospecting and mining activity over time in the EC. The number of mining permits, mining rights, prospecting rights and borrow pits received by the EC office was determined and compared against the number of mines that actually became operational. A density map indicating the locality of the mines per magisterial district, was compiled to indicate, historically (1995 to 2003), where the mines existed, and a comparison was made with this map against the current (2004 to 2008) locality of mines. The change in the type of minerals mined over the two periods was also determined.

Density map

A density map, per magistrate district, was produced to indicate the locality of the active mining concerns. This is important in determining the travel distances that the environmental officers will need to travel in order to conduct compliance inspections.

Mine closures

A discussion of closures was included to indicate the lack of data in this regard, and to highlight the assumptions that were made in order to incorporate this data into the research.

3.4.4 Inspections and audits

Inspections

Extensive document review involved the analysis of the frequency of compliance inspections at mining operations in the Eastern Cape by reviewing historical records dating back to 1995 (12 years). As discussed previously, the Regional Office (Port Elizabeth) only introduced compliance inspections on a formal basis in 1995. Frequency distributions were compiled with regard to the number of inspections undertaken per year from the start until closure of each mine. The frequency distributions were summarized to indicate yearly values in order to correspond to the requirement of the DME strategic plan related to the measurement of sustainability. The yearly inspection frequency distributions gave an indication of the capacity of the DME to respond to an increase in mining activity, based on past resources.

These values were then added together to represent the total number of inspections conducted per year for all active mining concerns during the same period. The total number of mines and the total number of audits per year were then compared graphically. The trend patterns were used to determine the potential active mining operations in 2009 and 2010. In terms of the inspection numbers, the number of inspections for 2008/9 financial year was 150 inspections. Based on the fact that no immediate plan has been made for an increase in MEM staff capacity beyond the current four posts, and in terms of the present ratio of the percentage time that the MEM officials spend on EMPR evaluation versus compliance inspections, it was assumed that the maximum number of inspections that MEM section would be able to execute would be 150 inspections.

Inspection capacity

The MEM section is characterized by a high turnover of staff. The human resources records were used to establish the dates when staff started at the DME and the dates when they left. This information was used to determine the number of environmental officers working at specific periods for DME, related to the number of mining concerns coming into operation. Since compliance monitoring continues until closure of the mine it is important to include statistics with regard to those mines that have still not obtained closure certificates.

The views expressed by the Environmental Officer’s were incorporated into the scenario development process, specifically in terms of how many times a mine should be inspected per year, as related to the mine size and commodity.

3.4.5 Scenario planning

Scenarios are used to identify possible futures, assuming that the future is shaped by economic forces beyond the control of the DME. Some of the benefits of scenario based approach (Schoemaker, 1995; Peterson *et. al*., 2003) is that

- Scenario's provide an aid for defining conditions and assessing consequences.
- Data and facts are placed within a context of understanding.
- The scenario can illustrate the implications of policy and can facilitate the discussion of future planning options and levels of management and staffing that will be required.
- The snapshot provided by the scenario can help decision maker's take stock of the situation.

The scenario analysis can assist in identifying priorities in terms of both problems and opportunities, in order to draw up a plan of action. Scenarios can also provide a description about the consequences of current policy and possible future situation that DME may face regarding compliance and monitoring.

The scenario analysis would indicate whether current resource allocations are appropriate or whether they needed to be reconsidered. It would identify what are the really important changes that should be considered. For example, is the current staff capacity sufficient to cope with the increasing trends in mining operations in the next years to 2012. In addition, is the current EMPR evaluation versus compliance inspections ratio the optimal ratio to use, taking international standards into account. In addition, is DME measuring sustainability correctly if they are basing the number of inspections required per year on staff capacity rather than the number of mining operations becoming active? This can assist the DME in developing a future-oriented attitude to compliance and monitoring, in order to enable the environmental officers to pursue compliance monitoring at a more effective rate and manner. This will provide an opportunity for the DME (EC) to plan for and be able to accommodate the future growth in the mining industry, in relation to the required staff capacity for compliance monitoring.

3.5 CONCLUSION

The project presents the results of a detailed computation of mining statistics for the Eastern Cape. Data reported on includes the number of applications received and authorised, commodity types, mine types, number of EMP's approved, provision of financial guarantees, site inspections performed and the spatial concentration of mining operations in the Eastern Cape. This is the first systematic compilation of statistical data for the Eastern Cape and presents the first study in the regional office in terms of environmental sustainability.

CHAPTER 4 : RESULTS AND DISCUSSION

4.1 INTRODUCTION

This chapter defines the current resource allocations in terms of the staffing component and the percentage of time spent on inspections. The first requirement for analysing the future of the mining sector is to characterize its operations at present, in terms of the number of mines, the type of mining operations, their localities and the future growth trends in mining as this growth will impact on the DME's capacity for EMPR evaluation and compliance monitoring. The next section deals with identifying the trends in prospecting and mining applications and the number of applications that have been successfully developed into active mining operations. This is important to confirm the trend towards an increasing number of mines in the Eastern Cape and the impact on the frequency of compliance inspections. The chapter concludes with an assessment of the frequency of inspections and evaluations of EMPR's at Eastern Cape mines.

4.2 CURRENT RESOURCE ALLOCATIONS

The first step in answering the original research questions was to confirm the number of inspectors working in the MEM section over the study period, with a view to comparing overall capacity to the actual number of compliance inspections undertaken.

4.2.1 Staffing component

Figure 4.1 indicates the MEM staffing component from 1995-2008, and a staffing component of 1.5 indicates that one official was employed for only 6 months of the year.

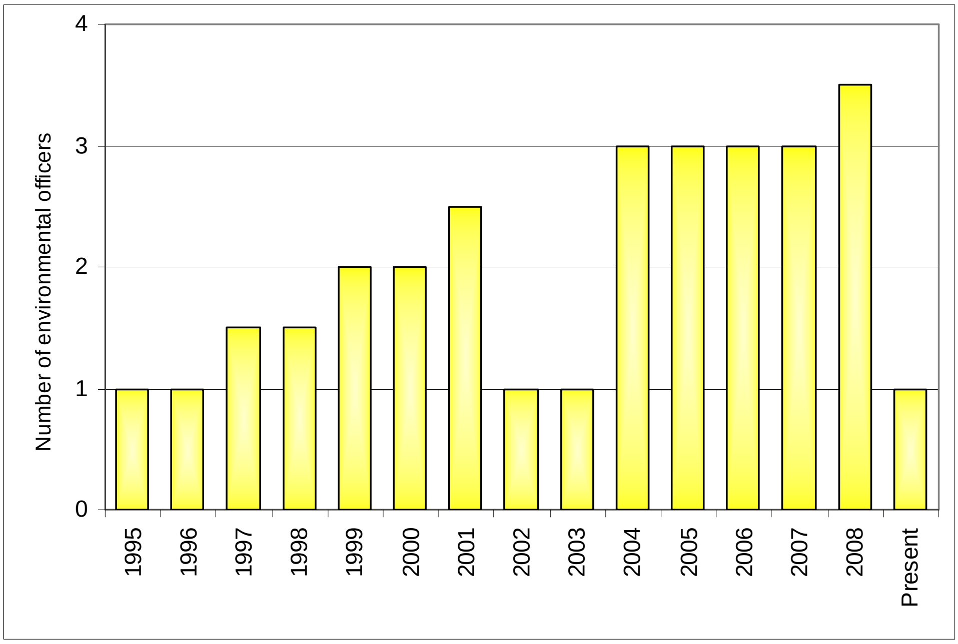

Figure 4.1: MEM staffing component (1995-2008), indicating the number of environmental officers employed per year, Eastern Cape, Department of Minerals and Energy.

Staff component has varied significantly over the years starting off with only one environmental officer for 1995-1998, with the assistance of an environmental officer for six months in 1997 and another environmental officer for six months in 1998. However, what needs to be taken into account is the fact that new staff need to be initiated into the whole programme of the EMP assessment and compliance monitoring, which usually takes at least three months. This, in effect, means that these environmental officers would have only been able to make an effective contribution after three months at the earliest. Over the period 2002-2003, the MEM section again comprised only one environmental officer, the Deputy-Director, who was responsible for evaluating all the EMP's, conducting site inspections and obtaining the financial guarantees. The number of environmental officers remained constant at three for the period 2004-2008 (Figure 4.1). In summary, an investigation into the number of staff within the MEM revealed that the number of experienced staff varied between one and three individuals over the study period. It was suspected that this would have had negative implications for the percentage of time spent on compliance audits due to the perceived pressure to process new applications as a priority.

4.2.2 Percentage of time spent on inspections

After confirming the number of staff within MEM over the study period, it was considered appropriate to determine the percentage of the available time was spent, on average, on site inspections.

Programme 3 of the Mineral Regulation branch of the DME deals specifically with the regulation of all mining activities and the purpose of the branch is "*to regulate the minerals and mining sector to achieve transformation and sustainable development*". According to Programme 3, the MEM section was required to conduct 12 inspections for the 2006/7 and 2007/8 financial years and is required to conduct 150 site inspections for each of the 2008/9 and 2009/2010 financial years (Table 4.1).

Table 4.1: DME's strategic objectives for contributing towards sustainable development (DME, 2008).

DME strategic objective	**DME strategic outcome**	**Branch initiatives**	**Measures**	**Timeframes targets (2008/9)**	**Timeframes targets (2009/10)**
Actively contribute towards sustainable development and growth	Sound environmental management	Evaluate EMP's, monitor and ensure compliance	Number of inspections	*150 inspections for the Eastern Cape*	*150 inspections for the Eastern Cape*
	Reduced government environmental risk and liability	Implement rehabilitation of ownerless and derelict mines projects	Number of rehabilitation projects	*1 mine in the Eastern Cape*	*1 mine in the Eastern Cape*

For the period 2004-2008, prior to the recent resignation of the MEM staff, the MEM section was comprised of three staff members and they were required to conduct 120 inspections per annum (i.e. 40 inspections each). Calculated on the basis of 335 working days per year and 1.5 days per audit (including travel and follow-up administration such as writing reports) (Van As, personal communication, 2008), this equates to each environmental officer spending 18% of their time on compliance monitoring and the remaining 82% on other duties, including the evaluation of EMPR's.

Figure 4.2 gives an indication of the percentage of the actual time that the environmental officers spent on inspections for the period 1995 to 2008, and takes into account the number of staff employed at that time. The time spent on inspections was calculated by using the formula below:

% time on inspections = [(number of inspections x 1.5)/335] x 100 …………Equation

Based on the above, in 1995 there was only one staff member in the MEM section, and he spent 67% of his time on inspections that year. Under the MPRDA, for the period 2004 – 2007, the inspection time spent per officer per annum was 29% (2004); 18% (2005); 21% (2006) and 26% (2007). Thus on average over the past four years, the environmental officers worked on a 24/76 split with 24% of their time spent on conducting on-site inspections and compliance monitoring and 76% of their time spent on other tasks including evaluating EMPR's.

However, taking into account the resignation of staff, the projected number of inspections for 2008/9 is 78 inspections based on the fact that 58 inspections had already been conducted for the first nine months of the 2008/9 financial year. As such, the percentage time spent on inspections over this time period was only 9%. Over the last two months, this dropped to zero percent since the resignation of all but one of the MEM staff. The remaining staff member has spent 100% of her time over the last two months evaluating EMP's. Implications for this were that during this period, EMP's were being evaluated without site inspections being conducted.

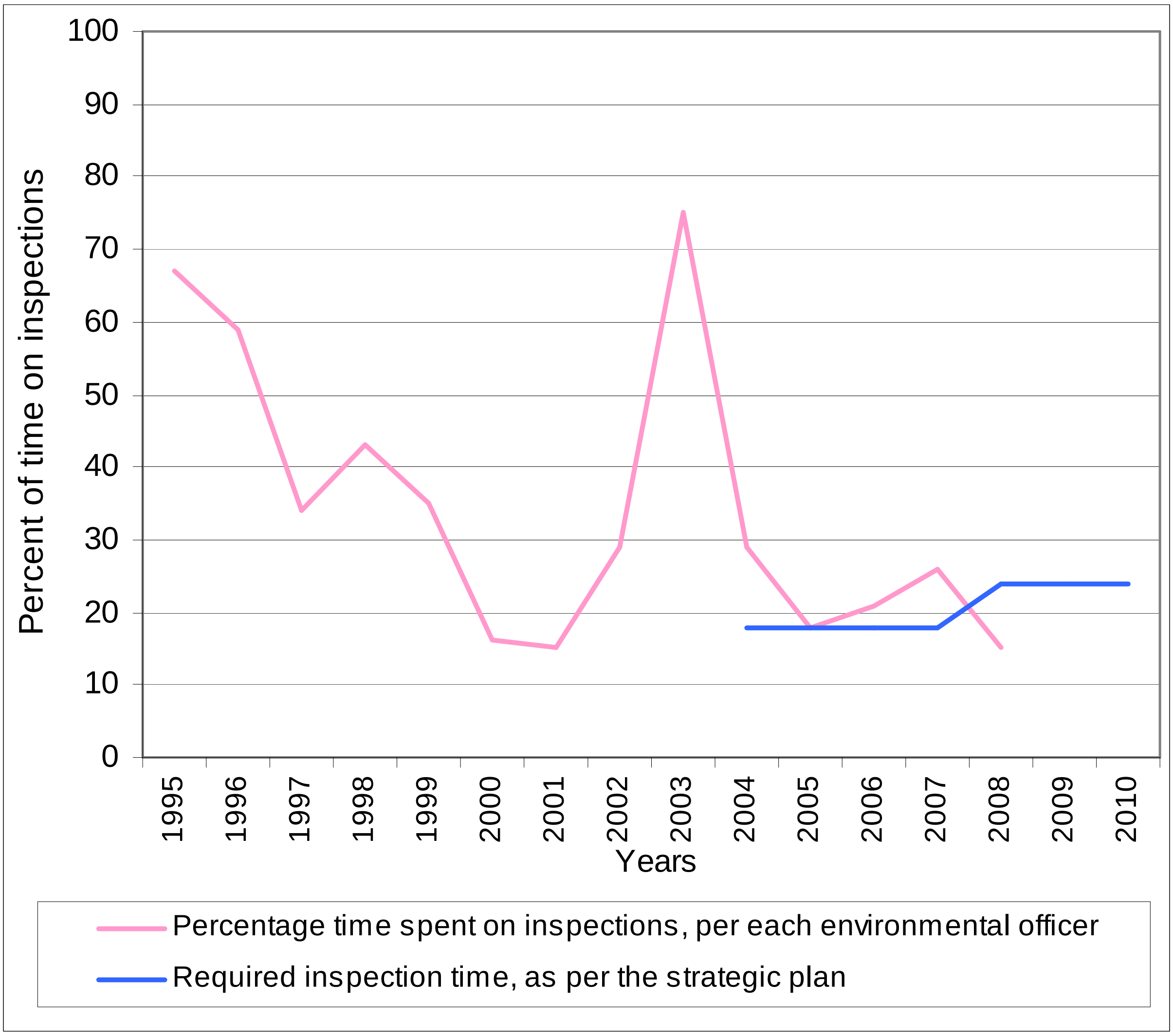

Figure 4.2: Mean percentage of time spent by MEM staff on inspections, 1995-2008, projected to 2010.

The important point to note here is that the top management of the DME have determined that 120 inspections (increased to 150 inspections for the 2009/10 financial year) will be conducted by the EC on the basis of staff capacity and not on the basis of the number of active mines. This means that if the staff compliment for the MEM office is restored to and remains at three, and the number of active mining operations continues to increase, then the frequency of inspections per mine will, on average, decrease. However, in order to gauge more accurately the likely frequency of inspections in the near future, it was necessary to obtain a more accurate prediction of the expected number of operational mines (based on successful applications and mine closures) and changes in trends for relevant factors such as the location of new mines.

The latter was expected to have implications for the time required to conduct individual audits (currently estimated at 1.5 days per mine).

4.3 ASSESSMENT OF EXISTING MINES

4.3.1 Trend analysis of existing mines

A review of the economic background of the mining sector is useful in indicating the major effects and potential growth of mining in the future. The first requirement for analysing the future of a sector is to characterise its operations at present, in terms of the number of mines, the type of operations, their localities and the future growth trends in mining, as this growth will impact on the DME's capacity for EMPR evaluation and compliance monitoring.

Analysis of the number of mines in the Eastern Cape (1992 – present)

The regional distribution of the mineral reserves in South Africa has impacted on the extent of mining operations within the nine regions of the DME (Figure 4.3). This explains the extent and type of mining operations that occur in the EC and will inevitably impact on the evaluation of the EMPRs and the type of compliance monitoring that will be required. The Limpopo, Mpumalanga, Northern Cape and the North-West regions were collectively responsible for over 74% of all mining and prospecting applications lodged at the DME for the period 2004 – 2008 (Figure 4.3). For the same period, the EC received only 4% of the total applications lodged at the DME. The graph represents the total number of applications in the various provinces and it is important to keep in mind the fact that not all of these applications will be successful.

Type of operations

In terms of the types of mining operations active in the EC, small mining concerns of 1.5Ha or less predominate with mining permits making up 38% (n=527) of the total applications received by the EC. Mining rights (for larger mines) make up 17% (n=238) and prospecting rights only comprise 14% (n=191) of all applications lodged (Table 4.2). This indicated that mining in the EC is predominantly small-scale concerns. Borrow pits make up 31% (n=428) of the applications received, but this number has fluctuated significantly over the years. Very few borrow pit applications were received up until 1999 and the reason for this is that the DRT were exempted from requiring mining authorisation from the DME. However, after audit inspections were conducted in 2000 by Head Office, DRT were required to obtain authorisation for their borrow pit applications and this directly relates to the substantial increase in borrow pit applications for the subsequent years 2000-2004. This trend has been sustained in the years 2005-2008, but to a lesser degree, as with the promulgation of the MPRDA, the EMP must be approved and evidence of the financial provision provided before a borrow pit application is approved, which has resulted in a considerable time lag. This questions how effective the DME have been, historically, in terms of their monitoring of the environmental compliance of DRT mining operations in the EC and what will be the impact in terms of the fact that legislation now requires these mining concerns to have an authorisation and approved EMP? Of the DRT applications, 5% are hard rock quarries, and the remainder are smaller borrow pit operations (Personal communication, Van As, 2008).

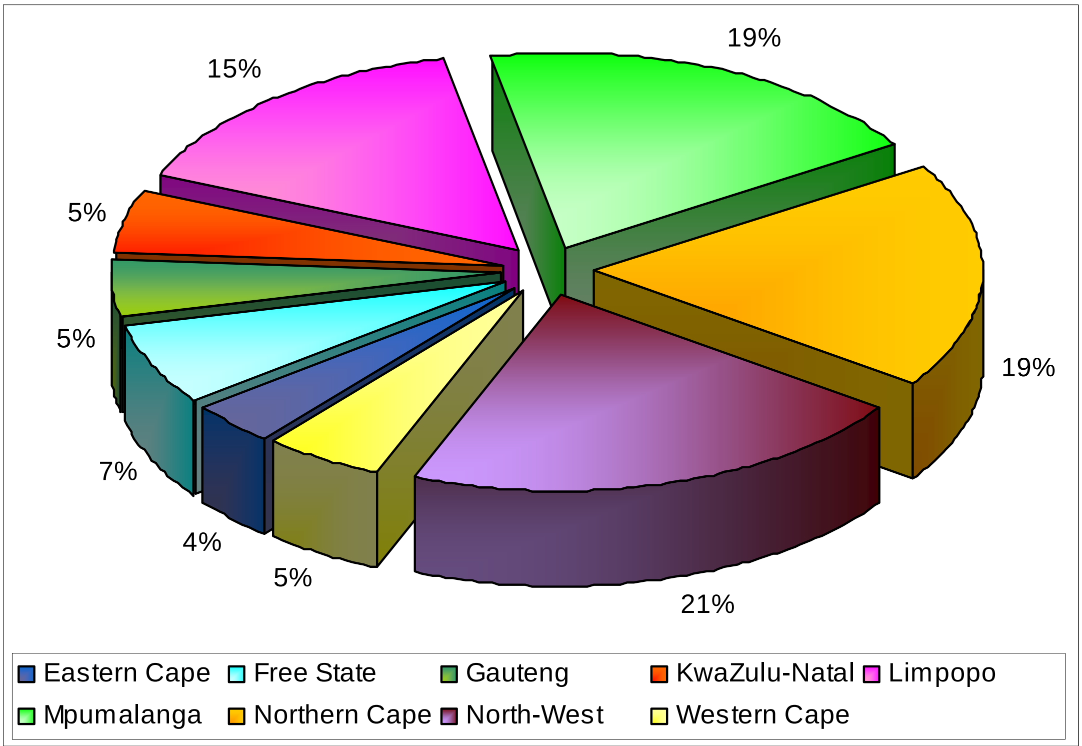

Figure 4.3: Number of mining and prospecting applications (as a percentage of the total number of applications received) per each regional office of the Department of Minerals and Energy (2004-2008).

Table 4.2: Application type divisions for all applications lodged in the Eastern Cape.

TYPES OF APPLICATIONS					
Year	Mining rights	Mining permits	Borrow pits	Prospecting rights	TOTAL
1992	32	49	13	8	102
1993	31	42	2	5	80
1994	9	23	5	10	47
1995	12	36	2	9	59
1996	12	28	5	9	54
1997	9	36	1	9	55
1998	10	32	0	12	54
1999	9	14	1	10	34
2000	12	15	28	5	60
2001	6	16	90	8	120
2002	9	13	61	6	89
2003	10	8	62	2	82
2004	7	21	48	4	80
2005	21	65	39	34	159
2006	21	58	31	26	136
2007	21	53	20	23	117
2008 to June	7	18	20	11	56
TOTAL	238	527	428	191	1384

Type of commodities mined

Analysis of DME data for the period 1992-2004 showed that, most mining operations within the EC mined sand (60.1%), stone and gravel (20.84%) or clay (12.8%). The remaining 7% of mines registered during this period were involved in the mining of other minerals including kaolin, limestone, calcrete, salt, etc. (Figure 4.4). A similar trend is indicated in the type of commodities mined currently (Figure 4.4). However, if the current prospecting for coal in Indwe, uranium in Aberdeen and titanium sands in the Xolobeni area is successful, the DME will be challenged with mining concerns that have the potential to create greater significant impacts, in comparison to the aggregate based mining concerns, and will therefore require more frequent compliance monitoring.

Locality of mines

A location density map was compiled to indicate the current extent and locality of mining and prospecting in the Eastern Cape. A coordinate point for each active mining concern was compiled and the mine was allocated to a Magisterial District. The map indicated that for all active mining concerns, 48% are active in the Western region, 45% in the Central region and only 7% in the Eastern region of the EC (Figure 4.5). In particular, 59% of all mining concerns are operative in the Magisterial Districts of Humansdorp, Uitenhage, Port Elizabeth, Grahamstown, Bathurst, East London and Maclear (Figure 4.6). This spatial distribution of mining concerns has implications in terms of compliance monitoring. It implies that most of the mining operations are within one day's travel distance from the regional office.

For those mining concerns further away, such as in Graaff-Reinet and Aberdeen, collective mine inspection is implemented and if these regions are visited, most of the mining concerns are visited in the region over a four-day period. For the mining concerns in the Eastern region, the Umtata office has been established in order to enable closer contact with the mining concerns in this region and to allow for shorter time periods spent on travelling to destinations.

Thus, the trends in terms of existing mines has been established, and it is clear that mining in the EC is predominantly characterised by small mining operations (mining permits) and DRT borrow pit operations and the minerals mined are stone/gravel aggregate and sand.

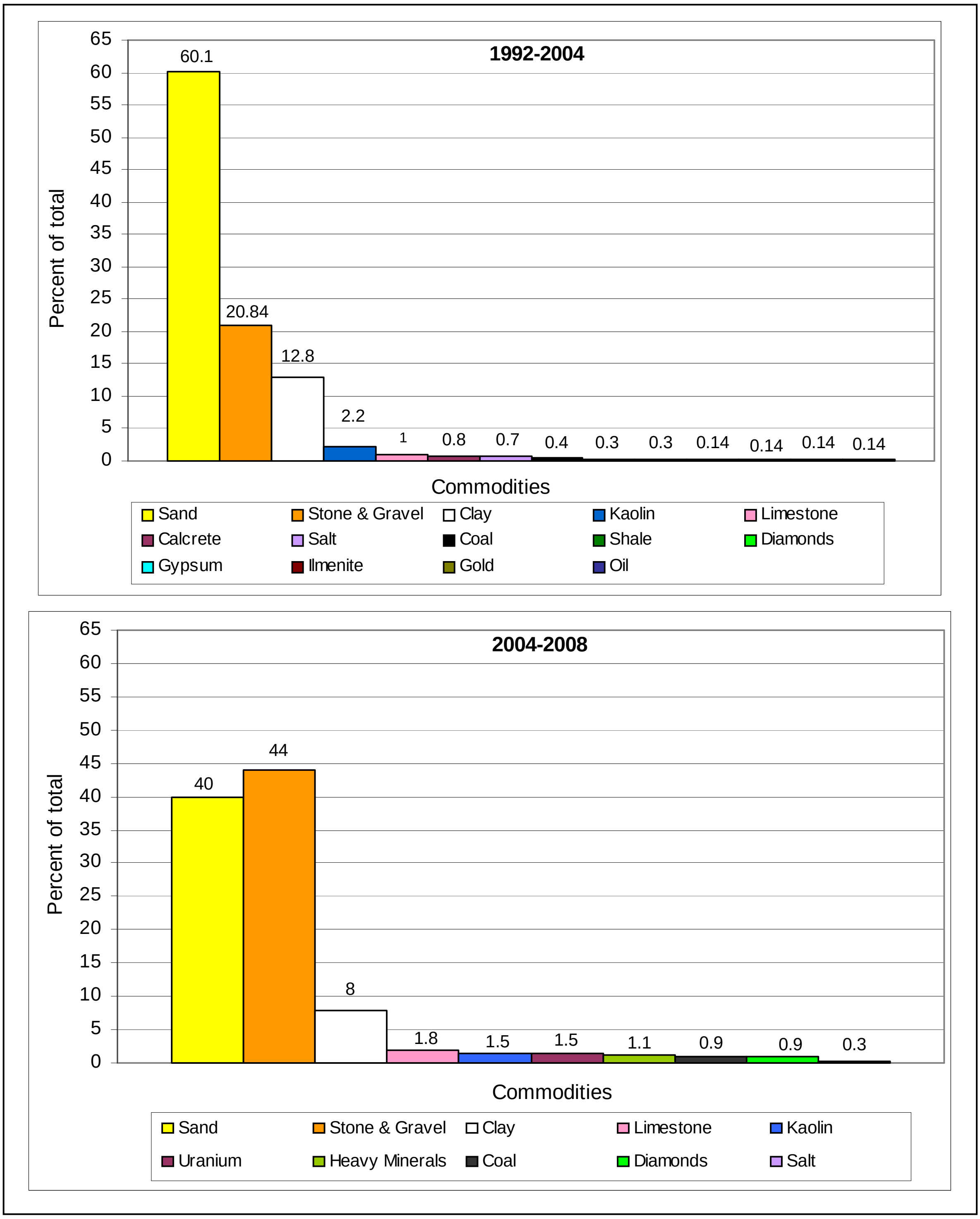

Figure 4.4: Commodities mined in the Eastern Cape : 1992-2004 and 2004-2008.

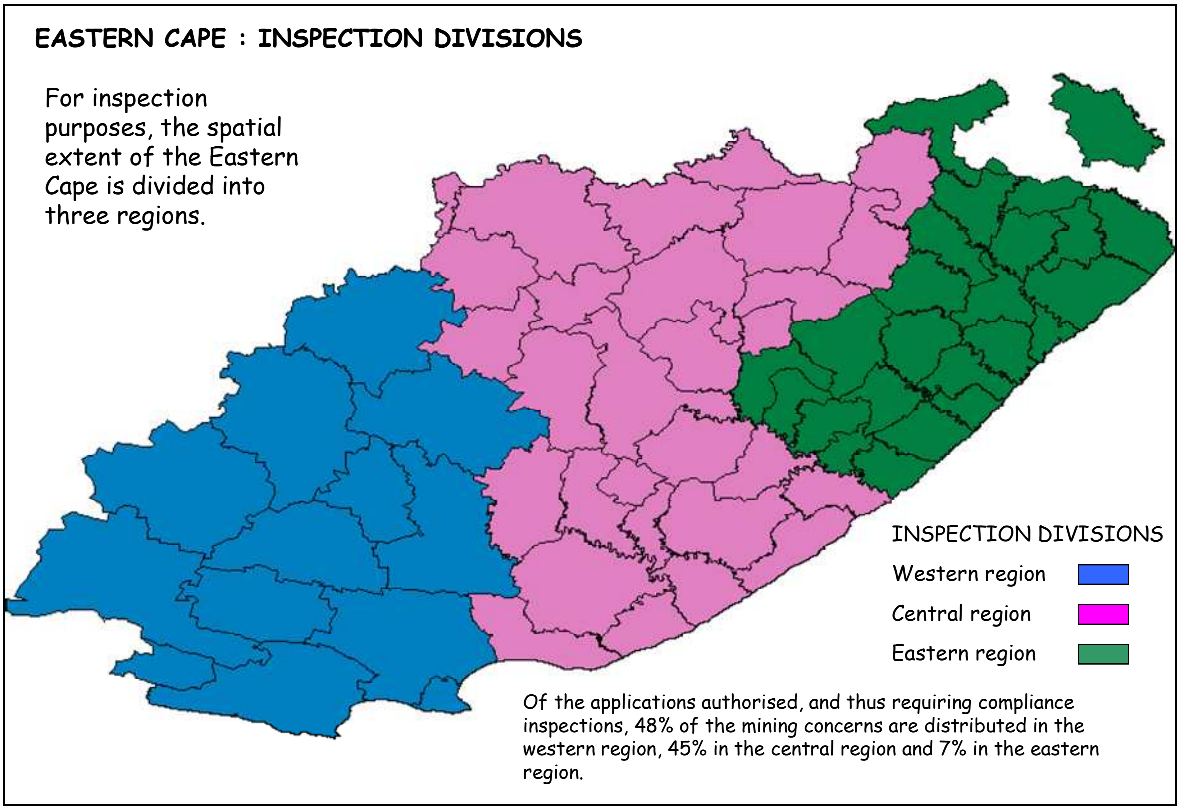

Figure 4.5: Inspection divisions (Western, Central and Eastern regions) for the EC.

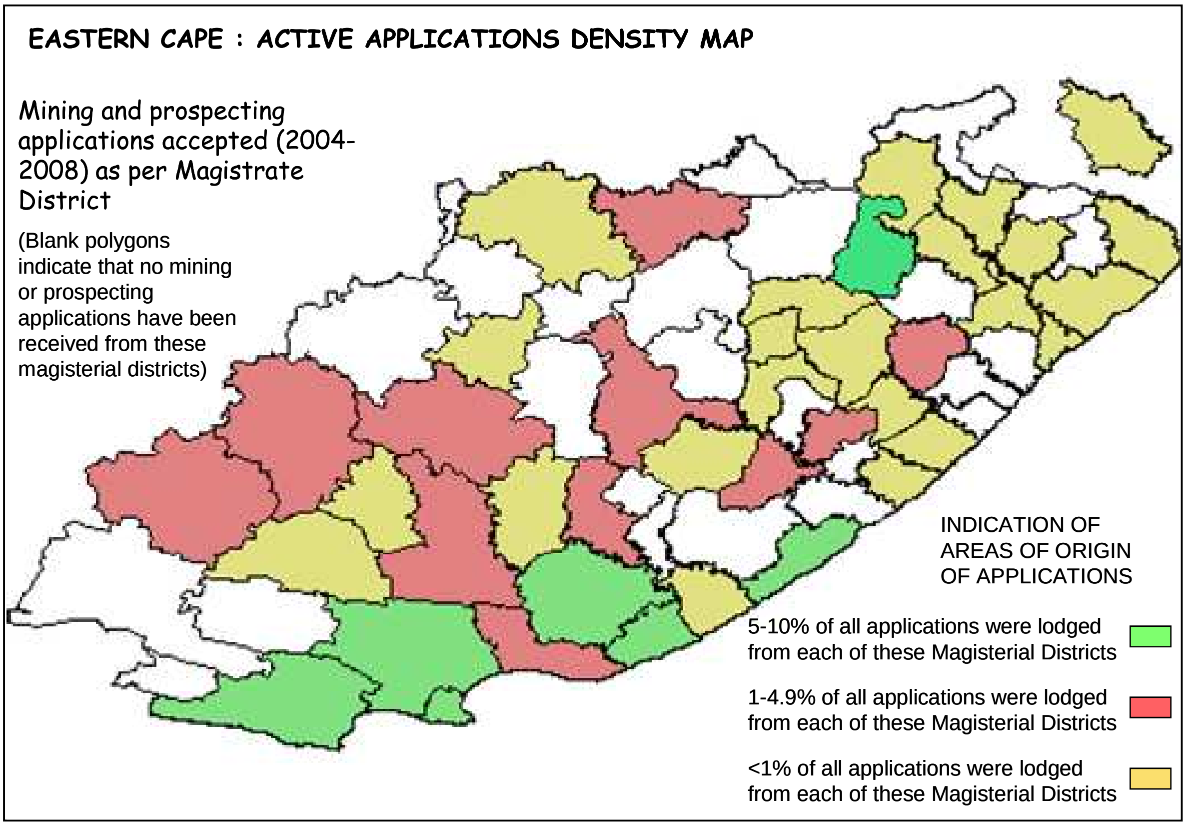

Figure 4.6: Spatial distribution of all active applications lodged at the DME, EC.

4.4 ASSESSMENT OF APPLICATIONS

This section concentrates on identifying the trends in prospecting and mining applications and the number of applications that have been successfully developed into active mining operations. This was considered important as it would then facilitate confirmation of the trend towards an increasing number of mines in the EC and would have significant implications for the frequency of compliance inspections.

4.4.1 Trends in prospecting and mining applications

Historical applications and acceptance rate

In terms of the acceptance rate i.e. the number of applications that are approved, data was only valid from 2004. Prior to 2004, all applications received were accepted (100%) under the Minerals Act, as there were no conditions for the acceptance of an application except the payment of a lodgement fee. However, under the MPRDA, there are a number of attachments that must accompany the lodgement of an application and this includes the completed application form, the application fee, a locality map and coordinate data indicating the exact position of the proposed mining concern, evidence of the financial and technical competence of the mining concern, the title deeds covering the area to be mined, and company details such as the certificate of incorporation and certificate to commence business. With a mining right application, the EMP, social and labour plan and mining work programme must also be included. Should these attachments not be included with the application, then the application will not be considered further for authorisation. In addition the attached documents must provide evidence, given appropriate mitigation measures, that the environmental and social costs are outweighed by the benefits from the mining activity.

Specific trends in the numbers and success rate of both prospecting and mining applications within the EC are discussed in more detail below.

Prospecting applications

The trend line for the projected number of prospecting applications in the future, is based on the number of prospecting applications *accepted* in the EC for the period

1992-2008 (Figure 4.7). Interestingly, the number of prospecting applications accepted for the period 2005 to 2008 (n=89) was 17% higher (over a four year period) than for the 12 year period covering 1992 to 2004 (n=76). Considering this pattern, it was considered appropriate to use the trend for the last four years (2005 – 2008) to predict the number of expected prospecting applications until 2013 (Figure 4.8). The number of prospecting applications has continued to grow so there is no reason to expect that the number of prospecting rights that will convert to mining right activities, would not follow the same trend.

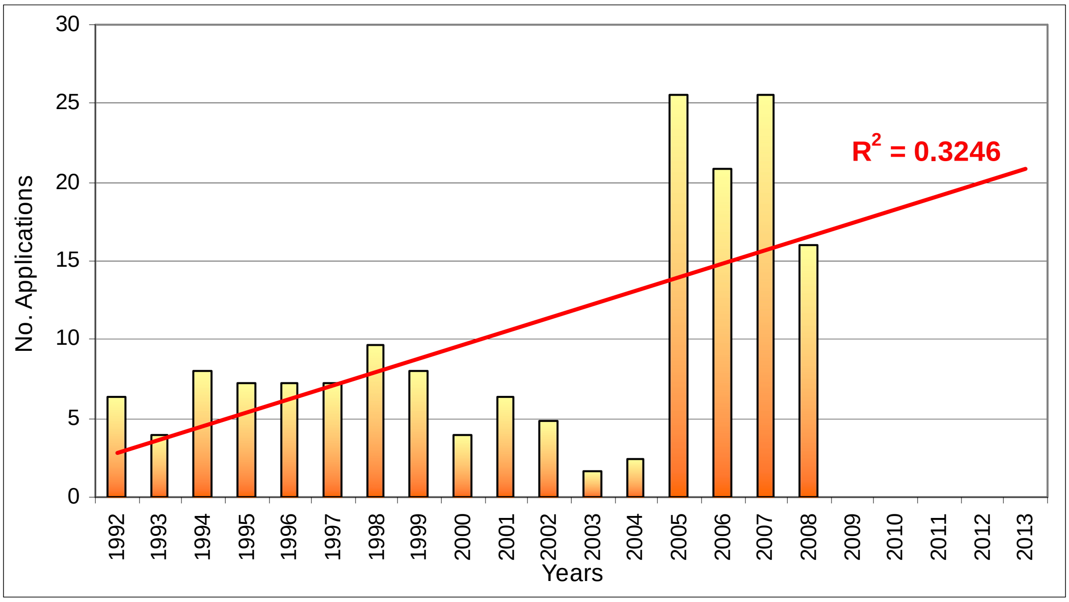

Figure 4.7: The number of prospecting applications accepted by the Department of Minerals and Energy, Eastern Cape (1992-2008).

Thus, of the prospecting applications received over the past three years, an average of 21 (±5) prospecting applications have been accepted per annum (2005 (n=26); 2006 (n=21); 2007 (n=26); 2008 (n=16 for the months January to October)). This increase in applications for the period 2005 to 2008 is predominantly linked to applications to prospect for coal and uranium, and can be directly linked to the power shortage problems currently being experienced in South Africa.

Based on the trend, the average projected value for the number of prospecting applications to be accepted in 2009-2012 is an average of 30 (±5) prospecting applications, representing an increase of 43% relative to the number received in 2008. The likely success rate of these applications is discussed in more detail below.

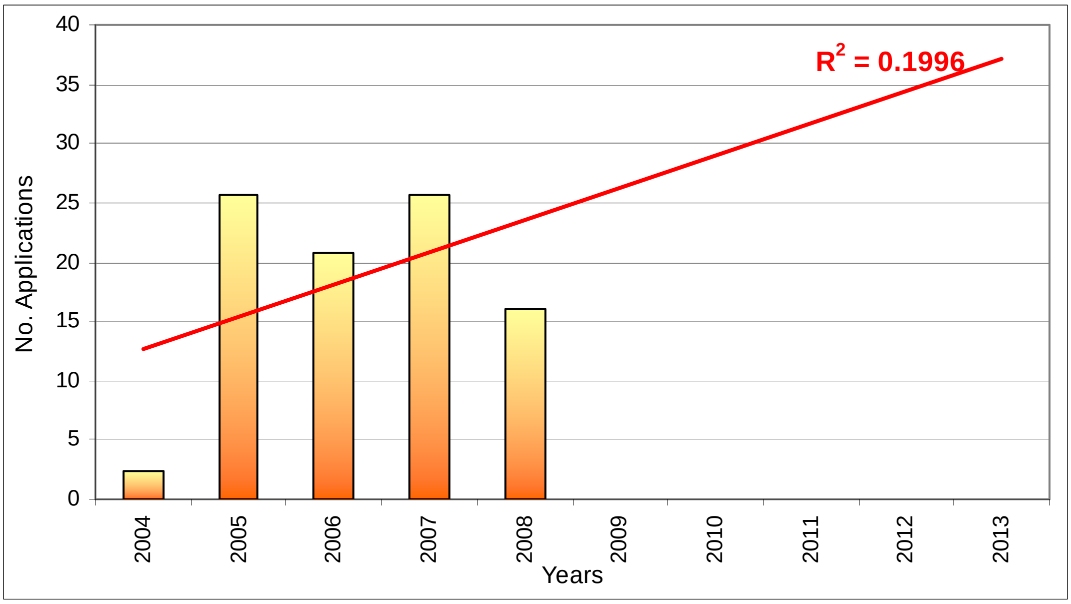

Figure 4.8: The number of prospecting applications accepted by the Department of Minerals and Energy, Eastern Cape (2004-2008).

This increase in applications for the period 2005 to 2008 is predominantly linked to applications to prospect for coal and uranium, and can be directly linked to the power shortage problems currently being experienced in South Africa.

A point to consider is the fact that, the applications for prospecting may result in new mines and will therefore have implications for compliance monitoring. However, currently only 9% of these prospecting rights have been converted to active mining rights and it therefore appeared that the number of prospecting applications would have little influence on the number of active mines over the short to medium-term. However, this low percentage of conversion of prospecting rights to active mines could be explained by the fact that most of the prospecting operations are still being undertaken. Prospecting applications are given authorisation for five years, renewable for an additional three years. Thus, basically this means that only the prospecting applications received in 2004 and early 2005 have completed their prospecting work and are ready to be converted to active mining concerns and can lodge applications for mining authorisations. The implication is that as these prospecting operations complete their prospecting, more will be converted to mining right operations, resulting in an increase in workload in terms of compliance monitoring for MEM. It is too early at this stage to accurately gauge the actual percentage conversion from prospecting to mining rights and this would therefore need to be carefully monitored by MEM in order to plan for future resource requirements.

Mining applications

82% of all applications lodged at the EC office for the period 2004-2008 were accepted. There has been a sustained annual increase in the number of applications received since 2004. Mining applications received by the DME have increased by 47% up in 2007 (January-May) over the same period in 2006 (January-May), and further increased by 100% in 2008 over the same period in 2007 (January-May). However, what is more significant is the number of applications that are being accepted, as the MEM section only receive the application once it is accepted by the Mineral Laws Sub-Directorate, in order to evaluate and either provide a positive or negative Record of Decision in terms of authorising the EMP. If the ROD is positive then the mining concerns will receive a mining authorisation, but if the ROD is negative, then the mining application will be refused authorisation and the file will be closed. From a resourcing and compliance monitoring perspective, this may have profound implications for MEM. It has already been shown that the number of active mines has increased steadily since 1995 and, considering the trend in the number of applications and the high approval rate, the number of active mines and monitoring requirements is also likely to continue with an upward trend.

As described in the methodology, the number of mining applications accepted for the period 1992 - 2008 was used to establish the projected number of mining applications likely to be operational within the EC until 2012. The trend line presented in Figure 4.9 covers the entire period from 1992-2008 and, although it shows a steady increase in the number of applications, it is slightly depressed when compared to the trend for the period 2004 – 2008 (Figure 4.10). This was explained by the fact that Figure 4.10 indicates the projected trend line for the number of mining applications likely to be accepted to 2013, based on the 2004-2008 data only. The impact is that the R^2 value has increased to from 0.0671 to 0.3034, indicating a greater confidence in the projected data.

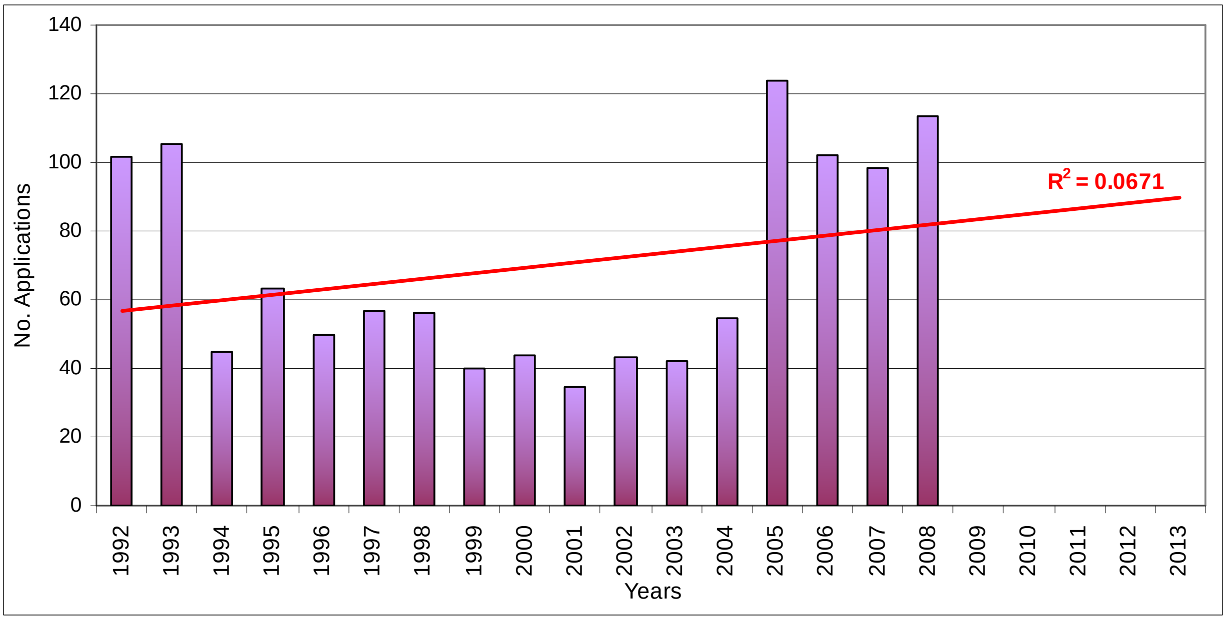

Figure 4.9: Trend line based on the number of mining applications accepted by the Department of Minerals and Energy, Eastern Cape (1992-2008).

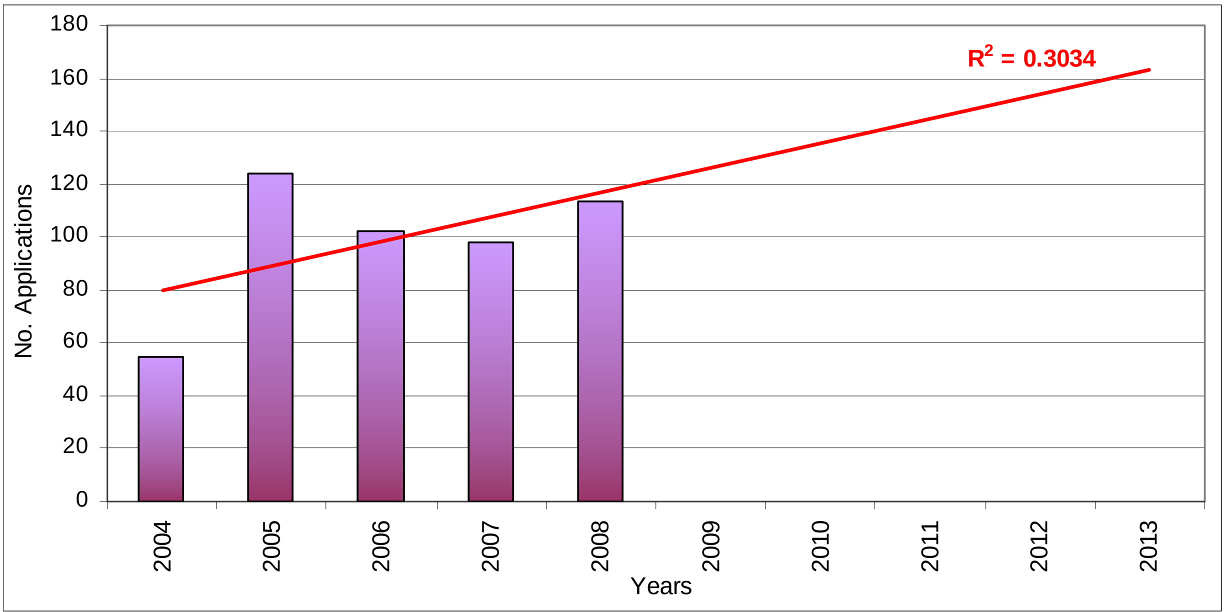

Figure 4.10: Trend line based on the number of mining applications accepted by the Department of Minerals and Energy, Eastern Cape (2004-2008).

The cumulative number of applications received in the EC region versus the number of mines that have been successful and become active for the same period, is indicated in Table 4.3 and is graphically represented in Figure 4.10. The R^2 values are close to one indicating that the estimated values for the trend line correspond well with the actual data. Figure 4.10 indicates that the number of active mines will increase from 728 in 2008, to 900 in 2012 and 1050 in 2015. This represents a future growth rate in the number of active mines of 44% in seven years.

Table 4.3: Cumulative number of applications received by the DME and the number of active mines per year, 1992-2008.

Year	**Cumulative number of applications received**	**No. of active mines**	**No. active mines as a percent of the total no. of applications received**
1992	145	45	31%
1993	279	141	51%
1994	337	179	53%
1995	422	209	50%
1996	489	257	53%
1997	560	308	55%
1998	636	334	53%
1999	691	358	52%
2000	748	370	49%
2001	796	451	57%
2002	850	536	63%
2003	906	623	69%
2004	981	608	62%
2005	1137	618	54%
2006	1266	675	53%
2007	1392	704	51%
June 2008	1476	728	49%

The reason there has been a smaller relative increase in the number of *active mines* over the past three years can be related to the concerted effort the DME in the EC is taking to obtain closure for old mining concerns and borrow pits that have remained dormant and unrehabilitated for many years. In addition, with the new MPRDA and regulations, the application procedure has lengthened with a mining permit requiring six months for authorisation and a mining right twelve months.

All used old order rights need to be converted by 31st April 2009 and for the EC office, it is expected that there are 89 used old order rights that will be submitted in addition to the current application workload. Thus, it is guaranteed that the 89 applications for the conversions will be submitted by the 31st April 2009, since these are active mining operations and should the application for conversion not be submitted on time, then the DME has the legislative right to close down these mining operations. For all these mining conversion applications (MRC) (which are currently active and are included in the active mining statistics), the EMP's are significantly outdated and not up to standard in terms of the MPRDA and regulations. The implication is that new EMPR's and financial provision for rehabilitation is required from the applicants and these EMPR's will need to be re-evaluated by the environmental officials, including site inspections. This will increase the workload of the MEM section.

Reasons for the identified trends in the prospecting and mining applications

For the four-year period 2000-2003, the increase in the number of applications per year was 6.8% compared to 12% for the period 2004-2007. Some of the reasons why the number of applications for mining has increased since 2004 can be related to the following :

- South Africa is hosting the 2010 FIFA World Cup, and over R5 billion will be spent on building new stadiums, and one of these stadiums will be built in the Eastern Cape (Port Elizabeth).
- Trevor Manual, South Africa's finance Minister, announced a R50 billion over-collection in the past tax year, and this capital will be spent on more social infrastructure (Nevin, 2007).
- The EC Department of Roads and Transport (DRT) is in the process of expanding its area wide road maintenance programme to 16 new local municipalities 2008-9 at a cost of R224million per annum in order to deal with road infrastructure challenges in the EC (South African Government Information, 2008). Adding to this boom the DRT have also set aside an additional R45 million that will be made available for the provincial rural access to transport programme to develop a sustainable rural transport network (Eastern Cape Provincial Government, 2008). The DRT's strategy for the next 10 years is to change the ratio of surface to gravel roads, with 80% of the EC provincial network to be surfaced and 20% to remain gravel.
- The Coega Spatial Development Framework is likely to continue for the next 30-40 years, in an effort to gradually bring the EC on a par with the rest of the industrialised regions of South Africa (CS Market Research, 2006; Zachariasen, 2008).

4.4.2 Mine closures.

In order to determine the likely future resourcing implications for the DME in the EC, it was important to not only consider the trends in new applications, but also the closure of existing mines. The closure of mines would mean that they would no longer need to be monitored.

The difficulty in attempting to account for mine closures in this study was the fact that the larger mines (mining rights) generally have a lifespan of 20-30 years while smaller mines (mining permits) normally last for three years. This means that there is no correspondence between the number of mines becoming active and the number of mines being closed due to differences in timeframes. However, from 1992-2008 the total number of active mines was 728 mines and the corresponding number of mine closures during the same period was 195 mines, representing a total closure rate for the entire period of 27%. Unfortunately, records for mine closures before 2004 have not been kept, and so yearly percentages of mine closures could not be ascertained. However, these figures indicate that an average rate of closure is 12 mines per annum. Of all the mines closed, 89% of them were mining permits (mined areas less than 1.5Ha). This was expected as they have a shorter life than the bigger mining concerns that continue to operate for up to 30 years.

However, the significance of mine closures in terms of compliance monitoring is the fact that for the period 2004-2008, 126 closure inspections were conducted and as a result of these inspections, only 38 mines were granted closure (30% success rate). This implies that the remaining 88 mines (70%) inspected for closure were not compliant with the conditions of closure, in terms of the standard of rehabilitation achieved. The implication is that the environmental officers will need to issue directives in terms of the rehabilitation required and later a follow-up closure inspection will need to be conducted. This increases the workload of the officials.

4.5 ASSESSMENT OF THE FREQUENCY OF INSPECTIONS AND EVALUATIONS OF EMPR'S AT EASTERN CAPE MINES

The MEM staff are required to both evaluate EMP/EMPR's together with a initial site inspection and are also required to conduct compliance inspections throughout the life of the mining operation to ensure compliance with the approved EMPR. In order to establish the future outlook for compliance monitoring the current workloads in terms of EMP/EMPR evaluations and number of inspections conducted must be determined.

4.5.1 EMP/EMPR evaluations

In terms of mining, the submittal, evaluation, and approval of the EIA is critical, because it ensures that environmental management is conducted in an acceptable manner and in this way, the DME can make a positive contribution to sustainable development. As shown in Table 4.4, of all active mining operations in the Eastern Cape (n=728), 52% (n=377) received authorisation under the Minerals Act (1991) and 25% (n=182) received authorisation under the MPRDA. These mines are operating with approved EMPR's. An additional 1% (n=9) of the mines have EMPR's that are still under the review process for approval. Thus 22% (n=160) are operating with no approved EMP, indicating a backlog in the EMP approval process (Table 4.4).

Table 4.4: Total number of active mining operations compared to the number of approved EMP/EMPR's

Total number of active mining operations	**728**
Number of EMP's approved under the Minerals Act (1991)	377
Number of EMP's approved under the MPRDA (2002) (new order rights)	182
Number of EMP's in process of approval (old order rights)	9
Number of EMP's not yet approved (old order rights)	160

This is a consequence of the Minerals Act (1991) legislation that allowed the DME to grant mining authorisations to the mining concerns *before* their EMP's were submitted or approved. Thus, once the mining concerns obtained the mining licence, it was very difficult to acquire an EMP from them, as they already had authorisation. However, as indicated in Chapter 2, the 'Save the Vaal' case changed this and after 1999 all mining licences were issued only once the EMP was approved (Director: Mineral

Development, Gauteng region and another V Save the Vaal Environment and others, 1999).

Thus, the 'backlog' EMP's are for applications received before 1999 and of this backlog, 94% (n=150) are Department of Roads and Transport borrow pits, while 6% (n=10) are regular mining concerns. In the past, Roads and Transport borrow pits were never followed up in terms of issuing closure. The significance of these backlog applications is the fact that it is very difficult to obtain closure for these mines, since no standards exists with regards to rehabilitation plans. However, by May 2009, all active mines need to have converted their mining rights under the MPRDA (2002) and one of the conditions of authorisation is the fact that these mining concerns will need an approved EMP. This will mean that the outstanding ten regular mining concerns without EMPR's will be required to submit EMP's for approval before May 2009. Although this will impact on the environmental officer's workload in terms of EMP evaluation, this will not have an impact in terms of inspections, as these mines are already inspected for compliance. However, the main problem is the 150 Department of Roads and Transport borrow pits, as all these 150 applications will need to obtain closure. This will have a significant impact on the environmental officers workload in that all these borrow pits will need to be inspected for compliance and the issuing of closure certificates. Currently, these mines have not been inspected.

Since it is now a legislative requirement, under MPRDA, that the mining concerns have an approved EMP before authorisation is granted, all mining concerns authorised since 2004 have approved EMP's (192 applications). This is a significant improvement in the legislation, and in terms of EMP evaluation and approval, has enabled the MEM section to effectively support sound environmental management.

The important point to consider is the fact that currently the environmental officers are spending 18% of their time on compliance monitoring and the remaining 82% on the evaluation of EMPR's (section 4.1.2), and perhaps this is the reason that they have been able to keep up with their mandate in terms of evaluating EMP's. However, this has been to the detriment of compliance monitoring as will be discussed under section 4.3.3.

In terms of the MPRDA, all active mines must submit annual assessment report wherein they must provide evidence that they are complying with the conditions of their EMPR. However, no database is maintained by the MEM section with regards to how many active mines have submitted their annual assessment reports, and the level of satisfaction of these reports and what follow-up measures were taken or need to be taken by the DME. Reminder letters are simply mailed on a yearly basis informing the mine operators that the annual audit reports are due. Currently audit reports are being assessed on a file-by-file basis, in that as the audit reports come in via Registry, they are assessed and the results of these assessments and follow up measures are then communicated to the mining operations. Since the staff capacity simply does not exist to conduct a site inspection in order to assess whether the audit report is a true reflection of what is happening in the field, the environmental officers are relying directly on the expertise and integrity of the independent consultants who conduct these audit reports.

However, in order to report on the contribution that the audit report assessment can make towards sustainability in mining, the MEM section need to maintain statistics that can be used as an indicator of the performance of the mining sector in the EC. Examples of useful indicators are discussed in the next chapter.

4.5.2 Frequency of inspections at Eastern Cape mines

Inspection frequencies

In the ideal world, DME would want to monitor mines once a year, but lack of resources and the large number of mines means that this is not realistic. Recognizing that the DME cannot be on site all of the time, they need to monitor mining operations frequently enough to ensure the detection of potentially irreversible environmental damage early enough to stop it.

As discussed in section 4.1.2, since the promulgation of the MPRDA (2004), the Eastern Cape MEM section has exceeded the 120 inspection per annum requirement. However, what is significant is the frequency of inspections in relation to the number of operational mines. Figure 4.11 indicates the year-on-year change in the number of inspections versus the year-on-year change in the number of active mines, compared to the number of applications received by the DME and Table 4.5 presents the inspection statistics 1995 – 2008.

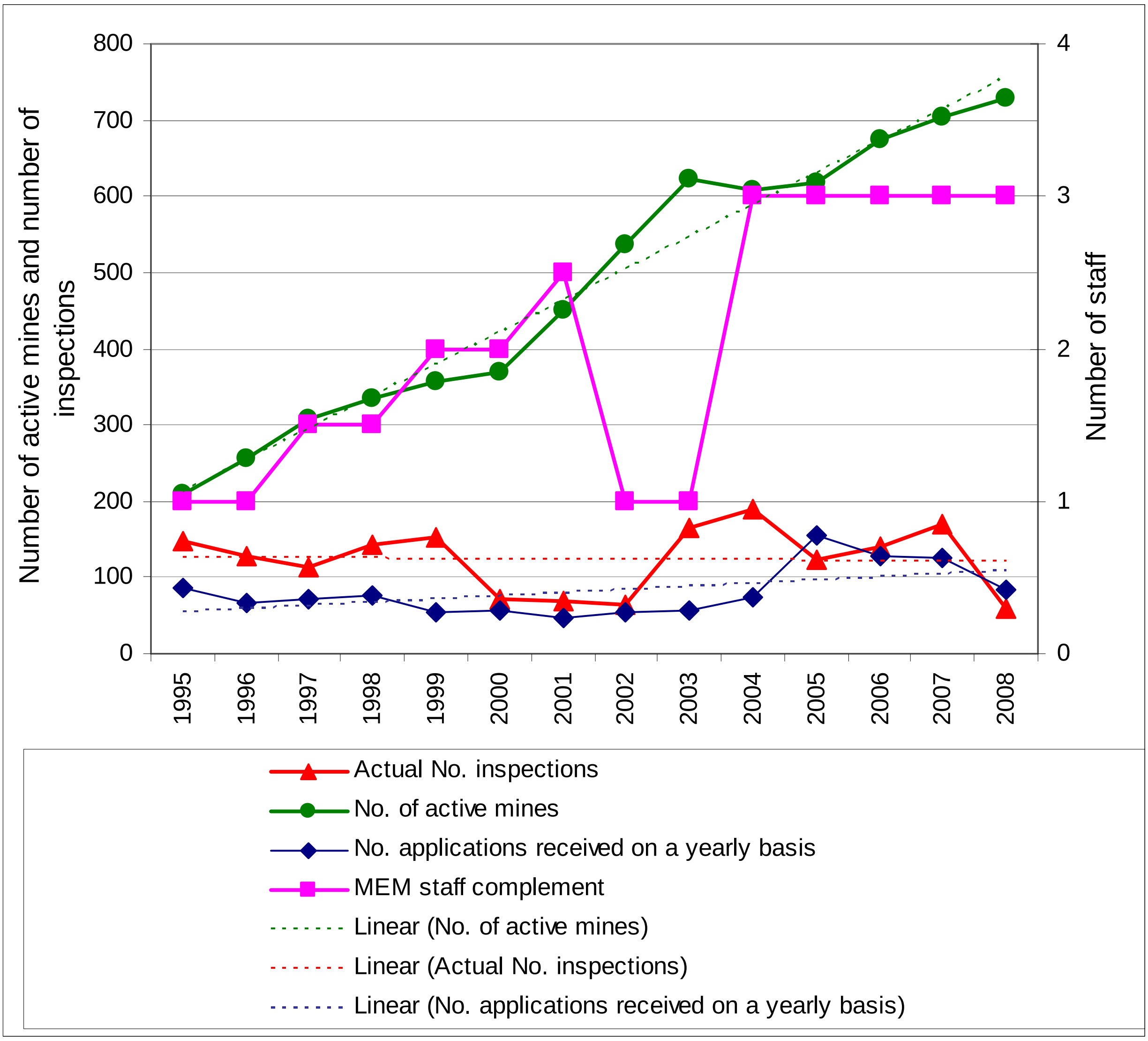

Figure 4.11: Year-on-year change in the number of inspections versus the year-on-year change in the number of active mines, compared to the number of applications received by the DME.

Table 4.5 indicates the percentage of mines inspected per annum. In 1996, 50% of all mines were inspected, indicating that a mine was inspected, on average once every two years. However, by 2007, the inspection rate dwindled to 24%, implying that each mine was inspected, on average, once every four years. However, with three of the four environmental officers having left the Department recently, the projected number of inspections to be conducted in 2008/9 financial year is 100, implying that only 14% of all mines will be inspected in 2008. If the current capacity problem is not addressed in the regional office, as is the current case, the inspection rate can drop to a mine being inspected for compliance once every seven years.

Table 4.5: Percentage of mines inspected per year (1995-2008), DME, Eastern Cape.

Year	**Number of active mines per year**	**Number of inspections per year**	**Percentage of mines inspected per year**	**MEM staff complement**	**% Time spent on inspections**	**Required No. inspections**	**Mean frequency of inspections**
1995	209	147	70	1	67	Targets stipulated by DME	1.4
1996	257	129	50	1	59		2.0
1997	308	113	37	1.5	34		2.7
1998	334	142	43	1.5	43		2.4
1999	358	153	43	2	35		2.3
2000	370	71	19	2	16		5.2
2001	451	69	15	2.5	15		6.5
2002	536	64	12	1	29		8.4
2003	623	166	27	1	75		3.8
2004	608	189	31	3	29		3.2
2005	618	122	20	3	18	120	5.1
2006	675	141	21	3	21	120	4.8
2007	704	169	24	3	26	120	4.2
2008	728	100 (Projected)	14	3	9	150	7.3

However, the number of inspections being conducted include inspections for both the evaluation of EMPR's and for compliance monitoring. Thus, there is a need to distinguish between the number of inspections being conducted for EMPR evaluations and the number of inspections being conducted in terms of compliance monitoring in order to determine the true level of compliance monitoring. This will be dealt with more comprehensively in section 4.5.

Prior to 2004, databases were not maintained with respect to the type of inspections being conducted and thus the data is unavailable. For the period 2004-2008, it is clear that 47% of inspections (n=264) were being conducted for mining operations that were in possession of old order rights i.e. mining concerns that received authorisation pre-2004. This can be linked to the fact that the DME are using target inspections to ensure best practices for those old mining concerns that still do not have an approved EMP.

18% (n=101) of the total number of inspections for the period, were for the issuing of closure certificates.

Of all the currently active mining operations, 30% are borrow pit applications. In terms of borrow pit applications, one inspection is conducted for each borrow pit pre-approval and once the borrow pit application is approved then an environmental control officer is assigned from the Department of Roads and Transport (DRT), to control environmental concerns and report on any incidents to the MEM section (Personal Communication, Van As, 2008). Once the DRT applies for closure, then a follow-up site inspection is conducted to assess the rehabilitation undertaken and ensure that all conditions of the EMP were adhered to before closure was issued. Thus it is not surprising that only 7% (n=38) of inspections covered borrow pits, as the MEM section rely directly on the assistance of the DRT environmental control officer to ensure that all conditions of approval of the authorisation are adhered to. This is a weakness in the system that could be improved upon if more resources were made available.

Routine inspections are standardized and generally the frequency of inspections is based on the perceived risk. Mines such as hard rock quarries that have a higher perceived environmental impact are inspected more often than those that are perceived to present less environmental risk. In many cases, the prioritisation of inspections is based on a response to a complaint from an interested and affected party. Mines that maintain a high level of compliance with their EMPR's are inspected less often. As the primary focus of the research is the frequency of compliance audits, this will be discussed in more detail below.

Figure 4.12 indicates that the office is tending to keep on track with regards to the number of inspections versus the number of mines becoming active over the same period. Although this accounts for the successful rate in terms of the evaluation of EMPR's for authorisation, the implication is that these deadlines are being met to the detriment of compliance monitoring. In effect, this means that, once a mine becomes active, it is not being monitored, with compliance inspections occurring once every four years.

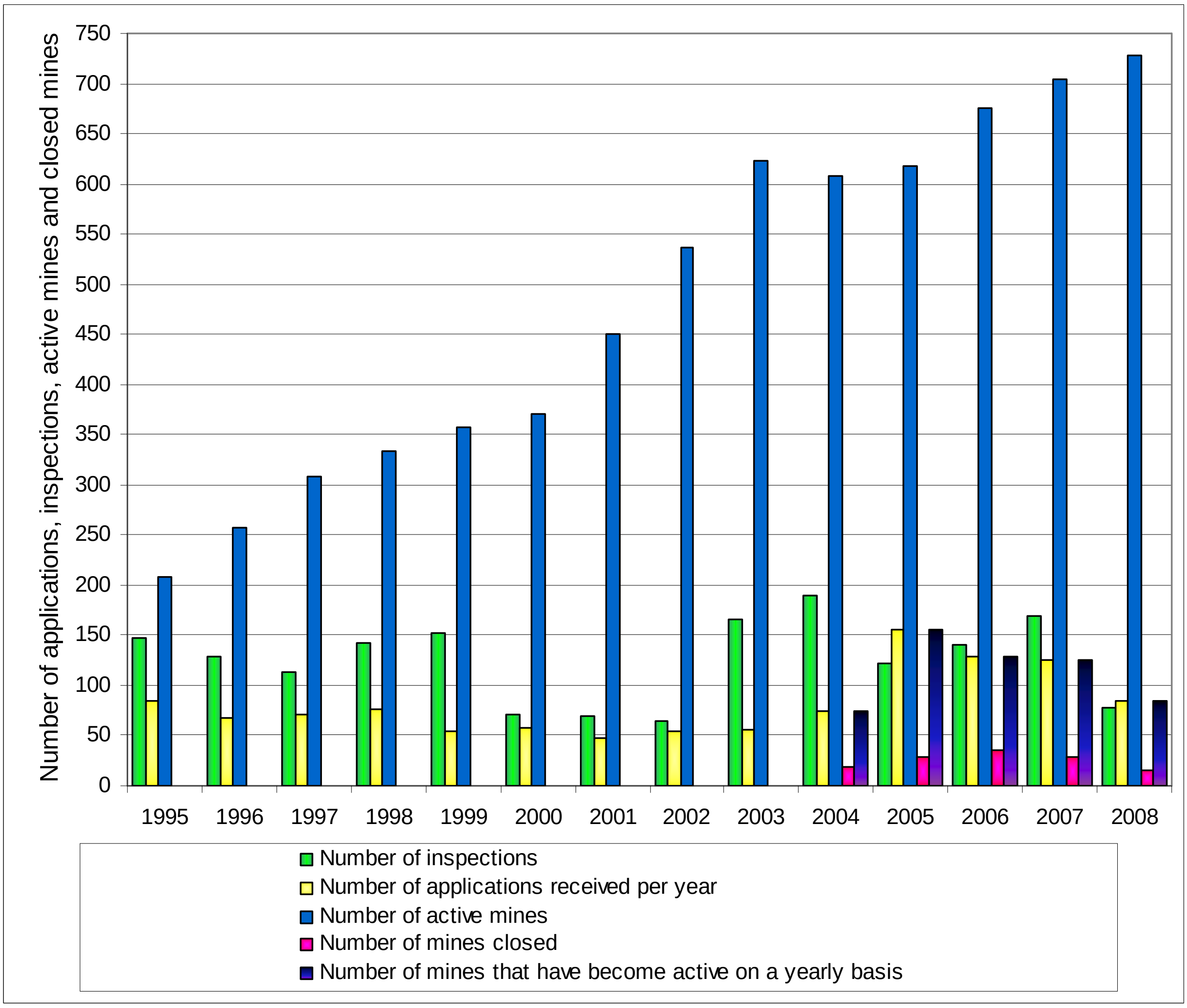

Figure 4.12: Number of active inspections, applications for mining, active mines and closed mines, 1995-2008, DME, Eastern Cape.

One may then ask the question, if this is the current situation, and the number of active mines is projected to increase 24% by 2012 and by 44% by 2015, to what extent is the MEM section conducting compliance monitoring in support of achieving sustainability in mining?

A literature review was conducted to determine international trends in the frequency of the inspection of mines (section 2.8.2). In Botswana, each mine is inspected 1.7 times per annum (Republic of Botswana, 2002). However, in relation to this figure, it is essential to note that the magnitude of mining is low, with only 185 mines that are active. In India there are 795 active mines (similar to SA, n=728) and over a five-year period, 40% of the mines were inspected (Mallick and Kaul, 2006). Converted to an annual figure, this means that 8% of the mines were inspected annually. EPA indicate that 18% of the total number of mines (n=4941) was inspected on an annual basis (EPA, 1995). For South Africa, according to the DME strategic plan, the EC is required to conduct 120 environmental compliance inspections annually (section 4.1.2). However, it is important to stress that DME have based the required number of inspections directly on staff capacity and not on the number of active mines in the Province. The environmental officers are required to conduct 40 inspections each, per annum.

4.6 FUTURE OUTLOOK FOR COMPLIANCE MONITORING

Based on the data presented in the previous sections, it is clear that the capacity of the MEM (EC) to conduct compliance audits is extremely limited given the available resources. In addition, due to a focus on older mines i.e. those without an approved EMP, newer mines (registered since 2004) are subjected to compliance audits less frequently than once in four years. This is far below the ideal (once per year) or international norms of one audit every two years. The objective of the final component of this study was then to identify those factors that could influence the frequency of compliance audits in the near future (up until 2012) and then, based on expected trends, to assess whether the frequency of audits was likely to change (positively or negatively) and what mitigation measures needed to be implemented by MEM.

Factors identified as exerting influence on the frequency of compliance audits were:

- Staff numbers
- The number of new applications
- The number of active mines and mine closures
- New targets in terms of approval times for applications
- The location of new mines relative to the MEM office

The likely future trend for each of these influencing factors is discussed below.

Staff numbers

From 2004-2008, there were 3 staff members fully employed in the MEM section, with an additional staff member employed at the Umtata office for half a year. However, for the past two months, there has only been one environmental officer working in the MEM section, as the other three environmental officers resigned. Prospects for an increase in the number of staff members within the MEM section are bleak as budgets are compiled for a five-year period and no funding has been set aside for the employment of additional staff within the MEM section until 2012. The implications for compliance monitoring are that there will be no additional capacity and, if all things remain equal, the frequency of compliance audits will remain approximately once in four years.

Number of active mining operations

The number of active mining operations is important in that each mine should ideally be inspected at least once every two years. Thus, as the number of mines increases (taking into consideration the number of new mines that become operational and older ones that close), so should the required total number of inspections. Section 2.8 presented a brief description of the DME processes in evaluating and monitoring the life cycle of a mine. Part of the authorisation phase is the evaluation of an EMPR together with a site inspection. Thus, an EMPR site inspection is required for all applications that have been accepted, and the number of EMPR site inspections must be deducted from the total number of inspections conducted by the MEM staff on an annual basis, to determine the number of inspections that were actually compliance inspections.

Unfortunately, with the staff exodus in September/October 2008, the projected number of inspections to be completed in 2008 is less than the required 150 inspections. In addition, 127 applications have already been accepted, which means that the DME is currently approving EMPR’s without conducting the required site inspections. The inspection rate is only 24%, which means that one mine is inspected every four years.

Table 4.6: Total number of inspections versus the number of EMPR inspections required and the number of compliance inspections undertaken per year (2004-2008, projected to 2012), DME, Eastern Cape.

YEAR	TOTAL NO. ACTIVE MINES	ACTUAL NO. INSPECTIONS	NO. EMP EVALUATION INSPECTIONS REQUIRED	NO. COMPLIANCE INSPECTIONS
2004	608	189	32	157
2005	618	122	129	0
2006	675	141	111	30
2007	704	169	101	68
2008	728	120	127	0
2009	764	150	160	0
2010	802	150	205	0
2011	841	150	258	0
2012	882	150	325	0

Data indicates that 82% of all applications that have been lodged at the EC office for the period 2004-2008, have been accepted (section 4.2.1). Using this acceptance percentage, the number of mining concerns that may become active for the period 2009-2012 was determined. Table 4.6 and Figure 4.13 indicate that in 2008 the DME is just breaking even in terms of conducting inspections for the evaluation of the EMPR's and no compliance inspections are being conducted. For 2009, the projections indicate a similar trend, but only because the number of inspections required by the DME has been increased to 150 inspections for 2009. However the reason for the increase in the number of required inspections is related directly to the increasing number of applications being accepted by the regional office and is not related to the total number of active mines. Thus, no account is being made for compliance monitoring. In addition, no account has been made for the fact that an additional 30 inspections will mean that the environmental officers will have less time to evaluate the EMPR's. Based on the expected number of mines in 2009, the DME's target of 150 inspections will, at best, mean that mines would be inspected once in five years. However, the target of 150 inspections will not actually even cover the expected number of EMP evaluation inspections. Thus by 2009, the EC office will have reached capacity in terms of the number of EMPR inspections that need to be conducted and in terms of the fact that there will be no capacity for compliance monitoring. The trend lines also indicate that by 2012, if the capacity of the MEM section does not increase, then the MEM section will only have the capacity to conduct EMPR inspections for half of the mining concerns being accepted.

Spatial distribution of active mines

The map indicating the spatial distribution of currently active mines (Figure 4.5) indicated that of the mining concerns that are authorised active mines, 48% of the mining concerns are distributed in the western region, 25% in the central region and 7% in the eastern region. This, in effect, means that the three environmental officers stationed in the Port Elizabeth office will be required to evaluate EMPR's and conduct site inspections and compliance monitoring for the western and central regions and the environmental officer stationed in Umtata will be required to deal with the 7% of the authorised active mines in the eastern region.

However, the eastern region is rife with illegal mining. There appears to be a perception in the eastern region that the tribal king and queen have the authority to grant permission to mine. The dire poverty situation may contribute to this perception and most of the illegal mining is small scale subsistence mining and the miners simply do not have the financial ability to apply for authorisation. These are the problems facing the DME in this region and without compliance officers that can police the illegal mining, the situation will not improve. Stationing one environmental officer at the Umtata office to deal with compliance will not make any significant impact. If the problem of illegal mining in this region is to be addressed, then additional resources will need to be allocated to MEM (EC) as current resources are insufficient to even cope with existing requirements for inspections.

EMPR evaluation/compliance monitoring ratio

Figure 4.13 indicates the projected number of inspections that will be required (2009-2012) based on the frequency of inspections, ie. whether a mine is visited once every four years; once every three years; once every two years or every year. The required staff component was calculated based on the DME determined ratio that environmental officers can conduct 30 inspections each per annum. At the current rate (18% of the environmental officers time is spent on inspections), with an increase in staff numbers to six environmental officers, the target of completing all EMPR inspections will be achieved. However, no compliance inspections will be possible.

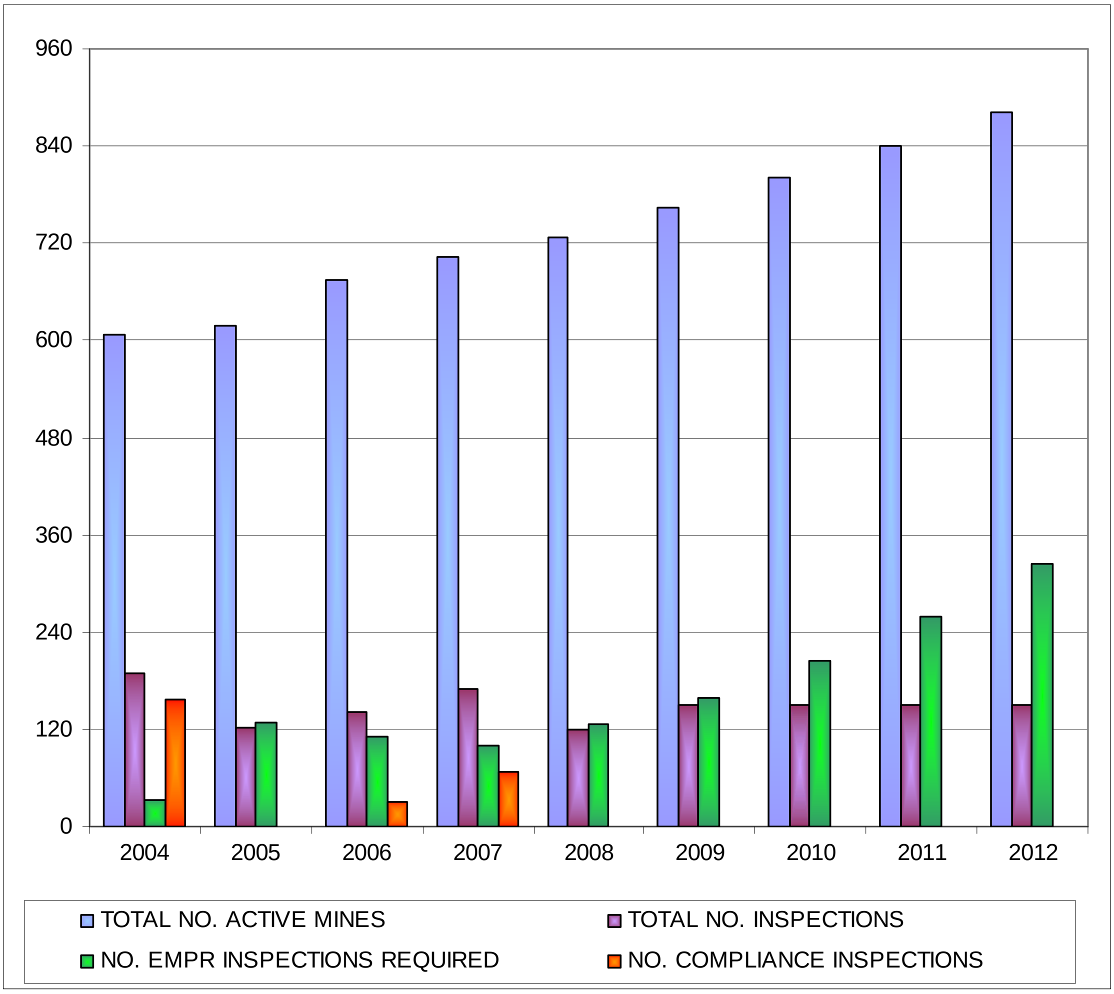

Figure 4.13: Total number of inspections versus the number of EMPR inspections required and the number of compliance inspections undertaken per year (2004-2008, projected to 2012), DME, Eastern Cape.

In terms of managing the EMPR and compliance monitoring inspections, the DME would need to increase the number of environmental officers to five, each working 40% of their time on compliance monitoring in order to cover the projected inspections required for 2009 (Table 4.7). An additional two environmental officers would be required to cover the projected number of inspections up until 2012. Thus, employing an additional two staff members, with all environmental officers working 40% on compliance monitoring and 60% on EMPR evaluation and inspections, would result in each active mine in the EC being inspected once every four years. Thus, these statistics simply maintain the current status quo of visiting 24% of the mines on an annual basis.

However, if the DME wants to improve on its compliance monitoring in order to comply with its mandate for sustainable mining in South Africa, then additional staff will be required. In order for a mine to be inspected once every three years, two additional staff members will be required (working on the 40/60 split) in order to complete all projected inspections required up to 2010. A further two environmental officers would be required in order to complete all projected inspections required up to 2012. Thus, in order to inspect all active mines once every three years up to 2012, the DME, in effect will be required to double it staff component from four to eight environmental officers at the EC office (Table 4.7).

In order to visit a mine once every two years, DME will be required to employ seven environmental officers to meet the projected number of inspections up until 2010 and nine environmental officers to meet the projected number of inspections up until 2012 (Table 4.7). Thus it is clear that the DME will need to double the MEM section staff component if they are to make any progress in terms of compliance monitoring in support of effective environmental management.

HUMAN RESOURCES

MINES INSPECTED ONCE EVERY FOUR YEARS

Percent of time on inspections	1 Env. Officer	2 Env. Officer	3 Env. Officer	4 Env. Officer	5 Env. Officer	6 Env. Officer	7 Env. Officer	8 Env. Officer	9 Env. Officer	10 Env. Officer
18%	30	60	90	120	150	180	210	240	270	300
20%	33	66	100	132	165	198	231	264	297	330
40%	67	134	200	268	335	402	469	536	603	670
60%	100	200	300	400	500	600	700	800	900	1000
80%	133	266	400	532	665	798	931	1064	1197	1330

MINES INSPECTED ONCE EVERY THREE YEARS

Percent of time on inspections	1 Env. Officer	2 Env. Officer	3 Env. Officer	4 Env. Officer	5 Env. Officer	6 Env. Officer	7 Env. Officer	8 Env. Officer	9 Env. Officer	10 Env. Officer
18%	30	60	90	120	150	180	210	240	270	300
20%	33	66	100	132	165	198	231	264	297	330
40%	67	134	200	268	335	402	469	536	603	670
60%	100	200	300	400	500	600	700	800	900	1000
80%	133	266	400	532	665	798	931	1064	1197	1330

MINES INSPECTED ONCE EVERY TWO YEARS

Percent of time on inspections	1 Env. Officer	2 Env. Officer	3 Env. Officer	4 Env. Officer	5 Env. Officer	6 Env. Officer	7 Env. Officer	8 Env. Officer	9 Env. Officer	10 Env. Officer
18%	30	60	90	120	150	180	210	240	270	300
20%	33	66	100	132	165	198	231	264	297	330
40%	67	134	200	268	335	402	469	536	603	670
60%	100	200	300	400	500	600	700	800	900	1000
80%	133	266	400	532	665	798	931	1064	1197	1330

MINES INSPECTED ONCE EVERY YEARS

Percent of time on inspections	1 Env. Officer	2 Env. Officer	3 Env. Officer	4 Env. Officer	5 Env. Officer	6 Env. Officer	7 Env. Officer	8 Env. Officer	9 Env. Officer	10 Env. Officer
18%	30	60	90	120	150	180	210	240	270	300
20%	33	66	100	132	165	198	231	264	297	330
40%	67	134	200	268	335	402	469	536	603	670
60%	100	200	300	400	500	600	700	800	900	1000
80%	133	266	400	532	665	798	931	1064	1197	1330

Table 4.7: Human resources (number of environmental officers) required per inspection frequencies of active mines (2009-2012), DME, Eastern Cape.

The scenario planning has identified a number of priority problems that need to be addressed. This will provide an opportunity for the DME (EC) to plan for and be able to accommodate the future growth in the mining industry in relation to staff capacity and compliance monitoring.

4.7 CONCLUSIONS

Based on the findings presented in this chapter, it can be concluded that the capacity of MEM to conduct regular compliance audits of mines in the EC is extremely limited and mines are, on the balance of probability, likely to be inspected once every seven years. Furthermore, when one considers the predicted future trends for factors that influence the frequency of compliance audits, it would appear that audits are likely to become even less frequent.

There is thus a need to recognize the limitations in compliance monitoring capacity currently in the EC region, and there is a need for the MEM section to set priorities and realistic targets. Some of the challenges facing the MEM section include the following:

- the MEM section must establish a rating scale in order to rate inspection sites on a scale that indicates the urgency of the required inspection
- an inspection and control plan should be developed to ensure that the sites needing the most attention get checked most often and so inspections can be prioritized
- where different departments have complementary compliance and enforcement responsibilities, such as the green scorpions, inter-departmental cooperation is crucial for effective enforcement of environmental requirements. For example, the fact that environmental officers from the Department of Roads and Transport (DRT) are assigned to the borrow pit mines means that this eases the pressure off the MEM section to conduct compliance inspections for these mines. In addition, the DRT are currently establishing an environmental unit in the EC that will be responsible for the submission of applications for authorisation of the borrow pits, the monitoring and operational control of the borrow pits and ensuring adherence to the EMPR's.
- to improve the effectiveness of environmental compliance and enforcement program, top management must initiate a rapid assessment program to develop

an integrated environmental compliance and enforcement system in order to (a) assess DME's capacity in terms of environmental compliance, for all regions and (b) assess DME's capacity in terms of environmental enforcement, successes and failures.

The MEM section needs to build capacity, and increase staff numbers in order to achieve concrete results within it's sustainability mandate. Resources are inadequate to assure effective compliance and currently the MEM section is forced to allocate limited resources to perform a small number of compliance activities. There is also a need to promote the development and implementation of improved environmental policies and this must be done through strengthening officer capacity through specialized training and skills development.

CHAPTER 5 : GENERAL DISCUSSION AND RECOMMENDATIONS

The State is in a contradictory position as promoter of economic development and as environmental regulator. Thus, state policy has searched for a compromise which would involve balancing environmentalism with economic growth, in the form of sustainable development. The environmental assessment and review process has become the “means by which governments have attempted to resolve their contradictory commitments to economic development and environmental protection” (Novek and Kampen, 1992 : 263).

The DME has promulgated the MPRDA and regulations to, amongst other things, promote environmental sustainability within the mining and energy sectors. What is now needed is for the DME to move to the next step and concentrate on compliance. Laws without compliance, and infringements without enforcement is still prevailing, leading to poor compliance outcomes. Legislation should provide for the enforcement of minimum standards through compliance monitoring in order to encourage the adoption of best practice. In terms of sustainable development, the most important challenge that DME will face in the future include:

- The incorporation of the sustainable development philosophy into decision making at all levels and achieving the desired change in DME culture to reflect sustainable development;
- Re-defining DME’s strategy to account for sustainability in the minerals sector via EMPR’s and compliance monitoring;
- Making required operational changes to address the lack of legal action following non-compliance.

The pursuit of sustainability is an important concept introduced into international and national legislation over the past decade to address the environmental impacts of resource exploitation, and advocates the use of management tools such as the environmental impact assessment (EIA) and ‘best practice’ methods. Monitoring is fundamental to EIA both to assess the adherence to standards and also to support management options. The big issue is what happens when the authorities cannot keep up with their mandate of enforcement and compliance monitoring in relation to capacity problems as a direct result of the growth in prospecting and mining operations within the EC.

5.1 Existing and future mining and prospecting trends

There has been a sustained increase in mining activity over the past four years, as a result of the boom in the construction industry and the accelerated road maintenance and improvement programmes in the EC. The number of applications received by the DME is at least doubling every five years. More specifically, over the past three years, an average of 105 mining applications has been accepted per annum. However, the average projected number of mining applications to be accepted in 2009-2012 is expected to be approximately 140 per annum, representing an increase of 34%. For the prospecting rights, an average of 21 applications have been accepted per annum over the past three years and the average projected number for the period 2009- 2009-2012 is 30 per annum, representing an increase of 43%. Thus the increase in mining and prospecting in the EC, will significantly impact on the MEM section in terms of their capacity to evaluate the additional EMPR's and, in the future, to conduct compliance inspections once these mines become active.

5.2 Mine closure

While new mining and prospecting mines are becoming active, it is also important to acknowledge that, simultaneously, some mines have completed their mining activities and are applying for closure. The difficulty in attempting to account for mine closures in this study was the fact that the number of mines that are active, generally have a lifespan of 20-30 years for a mining right and three years for a mining permit, renewable for two years. This means that there is no correlation between the number of mines becoming active and the number of mines being closed due to differences in timeframes. From 1992-2008, the total closure rate was 27%, much lower than the rate at which mining and prospecting operations are becoming active. However, the significance of mine closures in terms of compliance monitoring is the fact that for the period 2004-2008, 126 closure inspections were conducted and as a result of these inspections, only 38 mines were granted closure (30% success rate). This implies that the remaining mines inspected for closure (70%) were not compliant with the conditions of closure, in terms of the standard of rehabilitation achieved. The implication is that the environmental officers will need to issue directives in terms of the rehabilitation required and later a follow-up closure inspection will need to be conducted. It also implies that since mines are only visited on average once every four years, that mine operators are generally not complying with the conditions of their EMPR's. The lack of legal support, together with insufficient staff capacity, has meant that very few mines are being closed and that rehabilitation for these old mines has simply fallen by the wayside.

Legislative pressure can be placed on the mines to rehabilitate. However, this has not been very successful in the past and Elize Swart in her capacity as Director of Environmental Policy at the DME stated that at present there are around 8000 derelict ownerless mines on record in SA, which at current rates would take 800 years to rehabilitate at a cost of R100 billion (Brown, 2007). This coincides with the DME strategic plan to rehabilitate 13 mines per year. These challenges are not only limited to SA, but Australia, Canada and the US are developing policy and procedural measures in an ongoing attempt to deal with the problem of reclaiming abandoned lands (Roberts, *et. al*., 2000). It is clear that there is an essential need to have continuous inspection and enforcement processes that can assist in mitigating against these problems. The proactive approach is best, and total costs are much less if "environmental issues are assessed and dealt with at the start of a project, rather than sorting out the mess after a mine has closed" (Khanna, 2000 : 46). Thus, since 2004, DME have taken a stand and enforced the policy that rehabilitation must occur in phases and rehabilitation must start on the first phase once the second phase has started. This ensures that rehabilitation occurs concurrently with the mining. The implication is that the DME will need to monitor the rehabilitation process via regular inspections and clearly the current rate of one inspection every seven years would not be sufficient.

The DME does have a cleanup fund similar to the USA superfund. The problem is that although this fund is growing in terms of the monies available for rehabilitation, the processes to be followed to obtain the required funds for rehabilitating an abandoned mine is so fraught with bureaucratic constraints that it takes years before any funding is approved. An example from the EC is that a mining operation in possession of an old order mining right was declared insolvent. The mine had been operating without a financial guarantee and so the liability for the rehabilitation of the mine has been transferred to the DME. It has been over three years and the monies for the required rehabilitation have still not been approved for release.

5.3 Annual audit assessments

Monitoring involves checking up on the mining concerns to make sure that they are in compliance with the conditions of their EMPR's. In this respect, the MPRDA requires that mining concerns submit environmental performance assessments every two years, while prospecting concerns are required to submit these reports every year. This is extremely important in terms of compliance monitoring, because if the environmental officers are only visiting a mine once every seven years, at least they will be able to assess the performance assessment reports to determine whether the mining phases and the rehabilitation is on schedule. However, the regional office does not have a database that depicts this information, and the request for performance assessment reports is not followed up. As a result, it is suspected that a large majority of the mines do not submit their performance assessment reports. The implication is that it becomes even more critical that the DME develop the capacity to conduct yearly compliance inspections. Without these control checks (whether it be site inspections or performance assessment evaluations), it is not possible to determine what impacts have occurred and thus where further mitigation and environmental management activities are required. This can very easily lead to mining becoming 'out of control' in terms of not complying with the conditions of approval of their EMP and not adhering to the approved phases of mining and the required concurrent phases of rehabilitation.

There is also a clear need for a more strategic-oriented approach to the overall impact of mining on a regional basis (Marshall, 2005; Marshall, *et. al*., 2005; Canadian Arctic Resources Committee, 2007). A strategic environmental assessment (SEA) for mining in the EC will be beneficial in that mining resources can be identified and the overall impact of mining for the Province can then be assessed. Proactive approaches to follow-up can also be supported, with the mining companies taking some responsibility to support these regional studies. The SEA would indicate where mining is appropriate and where it is not (i.e where other land use options for, example tourism, would better serve the interests of sustainable development). This would then mean that mines could not be established in highly sensitive areas and the impact or risks of infrequent compliance monitoring would be reduced. A good example is the strategic assessment of resource use options at Wavecrest, Centane District, Eastern Cape (CES, 2001), and the SEA for water uses in South Africa (DEAT, 2000).

5.4 Compliance inspections

For DME, the primary indicator of compliant performance is the number of inspections. However, simply counting the number of inspections is all very well, but what is required is the follow up in terms of compliance monitoring. The EC regional office is required to conduct 120 environmental compliance inspections annually, increasing to 150 for the 2008/9 financial year. The MEM section have exceeded this amount since 2003, simply because the number of compliance inspections required is based directly on staff capacity. Rather, the number of inspections required should be based on the number of active mines rather than the number of staff. The current inspection rate has dropped to 14% indicating that currently EMPR's are being evaluated without site inspections being conducted. This has serious implications in terms of regulating the compliance of the mining concerns with their EMPR's. The low level of compliance monitoring can be directly related to staff capacity and logistics problems at the regional office. Environmental management and sustainability cannot be enforced under these capacity constraints.

In addition, the trend lines also indicate that by 2012, if the capacity of the MEM section does not increase, then the MEM section will only have the capacity to conduct EMPR inspections for half of the mining concerns being accepted. In terms of managing the EMPR and compliance monitoring inspections, the DME would need to increase the number of environmental officers to five, each working 40% of their time on compliance monitoring in order to cover the projected inspections required for 2009. However, to make inroads into the compliance inspection requirements, DME will need to double the MEM section staff component (from four to eight) if they are to make any progress in terms of compliance monitoring in support of effective environmental management.

5.5 The way forward

One way of assisting the environmental staff to achieve compliance is to ensure that the mining operations submit their annual assessment reports and that these reports are assessed timeously to ensure that they are in compliance with their EMPR. Thus it is recommended that the MEM section consider the following:

- There is a need to develop an Access database that contains the deadlines for the submission of annual assessment reports by the active mining concerns to enable the prioritization of the audit assessment process, and to ensure DME efficiency in terms of the notifications despatched to the mining concerns requesting the audit reports. The Access database will be able to provide statistics with regards to the percentage of mining concerns complying with the legislative requirements and can assist the environmental officers in identifying those mining concerns that are not submitting their annual assessment reports, and this can be followed up with directives to do so, and warning letters indicating that should they not comply, they run the risk of their mine being temporarily closed. This gives the MEM officials the opportunity to better plan their work processes and the early identification of any problems or any deviations from the EMPR.
- A database containing information with respect to the number of mining concerns complying with their EMPR's in comparison to the number not complying, which can assist in prioritizing inspections by establishing an inspection control plan.
- A database containing information with respect to the categorized measures taken against those mining operations that are not performing in accordance with the conditions of the EMPR approval, and these could range from a warning letter and instruction, administrative notice of pending actions, penalty and final licence suspension. This database will assist in identifying repeat offenders and these mining operations can be more strictly monitored and inspected on a more regular basis. This will enable the DME to identify those mining concerns that are willing to voluntarily and objectively monitor their operations and comply with their EMPR's.

In this way, the DME can also adequately communicate environmental compliance targets to the mining concerns, and the DME's performance in terms of EMPR evaluation can be benchmarked. EIA and EMP evaluation has very little value unless follow-up is carried out, because, without it, the process remains incomplete. Simply noting the number of EMPR's evaluated as a measure of sustainability in the strategic plan is insufficient, since this is the minimal legal requirement anyway. What is required is a measure of the follow-up process with regards to the implementation of the EMPR. There are also questions as to whether the DME adequately communicates environmental compliance targets to the applicants.

Thus, there is an urgent need for effective environmental management stewardship by DME, through audit checks and compliance monitoring, but there are also additional measures that can be implemented in order to more effectively control mine environmental management. There is a need to keep databases on and monitor

- The number of complaints received;
- The number of compliant companies versus the number of violators;
- The percentage of illegal mining activities still occurring;
- The number of assessment reports received in terms of the total percentage;
- The number of financial guarantees upgraded annually;
- Enforcement will always be a central part of effective environmental management and so the number of warnings, penalties issued and licences suspended.

In addition a list of mines to watch can be developed and a score sheet set up for each mine and the mines that scored below a certain score would be regarded as requiring careful monitoring. Keeping a list of companies that are blacklisted both locally and internationally would provide an early warning in terms of how these cases will be handled. These methods can more accurately capture the effectiveness of environmental management in achieving increased levels of compliance.

In terms of consultation with other government departments, the DME rely on the inspections and comments from other government departments such as DWAF, DEAT, DLA, and DA. However, in many cases, these departments still fail to contribute to the consultative process. It is recognized that most government departments are experiencing capacity problems. However, DME should be encouraged to strengthen their participatory processes and ties with other government departments so that a more integrated, interdisciplinary approach can be achieved, in order to strengthen the assessment of the EMP process and to ensure effective environmental evaluations. This can be seen as an opportunity for the regional office to play an important catalytic role in furthering knowledge and capacity building, sharing information, and disseminating good practice guidelines on environmental enforcement and compliance in order to tackle the regional environmental problems related to mining, proactively.

Other challenges to ensuring compliance include limitations with respect to institutional capacity, financial shortfalls and low public participation. The mining industry must be persuaded by regulation and public reaction to change its ways, and to recognise environmental management as a high priority, and to be made accountable for their actions. Although the enforcement of regulation and government controls is complex, it determines to a large extent, the effectiveness of the law. Yet it is surprising how many "discussions of government regulation implicitly assume that laws are somehow self-enforcing and that there is full compliance" (Fenn and Veljanovski, 1988 : 1055). In reality, the department does not possess the capacity either to uncover all non-compliance with standards or to take action against every instance of non-compliance.

Never before has the DME faced so many challenges, as it faces today in terms of achieving sustainability – environmental, social and economic. Some recommendations that have emerged from the project include:

Staff capacity and retention

- It is essential that the department responds with accuracy and clarity and prioritizes the development of training and guidance materials to assist the environmental officers. This will enable them to provide greater certainty and less ambiguity in terms of comments on the EIA's and setting the conditions of EMPR approval;
- The increasing trend in mining and prospecting activities indicates that environmental concerns are not going to go away. There is a need for strategic proactivity in order to address the issue of staff capacity now, to deal with future workloads. Delaying tactics in terms of filling vacant posts and ignoring the need for an increase in staff capacity only lead to disaster. There is a need to build

capacity by increasing staff numbers appropriately and also by upgrading staff training and providing staff with the appropriate decision support tools;

- Loss of staff to other sectors is significant. Generally the low level of renumeration in the public sector, compared to the private sector, means that once environmental officials have gained one to two years experience, they are then poached by other government departments or the private sector and consulting firms. This is not only applicable to the DME, but is an international challenge for the mining sector (Adgoroye, 1998). The possible solution could be to place environmental officials on a sliding salary scale and not the standard notches employed by DME, based on the expertise that they require to evaluate EMPR's, assess audit documents and conduct compliance inspections.

Industry specific SEA

- A strategic environmental assessment (SEA) for mining in the EC will be beneficial in that mining resources can be identified and the overall impact of mining for the Province can then be assessed. This will assist the DME in identifying where mining is appropriate and where it is more suited to other activities in the interests of sustainable development, such as tourism. This would then mean that mines could not be established in highly sensitive areas and the impact or risks of infrequent compliance monitoring would be reduced.

Monitoring

- Enforcement will have to be a central part of compliance monitoring if environmental management is to be effective. The DME should consider the employment of compliance officers, as the DEAT do, to specifically monitor and enforce compliance. There is a need to promote consistent and effective environmental assessment process across the entire Eastern Cape and not only in the western and central regions. This could assist with the identification of the significant number of illegal mining activities occurring in the Eastern region of the EC, in order to put a stop to these activities;
- There is a need to determine more effective strategies to improve on legal compliance such as the use of summonses, having a stricter fining system that can be enforced and the closing down of illegal mining concerns. This must include a strategy to promote self-regulation through audit assessments;

- There are several areas related to the operation and provisions of the Act that require improvement in terms of implementation, quality assessments and compliance;
- A significant attempt must be made to close all outstanding inactive borrow pits (150) that have not received closure certificates, as a medium-term objective. This will at least reduce the number of annual audits required, even though it will mean that more time will be spent on closing borrow pits.

Record keeping

- There is a need to develop decision support tools for improved monitoring, follow-up and compliance. The development of an access database will ensure that better records and statistics are maintained in order to support good decision-making.

Co-operative governance

- The DME needs to find ways to collaborate with other department's to maximize the efficiency of the environmental assessment process. There is a need to raise the awareness of environmental compliance and enforcement, and also to develop regional networks with other government departments, such as DWAF, DEAT, DLA and DA, for enforcement cooperation and to assist in strengthening capacity to implement and enforce environmental requirements, since all government departments are currently struggling in terms of capacity;
- There is a need to strive for a good working relationship with the public and the mining operations regarding environmental problems. This could entail the presentation of targeted workshops to sensitize the mining industry with regards to environmental issues. There is a need to raise the profile of mining in South Africa. Perhaps a good option would be to hold a 'Mining Week' such as DWAF's 'Water Week' where specific concerns regarding the sustainability (environmental, social, economic) of mining can be addressed, and attention can be focussed on the mining industry, it's role in the economy and the necessity for environmental compliance. There must be a sense of ownership and participation.

This project has indicated a range of generic problems standing in the way of effectively managing sustainability in the minerals sector. There is a need to speed up perception of approaching new realities, and to build strategies and action plans and frameworks to ensure the promotion of a longer term outlook. The action plan must have a clear time horizon so that staff can comprehend what they are up against. Delaying policies to mitigate and ensure compliance can only lead to greater urgency later to move speedily and the more damaging the environmental impacts. The project has also highlighted the need to investigate the current capacity of MEM sections within other provinces to conduct compliance investigations. Indeed, the lack of resources to effectively monitor compliance with environmental legislation may be common to DME in other provinces and also to other branches of environmental authorities.

CHAPTER 6 : CONCLUSIONS

The higher expectations from the general public, coupled with government reform agendas, has placed increased pressure on government departments to modernize and align their procedures as these often represent a key barrier to effective management. The compatibility of mining and sustainability has progressed from disbelief and rejection to general acceptance. The basic reason is the recognition of the fact that mineral resources are both essential and can be provided in a way that protects the environment and respects the needs and rights of communities. Doing so will, however, require that policies both provide and support sustainable outcomes. The DME must be in a position to challenge its critics, on an intellectual basis, on its contributions to sustainable development. The department must get the policy right and there is a need to base future actions on the idea of continuous development and improvement.

There are many challenges facing not only the DME, but also other International State departments responsible for the management of the environment, in terms of integrating sustainability within the mining sector (Hoskin *et al*., (2000), Khanna (2000), Gibson *et al*. (2003)). International inspection rates are similar or worse than those of the DME. The main problem is a perceptual one and policy makers will need to accommodate a shift in perception and attitude, leading to the prioritization of compliance monitoring (UNESCAP, 1990). There is a conflict between encouraging mining activities and regulating these activities to prevent environmental degradation. This problem can only be resolved “when policy makers recognize that the national goal of generating income has to be considered from various aspects and over time, including the aspects of irreversibility of damage to natural resource assets” (UNESCAP, 1990 : 1). Otherwise, in the long run, the damage to the environment could be irreparable.

A question that can be asked is whether South Africa needs an Environmental Protection Agency (EPA)? The EPA in the US has proved that a country can benefit from a single powerful advocate for environmental sustainability that has strong legislative backing, a large supporting budget, adequate staff capacity and sufficient influential power to enforce compliance. However, the benefits of an EPA can only be obtained with the high associated costs. IDRC (2008) advocate that the South African government can put in place the essential elements of an EPA system that consolidates other existing national departments, especially those responsible for environmental monitoring, compliance and enforcement, into a new agency for environmental monitoring that reports to the Minister for the Environment. This could play a catalytic role in moving South Africa from 'end-of-pipe' environmental control to pollution prevention based on the concept of sustainable development. This type of EPA would require legislative force and strong regulatory powers, independence, well-trained personnel, have the support of the public, research community, technical groups and other governing bodies so that objective decisions can be made. This will promote an integrated view of environmental management. In the future, it is clear that "a strong and competent office for environmental assessment and review, with legislative 'teeth' and a competent professional staff, will be needed, both in the interests of environmental protection and in the interests of a stable regulatory environment" (IDRC, 2008 : 11).

Generally, this research has found that top managers do not identify external factors impacting on the DME, but rather focus inward on internal factors and crisis solving. A major hurdle is the lack of awareness of the true extent of the monitoring that is required. There is an emphasis on operational issues such as budget and timeframes for authorisations, with a lack of commitment to other issues such as environmental sustainability. The question now is what is the next step it terms of our long term interests. DME must closely align its strategic priorities with its sustainable development goals. The sustainable development strategy should focus on a number of goals such as advocating credible high quality environmental assessments, improving the DME's capacity to monitor, assess and foster compliance, address gaps in the application of the act and enforcement procedures need to be enhanced and directions given.

Basically the DME can no longer rely on a 'coping strategy' and a basic commitment to the status quo. One of the key observations emerging from this study was that sustainability and compliance monitoring within the mining sector is a much more daunting challenge than it originally appears. The more the DME work at it the more the department will appreciate the complexities and be able to recognize the gaps and uncertainties in current policy. Whilst it cannot be denied that the achievement of sustainable development goals remains, currently, somewhat elusive, the prospects are improving. The political commitment to 'sustainable development' implies that, at the very least, the mining industry and government, together, "must ensure that wealth created today is used to create assets capable of generating an equivalent quantity of wealth in the future" (Manners, 1992 : 137).

It is human decisions that can bring about change, and it is these decisions that define our stewardship relationship with the earth. As individuals, we each have a right, a role and a responsibility to contribute to sustainable development. At present, sustainability commitments have had far too little practical effect. If the minerals sector is to contribute positively to sustainable development, it needs to demonstrate continuous improvement of its social, economic and environmental contribution, with new and evolving governance systems. An integrated sustainability-based approach will ensure more effective attention to the contributing causes of environmental degradation via mining, and a proper sustainability-based assessment would force public and industry attention to consider the full suite of social/economic/ecological interdependences.

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