



Australian Government

PMAOPS560A Plan and design tailings management facilities

Release 1

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Modification History

Release 1 – New unit

Unit Descriptor

This unit of competency covers the skills and knowledge needed to plan and design the management of tailings disposals and disposal sites; risk identification and management strategies (business and environmental); and responses to threats to tailings site integrity.

Application of the Unit

This unit applies to a person who has the responsibility for the planning and design of a company's tailings waste management system or the planning and design of tailings specific disposal sites from the early stage metalliferous processes. This would include the planning and design of an environmental management system focused on continual improvement to review, prevent, mitigate or ameliorate adverse environmental impacts and which will provide for the safe storage and disposal of residual wastes and process residues. The type of people to whom this unit may apply include (but are not limited to):

- environmental department manager/officer
- occupational health and safety manager/officer
- operations manager/officer
- site maintenance manager/officer
- inspection and monitoring manager/officer
- frontline manager.

This unit applies to an individual working alone or as part of a team or group and working in liaison with other shift team members and the control room operator, as appropriate.

This unit applies where the activities of a metals or minerals processing plant produces waste in the form of tailings (e.g. slag and slurry) or wastewater.

This unit requires a detailed knowledge about the characteristics of tailings (particularly as they will occur in regard to the facility for which the tailings waste management system is being planned and designed), the design of the tailings management facility, methods of tailings disposal and deposition and associated equipment, water balance issues and environmental risks. Understanding of related processes and plant procedures which produce tailings would be beneficial.

This unit has been written with a focus on early stage metal beneficiation processes in mind, particularly in regard to processes associated with aluminium, iron, gold, copper, tin, silver, lead and zinc. Tailings management facilities may have deposited material suspended in varying levels of water ranging from slurry (e.g. 'red mud'), through high slump pastes (e.g. filter cake) to low slump pastes, but the focus has been on sub-aerial deposition (not subaqueous or sea deposition). While not specifically considered, the unit should also be applicable to other types of waste that might be deposited in a tailings management facility, including overburden and possibly slag or other solid waste products from later metalliferous processes with appropriate contextualisation.

Licensing/Regulatory Information

State regulation of tailings storage facility design, construction and ongoing management may be covered by specific legislation (e.g. New South Wales the Dams Safety Committee oversees tailings containment regulation under the Dams Safety Act, 1978.) Different jurisdictions may also issue their own tailings management guidelines and where these exist they must be adhered to.

Pre-Requisites

Not applicable.

Employability Skills Information

This unit contains employability skills.

Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.

Elements and Performance Criteria

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|---|------------------|-----|---|
| 1 | Prepare for work | 1.1 | Identify work requirements |
| | | 1.2 | Identify and control work health and safety (WHS) |

- hazards and identify risks to the environment
- 1.3 Coordinate with appropriate personnel, including facility managers and team members
- 2 Research waste/tailings management requirements
- 2.1 Research and identify the type and volume of waste generated from process operations
- 2.2 Research and identify the type and amount of waste management equipment required
- 2.3 Research and identify specific legislation required for the development of tailings storage facility design, construction and ongoing management
- 2.4 Identify any organisational specific waste management requirements, practices or processes
- 2.5 Search for and cost out tailings equipment, resources, development and maintenance requirements
- 2.6 Research waste risk management plans and practices
- 2.7 Research environmental, WHS and community implications to waste management plan and design
- 2.8 Consolidate findings from waste/tailings management requirements research and use to inform planning and design considerations
- 3 Undertake site investigations
- 3.1 Conduct initial site visit to inform the planning and design of tailings management facility requirements
- 3.2 Determine facility needs, including scope for variety (i.e. throughout shifts, time and processes) using measured/indicated data and senses (e.g. sight and hearing), as appropriate
- 3.3 Plan contingencies for developing or future situations which may require action to be pre-planned
- 3.4 Adjust initial planning and design plans, as appropriate, to incorporate findings of investigations
- 3.5 Collect samples and information from site visit for further investigation to inform waste management

- planning and design
- 3.6 Identify key operating personnel, practices and equipment to be considered in the planning and design phase
- 4 Analyse and assess design criteria
- 4.1 Analyse and assess the design criteria requirements for the type and volume of waste generated from process operations
- 4.2 Analyse and assess the design criteria for the type and amount of waste management equipment required
- 4.3 Analyse and assess design criteria based on the specific legislation required
- 4.4 Analyse and assess design criteria in line with organisational specific waste management requirements, practices or processes
- 4.5 Analyse and assess tailings equipment, resources, development and maintenance requirements, and cost implications
- 4.6 Analyse and assess risk management plan design criteria
- 4.7 Analyse and assess implications to operational personnel, training needs and human resource requirements
- 4.8 Analyse and assess safety concerns
- 5 Assist drafting of tailings management plan
- 5.1 Plan and review tailings management scope
- 5.2 Develop timeline, schedule, milestone dates and time management plan
- 5.3 Develop cost management plan with built-in review and tracking processes
- 5.4 Develop quality management criteria plan with periodic reviews
- 5.5 Develop skill, knowledge, training and human resource requirements with built-in review processes
- 5.6 Develop information generation, distribution and

communication plan with structured review of outcomes

- 5.7 Develop risk management plan with risk management strategies, issues registers, opportunities identification and review of outcomes protocols
- 5.8 Develop procurement management plan complete with procurement criteria and requirements, procurement contract management processes and review periods

Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

Required skills

Required skills include:

- conducting a range of tests, site visits and research to identify tailings facility requirements, including for water treatment and storage, dam wall capacity, and so on
- interpreting outcomes from tests performed and research undertaken
- determining and planning for conditions which will lead to out of specification operations
- planning and developing enterprise procedures for the waste/tailings management plan with time constraints considered and for a manner relevant to the correct use of the equipment
- identifying, collecting and conveying information relevant to the plan facility clearly and effectively
- using communication technology
- driving vehicles in remote settings with limited support, as required
- maintaining appropriate levels of quality assurance
- reading and numeracy to interpret workplace documents, calculate various indices and interpret technical information
- applying mathematics to the level of year 10

Required knowledge

Required knowledge, to the breadth and depth required for the operation of the tailings management facilities and gathering systems, includes:

- principles of operation of waste treatment and management of different tailings and water types, volumes and consistency
- process parameters and limits of tailings disposal plant (e.g. pressure, flow and pH)
- duty of care obligations
- hierarchy of control
- communication protocols (e.g. radio, phone, computer, paper and permissions/authorities)
- typical issues causing problems (plant/equipment, process, environmental) and the resolution of those problems
- relevant alarms and actions
- physics and chemistry relevant to the tailings being managed and their chemical,

physical, handling and placement characteristics

- relevant environmental and heritage requirements
- mathematical formulae and their application to waste management calculations, as needed

Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria required skills and knowledge range statement and the Assessment Guidelines for the Training Package.

Critical aspects for assessment and evidence required to demonstrate competency in this unit

Critical aspects for assessment and evidence are:

- work requirements are identified
- appropriate routine checks, logs and paperwork are completed and appropriate action planned, as required
- plant and facility requirements are properly considered
- potential problems are identified and responses planned
- work environment and equipment are made safe for use.

Context of and specific resources for assessment

Assessment of this competency will occur over a range of situations which will include typical disruptions to normal, smooth operation. This will require access to an operating plant over an extended period of time, or a suitable method of gathering evidence of operating ability. Where safety, lack of opportunity or significant cost is an issue an industry-based simulation may be employed to assist the process.

Guidance information for assessment

Assessment processes and techniques must be appropriate to the language, competency and safety requirements of the site and consistent with workplace systems or procedures.

Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

Procedures

Procedures may be written, verbal, computer-based or

in some other form. They may include but are not limited to:

- all work instructions
- standard operating procedures
- formulas/recipes
- batch sheets
- temporary instructions
- any similar instructions provided for the smooth running of the plant
- good operating practice as may be defined by industry codes of practice

Procedures would be expected to comply with any relevant government regulations.

Logs and reports

Logs and reports may include:

- paper or electronic-based logs and reports
- verbal/radio reports
- reporting items found which require action

Appropriate action

Appropriate action includes, but is not limited to:

- collecting information as required in the form of pictures, notes, equipment and waste samples, and so on
- determining potential problems which may require action to be pre-planned
- accessing and applying relevant technical and plant data for planning and design purposes
- considering appropriate problem solving techniques for possible faults
- planning for problem rectification by applying appropriate solution techniques to areas of responsibility
- planning for possible incident items until final resolution has occurred
- developing problem reporting processes and structures for outside area of responsibility/ability to designated person

Typical problems

Typical problems may include, but are not limited to:

- insufficient appreciation given to possible rupture of the tailings slurry delivery pipeline or decant water return pipeline
- lack of full consideration of rainfall induced erosion of the tailings facility containment wall or water imbalance

- poor understanding of and planning for geotechnical failure/excessive deformation of containment wall
- lack of provision planned for overfilling with tailings beyond management facility capacity, especially the result of unpredicted tailings production
- unplanned seepage of hazardous materials through the dam wall or through the foundation into the ground water
- insufficient design to protect against dust emissions especially of toxic materials
- unplanned or uncontained floodwater in high rainfall areas

Tailings/waste characteristics

Tailings/waste characteristics include:

- mineralogy: residual resource potential, and plant nutrients
- chemical reactivity: toxicity, leachate potential, acid producing potential, spontaneous combustion, cementation/hydration and weathering
- physical characteristics: particle size distribution, particle density compressibility, shear strength, liquefaction potential, erodibility and dusting potential
- placement characteristics: placed dry density, particle sorting, permeability, bearing capacity and initial placement density
- handling characteristics: solids content of slurries, trafficability during placement, flocculation/settling time and abrasiveness

Tailings disposal strategy

Tailings disposal strategy can include:

- the location of discharge points
- the rotation sequence for discharges
- the duration of deposition in an area
- the location of settling ponds and decant facilities
- the location and timing of intermediate paddock bunding
- the likely landform created by the deposition processes at stages throughout operations up to and including final landform
- flowable volumes and potential flow paths
- operational maintenance requirements (e.g. dust suppression, fauna exclusion and drainage)

Health, safety and environment (HSE)

All operations to which this unit applies are subject to stringent HSE requirements, which may be imposed through state or federal legislation, and these must not be compromised at any time. Where there is an apparent conflict between Performance Criteria and HSE requirements, the HSE requirements take precedence.

Work requirements

Work requirements may come from briefings, handovers and work orders and may include:

- compliance documentation
- product specifications
- nature and scope of tasks
- achievement targets
- operational conditions
- geological data
- site survey data
- site layout and out of bounds areas
- worksite inspection requirements
- lighting conditions
- plant or equipment defects
- hazards and potential hazards
- coordination requirements or issues

Unit Sector(s)

Competency field Operational/technical

Unit sector

Custom Content Section

Not applicable.