

MANAGEMENT OF WATER QUALITY REGARDING THE  
MINING INDUSTRY IN THE REPUBLIC OF SOUTH AFRICA



S.A.P. Brown: Directorate: Water Quality Management,  
Department of Water Affairs and Forestry,  
Private Bag X313, Pretoria, 0001  
Republic of South Africa

KEYWORDS: Mining strategy, integrated environmental management, lead agent.

ABSTRACT

The development of the Department of Water Affairs and Forestry's (DWA&F's) water quality management strategy regarding the mining industry (mining strategy) is well advanced. The implementation of this strategy will introduce a completely new and multi-faceted approach to water quality management in this industry. Integrated environmental management is a core aspect of the mining strategy. This paper focuses on the water quality issues and DWA&F's role and perspective regarding this aspect of the mining strategy in an attempt to convey the new approach.

## INTRODUCTION

The mining industry is the single largest individual industrial sector in the Republic of South Africa (RSA). It is developed, organised and responsible but nevertheless contributes significantly to the pollution loads entering the RSA's water resources. In particular the industry is associated with a significant proportion of the diffused sources of water pollution. This form of water pollution is difficult to manage and control. In certain geographical areas within the country serious water quality problems are experienced due to mining activities.

In view of the above-mentioned the development of a water quality management strategy specifically focussing on the mining industry within the Department of Water Affairs and Forestry's (DWA&F's) broader water quality management strategy was undertaken. Industry/sector specific strategies form part of DWA&F's overall water quality management strategy. The mining industry is the first sector to be addressed and the development of a water quality management strategy for this industry (mining strategy) is well advanced.

The development of the strategy has been done in close collaboration with the mining industry and the Department of Mineral and Energy Affairs (DM&EA).

The implementation of the strategy will introduce a completely new and multi-faceted approach to water management in this industry. It is not possible to discuss all these facets in one paper and for this reason this paper will concentrate on those issues which will best illustrate the new approach.

The mining strategy embodies four main aspects, one of these is integrated environmental management (IEM). The conceptual IEM procedure as advocated by the Department of Environment Affairs was adapted for this purpose into a practically implementable process (IEM in mining). IEM promotes the dual objectives of pre-emptive impact management and integrated problem resolution.

This paper will focus on the water quality issues, and DWA&F's role and perspective regarding IEM in mining. However, other issues will also be touched on, as necessary, to place IEM in mining in context within DWA&F's water quality management strategy.

DM&EA will administer the IEM in mining on behalf of the authorities and the other interested parties. At present the other authorities involved are the following departments:

Water Affairs and Forestry;  
Agriculture;  
Environment Affairs; and  
National Health and Population Development.

The IEM in mining is legally enforced in terms of the Minerals Act, 1991 and is in the process of being implemented.

#### OVERALL POLICY AND IMPLEMENTATION

The Receiving Water Quality Objectives (RWQO's) approach and the precautionary principle are fundamental to DWA&F's water quality management strategy and thus also form the basis of the mining strategy. A brief outline of this overall policy and its implementation is thus required for the benefit of this paper.

The RWQO's approach is put into practice by dividing the country into logical functional entities usually established on a river catchment basis. These entities are termed management units. The setting of water quality objectives based on the user requirements (fitness for use) of legitimate users and the development of an associated management plan for a particular management unit is done on a site specific basis.

In order to ensure that the water quality objectives of a particular management unit are met, the collective impact on the water environment of all activities within the management unit must be compatible with the water quality management plan pertaining to the management unit. In essence this requires that the impact of each activity be quantified and evaluated in the context of the management plan. Mitigation will be required for those impacts not compatible with the plan.

The precautionary principle incorporates both the key elements of (i) anticipation of risk and (ii) protection against the degradation of the water environment. By the application of appropriate measures and mechanisms these elements are effected in practice. In terms of the protection element implementation of "best practice" based on the best available technology not entailing excessive cost (BATNEEC) will be enforced irrespective of whether impacts on the water environment are expected or not. The anticipating element necessitates upfront insight into activities in order to minimise risks. IEM in mining typically fulfils this requirement.

As outlined in "Water Quality Management Policies and Strategies in the RSA" (DWA&F, 1991) the requirements of the precautionary principle have to be met first before impacts on the receiving water body are considered.

#### PERSPECTIVE ON THE MINING STRATEGY

The Department's decision to focus on the mining industry stems mainly from the following:

- \* water pollution from non-point sources is becoming increasingly important. The mining industry has a great potential for diffuse source pollution;
- \* it is the single largest industry in the RSA;
- \* it is perceived to be developed, organised and responsible. As such the industry could assist in the development of the strategy; and
- \* the industry is already practising a measure of self-discipline regarding environmental matters.

The overall goal of the water quality management strategy for the mining industry is to minimise the inevitable impacts of mining operations on the water environment by appropriate management action.

In order to fulfil this goal the strategy embodies the following core aspects:

- \* integrated environmental management;

- \* precuniary provisions to cover environmental (water) liabilities;
- \* management of activities within the riverine environment; and
- \* more effective management of mine closures.

Other aspects addressed as part of the strategy include research guidance and co-ordination; legal matters; etc.

As the Department is especially concerned with specific aspects associated with mining activities the above-mentioned take full cognizance of the following:

- \* surface disturbances insofar as water quality is affected;
- \* waste management;
- \* water management on the mining site; and
- \* other diffuse or point source discharges which could impact on surface and groundwater resources.

The following guiding principles embodied in DWA&F's overall water quality management strategy have played a major role in the development of the mining strategy:

- \* the encouragement of self discipline and self-regulation;
- \* the achievement of a measure of consensus with the industry regarding the strategy;
- \* a consistent approach towards the implementation of the strategy throughout the Department.

#### INTEGRATED ENVIRONMENTAL MANAGEMENT (IEM) IN THE MINING INDUSTRY

Adoption of IEM stems from the precautionary principle embodied in DWA&F's management strategy. It will provide the Department with the necessary insight as to possible impacts and to manage for minimum adverse affect on the water resource.

The essence of IEM in the mining industry is that the proponent is involved in a process of consultation and planning before embarking on a project. In this way the proponent focuses all interested and affected parties' attention on the most significant possible impacts and provides for the timeous mitigation of these. In the process the required trade-offs and compromises can be made and agreed before the project proceeds.

The essential elements of the process are: .

- \* the proponent assumes responsibility for consultation with the interested and affected parties;
- \* the proponent prepares a report, termed an Environmental Management Programme Report (EMPR) based on the Aide Memoire<sup>1)</sup> which covers baseline environmental conditions, impact assessment and impact management;
- \* the EMPR is evaluated by interested and affected parties and is approved by the Regional Director of Mineral and Energy Affairs on behalf of the interested and affected parties after considering their collective inputs; and
- \* the proponent undertakes to review his performance relative to the objectives stated in the EMPR on a routine basis such that early warning of poor performance can be obtained or so that the EMPR can be modified if necessary.

From DWA&F's perspective it is essential that IEM, which is a holistic management process, be distinguished from the EMPR which is a physical document. DWA&F is most interested in being involved in the process of arriving at a final EMPR. That is in being able to influence the course of events and in particular to pre-empt actions which otherwise may inadvertently give rise to unnecessary or irreversible degradation of the water resource.

#### IEM IN MINING/WATER QUALITY MANAGEMENT STRATEGY

DWA&F's interest in IEM in mining lies in the fact that the Department seeks to ensure that water quality issues are not omitted from the set of environmental consequences which are considered by a mine. Thus IEM in mining and the EMPR in particular address water quality issues fully, but the submission of an EMPR does not absolve the proponent from complying with the requirements of the Water Act, 1955, or those

1) Aide Memoire for Environmental Management Programme Reports for Prospecting and Mining Projects - See addendum.

sections of the Environment Conservation Act, 1989 for which DWA&F has control. Such matters include:

- \* impacts on the water environment (section 21);
- \* disturbance within the riverine environment (section 20);
- \* water usage (section 12); and
- \* waste disposal (section 20, Environment Conservation Act).

However, the information requirements of obtaining the above permits is included in the Aide Memoire and will thus already have been considered in the EMPR. It is thus foreseen that in most cases where water quality catchment management plans are in place no further information will be required for the process of the issuing of these permits. Where management plans are not in place more extensive impact assessments than specified in the Aide Memoire could be required from the proponent. The extent of this will have to be negotiated between the proponent and the Department.

In the process of developing the EMPR, aspects which are of specific interest to DWA&F include:

- \* Demonstration by the mine that "best practice" based on the best available technology not entailing excessive cost (BATNEEC) will be implemented irrespective of whether impacts on the water environment are expected or not;
- \* Demonstration that the water resource related impacts associated with the mine's intended actions have been understood and that satisfactory mitigatory measures are proposed in order to meet the required water quality objectives; and
- \* Demonstration that the above two aspects will be effected during the full life cycle of the mining venture.

The Department is particularly interested in the demonstration of BATNEEC in the following areas:

- \* water management on the mining site;
- \* surface rehabilitation (insofar as water resources may be impacted);
- \* waste management; and
- \* groundwater and surface water impact mitigation.

## LEAD AGENT

As experienced world-wide the management of natural resources can no longer be done in isolation. Integrated resource management has therefore been recognised by the Department as an important component of its water quality management strategy. In addition the Department recognises the imperative of avoiding duplication of environmental legislation and resulting duplications of approvals for mining projects. Thus the concept of lead agent has been developed.

Lead agent is defined as: "Any competent authority which assumes responsibility for the resource it is mandated to manage whilst serving the collective interests of other interested and affected parties to the satisfaction of the parties concerned."

DM&EA is best placed to serve the interests of all interested and affected parties in the case of IEM in mining. As already stated, DWA&F, however, retains control of specific activities regarding the water environment such as river diversions, etc.

In order to govern the process of lead agent it is anticipated that DWA&F will enter into an agreement of understanding with DM&EA. It is envisaged that in essence the agreement will cover the aspects on which consultation and reporting must take place and will serve to clarify the respective areas of responsibility of the two departments.

With regard to the specific requirements of DWA&F in relation to the lead agent's role the following are viewed as most important:

- \* The implementation of procedures for the overall management of IEM and the EMPR in particular;
- \* provision for interdepartmental agreements on how the procedures will be implemented;
- \* provision of a forum for conflict resolution;
- \* provision of a forum for communication and liaison with other departments and industry with regard to procedures, policy implementation; and
- \* implementation of adequate provisions for pecuniary measures, auditing, monitoring and prosecutions.

Provided the above-mentioned arrangements concerning the lead agent fulfils DWA&F's needs, it is foreseen that probably no further regulatory requirements for overall environmental management in terms of the Water Act, 1956 will result.

#### EVALUATION OF EMPR'S

Distinct stages may be distinguished in the implementation of IEM in mining. The first and most critical stage involves the development of the EMPR and culminates in its approval.

Approval constitutes the collective approval of all the government departments involved. DM&EA would, however, play a pivotal role in piloting an EMPR through the process and would formally approve the document on behalf of the interested parties. In order to ensure that the processing and evaluation of the EMPR flows as smoothly as possible, standardised procedures should be in place.

The proposed procedure for the development and approval of EMPR's is outlined in Figure 1. The most important stages in which DWA&F should be intimately involved are:

- \* The initial consultation phase during which the proponent scopes the baseline studies and prepares the impact assessment. At this phase the Department will provide guidance on what is required and will assist the proponent in defining the scope of his investigations.
- \* The detailed evaluation phase during which the Department must satisfy itself as to:
  - the accuracy/reliability of the impact assessment;
  - the effectiveness of the proposed remedial measures in meeting required water quality objectives; and
  - the reliability of the proposed measures.

Provided that the proponent can demonstrate, to the satisfaction of the Department, that:

- \* the best available technology not entailing excessive cost will be implemented;
- \* prescribed water quality objectives have been met,

there should be no reason why the EMPR should not be approved.

Figure 2 illustrates generic evaluation criteria for EMPR's. The situation described above (the most simple cases) would typically follow the left hand route. It is anticipated that most cases will fall into this category.

Not all cases are, however, likely to be simple. For the more complex cases, the right hand branch in Figure 2 will be applicable. If by simple technical proofs (experimental, pilot scale, etc.) the proponent can demonstrate that his proposed methods will satisfy the stated water quality objectives, the Department may approve the EMPR. If, on the other hand, the necessary technical proof is either unconvincing or not forthcoming the proponent may be required to adopt an investigative approach in order to demonstrate that the proposed measures will satisfy the prescribed objectives. In these cases the proponent will be required to show that a viable alternative, which will meet the prescribed objectives, does exist and that this alternative could be implemented should the proposed method fail.

The Department recognises that "fitness for use" is only one of many objectives which must be satisfied regarding a mining venture. Unfortunately this objective is not always consistent with others such as development objectives. Compromise may therefore be required.

DWA&F can, however, not compromise its mandate to maintain the RSA's water resources in a state fit for use. Although limited degradation may be permitted under special circumstances. It is, however, recognised that it will be necessary to explore all possibilities for compromise before an authorisation to mine is turned down. DM&EA as

lead agent will play a major role in facilitating compromise. At present DWA&F does not accept responsibility for assessing the importance of objectives outside its mandate and is thus not in the position to make trade-offs which may, for example, be driven by socio-economic or developmental considerations.

#### CONCLUSIONS

Implementation of the mining strategy will introduce a completely new approach and dimension to water quality management regarding the mining industry.

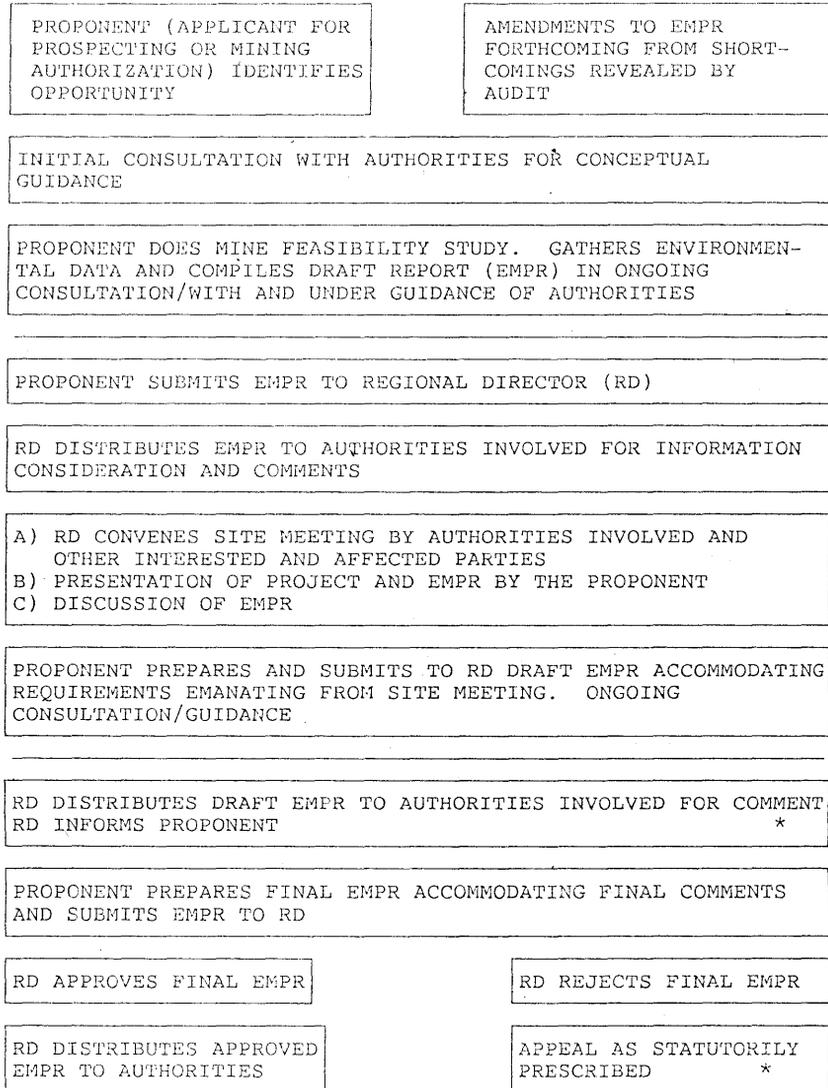
The integrated environmental management process (IEM in mining) is one of the main aspects embodied within the mining strategy. By addressing the water quality aspects and DWA&F's perspective of this process a measure of the new approach can be conveyed.

IEM in mining will be administered by DM&EA as lead agent on behalf of the authorities and other interested and affected parties.

DWA&F is co-involved in IEM in mining mainly for the following reasons:

- to ensure that water quality issues are not omitted from the set of environmental consequences which are considered by a mine;
- to gain the necessary fore/insight into events in order to influence the course of these to ensure the minimum adverse affects on the water resource; and
- to avoid the duplication of environmental legislation.

IEM in mining and the EMPR in particular address water quality issues fully. While the submission of an EMPR will not absolve the proponent from complying with the requirements of the Water Act, 1956, it will nevertheless generate the information necessary to apply for the relevant permits. Thus during the evaluation of the water quality aspects of the EMPR various policy and other criteria will have to be met.



\* PRESCRIBED IN THE MINERALS ACT, 1991

FIGURE 1: PROPOSED PROCEDURE FOR DEVELOPMENT OF AN EMPR

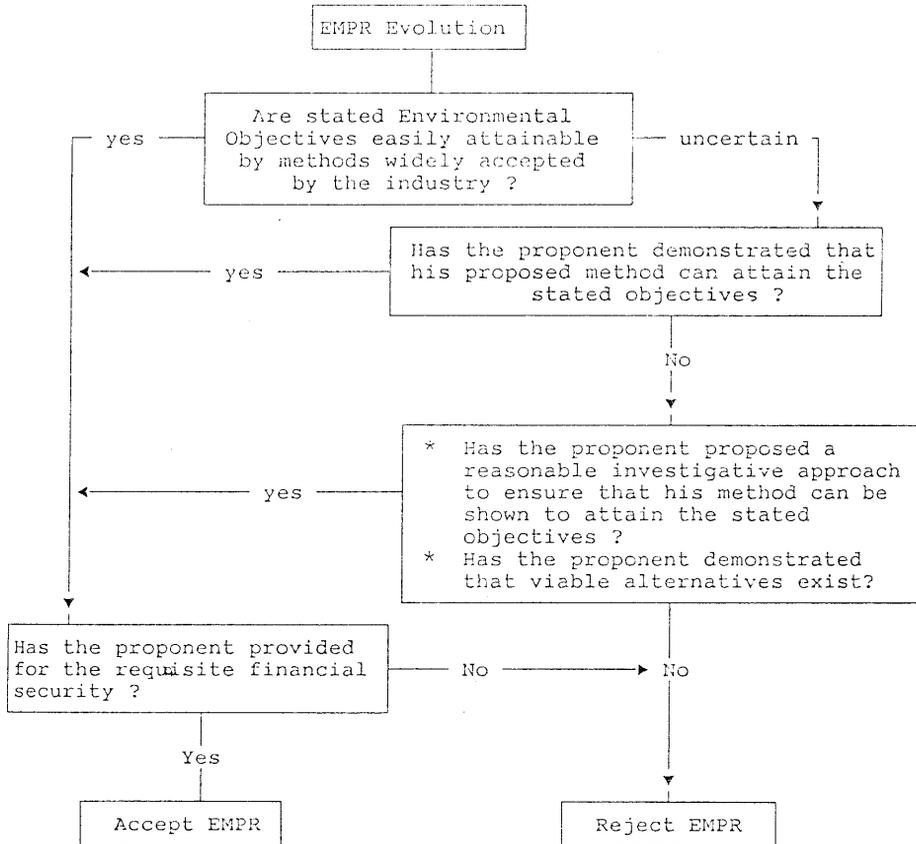


FIGURE 2: GENERIC EVALUATION CRITERIA FOR EMPR'S

ADDENDUM: ENVIRONMENTAL MANAGEMENT PROGRAMME  
REPORTS FOR PROPOSED PROSPECTING AND MINING PROJECTS

INTRODUCTION

IEM in mining is enforced in terms of the Minerals Act, 1991. The act requires the acquisition of the necessary authorisation to prospect or mine for any mineral. An approved EMPR is a prerequisite to obtain an authorisation.

PURPOSE OF THE AIDE MEMOIRE

The Aide Memoire has been compiled to assist applicants for, and holders of, prospecting permits or mining authorisations to draw up environmental management programme reports (EMPR's) in accordance with an established approach which is acceptable to all the regulating authorities concerned and to secure the approval thereof.

The Aide Memoire is available from the Department of Mineral and Energy Affairs.

OUTLINE OF ENVIRONMENTAL MANAGEMENT PROGRAMME REPORT (EMPR)

It is a document that aims to achieve the following overall objectives:

1. To meet the environmental requirements and directives under the Minerals Act, 1991 (Act 50 of 1991) and its regulations.
2. To provide a single document that will satisfy the various authorities concerned with the regulation of the environmental impacts of mining.
3. To give reasons for the need for, and the overall benefits of, a proposed project.
4. To describe the relevant baseline environmental conditions at and around the proposed site.
5. To describe briefly the prospecting or mining method and associated activities so that an assessment can be made of the significant impacts that the project is likely to have on the environment during and after mining.

6. To describe how the negative environmental impacts will be managed and how the positive impacts will be maximised.
7. To set out the environmental management criteria that will be used during the life of the project so that the stated and agreed land capability and closure objectives can be achieved and a closure certificate can be issued.
8. To indicate that resources will be made available to implement the environmental management programme set out in the document.