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Integrated environmental management in the mining industry

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SYNOPSIS
Integrated Environmental Management (IEM) involves the integration of environmental factors into project planning, execution, and operation from inception to final closure and after-care. The objective is to develop the most cost-effective, environmentally acceptable manner in which the project can proceed, and to gain the approval of the authorities and the support of the interested and affected parties (I & APs) for the benefit of the developer, the economy, the people of South Africa and the environment on which they depend.

SAMEVATTING
Geïntegreerde Omgewingsbestuur behels die integrasie van omgewingsfaktore by die beplanning, uitvoering en bedryf van projekte vanaf die begin tot die finale sluiting en nasorg. Die oogmerk is om die mees kostedoeltreffende wyse wat uit 'n omgewingsoogpunt aanvaarbaar is, te ontwikkel waarvolgens die projek, met die goedkeuring van die owerhede en die steun van die belanghebbende geaffekteerde partye tot voordeel van die ontwikkelaar, die ekonomie, die mense van Suid-Afrika, en die omgewing waarvan hulle afhanklik is, kan voortgaan.

INTRODUCTION

Background

The earliest legislative response to growing environmental awareness was the National Environmental Policy Act passed by the United States in 1969.

One of the procedures stemming from this act was the Environmental Impact Assessment or EIA. Unfortunately, the idea of an EIA prepared by the developer as a basis to obtain a permit to proceed, was flawed. It often led to confrontation, litigation, delays, and unwarranted costs. If accepted by the authorities, it would have served the developer's purpose without satisfying other affected parties, or ensuring that the developer would either respect it or update its contents.

From a distance, South Africa has benefited from this experience. The result has been the development of Integrated Environmental Management or IEM[1]. This is a South African initiative, still being refined by the Council for the Environment. It is a thoughtful and positive response to the perceived conflict between conservation and development, recognizing particularly the interdependence of a healthy environment and a strong economy.

IEM seeks solutions by anticipating environmental impacts of development at an early stage. It then examines ways in which negative consequences can be minimized while optimizing the positive. IEM is not confrontational. It is designed to be the opposite, by involving the proponent, the authorities, and the interested and affected parties (I & APs) co-operatively to reach the best solution.

In South Africa, in contrast to early American experience, the EIA has come to be regarded as an essential step in the overall IEM process. It is not simply a once-off legal requirement as a basis for acquiring a development permit, subsequently to be shelved and forgotten. The purpose of the EIA has moved from *whether* a project should be allowed to go ahead to *how* it can proceed with minimum distress to the environment. The conclusions and recommendations of the EIA should distil out the critical information required for design to achieve this objective.

IEM is a process by which all proposed actions which impact on the environment become the subject of continuous, systematic scrutiny throughout the project's life. It is therefore anticipatory, proactive, and iterative. When coupled with awareness, it runs like a golden thread throughout the project programme, from earliest concept to final closure and after-care.

Objectives

With the application of IEM, the mining industry places itself squarely inside the natural and sociological environments of which it forms a part. It provides for cost-effective project development while conserving the natural and enhancing the sociological environments, and sustaining the country's renewable resources for future use. This implies a meeting of minds: a recognition by authorities and interested parties of the need for development and a genuine willingness on the part of the developer to accommodate valid views of society.

IEM is consistent with free market forces and carries the potential to enhance the image of business. It not only seeks out and manages negative effects of development, but also identifies positive elements, and aims to draw the maximum benefit from them.

In addition, it provides a positive and mature role for the media as constructive critics and informed communicators. As James Clarke[2] has noted:

'...the 'them and us' persists between industry and the public, mainly, I think, because there is no bridge between the two. The bridge function could, and maybe should, be filled by the media...'

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PROCEDURE

IEM for projects is a cradle-to-grave discipline imposed on all levels of management and applied to every activity which may affect the environment. Awareness is the key.

IEM will be most effective, and cause the least disruption to existing project procedures, if environmental factors are integrated into the planning process right from the start. The environment should rank equally with the technical, economic, social, political, and financial aspects of a project which have always formed part of the planning recipe. As these elements are iteratively developed, so is environmental understanding increased throughout the feasibility study phases to preparation of the favoured option. By the time this reaches a Board of Directors, it should be backed by an approved Environmental Management Programme Report (EMPR) (required under the Minerals Act No. 50 of 1991), and have the support of the I & APs.

The parallel movement of the environmental management programme and the project programme is depicted in Figure 1, to which reference should be made throughout the rest of this paper.

Project Generation (Phase I)

Projects may arise from a new business development programme by acquisition or from systematic prospecting. The need for environmental awareness is evident for both.

In the first instance, the environmental problems that may be inherited should be uncovered up-front. This may prove difficult. Information may not be readily available, even where the seller's integrity is beyond question.

Prospecting, no less than projects, requires preparation of an EIA and EMPR and an acceptable rehabilitation plan. Grid drilling, aditing or trenching certainly impact on the environment, and the process should be managed as if it were a major development project.

However, the exploration geologist has a still wider role. Where the orebody has been discovered and ore reserve definition is in progress, the geologist should continuously provide the mining and metallurgical engineers with information on environmentally sensitive matters such as groundwater and the presence of minerals (other than those of obvious economic interest), which may cause adverse impacts along the processing route. These would include sulphides and arsenides which, in waste rock, might oxidize, leading to acid mine drainage problems.

Project Evaluation (Phase 2)

During this stage, information obtained during project generation is augmented by input from mine design, process engineering, staffing, finance, marketing, and other disciplines in a series of iterative pre-feasibility studies. A commitment to a full EIA is not necessary at this stage, but environmental factors that were exposed during prospecting, or continue to be noted from development of mining, transport, and treatment methods, should be folded into the pre-feasibility studies. In this way, no recommendation will go through to the feasibility stage without knowledge of its environmental implications.

Approval for the funding of a definitive feasibility study must include an allowance for an EIA, probably to be undertaken by a specialist consultant as an extension of the project team's own expertise. With terms of reference clearly set out, the progress of the EIA should be managed to the same standards as would apply to the design of the mining operation or the treatment plant.

The end product of the EIA is the EMPR, which is integral to the feasibility report. A feature of the EMPR is that it must have received the approval of the Regional Director in terms of the Minerals Act No. 50 of 1991 and its regulations.

By the time it is submitted to the Board, the EIA will have contributed to: the selection of the most cost-effective, environmentally acceptable approach to the project; official approval; the acceptance of the project by the I & APs; and the data for design and for environmental management plans (EMP) in order to carry the project through to commissioning and the first year of operation.

Design and Construction (Phase 3)

Once the Board has approved the project and voted the necessary funds, the project team moves into detailed design, procurement, and construction. At the same time environmental management plans based on the EIA and EMPR are developed and integrated with design in the preparation for short, medium and long term application.

If the EIA and EMPR have satisfied all requirements to the Board approval stage, it would make sense to commission the same consultant to prepare environmental control guidelines. These would lay down contractor performance standards during project construction. As an example, specific areas would be defined for stores, usable soil stockpiles, construction camps, and waste dumps. Routes for vehicle movements would be defined. Protected areas such as sensitive landscapes and archaeological sites would be demarcated. Guidelines would also prescribe the early development of features such as tree lines to screen the future tailings dam from sight and to prevent arisings of windborne dusts.

Induction and training programmes for operating staff should be prepared. The process will have been designed taking environmental factors into account. It now becomes necessary to carry the thought process over to the commissioning and operating teams. This is as necessary for successful environmental protection as it is for optimal process operation.

Operation (Phase 4)

Environmental management plans are also required for operations. These would include programmes to monitor emissions ensuring that limits of pollution of water, air, and soils are not exceeded, and that equipment and processes are maintained to operate to design specifications.

The environmental management programme should make provision for regular environmental audits. The first should take place within a year of commissioning and be repeated at annual intervals to review critically the effectiveness of the EMP. In an inevitably changing world, political, economic, social, and technological change will demand

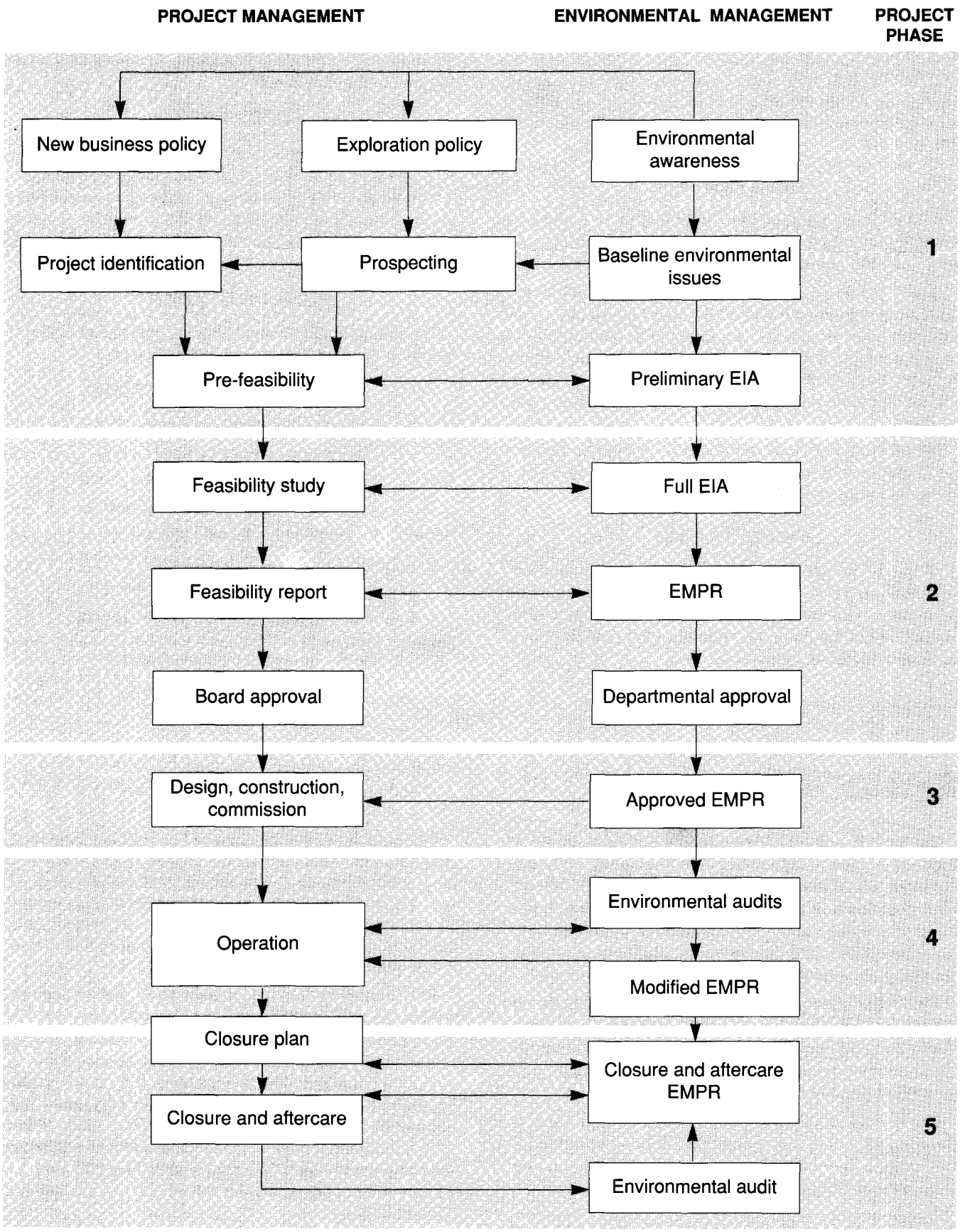

Figure 1—Integrated Environmental Management: parallel development of project and environmental management

reappraisal of optimum operating levels. Threshold limits for emissions may be tightened, new processes developed or product specifications may alter. The overall profitability of the venture may compel changes in operating parameters. The new data from the audit is compared with the EMPR and, where necessary, the environmental management plans are modified and recorded in the EMPR with the approval of the Regional Director in terms of the Minerals Act.

Existing Operations

IEM is a new concept. How then is it to be applied to existing operations which lacked the benefit of environmental planning from the start?

The first step is, necessarily, an EIA to identify those parts of the operation which need immediate attention. The company may, as a result, be compelled to take urgent and costly remedial measures to bring itself into line. There may be strong resistance, but management would have to realize that avoidance simply postpones inevitable expense at closure.

Armed with an EIA, it should not be difficult to develop an environmental management programme and to subject that programme to an annual audit.

Closure (Phase 5)

If the principle of IEM has been followed since inception, or since its adoption by a previously existing operation, closure should not present a problem. Rehabilitation should be on schedule and remaining work to closure should be minimal.

A closure certificate issued by the responsible authority brings the accountability of the operator to an end. Often, however, certificates issued are only partial. For the remainder, a measure of after-care is usually necessary for which the cycle of EMP and auditing continues until a full closure certificate is issued.

CONCLUSION

The concept and application of IEM is still comparatively new to the mining industry. It holds much potential but needs further development and refining as experience accumulates. It is incumbent on the mining industry to provide the feedback that is continuously necessary to improve the product.

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DEFINITION OF ABBREVIATIONS

EIA	Environmental Impact Assessment
EMP	Environmental Management Plans
EMPR	Environmental Management Programme Report
IEM	Integrated Environmental Management
I & APs	Interested and Affected Parties

REFERENCES

1. Integrated Environmental Management in South Africa, April 1989. Council for Environment, Private Bag X447, Pretoria 0001.
2. Industry and the Environment: A Crisis of Co-Existence, James Clarke, Catalyst. *The Journal of Sentrachem* Jan. 1990.

Rescue '91 *

Rescue '91, a series of five one-day colloquia, ended in June 1992. The programme started in September 1991 with the objective of providing a forum for speakers from as wide a spectrum as possible, who would share their views on what had been done, and what could still be done, to make the gold-mining industry more profitable in view of the 'flat' gold price in real terms over the past five years.

The format of the proceedings was designed to encourage discussion, and each day included two panel discussions. While some of the panel discussions deviated from the topic, lively discussions generally took place, and participation by the delegates was sometimes heated.

The session on improved mining methods gave some of the marginal mines the opportunity to show that changes can be made in our by-and-large conservative industry, and that innovative management can result in reduced costs.

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The topic of improved organization resulted in several authors questioning whether the present organization was not detrimental to good productivity. Unfortunately, vested interests, and, to a certain extent, resistance to change stand in the way of radical changes. This was specifically discussed during the panel discussions but with very few constructive suggestions being made.

The sessions on training and education also highlighted the necessity for change, although once again this view was not shared by all.

The importance of securing prominent speakers for the keynote address and closing remarks at such meetings was highlighted on each occasion. The keynote address sets the tone for the rest of the day and the sessions to come. It was very fortunate that each of the keynote speakers addressed the delegates in a practical way, highlighting the need for change if the gold-mining industry is to survive into the next century.

Each day's proceedings concluded with a cocktail party, at which discussions continued for some time into the evening.