DEPARTMENT: MINERALS AND ENERGY
MINERALS AND ENERGY FOR DEVELOPMENT AND PROSPERITY

Minerals and Energy for Development and prosperity

MINE HEALTH AND SAFETY INSPECTORATE

GUIDELINE FOR THE COMPILATION OF A MANDATORY CODE OF PRACTICE ON MINE RESIDUE DEPOSITS

Chief Inspector of Mines

DATE FIRST ISSUED: 30 NOVEMBER 2000
EFFECTIVE DATE: 31 MAY 2001

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PART A: THE GUIDELINE

1. FOREWORD

Residual material from mining and associated beneficiation operations are commonly managed by deposition on surface, or by disposal in mine workings excavated below the natural surface of the land. In both cases, the residual material constitutes a potential source of pollution by either wind-borne or water-borne migration of contaminants. Furthermore, unexpected flow failures of residue deposits on surface have in the past resulted in massive outflows of the stored material, causing loss of life, damage to property, and/or environmental pollution. Residue deposits on surface may also fail by liquefaction as a result of shock loading associated with seismic action. Noteworthy examples of residue deposit failures causing significant loss of life include:

1962: failure of copper tailings dumps at El Cobre mine, Chile, killing 200 persons;

1967: failure of heaped coal washery discards at Aberfan, Wales, killing 144 non-mining persons;

1970: inrush of liquifacted coppers tailings at Mufulira mine, Zambia, killing 89 miners underground;

1972: failure of coal refuse dams at Middle Fork Buffalo Creek, West Virginia (USA), killing 125 non-mining persons;

1974: failure of platinum mine tailings dam at Bafokeng mine, South Africa, killing 9 miners on surface and underground; and

1994: failure of gold mine tailings dam at the Merriespruit section of Harmony mine, South Africa, killing 17 non-mining persons.

Loss-of-life disasters aside, failures causing extensive damage to property and/or widespread environmental pollution have received less public attention but have often represented near-miss disasters.

The environmental impacts of mine residue often have a direct and/or indirect impact on health and safety at or off the mine. These impacts are also of a residual nature with cumulative and latent effects that again could impact on health and safety.

The failure of MRDs around the world has been commonly attributed to inadequate management of those deposits. The management of MRD is not limited to technical aspects but also includes a management plan that covers policy setting, objectives and management structure, with definition of responsibilities, procedures and operating specifications, training, monitoring, recording, reporting, review and auditing. An appropriate and effective management plan for MRD is therefore essential.

2. INTRODUCTION

2.1 The management of MRDs is an integrated process that relies upon the implementation and management of all applicable design assumptions and principles during the life cycle of the MRD. The mandatory COP for MRDs should set out the management plan and have an underlying theme that identifies all aspects to be given consideration throughout the life cycle and the course of action that should be instituted, should the performance fall outside the boundaries of the design criteria.

2.2 The purpose of a mandatory COP to which this guideline relates, is the protection of the health and safety of any person working at the mine and any other person that may be affected by a MRD. The guideline does not deal with the management of environmental impacts (addressed through an approved Environmental Management Programme Report required in terms of the Minerals Act), although the two issues are closely related and should be addressed in an integrated manner.

3. LEGAL STATUS OF GUIDELINES AND COPs

3.1 In accordance with section 9 (2) of the MHSA an employer must prepare and implement a COP on any matter affecting the health and safety of employees and other persons who may be directly affected by activities at the mines if the Chief Inspector of Mines requires it. These COPs must comply with any relevant guideline issued by the Chief Inspector of Mines (section 9 (3)).

3.2 Failure by the employer to prepare or implement a COP in compliance with this guideline is a breach of the MHSA. Any contravention of, or failure to comply with a COP is not, in itself, a breach of the MHSA, except a contravention or failure by an employer that also constitutes a failure to implement the COP. Since the DME does not approve COPs, its focus is not to enforce them either. The focus of the DME is to ensure that employers provide healthy and safe working environments at mines, i.e. focusing on system failures and compliance with the MHSA, rather than enforcing compliance with the COP.

3.3 The fact that a contravention of, or failure to comply with a COP is not a breach of the MHSA, does not mean that such breaches will have no legal implications. As far the employer is concerned, there are numerous specific and general obligations on the employer in the MHSA aimed at ensuring the health and safety of all employees and all persons who are not employees, but who may be directly affected by the activities at the mine. Where any failure to comply with a COP also constitutes a breach of any of the employer's obligations under the MHSA, the employer could be liable to an administrative fine for such breach. An inspector could also issue various instructions to the employer and employees in terms of section 54 to protect the health or safety of persons at the mine. Failure by an employer to comply with such an instruction could render the employer liable to an administrative fine.

3.4 As far as employees are concerned, section 22 places a number of obligations on employees, including that they must take reasonable care to protect their own health and safety and the health and safety of other persons who may be affected by their conduct. Where a failure by an employee to comply with a COP would also constitute a breach of the employee's duties in terms of section 22 (or a breach of section 84, 86 (1) or 88), the employee could be criminally charged for such breach. As is the case with employers, the inspectorate could issue instructions to

employees in terms of section 54 and failure to comply with such an instruction constitutes a criminal offence.

3.5 Employers should deal with breaches by employees of COP in terms of the mine's standard instructions and the employer's disciplinary procedures. This is not the responsibility of the State.

4. SCOPE

This guideline covers the site selection, design, construction, operation, maintenance, modification, and decommissioning of all types of MRDs. The guideline is based on the fundamental requirement that hazard identification and risk assessment should play a major role in all of these phases. The guideline is applicable to planned, existing, and extensions to existing MRDs. The guideline specifies the minimum requirements with which a mandatory COP must comply.

5. OBJECTIVES

The objectives of this guideline are—

5.1 to guide the employer through the process of compiling a mandatory COP for MRDs which, if properly implemented and complied with, will help to ensure that the employer's statutory health and safety obligations relating to MRDs are met; and

5.2 to reduce as far as reasonably practicable the risks of death, injury and health damage to persons, and damage to property arising from MRDs, while at the same time being consistent with measures to reduce pollution of the environment.

6. DEFINITIONS AND ACRONYMS

In this guideline for a COP or any amendment thereof, unless the context otherwise indicates—

"competent person" means a person who—

(*a*) is qualified by virtue of his knowledge, training, skills, and experience to organise the work and its performance;

(*b*) is familiar with the provisions of the MHSA (including applicable subordinate legislation) which apply to the work to be performed; and

(*c*) has been trained to recognise any potential or actual danger to health or safety in the performance of the work.

"COP" means Code of Practice;

"closure" means the point in the life cycle of a mine or any part thereof when a certificate in terms of section 12 of the Minerals Act or Regulation 2.11 of the Minerals Act Regulations has been issued in respect of that mine or any part thereof;

"decommissioning" means the process followed, after deposition of the mine residues, to ensure that the MRD is secured against becoming an unacceptable health and safety hazard and a source or cause of further potentially significant residual environmental impacts;

"hazard" means a source of or exposure to danger;

"MHSA" means Mine Health and Safety Act, 1996 (Act No. 29 of 1996);

"mine residue" means any waste rock, slimes or tailings derived from any mining operation or from processing of any minerals; it includes the part of the material that remains or results after processing to extract those constituents or parts which are extracted at the time, but excludes material used for backfill in underground mines and overburden removed in the course of open cast mining;

"MRD" means Mine Residue Deposit, which is a dump, heap, pile, filling or tailings dam consisting of mine residue, which usually projects above the natural ground surface but may occupy the space of a pre-existing excavation;

"Minerals Act regulation" means a regulation in force in terms of item 4 of Schedule 4 of the MHSA;

"professional engineer" means a competent person registered as a professional engineer or as a professional technologist with the Engineering Council of South Africa;

"regulation" means a regulation made under section 98;

"risk" means a likelihood that occupational injury or harm to persons will occur.

7. MEMBERSHIP OF TASK GROUP

This guideline was compiled by the Mining Regulation Advisory Committee Task Group on MRD, which comprised—

Name	Organisation Representing
MMA Zondi (Chairman)	Department of Minerals & Energy State
C L van den Berg	Department of Water Affairs and Forestry State
K A van Gessel	Anglogold Employers
(to February 1998)	
H C van Zyl	Amcoal Employers
(from March 1998)	
D G Wymer	Chamber of Mines Employers
(from March 1998)	
M J Martinson	National Union of Mine Workers Employees

PART B: AUTHOR'S GUIDE

1. The COP must, where possible, follow the sequence laid out in Part C "Format and Content of the COP". The pages as well as the chapters and sections must be numbered to facilitate cross-reference. Wording must be unambiguous and concise.

2. It should be indicated on each annex to the guideline whether—

   2.1 the annex forms part of the guideline and must be complied with or incorporated in the COP or whether aspects thereof must be complied with or incorporated in the COP; or

   2.2 the annex is merely attached as information for consideration in the preparation of the COP (i.e. compliance is discretionary).

3. When annexes are used, the numbering should be preceded by the letter allocated to that particular annex and the numbering should start at one (1) again. (e.g. 1, 2, 3, A1, A2, A3).

4. Whenever possible, illustrations, tables, graphs and the like, should be used to avoid long descriptions and/or explanations.

5. When reference has been made in the text to publications or reports, references to these sources must be included in the text as footnotes or sidenotes as well as in a separate bibliography.

PART C: FORMAT AND CONTENT OF THE COP

1. TITLE PAGE

The Title Page must include the following information—

1.1 name of the mine;

1.2 the heading: "Mandatory Code of Practice for Mine Residue Deposits";

1.3 a statement to the effect that the COP was drawn up in accordance with Guideline DME Reference Number DME 16/3/2/2-A1 issued by the Chief Inspector of Mines;

1.4 the mine's reference number for the COP;

1.5 effective date; and

1.6 revision dates (if applicable).

2. TABLE OF CONTENTS

The COP must have a comprehensive table of contents.

3. LIST OF FIGURES

The COP must include a complete list of all figures (drawings) used. The List of Figures must be set out on a new page following the Contents page but before the List of Tables. The List of Figures must include the relevant page numbers on which the figures appear.

4. LIST OF TABLES

The COP must include a complete list of all numerical tables used. The List of Tables must be set out on a new page following the List of Figures page. The List of Tables must include the relevant page numbers on which the tables appear.

5. LIST OF SYMBOLS

The COP must include a complete list of symbols for physical quantities used and their meaning. Units of measurement must be expressed according to the International System of Units (SI).

6. STATUS OF COP

This section must contain statements to the effect that—

6.1 the COP was drawn up in accordance with Guideline DME Reference Number DME 16/3/2/2-A1 issued by the Chief Inspector of Mines;

6.2 this is a mandatory COP in terms of section 9 (2) and (3) of the MHSA;

6.3 the COP may be used in an accident investigation/inquiry to ascertain compliance and also to establish whether the code is effective and fit for purpose; and

6.4 the COP supersedes all previous relevant COPs. All managerial instructions, recommended procedures and standards on the relevant topics must comply with the COP and must be reviewed to ensure compliance.

7. MEMBERS OF DRAFTING COMMITTEE

7.1 In terms of section 9 (4) of the MHSA the employer must consult with the health and safety committee on the preparation, implementation and revision of any COP.

7.2 It is recommended that the employer should, after consultation with the employees in terms of the MHSA, appoint a committee responsible for the drafting of the COP.

7.3 The members of the drafting committee assisting the employer in drafting the COP should be listed giving their full names, designations, professional qualifications, affiliations and experience. This committee should include competent persons sufficient in number to effectively draft the COP.

8. GENERAL INFORMATION

The general information relating to the mine must be stated in this paragraph. The following minimum information must be provided—

8.1 location and brief description of mine;

8.2 name of mine and name of owner;

8.3 telephone and telefax numbers (and area code in parentheses) and e-mail address;

8.4 magisterial district in which the mine is located;

8.5 commodities produced;

8.6 design run-of-mine tonnage per month;

8.7 identification and listing of each MRD; and

8.8 metallurgical process, including methods of transport and placement with respect to MRDs.

9. TERMS AND DEFINITIONS

Any word, phrase or term of which the meaning is not absolutely clear, or which will have a specific meaning assigned to it in the COP, must be clearly defined. Existing and/or known definitions should be used as far as possible. The drafting committee should avoid jargon and abbreviations that are not in common use or that have not been defined. The definitions section should also include acronyms and technical terms used.

10. RISK MANAGEMENT

10.1 Section 11 of the MHSA requires the employer to identify hazards, assess the health and safety risks to which employees may be exposed while they are at work and record the significant hazards identified and risks assessed.

10.2 The COP must address how the significant risks identified in the risk assessment process must be dealt with, having regard to the requirements of sections 11 (2) and (3) that, as far as reasonably practicable, attempts should first be made to eliminate the risk, thereafter to control the risk at source, thereafter to minimise the risk and thereafter, insofar as the risk remains, to provide personal protective equipment and to institute a programme to monitor the risk.

10.3 In addition, section 5 (2) requires the employer as far as reasonably practicable, to identify hazards and assess risks to persons who are not employees, and to ensure as far as reasonably practicable that such persons are not exposed to any hazards to their health or safety.

11. RISK ASSESSMENT

11.1 Risk Assessment

11.1.1 When addressing the planning and implementation of the risk assessment process in the COP; the SIMRAC Guide (3) must be consulted.

11.1.2 Application of the SIMRAC Guide to MRDs will require attention to more specific techniques and approaches and, in this regard, the following aspects must be addressed in the COP if relevant—

11.1.2.1 to allow for a comparison of the various potential impacts of MRDs, the individual components of the risk assessment must be performed in an integrated fashion;

11.1.2.2 the risk assessment must be performed prior to commencing operations, and updated whenever there is a change in circumstances that may have a significant impact on risks;

11.1.2.3 the risk assessment must cover the hazards during the operational and post- closure phases;

11.1.2.4 the risk assessment must include—

(*a*) an analysis of the physical safety of the MRD;

(*b*) a consequence analysis for releases of harmful contaminants, taking into consideration all relevant contaminants and their possible impacts; and

(*c*) the management of post-closure impacts.

11.1.2.5 the impacts of MRDs are often site-specific, and the actual risks associated with a particular MRD can only be assessed with a site-specific methodology based on a characterisation of the site and its environment. Guidance on how to address site characterisation in the COP is given in section 12.4 below;

11.1.2.6 the SIMRAC Guide (3) refers to the need for a baseline risk assessment. Baseline data must therefore be collected during the pre-operational phase for use as reference levels during the closure and post-closure phases. Using the baseline data, a distinction should be drawn between pre-existing natural contaminant levels and incremental levels arising from the MRD;

11.1.2.7 all MRDs on a site must be considered as an integrated system, and the performance of the entire system must be reviewed as an entity and must satisfy any relevant regulatory requirements, such as environmental contamination limits;

11.1.2.8 to the extent practicable, scenarios considered in the risk assessment should be based on lifestyles and living conditions of the persons potentially affected;

11.1.2.9 future events which can give rise to increased risks must be considered where appropriate. These include—

(*a*) human activities (e.g. farming, housing, unauthorised use of mine residues);

(*b*) natural processes and events that may affect the integrity of the MRD (e.g. storm erosion, flooding, seismic activity);

(*c*) internal processes (e.g. acid generation, weathering, differential settlement);

(*d*) mining activities; and

(*e*) processing and engineering activities;

11.1.2.10 because it is difficult to predict accurately the long term effectiveness of engineered barriers such as embankments and covers, changes in weather conditions, seismic action, and future demographic developments, risk assessments should be limited to realistic time periods; and

11.1.2.11 certainties in risk assessments should be handled either by the use of conservative predictions or, where this would lead to unrealistic risk estimates, by mathematical techniques based on probability considerations.

11.2 Safety Classification

11.2.1 In compiling the COP, attention must be given to ways of ensuring that efforts are concentrated on those hazards posing the significant risks, and MRDs must therefore be assessed according to a safety classification system. The SIMRAC Guide (3) provides a basic method that could be followed in prioritising risks based on a consideration of the consequences and the frequency.

11.2.2 The SABS Code (4) provides a method for classifying MRDs according to the potential consequences of failure; it differentiates between MRDs of high, medium and low hazard potential. Annex A of the SABS Code provides a questionnaire for determining the classification.

11.2.3 A full risk prioritisation must take all other relevant factors into account, such as the probabilities of occurrence of various events.

11.2.4 For existing MRDs classified as high or medium risk, efforts should be made to reduce the safety classification to a lower level as far as reasonably practicable.

11.2.5 For planned MRDs, a high-risk situation is not acceptable, and medium risk situations should be avoided where possible.

11.2.6 High and medium risk situations, where unavoidable, should be subject to increased levels of supervision and control.

12. ASPECTS TO BE ADRESSED IN THE COP TO ENSURE MANAGEMENT OF SIGNIFICANT RISKS RELATING TO MRDs

The COP must lay down clear instructions and directions regarding the technical design and specifications for MRDs, and must include a description of the management plan for managing the significant risks relating to MRDs identified by the risk assessment process.

12.1 Reference Material

12.1.1 The Chamber of Mines Guidelines (Volume 1) (5)

The Chamber of Mines Guidelines (Volume 1) provides guidance on most of the technical questions that may arise in the design, construction, operation and decommissioning of MRDs. The Chamber of Mines Guidelines (Volume 1) apply in principle to almost all types of MRDs and, for such situations, must be regarded as providing the minimum requirements for good practice on which to base the technical content of the COP. In exceptional cases where it would be inappropriate to base the technical content of the COP on the Chamber of Mines Guidelines (Volume 1), any alternative course of action must be fully explained and justified in the COP.

12.1.2 SABS Code (4)

The SABS Code provides guidance on legal considerations, management systems and procedural requirements that need to be taken into account. The SABS Code must generally be regarded as providing the minimum requirements for good practice on which to base the relevant sections of the COP. Again, as in 12.1.1 above, any deviation must be fully explained and justified in the COP.

12.1.3 Guidance for Radiation Protection

Where an MRD is identified in terms of sections 5 (2) or 11 of the MHSA as giving rise to a radiological hazard, the additional measuresrequired for protecting the health of workers and the public must be addressed in accordance with the relevant regulatory requirements.

12.1.4 Environmental Management Programme (EMP)

Section 39 of the Minerals Act (2) requires the employer to submit an EMP to the Director: Mineral Development for approval before mining operations commences. Due regard must be given to the requirements embodied in any approved EMP in compiling a COP on MRDs, and care must be taken to ensure that there is no conflict between the COP and the EMP.

12.1.5 Aide-Mémoire for the Preparation of Environmental Management Programme Reports (6)

The Aide-Mémoire for the Preparation of Environmental Management Programme Reports is intended to assist in the compilation of the EMP.

12.1.6 The Chamber of Mines Guidelines (Volume 2) (7)

The Chamber of Mines Guidelines (Volume 2) provides guidance on the protection of the environment against wind and water erosion of MRDs.

12.2 Technical Reports

The COP must require the compilation of the following comprehensive technical reports, including the results of the risk assessment as applied at the various stages of the entire process—

12.2.1 the results of a detailed investigation of the characteristics of the mine residue, compiled in terms of paragraph 12.3 below, in which attention is drawn to features that may impact upon the design of the proposed MRD;

12.2.2 the rationale of the site selection process carried out in terms of paragraph 12.4 below, including all quantifiable aspects;

12.2.3 the final design of the residue deposit, and the design rationale, compiled in terms of paragraph 12.5 below;

12.2.4 the work procedures that must be followed in the construction and operation of the MRD, compiled in terms of paragraph 12.6 below;

12.2.5 for MRDs classified as high or medium risk (see paragraph 11.2 above), the COP must require that—

12.2.5.1 the reports referred to in 12.2.2, 12.2.3, 12.2.4 above be reviewed by a professional engineer; and

12.2.5.2 the reports be certified by the professional engineer, if after such review, the professional engineer is satisfied, with particular regard to health and safety considerations, that—

12.2.5.2.1 with respect to the report referred to in 12.2.2 above, the site selection is optimal and the site is suitable for the MRD in question;

12.2.5.2.2 with respect to the report referred to in 12.2.3 above, the design is acceptable for the intended purpose; and

12.2.5.2.3 the report referred to in 12.2.4 above covers construction and operation adequately;

12.2.6 for MRDs classified as low risk (see paragraph 11.2 above), the COP must require that the reports referred to in 12.2.2, 12.2.3 and 12.2.4 above be reviewed by a professional engineer; and

12.2.7 the reports referred to in 12.2.1 to 12.2.4 above must be—

12.2.7.1 kept in a safe place by the employer until the closure certificate has been issued for the MRD; and

12.2.7.2 made available upon request for scrutiny by the mine health and safety committee and other persons.

12.3 Characteristics of the MRD

12.3.1 A knowledge of the ore body size and characteristics, the surrounding and overlying geology of areas to be excavated to gain access to the orebody, mineralogy and grades, geochemistry, mining methods, plans and sequences of operations, ore processing methods, ore processing reagents required, and water balance, is required for the determination of the characteristics of the mine residue.

12.3.2 The COP must require that competent persons undertake a detailed investigation of all relevant characteristics of the mine residue to be deposited, or already deposited, with a view to identifying any potentially significant health and safety hazard that may be associated with the residue when deposited at the site(s) under consideration.

12.3.3 The investigation must include all characteristics that may directly or indirectly affect the health and safety of mining and non-mining personnel in the vicinity of the site, and would typically include studies to determine the following properties:

12.3.3.1 Physical characteristics, such as—

(*a*) the size distribution of the principal constituents;

(*b*) the permeability of the compacted material;

(*c*) void ratios of the compacted material;

(*d*) the consolidation or settling characteristics of the material under its own weight and that of any overburden;

(*e*) the shear strength of the compacted material;

(*f*) the specific gravity of the solid constituents; and

(*g*) the water content of the material at the time of deposition, after compaction, and at other phases in the life of the MRD;

12.3.3.2 Chemical characteristics, such as—

(*a*) the toxicity;

(*b*) the propensity to oxidise and/or decompose;

(*c*) the propensity to undergo spontaneous combustion;

(*d*) the pH and chemical composition of the water separated from the solids;

(*e*) stability and reactivity and the rate thereof;

(*f*) factors affecting synergy and sequence of reactions; and

(*g*) neutralising potential.

12.3.3.3 Transport characteristics, i.e. the propensity of the constituent materials for being transported by airborne, surface water or ground water mechanisms. This will be determined by the physical and chemical characteristics;

12.3.3.4 Radiological characteristics (where appropriate), such as—

(*a*) the constituent radio-nuclides and their activity concentrations;

(*b*) the activity median aerodynamic diameter of particles becoming airborne; and

(*c*) the predicted radon exhalation rates at the time of deposition, after compaction, and at other phases in the life of the MRD.

12.3.3.5 Current and projected rates of production throughout the life of the mine.

12.3.4 More detailed guidance is given in Section 6 of the Chamber of Mines Guidelines (Volume 1) (5).

12.4 Site Selection

12.4.1 General Principles

12.4.1.1 The COP must ensure that site-specific advantages are utilised, and disadvantages considered as extensively as possible in the site selection process. Site-specific disadvantages must be compensated for by appropriate design and engineering, and for this reason decisions on final site selection are generally arrived at concurrently with those pertaining to design. The COP must also ensure that site selection takes into account the characteristics of the mining and/or processing operation, and the physical, chemical and (where appropriate) radiological properties of the residue to be deposited;

12.4.1.2 Aspects to be considered in the site selection process must include—

(*a*) health, safety and environmental considerations;

(*b*) the extent of post-closure aftercare measures and controls required, such as ongoing monitoring and maintenance;

(*c*) restrictions on future use of property or affected water supplies; and

(*d*) social (including public acceptance) and economic considerations;

12.4.1.3 An important aspect to be addressed by the COP is the selection of a site that is both geologically and geomorphologically stable. The site selection process in this regard consists of collecting appropriate information regarding the natural conditions, geology and geomorphology and hydrology (including geohydrology) of the region concerned, and then identifying a favourable combination of conditions for those factors that govern the long term integrity of the MRD;

12.4.1.4 Particular attention must be given to stability considerations at sites that are subject to undermining, that are in close proximity to mining activities, or that are potentially susceptible to natural or mining-induced seismicity.

12.4.2 Steps in the Site Selection Process

12.4.2.1 The COP must require that investigations be undertaken of candidate sites for any new MRD, and for any planned extension to an existing MRD, to enable the optimal site to be selected. The process must entail the following steps—

(*a*) identification of a sufficient number of candidate sites to ensure an adequate consideration of possible alternatives;

(*b*) qualitative evaluation and ranking of all the candidate sites;

(*c*) more detailed qualitative investigation of the top ranking sites to review the ranking;

(*d*) a feasibility study, involving a preliminary safety classification, environmental and social impact assessments, and geotechnical and geohydrological investigations, carried out on the highest ranking sites(s) with the view of assessing all risks relating to health or safety;

(*e*) obtaining input and acceptance from interested and affected parties and communities; and

(*f*) conducting a detailed site investigation on the selected site.

12.4.3 Site Investigation

12.4.3.1 In order to confirm the final choice of site for an MRD and to enable the design to proceed, the COP must specify requirements in respect of a detailed investigation to be conducted at the selected site. Considerable technical information is normally required for the site investigation, to ensure that all factors that may directly or indirectly affect the health or safety of mining and non-mining personnel in the vicinity of the site are taken into consideration, including the following observable surface and meteorological features associated with the site and any potentially affected surrounding area—

(*a*) land use;

(*b*) topography and surface drainage;

(*c*) infrastructure and man-made features;

(*d*) climate;

(*e*) flora and fauna;

(*f*) geology, including faults, joints and fractures;

(*g*) soils;

(*h*) ground water morphology, flow, quality and usage; and

(*i*) surface water.

12.4.3.2 For more information on these features, Section 3 of the Chamber of Mines Guidelines (Volume 1) (5) may be consulted.

12.5 Design

12.5.1 The COP must require that the design of all MRDs be—

12.5.1.1 undertaken by competent persons;

12.5.1.2 based on rational design criteria; and

12.5.1.3 consider and incorporate all factors having a bearing on potential health and safety issues associated with the proposed MRD.

12.5.2 The design considerations incorporated into the COP must take into account all phases of the life cycle of the MRD, from construction through to closure, and must include—

12.5.2.1 the characteristics of the residue (see paragraph 12.3 above);

12.5.2.2 the characteristics of the site (see paragraph 12.4 above) and the surrounding (receiving) environment;

12.5.2.3 the general layout of the deposit whether it is a natural, valley or ring dyke impoundment, or a combination thereof and its three-dimensional geometry at appropriate intervals throughout the planned incremental growth of the MRD;

12.5.2.4 the type of deposition system used – paddock, spigot or cyclone deposition method, whether sub-aqueous or sub-aerial; and

12.5.2.5 the rate of rise of the MRD.

12.5.3 The design must incorporate other detailed design considerations covered in Section 8 of the Chamber of Mines Guidelines (Volume 1) (5), as appropriate to the particular type of MRD, such as—

12.5.3.1 the control of storm water on and around the MRD by making provision for the maximum precipitation to be expected over a period of 24 hours with a frequency of once in a 100 years, in accordance with regulations made under the Water Act (8);

12.5.3.2 the provision, throughout the system, of a freeboard of at least 0.5m above the expected maximum water

level, in accordance with regulations made under the Water Act (8), to prevent overtopping;

12.5.3.3 keeping the pool away from the walls; where there are valid technical reasons for deviating from this, adequate motivation must be provided in the COP and the design must be reviewed by a professional engineer; a COP incorporating such a deviation may in addition require further review in terms of sections 9 (6) or 9 (7) of the MHSA;

12.5.3.4 the control of decanting of excess water under normal and storm conditions;

12.5.3.5 the retention of polluted water in terms of Government Notice R.991 (9); measures may be required to prevent water from the residue deposit from leaving the residue management system unless it meets prescribed requirements;

12.5.3.6 the design of the penstock, outfall pipe, under-drainage systems and return water dams;

12.5.3.7 the height of the phreatic surface, slope angles and method of construction of the outer walls (downstream, centre-line or upstream method), and their effects on shear stability;

12.5.3.8 the erosion of slopes by wind and water, and its control by vegetation, berms, and catchment paddocks; and

12.5.3.9 the potential for environmental pollution and pollution prevention measures, as detailed in the Aide-Mémoire (6) and referred to in the Chamber of Mines Guidelines (Volume 2) (7).

12.6 Construction and Operation

12.6.1 The COP must require measures to be instituted to ensure that the MRD, including any surrounding catchment paddocks, is constructed and operated in accordance with the approved design, that the deposit is operated in accordance with standards prescribed in the COP, and that appropriate systems are established to monitor adherence to the design and to the operating standards.

12.6.2 Such measures must be formulated by competent persons, who must familiarise themselves with the reports referred to under paragraphs 12.2.1, 12.2.2, and 12.2.3 above. Specific areas to be considered include—

12.6.2.1 the establishment of systems to ensure that the design of the MRD is followed implicitly throughout the construction period, and that any deviations from the design that may have implications for health or safety, are reported immediately to the employer;

12.6.2.2 as part of the monitoring systems referred to under this section, measurements of all residues transported to the site and of all surplus water removed from the site are made at defined intervals;

12.6.2.3 the provision of appropriate security measures to limit unauthorised access to the site and intrusion into the MRD;

12.6.2.4 the prohibition and prevention of the deposition in the MRD, of any waste materials not included in the report referred to in paragraph 12.2.1 above;

12.6.2.5 the compilation of instructions and procedures regarding all relevant aspects of the operation and monitoring of the MRD, with particular reference to the methods and communication channels for reporting failures, defects or anomalous occurrences;

12.6.2.6 specific actions to be taken in respect of any sign of weeping, piping, sloughing, cracking or any other sign of potential failure; and

12.6.2.7 the measurement and recording of rainfall in the vicinity of the site on a daily basis, and measures to ensure immediate special inspections of the condition of the deposit after major rainstorms or during periods of prolonged high rainfall.

12.6.3 The COP must normally specify that an MRD may not be used for storage of water. Where there are valid technical reasons for deviating from this, adequate motivation must be provided in the COP and the design must be reviewed by a professional engineer, a COP incorporating such a deviation may in addition require further review in terms of sections 9 (6) or 9 (7) of the MHSA.

12.6.4 The COP must specify any measures to be taken during the operation of the MRD to adequately control—

12.6.4.1 erosion of the slopes by wind; and

12.6.4.2 erosion of the slopes by water over and above those measures implicit in the design.

12.6.5 The COP must also specify the details of any vegetation programme to be implemented during the operational phase, as referred to in the Chamber of Mines Guidelines (Volume 2) (7).

12.7 Maintenance and Repair

The COP must provide for the establishment of a system of routine maintenance and repair in respect of the entire MRD site to ensure the ongoing integrity, healthy and safe operation of that site.

12.8 Modifications to an existing MRD

The COP must require that modifications to existing MRDs, including modifications to the geometry, deposition rate and characteristics of material deposited, are designed and implemented according to the same requirements as those for new MRDs detailed in paragraphs 12.2 to 12.6 above, as appropriate.

12.9 Decommissioning

12.9.1 The COP must require that when the deposition of mine residues at the site ceases, the deposit be decommissioned such that it does not present an unacceptable health or safety hazard for the foreseeable future.

12.9.1.1 Decommissioning of an MRD includes actions such as—

(*a*) ensuring the stability of the deposit structure;

(*b*) protecting the sides and top surfaces of the MRD against wind and water erosion;

(*c*) upgrading and securing all water drainage pipes and channels; and

(*d*) providing permanent spillways to all water storage ponds or dams.

12.9.2 Although decommissioning generally is conducted after cessation of operations, where possible the COP must make provision for appropriate decommissioning activities to take place as an integral part during the course of operations, e.g. covering or vegetating of slopes that have reached their final profile.

12.9.3 The COP must address the need for—

12.9.3.1 planning and preparation for decommissioning to be started, and documented, as early as possible in the life of the operation; and

12.9.3.2 prior to closure, the employer is to ensure that, for MRDs classified as high risk or medium risk, the deposit is inspected by a professional engineer, who must prepare a report that describes the existing state of the deposit and sets out a final plan of action for measures that need to be taken to put the deposit into a safe condition for the future.

12.9.4 For more information on decommissioning Section 12 of the Chamber of Mines Guidelines (Volume 1) (5) may be consulted.

12.10 Inspections by Mine Personnel

12.10.1 The COP must make provision for a system of periodic inspections linked to the ongoing risk assessment process in place on the mine. For MRDs classified as high risk or medium risk, the COP must require the following inspections to be carried out:

Person Conducting Inspection Frequency

A competent person designated in writing by the Every shift employer.

A competent person designated in writing by the Every day shift employer.

A competent person designated in writing by the Every Month employer.

12.10.2 The COP must set out:

12.10.2.1 what needs to be inspected and recorded in terms of each of the above levels of inspection;

12.10.2.2 the procedures for reporting urgent matters to the employer without delay, and for subsequently recording them in a log book; and

12.10.2.3 the details to be recorded in the log book—

(*a*) that the required inspections have been completed;

(*b*) the name of the person conducting the inspection;

(*c*) any relevant observations; and

(*d*) actions taken;

12.10.2.4 procedures for inspection of the log book by a competent person and for review of actions taken; and

12.10.2.5 for MRDs classified as low risk, the employer must determine, and specify in the COP, appropriate systems of inspection considering the overall characteristics of the deposit.

12.11 Audit Inspections by Professional Engineer

The COP must specify the following requirements for audit inspections by a professional engineer of MRDs classified as high risk or medium risk, and the reporting thereon—

Risk Classification Frequency

High Every 12 months

Medium Every 24 months

12.12 Emergency Preparedness

The COP must provide for contingency plans and allocation of responsibilities in the event of emergency situations. In the event of a major accident, such plans must include arrangements to evacuate inhabited areas at short notice, and the provision of medical assistance and emergency services.

12.13 Recommissioning

12.13.1 The COP must require that if an MRD classified as high or medium risk has been decommissioned, or has been inactive for more than six months, it must be inspected by a professional engineer before any further mine residues are deposited. The professional engineer must be required to certify in writing that recommissioning may safely commence, subject to any conditions that he may impose. No MRD classified as high or medium risk may be recommissioned in accordance with these requirements other than for the conditions and circumstances contemplated in the design, as certified in terms of paragraph 12.2.5.2 above.

12.13.2 If an MRD is to be recommissioned for purposes other than those for which the deposit was originally designed, the COP must require the MRD to be reassessed in terms of all of the requirements of this guideline, as though it were a pre-existing MRD for which no assessment had previously been carried out.

PART D: IMPLEMENTATION

1. IMPLEMENTATION PLAN

1.1 The employer must prepare an implementation plan for its COP that makes provision for issues such as organisational structures, responsibilities of functionaries and programmes and schedules for this COP that will enable proper implementation of the COP. (A summary of and a reference to a comprehensive implementation plan may be included).

1.2 Information may be graphically represented to facilitate easy interpretation of the data and to highlight trends for the purposes of risk assessment.

2. COMPLIANCE WITH THE COP

The employer must institute measures for monitoring and ensuring compliance with the COP.

3. ACCESS TO THE COP AND RELATED DOCUMENTS

3.1 The employer must ensure that a complete COP and related documents are kept readily available at the mine for examination by any affected person.

3.2 A registered trade union with members at the mine or where there is no such union, a health and safety representative on the mine, or if there is no health and safety representative, an employee representing the employees on the mine, must be provided with a copy on written request to the manager. A register must be kept of such persons or institutions with copies to facilitate updating of such copies.

3.3 The employer must ensure that all employees are fully conversant with those sections of the COP relevant to their respective areas of responsibilities.

ANNEX 1
REFERENCES

(FOR INFORMATION ONLY)

1. Mine Health and Safety Act, 1996 (Act No. 29 of 1996)

2. Minerals Act, 1991 (Act No. 50 of 1991)

3. Practical Guide to the Risk Assessment Process, SIMRAC Tripartite Working Group on Risk Assessment, 1997

4. South African Standards: Code of Practice, Mine Residue, SABS 0286: 1998

5. Guidelines for Environmental Protection, Volume 1/1979 (Revised 1983 and 1995): The Engineering Design, Operation and Closure of Metalliferous, Diamond and Coal Residue Deposits, Chamber of Mines of South Africa, March 1996, and any Addenda published subsequently.

6. Aide-Mémoire for the Preparation of Environmental Management Programme Reports for Prospecting and Mining, Department of Mineral and Energy Affairs, 1992

7. Handbook of Guidelines for Environmental Protection, Volume 2/1979: The Vegetation of Residue Deposits against Water and Wind Erosion. Chamber of Mines of South Africa, July 1979.

8. Water Act Regulations – R.287. Regulations made in terms of section 26 (*c*) and (*d*) of the Water Act, 1956 (Act 54 of 1956). 20 February 1976.

9. Requirements for the purification of wastewater or effluent. Government Notice No. R.991, *Government Gazette*, 18 May 1994.