



WATER AND RIVERS
COMMISSION



Water Quality
Protection
Guidelines
No. 9

Mining and Mineral
Processing

Acid mine drainage

2000



1. Introduction

Acid minewater is formed from the oxidation of sulphide-rich minerals. This results from the exposure of sulphidic material to atmospheric oxygen and water during the mining process. Sulphide-rich host rocks are commonly associated with gold, nickel, copper, iron ore, lead and coal deposits.

Drainage of acid water (known as acid mine drainage) has the potential to impact on the quality of water resources. In Western Australia, most mine sites are located in arid to semi-arid climates. The low annual rainfall and extended drought periods are likely to reduce the risk of acid mine drainage

Even so, there is still potential to affect nearby rehabilitation sites, native vegetation, local groundwater and streams.

2. Purpose

These guidelines are designed to be used where there is the potential to generate acid minewater, or where acid minewater exists and has the potential to impact on the quality of the region's water resources.

3. Scope

These guidelines apply to mining and mineral process operations that have the potential to generate acidic minewater, or where acid minewater exists.

4. Regulatory requirements

There are provisions under the *Environmental Protection Act 1986* (the EP Act) and the *Mining Act 1978* to control discharge of acid minewater from mine sites. Where discharge of acid minewater is likely to occur, the proponent should initially refer the proposal to DME for comment. If approved, the DEP and DME will set conditions for the proposal. Proposals that may have a significant impact on the environment will be referred to the EPA for environmental impact assessment.

5. Guidelines

5.1 General

- a. Acid-generating potential must be determined in the planning phase and addressed in the operational phase. Professional advice should be sought to assess acid production potential and to develop and implement site-specific methods to manage any acid minewater. The method adopted should render the contaminated material inactive in order to minimise environmental impact.
- b. Site management planning should also include rehabilitation of the mining pit to avoid acidification from sulphidic material left exposed in the walls.

5.2 Prevention

Minimising the generation of acid minewater is the best management approach. Various methods can be applied, including:

- blending the sulphidic material with alkalis – e.g. lime, limestone – and encapsulating it;
- containing waste to limit contact with water by using:
 - an air-resistant barrier, e.g. surfactants
 - a layer of organic matter
 - liner material
 - a layer of compacted waste material.
- separating the sulphidic material and the non-acid-forming materials;
- mixing the sulphidic material with construction material such as concrete and using it for construction purposes;
- covering the sulphidic material with rock or fines or keeping it under water. If this method is proposed, it should be demonstrated that:
 - mine waste does not contain significant readily soluble deleterious substances
 - dewatering and production wells are kept outside the radius of impact of the sulphide material
 - the water balance ensures that all potentially acid-generating waste will be permanently covered
 - there will be no significant erosive impacts resulting from natural events, e.g. flooding.

5.3 Disposal of acid minewater

- a. Various methods have been used successfully to dispose of acid minewater in an environmentally responsible manner, for example:
 - storing and evaporating the acidic water;
 - separating the acidic water from other minewater and treating it separately (care will be needed that salts formed by neutralisation do not threaten environmental values in areas of water release);
 - diluting prior to discharge.
- b. The potential environmental impacts on the receiving environment should be assessed prior to any discharge. Management strategies should be developed to overcome any detrimental impacts identified during this assessment. For further guidance, see *Water Quality Protection Guidelines No. 11 – Mine dewatering*.

5.4 Monitoring

- a. Where the threat of acidic minewater exists, a monitoring program should be established to identify and classify the waste types, and facilitate the early detection of any acid mine drainage and ongoing effectiveness of any acid drainage management program.

- b. Further advice on aspects of monitoring are available in *Water Quality Protection Guidelines No. 5 – Minesite water quality monitoring*.

6. Useful references

Some components of these guidelines have been based on work already undertaken and reported in the following publications:

1. Australian Centre for Minesite Rehabilitation Research (ACMRR) (1997). *The Third Australian Acid Mine Drainage Workshop*, Darwin 15–18 June 1997.
2. Department of Minerals and Energy (Queensland) (1995). *Technical Guidelines for the Environmental Management of Exploration and Mining in Queensland*, DME, Brisbane.
3. Department of Minerals and Energy (WA) (1996). *Guidelines for Mining in Arid Environments*, DME, Perth.
4. Williams, R.D. (1995). *An Overview of Acid Rock Drainage Potential in Arid and Semi-arid Regions of Western Australia*, DME, Perth.

Glossary and Abbreviations

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| 1. Commission | Water and Rivers Commission |
| 2. DME | Department of Minerals and Energy |
| 3. DEP | Department of Environmental Protection |



Further enquiries

Any project where the proponent/operator is unable to comply with these guidelines, or where site conditions prevent the application of these guidelines, should be submitted to the Commission as early as possible in the development of the proposal so that the matter may be resolved.

Any queries relating to the **content of these guidelines** should be directed to:

Program Manager Assessment and Advice
Water Quality Protection Branch
Water and Rivers Commission
Level 2, Hyatt Centre
3 Plain Street
EAST PERTH, WESTERN AUSTRALIA 6004
Phone (08) 9278 0300
Fax (08) 9278 0585

For further enquiries on any matter relating to the **management of water resources**, please contact the Water and Rivers Commission's regional offices.

Swan-Goldfields-Agricultural Regional Office

849 Albany Highway
VICTORIA PARK WA 6100 Phone (08) 9362 0555 Fax (08) 9362 0500

Or
254 Fitzgerald St
NORTHAM WA 6401 Phone (08) 9690 2821 Fax (08) 9622 7155

North West Regional Office

Chiratta Road
KARRATHA WA 6714 Phone (08) 9144 2000 Fax (08) 9144 2610

South West Regional Office

U2 Leschenault Quays,
Austral Parade
BUNBURY WA 6230 Phone (08) 9721 0666 Fax (08) 9721 0600

Or
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21 Sholl St
MANDURAH WA 6210 Phone (08) 9535 3411 Fax (08) 9581 4560

Mid-West Gascoyne Regional Office

Pass Street
Geraldton WA 6530 Phone (08) 9964 5978 Fax (08) 9964 5983

South Coast Regional Office

5 Bevan Street
ALBANY WA 6330 Phone (08) 9842 5760 Fax (08) 9842 1204

These guidelines are also available from the Water and Rivers Commission's web page at:
<http://www.wrc.wa.gov.au/protect/policy/>



Other draft guidelines in this series include:

WATER QUALITY PROTECTION GUIDELINES NO. 1

Water quality management in mining and mineral processing: An overview

WATER QUALITY PROTECTION GUIDELINES NO. 2

Tailings facilities

WATER QUALITY PROTECTION GUIDELINES NO. 3

Liners for waste containment

WATER QUALITY PROTECTION GUIDELINES NO. 4

Installation of minesite groundwater monitoring bores

WATER QUALITY PROTECTION GUIDELINES NO. 5

Minesite water quality monitoring

WATER QUALITY PROTECTION GUIDELINES NO. 6

Minesite stormwater

WATER QUALITY PROTECTION GUIDELINES NO. 7

Mechanical servicing and workshop facilities

WATER QUALITY PROTECTION GUIDELINES NO. 8

Laboratory waste discharge

WATER QUALITY PROTECTION GUIDELINES NO. 10

Above-ground fuel and chemical storage

WATER QUALITY PROTECTION GUIDELINES NO. 11

Mine dewatering



