



WATER AND RIVERS
COMMISSION



Water Quality
Protection
Guidelines
No. 5

Mining and
Mineral
Processing

Minesite water
quality monitoring

2000



1. Introduction

Monitoring of minesite water quality is an essential part of the environmental management of a mining and mineral processing operation. It enables water quality and chemical containment performance to be assessed. Undesirable impacts can thus be detected at an early stage and remedied.

2. Purpose

These guidelines are designed to be used for establishing and operating minesite water monitoring programs in order to protect the quality of the region's water resources.

3. Scope

These guidelines are to apply where a program is used to monitor changes in water quality resulting from a mining operation involving, for example, handling of chemicals and the disposal of wastes. They apply to samples taken for physical and chemical analyses only, not to bacteriological or biological samples.

4. Regulatory requirements

There are provisions under the *Environmental Protection Act 1986* (the EP Act) to issue a Works Approval (to construct) and a Licence (to commission and operate) which may require installation of a bore to monitor water resources.

Projects involving monitoring of water quality on prescribed premises should be referred to the Department of Environmental Protection (DEP) for assessment. The DEP may seek advice from the Commission on issues relating to the protection of water resources.

5. Guidelines

5.1 Designing an effective monitoring system

- a. The following factors should be considered:
 - baseline and background water resource conditions;
 - key water quality indicators and the appropriate sensitivity of measurement;
 - temporal and spatial sampling frequency;
 - appropriate sample collection, sampling preservation and analytical methods;
 - waste characteristics and variability;
 - disposal environment (climate, hydrology and local geological and geochemical conditions);
 - potential migration pathways and likely migration times;
 - potential impacts of pollutants in the receiving environment taking into account its sensitivity.

For example, in designing a monitoring system to determine the potential impacts of leachates, an understanding of materials being stored, the characteristics of the materials used in the construction of the storage facility, seepage migration, groundwater flow conditions, interaction of the leachate with the soils and proximity to environmentally sensitive areas should be considered.

- b. Where a high degree of risk is indicated by an assessment of the project, frequent recording should be an integral part of the monitoring system.

5.2 General sampling requirements

- a. Sample containers should be appropriate for specific parameters to be measured, as specified by the laboratory. For example, 1 litre polyethylene containers are used for non-organics and 2 litre laboratory cleaned brown glass bottles for organics.
- b. Under no circumstances use secondhand containers such as food or drink bottles, as residual contents may contaminate the sample.



- c. Write details of sampling point, number, date and type on the bottles with a solvent marker pen and complete laboratory advice sheet (see example provided in these guidelines). Information on the intended uses of water will assist the laboratory in analysing the appropriate parameters and sensitivity levels.
- d. The sample bottle and cap should be thoroughly rinsed at least three times with water from the source to be sampled to minimise risk of contamination.
- e. Containers should be completely filled (unless specifically requested by the lab) with sample water and securely capped with a watertight seal.
- f. Care should be taken to ensure that a representative sample is taken and that the collector does not inadvertently contaminate the sample.
- g. Generally, samples should be stored on ice in an insulated cooler and consigned to reach the laboratory within 24 hours, along with a sample details sheet and authorisation note. Collection and preservation guidelines for specific parameters are provided in Australian Standard 5667.1:1998. These should be confirmed with the laboratory prior to sample collection. Laboratories should be registered by the National Association of Testing Authorities (NATA).
- h. Contact the laboratory to let them know that samples have been taken, confirm their acceptance and advise anticipated arrival time.
- i. For clarification on any of these matters, contact the senior chemist at your chosen laboratory.

5.3 Sampling surface water

- a. The sample should normally be taken from flowing surface water by holding the bottle by its base and immersing it with the opening facing against the flow.
- b. It is good practice to use the container that will be consigned to the laboratory to scoop the water sample.
- c. If a sampling scoop is used for multiple samples, always sample clean water first,

progressing to the most potentially contaminated point. Pre-rinse the scoop with water from the source to be sampled to avoid cross-contamination.

- d. Where water quality is likely to vary greatly over a short time period, collect samples every 15 minutes over a period of 1 to 2 hours and combine to produce a composite sample. Degradable samples should be protected from contamination and kept on ice.
- e. Some samples require special preservation techniques, e.g. acidification. Do not immerse these bottles, as you are likely to lose the preservatives during sampling.

5.4 Sampling groundwater

- a. Pumped groundwater normally provides a more representative sample than bailed water. Always collect samples from the same measured depth (e.g. mid-point in bore casing slotted interval).
- b. For pumped samples, at least **three casing volumes** should be expelled from bores prior to a sample being collected.
- c. Pumped water should be discharged into a pre-rinsed 20-litre bucket, and sediment allowed to settle before the sample is withdrawn.
- d. Samples for analysis of nitrogen and phosphorus which contain visible turbidity should be filtered through a 0.45-micron filter.

5.5 Monitoring frequency

- a. Monitoring frequency should be determined by the associated risks and potential impacts of the activity to be monitored – the higher the risk or more significant the impact, the more frequent the sampling.

As a guide:

- Where anomalous analytical results occur, the site should be immediately resampled to check the validity of the result.
- The integrity of a tailings wall should be checked daily for seepage.
- Monitoring bores should be sampled at least three-monthly for key likely pollution indicators associated with the project.



5.6 *Text deleted*

5.7. Water quality criteria

- a. Water quality criteria (based on scientific evidence and judgment) describe the water quality that must be maintained in order to sustain beneficial uses or to protect environmental values (ANZECC 1994).
- b. The values or uses outlined in the *Australian Water Quality Guidelines for Fresh and Marine Waters* are:
 - protection of aquatic ecosystems;
 - recreation water quality and aesthetic;
 - raw water for drinking water supplies;
 - agricultural water use;
 - industrial water use.
- c. Water quality should comply with the criteria set by the Australian and New Zealand Environment and Conservation Council (ANZECC) for the above uses. Where baseline monitoring indicates natural conditions are above these criteria, site-specific values (including triggers for investigation) will be incorporated into approvals from DEP and DME.
- d. National Health and Medical Research Council (NHMRC) / Agriculture and Resource Management Council of Australia and New Zealand (ARMCANZ) (1996) drinking water guidelines should be used for potable water supplies.
- e. Site-specific water quality problems should be referred to the Commission for assessment.
- f. Water quality data that exceed the criteria established for the project should be sent in writing to the DEP, along with details of remedial action.

5.8. Water monitoring reporting

All monitoring data should be assessed and a report compiled by a competent environmental professional such as a hydrogeologist, engineer or scientist. The report should meet the requirements specified by DEP or Department of Minerals and Energy (DME).

6. Useful references

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

1. Agricultural and Resource Management Council of Australia and New Zealand and Australian and New Zealand Environment and Conservation Council (1992). *National Water Quality Management Strategy – Australian Water Quality Guidelines for Fresh and Marine Waters*.
2. Agricultural and Resource Management Council of Australia and New Zealand and Australian and New Zealand Environment and Conservation Council (1994). *National Water Quality Management Strategy – Policies and Principles*.
3. Environment Protection Agency (1995). *Best Practice Management in Mining – Environmental Monitoring and Performance Module*, Commonwealth of Australia, Canberra.
4. Environment Protection Agency (1995). *Best Practice Management in Mining – Tailings Containment Module*, Commonwealth of Australia, Canberra.

Glossary and Abbreviations

1. **Licence** Licence granted and in force under Part V of the *Environmental Protection Act 1986*.
2. **Groundwater** Water that occupies the pores and crevices of rocks or soil.
3. **Surface water** Water flowing or held in streams, rivers or other wetlands in the landscape.



Further enquiries

Any project where the proponent/operator of a project 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
'Sholl House'
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 related 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. 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. 9

Acid mine drainage

WATER QUALITY PROTECTION GUIDELINES NO. 10

Above-ground fuel and chemical storage

WATER QUALITY PROTECTION GUIDELINES NO. 11

Mine dewatering



ACME CHEMICAL COMPANY

LABORATORY REQUEST FORM

Laboratory: Chemical Analysts Pty Ltd, Springfield
Project details: Monitoring of wastewater impact on Ruby Street Main Drain
Sample source: Acme Chemical Company, 36 Smith Street, East Perth
Sampling officer: J. Jones **Title:** Environmental Officer **Section:** Environmental Management
File reference: ABC1234 **Resource Code:** 01-WQM-309-625 **Sampling date:** 1/7/99

Sample number	Time taken	Sample location	Sample description	Parameters for analysis	Sample size	Detection Limit Criterion ¹
RSD1	9:05 am	Drain 50 metres upstream of ACME	Ruby drain	pH, TDS, Cu, Cd, surfactants (MBAS)	2000 mL	AE
RSD2	9:10 am	ACME discharge to drain	Wastewater	as above	2000 mL	AE
RSD3	9:15 am	Drain 130 metres downstream of ACME	Ruby drain	as above	2000 mL	AE

Preservation details: Ice
Samples accepted by: B. Johnson **Title:** Lab technician **Date:** 1/7/99 **Time:** 11:35 am
Comments: Sample taken after morning washdown of equipment at ACME

Note¹: Detection limits compatible with ANZECC criteria: AE – fresh water aquatic ecosystems, DW – drinking water (default limit), IW – irrigation water, SW – stock water, IW – industrial water supply, AR – aesthetic/recreation needs, LP – lowest possible limit, AO – assay only, or as specified e.g. <0.1 mg/l

Return analysis results to: Attention: <u>J. Jones</u> c/- Environmental Management Section Acme Company PO Box 123 PERTH WA 6000	Tick relevant analysis required: Routine analysis: () or Urgent analysis: (✓) or Legal action analysis ()	- fax results to (08) 9123 4567 - ensure chain of custody and validation
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