



Minerals Regulatory Guidelines | MG5

Guidelines for miners: tailings and tailings storage facilities in South Australia



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1.2	26/02/08	Final version incorporating EPA comments.
1.3	18/11/08	Added map of water protection areas.
1.4	30/09/09	Reformatted; edited.

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Shortened forms

ANCOLD	Australian National Committee on Large Dams
ARPNSA	Australian Radiation Protection and Nuclear Safety Agency
EPA	Environment Protection Authority (South Australia)
MARP	mining and rehabilitation program
MCA	Minerals Council of Australia
MCMPR	Ministerial Council for Mineral and Petroleum Resources
PIRSA	Primary Industries and Resources South Australia
RWMP	radioactive waste management plan
TSF	tailings storage facility

1 Introduction

This document advises proponents of mining activities and miners of the outcomes sought and the processes required for ensuring that tailings and tailings storage facilities are appropriately managed throughout their life cycle. This includes the production, transport, placement and storage of tailings and the design, construction, operation and closure of the tailings storage facility. The guidelines are designed to assist in meeting obligations under the *Mining Act 1971*, the *Environment Protection Act 1993* and, where applicable, the *Radiation Protection and Control Act 1982*. It is a joint publication of Primary Industries and Resources South Australia (PIRSA) and the Environment Protection Authority (South Australia) (EPA).

Tailings¹ are a combination of the fine-grained solid material remaining after the recoverable metals and minerals have been extracted from the crushed and ground mined ore, processing chemicals and any process water remaining. A tailings storage facility (TSF) is an area used to confine tailings. The primary purpose of a TSF is to safely store tailings and, as appropriate, to achieve solid sedimentation, consolidation and desiccation, and to facilitate water recovery or removal without impacting on the environment. The term TSF refers to the overall facility and may include one or more tailings storages.

These guidelines describe the desired outcome for tailings and TSF management. A set of principles to be followed in achieving this outcome and an outline of the process that proponents of mining activities are to follow are also provided. These are consistent with the *Strategic framework for tailings management* published jointly in 2003 by the Ministerial Council on Mineral and Petroleum Resources (MCMPR) and the Minerals Council of Australia (MCA).

Adherence to these principles and process is needed to ensure regulators and stakeholders can be satisfied that the environmental, social and economic risks associated with tailings and TSF management in a particular case have been considered and will be appropriately controlled. The major risks to be considered include effects on ground and surface waters, flora and fauna, dust and public safety, health and wellbeing.

These guidelines **do not** provide guidance on technical solutions for the management of tailings and for the design, construction and operation of a TSF in particular circumstances. A number of other publications are available that provide such information. The principal one is *Guidelines on tailings dam design, construction and operation* published in 1999 by the Australian National Committee on Large Dams (ANCOLD). Additional publications are listed in Section 7.

2 Legislation

The principal legislative provisions relating to tailings and tailing storage facility management are described below (Sections 2.1 to 2.4).

2.1 Mining Act

Section 34 of the Mining Act provides that the minister, in determining the terms and conditions to apply to a mining lease (including an extractive mining lease), should give proper consideration to various matters related to the environment and any other factors considered appropriate in a particular case. Applicants for a mining lease are required to provide the information necessary for the minister to exercise his/her discretion in granting a mining lease. In addition, under regulation 42 to the Mining Act, a mining and rehabilitation program (MARP) must be approved before mining can commence. The MARP may be updated periodically to reflect changes in both the mining operational requirements for the site and community expectations. The specific requirements for these stages are described in Minerals Regulatory Guidelines MG2, *Guidelines for*

¹ The definitions of tailings, tailings management and tailings storage facilities are adapted from *Tailings management* (Department of Industry, Tourism and Resources 2007b).

miners: preparation of a mining lease proposal or mining and rehabilitation program (MARP) in South Australia.

2.2 Environment Protection Act

Section 25 of the Environment Protection Act imposes the general environmental duty on all persons undertaking an activity that may pollute, to take all reasonable and practicable measures to prevent or minimise any resulting environmental harm. Section 36 of the Act specifies the need for a licence to undertake certain activities, including (as identified in Schedule 1) processing mineral ores, sands or earths to produce mineral concentrates and associated tailings storage facilities. Environment protection legislation also includes environment protection policies, which outline requirements for the protection of a particular aspect of the environment. In addition, the terms and conditions of any relevant environmental licence granted by the EPA need to be observed.

2.3 Environment Protection (Water Quality) Policy

The Environment Protection (Water Quality) Policy 2003 establishes principles and mandatory requirements for the management of water including wastewater. The policy, which is legally enforceable under the Environment Protection Act, establishes environmental values to be protected and provides a combination of restrictions and outcome-based mandatory requirements to achieve these values. In relation to tailings management, the following sections are especially relevant. Proponents intending to construct a TSF should evaluate their proposed design against the requirements of each of the following sections with a view to demonstrating to the regulator, consistent with the following, which section(s) their proposal conforms to and how it does so.

In essence a TSF proposal must meet the requirements of **both** sections 18 and 17. It is recommended that for practical reasons consideration be first given to the requirements of section 18.

Section 18 (wastewater storage lagoons). Any TSF or associated structure that is designed to store water for recycling (i.e. that contains a head of water) may be considered a wastewater lagoon and the construction of such a structure is to be avoided in certain locations (refer to section 18(1)). Nevertheless, construction of a wastewater storage lagoon that will or does contain a pollutant listed in Schedule 5 is prohibited if it is located in:

- the flood plain known as the '1956 River Murray Flood Plain'
- a water protection area within the meaning of Part 8 of the Environmental Protection Act — this includes the River Murray and Mount Lofty Ranges water protection areas.

Note: Most metalliferous mining TSFs are very likely to contain Schedule 5 pollutants. Where construction of such a facility is permitted, section 18 also specifies a number of requirements for its construction. In general this will mean that at least part of the facility will be required to be double lined to meet the requirements of this section. Where the requirements of section 18 cannot be demonstrated to be met, a general exemption may be applied for. For an exemption to be considered under these sections, detailed modelling may be required to demonstrate the effects of the discharge on other potential users of the water.

Section 17 (discharge of pollutants). This section requires that the TSF (whether there is a head of water or not) be designed in such a way that it is **not** 'reasonably likely' that pollutants will discharge from the facility into surface waters or groundwater. The term 'reasonably likely' may be taken to mean under normal operating conditions. This outcome might be demonstrated by appropriate modelling of the design. If a proposal meets the standard for sections 18 and 13 but not section 17, a general exemption may be applied for.

Section 13 (obligation to meet water quality criteria) and sections 14 and 15 (exemptions). If the proposed TSF design cannot be demonstrated to meet the requirements of section 17 and 18 and the modelling indicates that the requirements of section 13 may also not be met, (after first determining the appropriate environmental values) the proponent may seek an exemption under sections 14 and/or 15. For an exemption to be considered under these sections, detailed modelling may be required to demonstrate the effects of the discharge on other potential users of the water. No exemption will be granted, or amendment to the Environment Protection (Water Quality) Policy allowed, for TSFs containing Schedule 5 listed pollutants in:

- the flood plain known as the '1956 River Murray Flood Plain'
- a water protection area within the meaning of Part 8 of the Environmental Protection Act — this includes the River Murray and Mount Lofty Ranges water protection areas.

Section 6 (amendment of policy without following normal procedure). Finally, where the TSF design does not conform to Clauses 13 (and associated exemption Clauses 14 and 15), Clause 6 of the Environment Protection (Water Quality) Policy provides for a consultative process to change environmental values to reflect uses and community values.

It should be noted that pursuing this approach may be time and resource intensive on the part of the applicant, and would probably only be considered for major projects. Additionally, it should be noted that there is potential for community derived values to conflict with mining interests.

2.4 Radiation Protection and Control Act

The Radiation Protection and Control Act applies to operations involving the mining or processing of radioactive minerals. A licence is required under the Act for these operations with the primary licence condition being compliance with the Commonwealth *Code of practice on radiation protection and radioactive waste management in mining and minerals processing* (Australian Radiation Protection and Nuclear Safety Agency (ARPNSA) 2005). This code requires the operator to develop a radioactive waste management plan (RWMP), which addresses the construction of the tailings dam and the management of the contained wastes.

3 Outcome

Tailings and TSFs are to be managed to provide safe, stable and economic storage of tailings in a way that complies with all legislative requirements, and presents negligible public health and safety risks and acceptably low social and environmental impacts both on and off site during operation and indefinitely post-closure.

4 Principles

In achieving and auditing this outcome the key principles to be followed include:

- Consideration of economic, environmental and social impacts of tailings and TSF management at all stages of the mine life cycle.
- Application of risk-management techniques on a site-specific basis to achieve sound outcomes throughout the life of the mine.
- Early, ongoing and effective stakeholder engagement that results in the community and government being satisfied with the processes for tailings and TSF management.
- Minimisation of the production of tailings/water content and maximisation of their safe re-use in accordance with the waste management hierarchy (refer to MCMPR and MCA 2003).

- Tailings management is to the standard of the most appropriate technology at the time.
- Tailings and TSF management is in accordance with any environment authorisation or licence issued by the EPA, the Environment Protection (Water Quality) Policy and the provisions of the relevant MARP (as modified from time to time).
- All tailings structures are operationally stable, retain their long-term integrity and are able to be rehabilitated.
- Rehabilitation of TSFs is achieved consistently with general standards for rehabilitation as set out in relevant PIRSA publications, and the specific standards for the site as set out in the relevant MARP or RWMP requirements.
- Demonstrated capacity and capability of the miner to implement the tailings and TSF management plan at all stages of the mine life cycle.
- Effective monitoring and reporting on tailings and TSF management practices.

5 Process

Proponents will be required to clearly demonstrate that they have undertaken a comprehensive risk assessment process leading to the development of an effective tailings and TSF management process in line with the outcome and principles above. The steps that need to be undertaken in order to demonstrate this are given below. Note, professional input at all stages is recommended.

5.1 Site and tailings characterisation

Site and tailings characterisation involves a comprehensive description of the environment, location and relevant features of the proposed location of the TSF.

The requirements for this are defined in Minerals Regulatory Guidelines MG2, *Guidelines for miners: preparation of a mining lease proposal or mining and rehabilitation program (MARPs) in South Australia*. Information is required in respect of:

- the local community
- land use
- proximity to housing and infrastructure
- amenity
- noise, dust and air quality
- topography and landscape
- climate
- geohazards
- hydrology
- groundwater
- vegetation, weeds and plant pathogens
- fauna
- topsoil and subsoil
- heritage
- proximity to conservation areas
- pre-existing site contamination and disturbance.

In regards to tailings management, particular attention needs to be paid to:

- The geographic location of the proposed site — especially in relation to ground and surface waters. Particular attention needs to be paid to the location of the site with respect to water protection areas (App. 1) and the 1956 River Murray flood plain, nearby centres of population and climate (including the potential for stormwater on the TSF surface).
- Chemical, radiological and physical components of the tailings, their stability, as well as flotation and processing chemicals to remain with the tailings and any wastes to be disposed to the TSF. This includes the identification of issues relating to acid and metalliferous drainage and other chemical reactions that may occur in the tailings dam and releases of radioactive materials.
- Where a tailings dam is to hold radioactive waste, baseline radiological conditions need to be determined prior to construction in accordance with the requirements of ARPNSA (2005) and relevant EPA guidelines.

Site characterisation is a progressive process. More detailed characteristics should be identified as the project develops and as conditions at the site change.

5.2 Identification of potential impacts/hazards

This step includes identification of the various effects that may occur. These may include impacts on or hazards to:

- surface, ground and nearby marine waters (the Environment Protection (Water Quality) Policy defines some of these environmental values)
- air quality
- flora and fauna
- humans, such as amenity, public safety, health and wellbeing
- post mining land use including on adjacent properties.

Identification and assessment of all potential sources, pathways and targets is also required.

Particular attention must be paid to situations where acid and metalliferous drainage or releases of radioactive materials are a possibility.

5.3 Development of controls for identified impacts/hazards and estimation of residual risk

Based on the analysis undertaken in both the previous steps, options for the control of risks are to be developed and assessed. This stage should include:

- optimal tailings management methods in terms of the waste management hierarchy, giving preference to minimisation strategies over treatment and disposal methods
- tailings delivery (e.g. paste, thickening, grain size distribution of wastes, water balance management)
- tailings containment design, construction, operation and decommissioning
- management of odour, dust and gas emissions
- opportunities for underground or open pit backfilling
- closure and post closure issues (e.g. capping and the formation of stable surface landforms consistent with the surrounding areas).

Once again, particular attention must be paid to situations where acid and metalliferous drainage and radioactive releases are a possibility.

The proposed design should be evaluated for residual risk following a risk assessment process consistent with the Australian standard for risk management (AS/NZS 4360:2004). The design should be assessed against the outcome set in this guideline (Section 3) and the potential impacts of residual risks and contingency plans analysed to demonstrate compliance with the outcome, legislation (particularly the Environment Protection (Water Quality) Policy) and principles. Modelling of the fluid pathways in the design under expected operating conditions would assist in providing this demonstration.

If the modelling does not demonstrate compliance with the Environment Protection (Water Quality) Policy, further modelling of the wider effects on the environment may be required to support any application for an exemption from the policy.

5.4 Documentation

Site characterisation, the development of controls for identified impacts/hazards and estimation of residual risk are to be documented consistently with the requirements of Minerals Regulatory Guidelines MG2, *Guidelines for miners: preparation of a mining lease proposal or mining and rehabilitation program (MARPs) in South Australia*.

Where sites are subject to the Radiation Protection and Control Act, radioactive waste management must be in accordance with an approved RWMP for the operation. The RWMP defines a system of tailings management, monitoring, dose assessment, reporting, contingency plans and the eventual decommissioning and rehabilitation of the TSF.

As noted above, site characterisation is a dynamic process and as the situation on a particular site changes, these will flow through to amendments to documents relevant to the regulatory process, for example, the MARP and EPA environmental authorisation/licences.

6 Definitions

Miner is any person or organisation involved in any **mining activity** at any stage of the mining life cycle.

Mining activities are activities defined in legislation² passed by the South Australian Parliament whose purpose either is (or is related to) the extraction, concentration and/or smelting of economic minerals from a mineral deposit. The activities include all stages of the mining life cycle, namely exploration, development of mineral deposits, construction of the mine and mining (extracting and processing the ore) and closure.

7 Currency of this guideline

This guideline offers advice to assist in complying with:

- The requirements of applying for a mining lease (including an extractive mining lease) and the preparation of a MARP under the Mining Act and compliance with the Mining Act and the relevant MARP.
- The general environmental duty and specific environmental policies under the Environment Protection Act.
- Where relevant, the requirements for meeting EPA licence conditions under the Radiation Protection and Control Act.

These requirements are subject to amendment and persons relying on the information in this guideline should check with PIRSA and the EPA to ensure that it is current at any given time.

² Principally the Mining Act and the *Mines and Works Inspections Act 1920*.

8 References and resources

8.1 References and further reading

ANCOLD — see Australian National Committee on Large Dams

ARPNSA — see Australian Radiation Protection and Nuclear Safety Agency

Australian National Committee on Large Dams 1999. *Guidelines on tailings dam design, construction and operation*. Australian National Committee on Large Dams, Malvern East, Victoria.

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Standards Australia International 2004. *Risk management*, AS/NZS 4360:2004. Standards Australia International, Sydney.

Standards Australia International 2004. *Risk management guidelines, companion to AS/NZS 4360:2004*, Handbook 436:2004. Standards Australia International, Sydney.

8.2 Legislation

www.legislation.sa.gov.au

Copies of the Acts and Regulations and the latest version of the Environment Protection (Water Quality) Policy are available at cost from ServiceSA, EDS Centre, 108 North Terrace, Adelaide SA 5000, phone 13 23 24, or for free download from the South Australian Legislation website (Attorney-General's Department).

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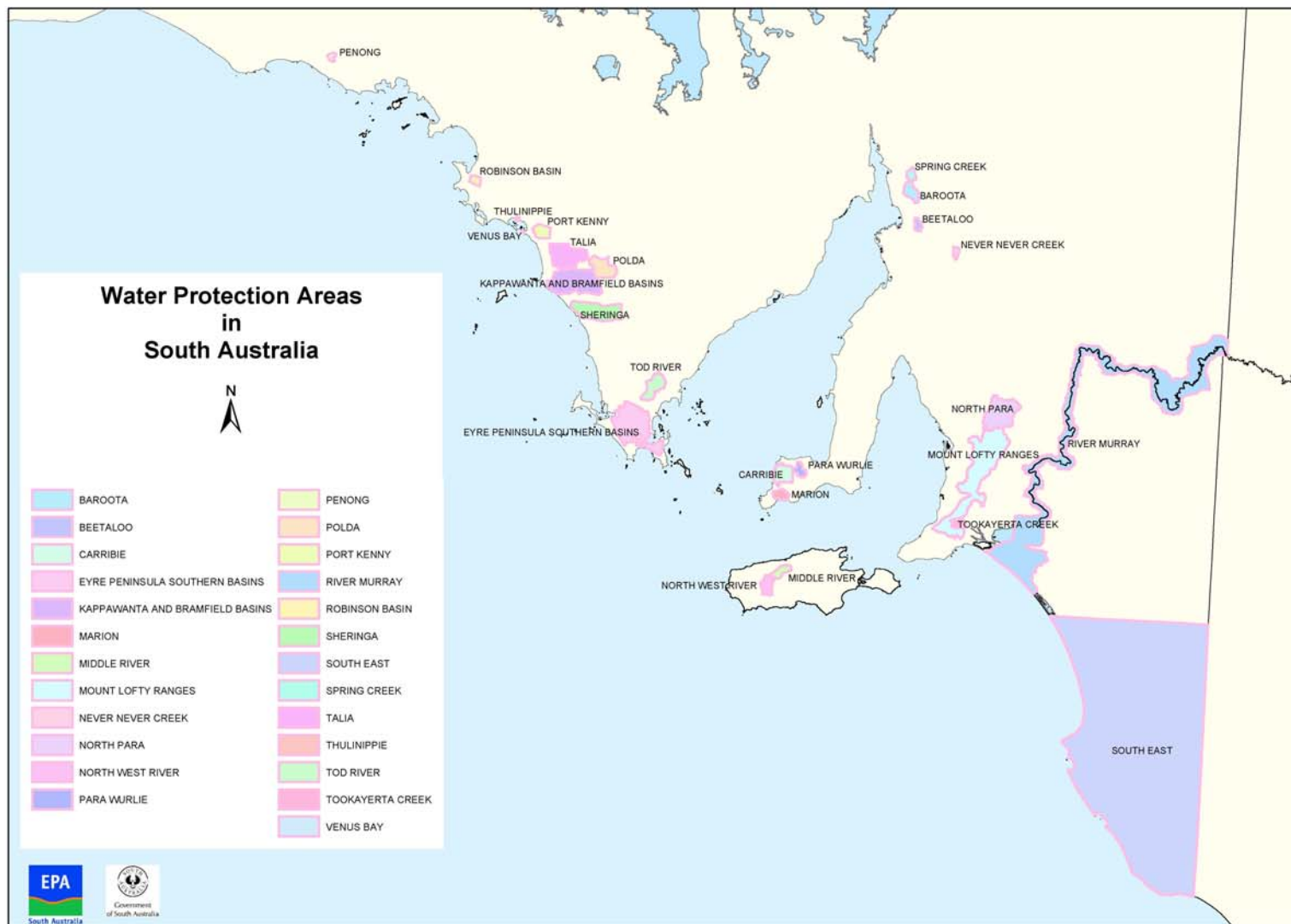
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Appendix 1 Water protection areas in South Australia



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