DRAFT

Code of Practice

MINE CLOSURE

Image courtesy of New South Wales Department of Trade and Investment, Regional Infrastructure and Services

safe work australia

TABLE OF CONTENTS

FOREWORD

This Code of Practice (this Code) on mine closure is an approved code of practice under section 274 of the *Work Health and Safety Act* (the WHS Act).

An approved code of practice is a practical guide to achieving the standards of health, safety and welfare required under the WHS Act and the Work Health and Safety Regulations (the WHS Regulations).

A code of practice applies to anyone who has a duty of care in the circumstances described in the code. In most cases, following an approved code of practice would achieve compliance with the health and safety duties in the WHS Act, in relation to the subject matter of the code. Like regulations, codes of practice deal with particular issues and do not cover all hazards or risks which may arise. The health and safety duties require duty holders to consider all risks associated with work, not only those for which regulations and codes of practice exist.
Codes of practice are admissible in court proceedings under the WHS Act and Regulations. Courts may regard a code of practice as evidence of what is known about a hazard, risk or control and may rely on the code in determining what is reasonably practicable in the circumstances to which the code relates.

Compliance with the WHS Act and Regulations may be achieved by following another method, such as a technical or an industry standard, if it provides an equivalent or higher standard of work health and safety than the code.

An inspector may refer to an approved code of practice when issuing an improvement or prohibition notice.

This Code has been developed by Safe Work Australia in conjunction with the National Mine Safety Framework Steering Group as a model code of practice under the Council of Australian Governments' *Inter-Governmental Agreement for Regulatory and Operational Reform in Occupational Health and Safety* for adoption by the Commonwealth, state and territory governments.

A draft of this Code was released for public consultation on *[to be completed]* and was endorsed by the Select Council on Workplace Relations on [*to be completed*].

SCOPE AND APPLICATION

This Code provides practical guidance on how to meet the requirements under the WHS Regulations to ensure a mine is safe and secure from unauthorised access before it is closed or suspended. A mine operator must not abandon the mine.

This Code provides practical guidance to those persons involved in the closure of a mine site and covers the control methods that should be used to eliminate or minimise health and safety risks to the public and other persons who may access a mine site following closure.

This Code does not cover those duties required under Environmental Law. A coordinated approach is therefore necessary between the relevant Environmental Agency and Mine Safety regulator to ensure requirements of mine closure are attended to.

Who should use this Code?
You should use this Code if you are a mine operator or mine holder with duties to ensure the health and safety under the WHS Act and Regulations as a person who has management control of a mine that is to be closed or abandoned.

This Code will help you make informed decisions about the best way to eliminate hazards or minimise health and safety risks involved in closing a mine.

This Code will also be used by those persons who may be impacted by the closure of a mining operation.

How to use this Code

In providing guidance, the word 'should' is used in this Code to indicate a recommended course of action, while 'may' is used to indicate an optional course of action.

This Code also includes various references to provisions of the WHS Act and Regulations to provide context with legal requirements. These references are not exhaustive.

The words 'must', 'requires' or 'mandatory' indicate that these legal requirements exist, which must be complied with.

1 INTRODUCTION

1.1 When is a mine site considered closed?

Mine closure can occur at any stage of the life cycle of the operation. Therefore it is critical that as far as reasonably practicable the mine is left in a safe and stable state in line with agreed expectations of all relevant stakeholders.

Types of mine closure include:

- Planned closure
- Sudden or unplanned closure
- Temporary closure (suspension)

1.2 Who has responsibility for managing health and safety risks?

A person who conducts a business or undertaking at a mine has the primary duty to ensure the health and safety of workers and other persons at the workplace until such time the site is closed and the mining tenement has been relinquished.

Regulation 9.2.31 of the WHS Regulations requires a mine operator (or mine holder) to ensure that at the time of closure, ensure, so far as is reasonably practicable, that the mine is left in a safe and secure condition so that persons are not exposed to post closure hazards and not placed at risk of injury or death.

Managing risks

To effectively control the risks at a mine, requires the mine operator to follow a *risk management process*. This Code provides practical guidance on how a Ventilation Control Plan can assist in managing and controlling the risks associated with ventilation.

Managing risks allows:

- identification of hazards, risks and opportunities when abandoning a mine site
- consequence (severity) and likelihood (probability) of risks to be analysed and compared
- development of risk mitigation measures and options based on priority
- transparent decision making regarding the management of sites/features
- a common framework for management decisions by multiple site stakeholders, and,
- The transparent allocation of funds.

Further guidance on risk is available in the *Code of Practice: How to Manage Work Health and Safety Risks.*

Consultation

As part of the risk management process effective consultation with internal and external stakeholders should be undertaken throughout the life cycle of the operation. The type of consultation may vary between life cycle phases, but consultation during the operational phase of a mine should be at an appropriate level of frequency throughout. The process of consultation should be used to identify hazards that may be present before and following closure of the mine and the implementation of suitable controls to minimise risk.

Further guidance on consultation is available in the *Code of Practice: How to consult on work health and safety matters.*

1.3 When to plan a mine closure?

Planning should occur at various stages of the Mine Life Cycle. This will include exploration, pre-feasibility, feasibility, construction, operations, decommissioning, closure, post closure and relinquishment.

Stakeholders need to be involved at all stage of process and will fall into two categories internal and external.

These groups include:

Internal – These groups may vary within the company or business depending on the stage of development. It could include groups such as exploration, construction, environmental and operations.

External – Key groups in this area would be land owners, communities, local authorities, state governments, environmental and heritage groups.

Stakeholders such as the background landowner, immediate neighbours, employees, government agencies and other persons directly affected by the operation and closure of the mine should be involved throughout the planning process. The most effective way of involving external stakeholders is through the establishment of a forum such as a closure committee or group that meets formally or informally to discuss issues as appropriate. This will ensure that members of the community and government agencies are kept abreast of the future plans for the mine thereby providing for a transparent process.

Initially the mine owners would be expected to plan for the mine closure as the life cycle of the mine nears its end consultation with external bodies will become more relevant.

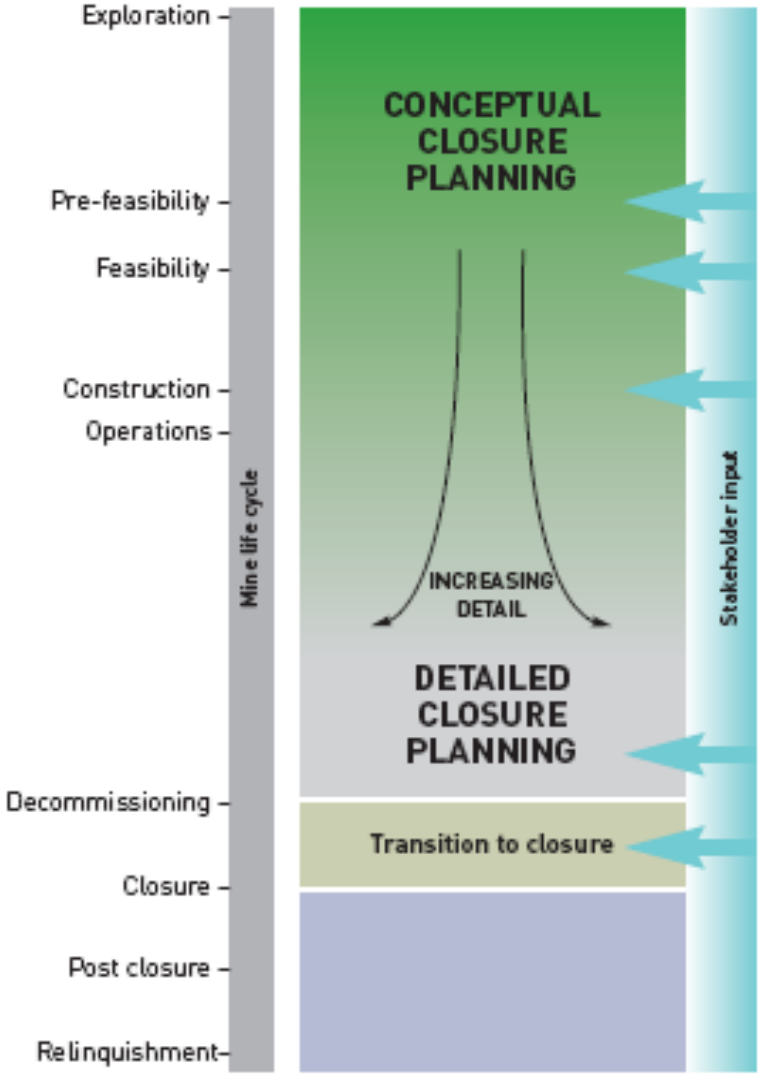

Figure 1: Mine Life Cycle (International Council on Mining and Metals, 2008)

These plans should allow for closure at any part of the cycle and allow for the relevant stakeholder input to be duly considered.

1.4 Who needs to be notified in the event of mine closure?

Before a mine closure is to occur the relevant Mine Safety and Environmental regulatory of the state in which the mine is located are to be notified as soon as is practicable. This process would also involve keeping all the relevant stakeholders advised of these plans.

The Mine Safety and Environmental regulators require that sufficient work is undertaken prior to the project approval stage or as early as possible to ensure all key issues and workable management mechanisms relevant to mine closure are identified. This will allow for strategies and mitigation measures to be developed and reviewed in the years leading up to the enclosure.

1.5 Who has authority to ensure area is safe and responsibility is relinquished?

When the authority of the site is relinquished back to the land owner they accept responsibility for the site. An agreement between the mining business and the landowner should be in place. This agreement should be well understood and may involve significant factors such as safety and environmental issues. The landowner should at this point be provided all relevant records for the site in order to make informed decisions on residual risks related to the property.

This is important as even when the mine closure process is done properly, deterioration over many years may lead to potential hazards being created as precautions put in place at the time of closure gradually age or become less effective.

2 TYPICAL HAZARDS IN RELATION TO MINE CLOSURE

The first step in the risk management process is to identify hazards. This involves identifying anything that may cause injury or harm to the health of a person.

Depending on the type of mine the type of potential hazards will vary considerable. Some sources of hazards that face mine closure include, but are not limited to:

2.1 Hazardous Substances, Dangerous Goods & Waste

Hazardous substances used as part of the mining process and those wastes produced may present occupational safety and health risks for persons following mine closure. For this reason the site may also be classed as a contaminated site by the relevant Environmental Agency.

The hazards from contaminants may include substances such as volatile organic solvents, fuels such as petrol and diesel, heavy metals, pesticides and hazardous wastes. The contaminants could be in a solid, liquid, vapour or dust form. They may be in the soil or groundwater. Most commonly, contaminants are located in chemical storage areas, workshop areas, tailings dams or places where there has been waste disposal. They can also be found where there are leakages from storage facilities into the surrounding environment.

Further guidance on contaminated sites is available in the *Guidance Note: Occupational Safety and Health management and Contaminated Sites Work.*

Further guidance on hazardous substances is available in *National Code of practice for the Control of Hazardous Substances.*

Further guidance on dangerous goods is available in the *National Code of Practice for the Storage and handling of Dangerous Goods.*

2.2 Vertical or near vertical Faces

Vertical or near-vertical faces (also called highwalls) from which material was extracted are common features of open pit mines and quarries. These highwalls can be unstable and prone to collapse.

Further guidance on high walls is available in the *Guideline: Safety Bund Walls around Abandoned Open Pit Mines* and the *Code of Practice: Excavation.*

2.3 Gases and Oxygen Deficiency

Lethal concentrations of methane, carbon monoxide, carbon dioxide, hydrogen sulphide, sulphur dioxide and several other gases can accumulate in underground workings. Pockets of still air with little or no oxygen can be encountered, due to the fact that the process of oxidation of certain minerals can literally consume a significant proportion of the oxygen normally present in the atmosphere. By the time persons feel ill, they may no longer be able to react in an appropriate fashion to remove themselves from the hazard.

Further guidance on oxygen deficient environments is available in the *Code of Practice: Confined Spaces.*

2.4 Falls from Height

Falling down vertical or near vertical openings is the most common cause of death and serious injury in abandoned mines. This can include shafts, open holes and drill holes. Darkness, loose debris, and false floors can hide vertical openings. Weathered rock at the edge of an opening can break away and slide into the open hole under the weight of a person. Failure to prevent persons accessing platforms at height that have no edge protection can result in serious injury or death.

Further guidance on fall is available in the *Code of Practice: How to Prevent Falls at Workplaces.*

Un-capped shaft with sinkhole in foreground.

2.5 Water

Many abandoned mines become flooded. Shallow water can conceal sharp objects, drop-offs, and other hazards. Swimming or scuba diving in pools which have accumulated in old mines can be very dangerous due to the potential hazards of underwater rock falls or becoming caught on abandoned equipment.

2.6 Unsafe Structures

Support structures, timbers, and ore pillars may have been removed or left to deteriorate through dismantling or demolition processes.

Underground or surface support timbers, ladders, buildings, pumps, tanks, and other mining related structures may crumble or collapse under a person's weight.

Further guidance on demolition is available in Australian *Standard 2061 – The Demolition of Structures.* See also *National Code of Practice for Precast Tilt up and Concrete elements in Building Construction.*

2.7 Explosives

Unused or misfired explosives may be deadly. Because old explosives containing nitro-glycerine may become unstable, minimal vibrations from a touch or footfall can trigger an explosion. Explosives are should be removed or disposed of on mine closure.

Further guidance on explosives is available in the *National Code of Practice for the Storage and handling of Dangerous Goods.*

2.8 Rock falls and Ground failure of underground workings

Mine workings can cave in or fall at any time. The effects of blasting and weathering can destabilise once-competent rock over time.

Further guidance on high walls is available in the *Draft Code of Practice: Ground Control in Underground Mines, Guideline: Safety Bund Walls around Abandoned Open Pit Mines* and the *Code of Practice: Excavation.*

2.9 Radioactive Materials

Some minerals such as uranium and thorium, which are radioactive and many mines worked for other minerals may contain the radioactive gas, radon. Similarly radioactive sources originally used in instrumentation (such as density gauges) could be encountered. Because the effects of radiation exposure are cumulative through a lifetime, any exposure may potentially increase harmful effects on your body.

2.10 Stockpiles

Waste dumps, ore stockpiles or spoil banks from surface and underground mines and natural slopes at abandoned open pit mines may sometimes become unstable.
The most common causes of landslides or slips include the following: steep slopes; saturation of slopes by water from mine sources or natural aquifers and the inherent instability of the disturbed materials. Walking on the surface of such piles can cause a slip even in apparently stable material.

2.11 Fibrous minerals (including asbestiform)

It is well known that there are significant health risks associated with the inhalation of airborne fibrous minerals which will need to be considered. Particularly if fibres of a respirable size are allowed to become airborne.

Further guidance on asbestos is available in the *Guideline: Management of Fibrous minerals in Western Australian operations.*

2.12 Underground and above ground services

Further guidance on underground and above ground services is available in the *Code of Practice: Excavation.*

2.13 Other Considerations

Access to the Mine Site

Roads that lead to and from mine sites may constitute a hazard such as causing vehicles to fall from height. Considerations should be made to prevent access to a closed mine by all forms of transport capable including ATV and motorcycles.

Rescue

Mine rescues are extremely hazardous. Mine rescue teams, despite their extensive training, are at significant risk every time they enter an abandoned mine and the way to ensure that they do not have to put their safety at risk unnecessarily is to stay out of abandoned workings and prevent access to abandoned workings.

3 PLANNING FOR CLOSURE

3.1 Targeted Communication Strategy

Engaging stakeholders to assist in identifying the true value of an abandoned mine site (including environmental, social and economic considerations) can assist in developing appropriate management options for the site.

An open and transparent approach which involves stakeholders in the management and planning of a rehabilitation project can give stakeholders “ownership” of the rehabilitation and help improve awareness about issues requiring management. Setting “joint” rehabilitation goals, including key matters such as defining the future beneficial uses for a site, builds trust and improves stakeholder support for abandoned mine site projects.

3.2 Adequate Resources

Resources should be directed towards priority risks and partnerships can provide innovative resourcing solutions, with mutual benefits and improved outcomes.

Given the limited funding normally available for abandoning mines, resources should be directed towards the highest priority site risks requiring management. There are opportunities for innovative funding/resourcing options, including partnerships, to increase the resources available for abandoning mines.

As well as bringing new resources, partnerships may bring new approaches, and provide a sharing of the responsibilities for site management.

Before allocating resources towards abandoning mining projects, parties with responsibility for managing a site (or group of sites) should initially conduct applied assessments to quantify and prioritise the risks. This process assists in allocating appropriate resources towards both high-risk issues that require immediate attention, and also the ongoing long-term management activities.

3.3 Partnerships

Partnerships can contribute towards enhancing the “value for money” when abandoning mines. There are a number of different partnership types which offer various advantages. Liability for works carried out at abandoned mine sites can be an obstruction to achieving partnerships which contribute to solving site problems. These considerations often relate to due diligence and ongoing responsibility for works which are conducted by partners. Solutions should consider the individual site contexts.

Partnerships for abandoned mines projects may include:

Impacted Stakeholder Partnerships – Impacted stakeholders are parties that are directly affected by the closure works. This may include landowners, adjoining landowners, Indigenous groups and local communities.

Community/Organisation Partnerships – This option may include partnerships with community groups such as Landcare, Rivercare, Heritage Societies and other organisations within the locality. The type of partnership usually depends on the focus of the organisation. Community involvement can also be a good source of information for identifying risks and planning.

Government – Government Partnerships – There are benefits and savings when government organisations work together to produce agreed outcomes.

Government – Industry Partnerships – Industry contribution towards abandoning mines can include project management services, environmental monitoring, community engagement and advice about planning/approval processes or environmental management matters.

Partnerships with Private Companies with Economic Interest in the Mine - A private company (not necessarily a mining company) may offer to rehabilitate a site so that the site can be used for a different and more productive end land use. An example is the rehabilitation of an abandoned mine into a waste disposal facility. The benefit of this resourcing option is that the site is used for another productive purpose, rather than forever remaining an abandoned mine.

3.4 Mine Closure Plans

Plans need to be developed at all stages of the mine life cycle. This will involve variously detailed plans depending on the type of operation.

The plan will begin as a conceptual plan moving through to a detailed one during the operation of the mine.

The level of risks and unknowns will be well understood as the mine life extends.

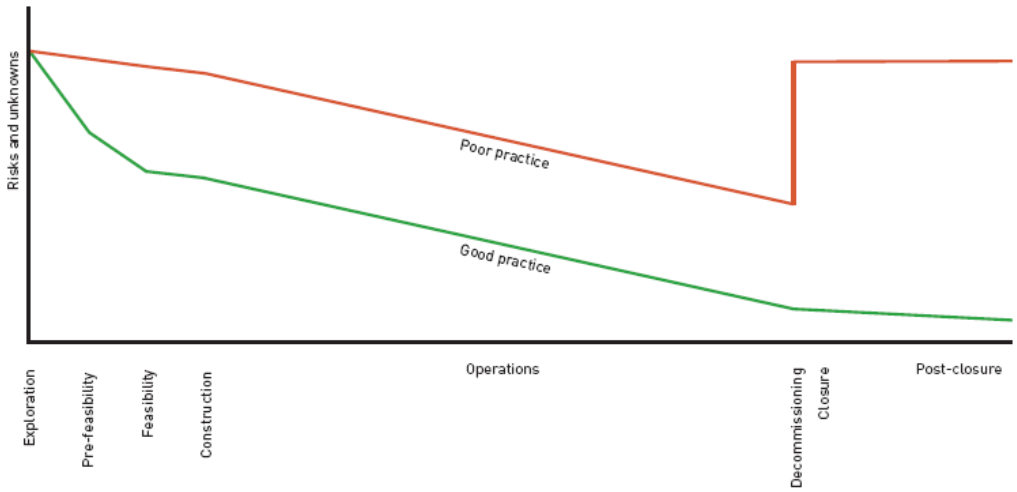

Figure 1: (International Council on Mining and Metals, 2008)

3.5 Regular and Critical Review

The Closure Plan should be modified as a result of any operational change, new regulations or new technology, and should be comprehensively reviewed on a regular and pre-determined cycle (eg. every 3 to 5 years). It should always remain flexible enough to cope with unexpected events. The Plan should include the management of social as well as environmental issues.

Abandoning mines is as much about identifying opportunities, as well as risks. Proactive engagements and improved communication of management techniques promotes sustainable long term management and inclusiveness in the ongoing stewardship of abandoned mines.

4 IMPLEMENTATION OF CONTROLS

Well planned closure programmes consist of two distinct sequential phases; planning and implementation. Coordinating these stages will result in a well-designed, systematic, safe and cost-effective mine closure (Hordley, 1998).

The following considerations need to be taken into account in the management and implementation of Closure Plans:

- accountability for plan implementation;
- the resources needed to assure conformance with the plan; and
- on-going management and monitoring requirements after closure of the operation.

4.1 Accountability for Closure

In theory, closure is the converse of commissioning, requiring similar skill levels, operational experience, motivation and commitment (Hordley, 1998). The closure process will be enhanced if there is a dedicated team structure, reporting to a project manager. Roles and responsibilities need to be clearly established.

4.2 Adequate Resources

Provisioning is designed to ensure that adequate funds are available to meet closure commitments. If the estimated provisions are inadequate to meet commitments, funds will need to be provided from other sources.

4.3 On-going Management

It should be the objective of all mine closure programmes to achieve a final land use which is maintenance free. However, under some closure scenarios (such as treatment of acid mine drainage) there may be a need to provide long-term, active management and/or monitoring of the closed site. The post-mining management and monitoring requirements need to be assessed and adequately provided for.

4.4 Closure Business Plan

A closure project should be managed as a self-funding operation, complete with comprehensive business plan, including costs, revenues, profit/loss and cash flows (Hordley,1998). The development of a business plan provides the basis for measuring progress and highlighting any changes needed to the closure process, and should also include a schedule of actions, responsibilities, resources and timeframes.

4.5 Closure Implementation

Closure may be initiated in a number of different scenarios including: planned closure, sudden closure, temporary closure and maintenance and monitoring.

Planned Closure

Planned closure involves the preparation of a Conceptual Closure Plan, and the timely evolution from it of the Closure Plan. When developed, the Closure Plan is based on the current level of bio-physical and socio-economic information, and mine planning and development detail. As the Project advances, the Closure Plan should be regularly updated and refined to reflect changes in mine development and operational planning, and

environmental conditions. Planned closure requires the preparation of a decommissioning plan some years prior to closure, and the systematic implementation of this plan.

Sudden (Unplanned) Closure

In the event of sudden or unplanned closure, an accelerated closure process will need to be implemented. This involves the immediate preparation and implementation of a decommissioning plan (based on the pre-existing Closure Plan), taking into account the site's non-operational status. Where provision accounts are inadequate to fund the full closure requirements, funds will need to be provided from other company sources.

Temporary Closure (Care & Maintenance)

As a result of economic or operational circumstances, it is possible that mining and/or milling activity may cease and the operation will shut down on a temporary basis. A temporary shutdown of this nature is normally planned and assumes that the operation will recommence. The care and maintenance process involves the immediate preparation and implementation of a decommissioning plan, taking into account the potential for future operations at the site. It is recommended that where possible, and economically sensible, rehabilitation should be undertaken on all disturbed areas, even if it is likely that some of these areas will be disturbed in the future. Site remediation, and works to prevent potential off-site contamination, should be implemented as if for a final closure scenario. A temporary closure should always trigger a review of the final Closure Plan, which will be required to be implemented if circumstances remain adverse to the reopening of the operation.

Management & Monitoring

Provision should be made in closure planning for an adequate period of maintenance and monitoring. Monitoring should be designed to demonstrate that completion criteria have been met and that the site is safe, stable and has achieved the land use objectives set during the planning process. It is unlikely that such conditions can be demonstrated in less than 5 years following cessation of mining. Of particular importance is the development of support mechanisms for the maintenance and monitoring phase, when operational support (accounting, maintenance, etc.) is no longer readily available. The need for maintenance recognises that not all closure strategies will be initially successful. All closure situations are unique, and although past experience and good planning can minimise the risks of failure, some remedial activity will usually be necessary. Where the opportunity exists to relinquish tenement progressively this should be taken.

4.6 Minimum Controls for Mine Closure

In implementation of the mine closure plan suitable controls will be identified through the risk management process. As agreed through stakeholder interacts it will be necessary to have these in place prior to closure. As a minimum the control measures that should be in place prior to mine closure:

- Adequate measures that have been taken to prevent unauthorised access or entry to the mine; this should include "No Entry" signage in a prominent place and considerations for appropriate barriers.
- Adequate precautions taken to ensure that access to underground workings has been secured against unauthorised entry;
- Adequate precautions taken to prevent inadvertent access to open pit workings;
- Adequate precautions taken to prevent, so far as is practicable, any post mining subsidence into underground workings, by back-filling stope voids and by other appropriate measures;
- Adequate precautions taken to ensure that all plant and equipment have been removed or secured and left in a safe condition;

- Adequate precautions taken to remove or properly dispose of all hazardous substances at the mine.

5 RELINQUISHMENT

Despite the magnitude and complexity of mine closure, over time most operators will be able to satisfy their obligations under Federal and/or State regulations. The expectation is that the Responsible Authority will accept the operator's performance and release the surety, and accountability will revert to the State or a subsequent land owner. However, while it is one thing to expect to be released from mine closure obligations, it is quite another to expect to be discharged from further liabilities under broad environmental and civil laws (Williams, 1993).

5.1 Responsible Authority

The Responsible Authority (usually State Department of Mineral Resources or equivalent) will make a judgement on the achievement of the agreed completion criteria after consultation with other involved regulatory agencies, including the future land controller. All release criteria are predicated on the prescribed or agreed post-mining land use.

A sufficient period of time should have elapsed to demonstrate the stability of the site. For revegetated areas, this may require verification that the vegetation is, or is trending towards, a self sustaining status. Potential impacts on groundwater may also take several years of monitoring to establish or refute.

The site should not endanger public health and safety, should alleviate or eliminate environmental damage, and allow a productive use of the land similar to its original use or an acceptable alternative. A site requiring active maintenance is unlikely to be acceptable to government agencies. Release of securities and bonds may be progressive, and reflect the progress of rehabilitation. To facilitate this process, Governments may wish to consider additional incentives for timely completion of closure commitments.

5.2 Relinquishment

When the Responsible Authority has agreed to relinquishment of the site, the management and maintenance of the site would rest with subsequent owners or the State. Successful closure may preclude certain post-mining land uses.

Where land uses are recognised as incompatible with any fragility in the rehabilitated site, these should be recognised and prohibited by either covenants on the title or by local government land zonings. Failure of rehabilitation due to faulty land management practices by the post-mining land user will not impose any retrospective liability on the mining company.

5.3 Record Retention

In the past, when mines have closed and the tenure has been relinquished or surrendered, many of the records of activities that occurred on the sites have been lost, destroyed or inadvertently disposed of. These records, while potentially of no further use to the company that once operated the site, are valuable to governments and potential future land users (and stakeholders).

The retention of mine records is important because they provide:

- a history of past developments
- information for incorporation into state and national natural resource data bases, and
- the potential to improve future land use planning and/or site redevelopment.

APPENDIX A – EXAMPLE OF CLOSURE PLAN CONTENTS

The development of a Closure Plan needs to take into account both the legal requirements and the unique environmental, economic and social properties of the operation.

Outlined below are the typical contents of a Closure Plan, which will vary depending on individual circumstances. In developing the Closure Plan, the following four key objectives should be kept in mind:

- to protect the environment and public health and safety by using safe and responsible closure practices;
- to reduce or eliminate environmental effects once the mine ceases operations;
- to establish conditions which are consistent with the pre-determined end land use objectives and
- to reduce the need for long-term monitoring and maintenance by establishing effective physical and chemical stability of disturbed areas.

Closure Plan: typical contents of a Closure Plan (not a minimum requirement or template):

- Introduction & Project Description – Land tenure
- Objectives of Closure
- Baseline Environmental Data
- Legal & Other Obligations– Key statutes & regulations, Responsible Authority and Regulatory instruments
- Stakeholder Involvement – Stakeholder identification and Community consultation
- Risk Assessment – Existing legacies, Future risks and Cost/benefit analysis
- Closure Criteria
- Closure Costs – Provisions and Securities
- Closure Action Plan - Human resources/responsibilities, Progressive rehabilitation, Decommissioning, Remediation, Geotechnical assessment, Landform establishment, Revegetation, Aesthetics, Heritage, Health & safety, Post-closure maintenance &
- Monitoring, Survey (remaining structures & areas
- of contamination) and Documentation/reporting/records
- Tenement Relinquishment

APPENDIX B – RISK MANAGEMENT CASE STUDY - BOTTLE CREEK MINE, WESTERN AUSTRALIA

This case study of an unplanned closure makes three important points:

1. It can take considerable persistence by a company to achieve relinquishment, particularly if early rehabilitation is inadequate for the task
2. The selection of a robust and verifiable process to monitor and demonstrate completion criteria is crucial for closure
3. Early establishment of verifiable completion criteria is critical to receiving acceptance and approval for relinquishment by the regulator.

The Bottle Creek Gold Project is located 95 kilometres north-west of Menzies in the northern Goldfields of Western Australia (WA). The mine commenced operation in June 1988 but, due to a limited gold resource, ceased operation in November 1989. Three open-pits and waste landforms, a plant site, run-of-mine pad and two tailings storage facilities were established during the operational stage of the project.

In May 1990 a proposal to rehabilitate the site was submitted by Norgold Limited to the then WA Department of Minerals and Energy (DME). In 1992 the Minister for Mines approved a refined plan and required unconditional performance bonds to be lodged.

The mine was largely rehabilitated by 1994 but, soon after this, 300 millimetres of cyclonic rainfall resulted in significant erosion and gullying on the landforms. DME requested that Norgold undertake appropriate rehabilitation works to repair the damage caused by the cyclonic event.

In September 1996, Norgold requested that DME release the bonds. The environmental inspector raised a number of issues that required attention prior to bonds being retired. These issues included remediation of erosion gullies, reseeding poorly vegetated areas, battering-down of slope angles (on some of the remaining structures), application of topsoil to several areas, and backfilling of drill holes.

Two more joint site inspections were undertaken in October 1996 and in June 1997. Norgold was requested to submit a new rehabilitation plan to detail how, when and to what standard it would undertake the remediation works required by the DME.

In November 1997, Norgold submitted a new rehabilitation plan. The work was completed by May 1998. DME undertook another site inspection in May 1998 and identified further small works.

In November 1998, Norgold submitted a compliance review as well as a monitoring program report which included a validation of the rehabilitation and developing ecosystem using ecosystem function analysis (EFA).

This monitoring system, developed by CSIRO reports on the condition of the ecosystem by comparison of the level of functionality displayed by the rehabilitation with a comparison from control/analogue sites in the surrounding region.

A closure inspection was undertaken in December 2000 which identified two issues that had not been resolved to the satisfaction of the DME—the potential for acid rock drainage and the presence of feral goats within the fenced area.

Rio Tinto (which acquired Norgold) investigated and subsequently addressed these issues to the satisfaction of the DME which recommended that the bonds be returned and that all tenement conditions relating to the project be deleted from the schedule of conditions attached to each tenement. In November 2001, the Minister for Mines deleted all tenement conditions and returned the bonds, confirming that Norgold had rehabilitated the site to the satisfaction of the state mining engineer.

Persistence in closure works, consultation and meeting final requirements eventually worked for Norgold-Rio Tinto. The use of a robust monitoring technique over time was able to adequately demonstrate completion criteria in the rehabilitation. This evidence was accepted by the regulator leading to final relinquishment. The regulator continues to monitor Bottle Creek Mine by conducting occasional monitoring programs with departmental officers and a Perth-based consultancy, which retrieves and analyses EFA data from the fixed monitoring transects at the site.

Further details about this case study can be found in Anderson et al. (2002).

APPENDIX C – RISK MANAGEMENT CASE STUDY

Kohimoor Pit, Meekatharra, Western Australia

Four years ago the Department of Mines was advised of a fatal incident at an abandoned mine site, the Kohimorr Pit which is located 50 km south of the town of Meekatharra. The Kohimoor Pit was an active gold mine site on and off from 1857 till its closure min 1993. At the time of the incident the Kohimoor pit was on a local gold mine tenement but was not an active part of the site. The pit floor is estimated to about 65 m below the ground level with about 30 m of water in the pit.

The deceased was a self employed person was known to be contracted to the Shires of Meekatharra and Mount Magnet to collect town refuse using an International cab over style Class 4, 3 axle rigid truck registration with a refuse compactor unit and a side loading bin lifter mechanism. He also had been engaged in disposing of tyre casings as a private arrangement for unknown clients. This activity was not connected with his refuse contracts with the Shires.

On the day before the incident the deceased loaded some unserviceable tyres at his business premises in Meekatharra using his forklift. He then left the yard with his loaded truck for some 2 ½ hours before returning to load more tyres. At around 5.00 PM, was last seen driving the refuse truck south on the Great Northern Highway driving northward into Meekatharra from the Mercator mine site.

The deceased was driving the truck from the right hand side driver position (conventional road driving position). These trucks are usually fitted with dual control drive systems to enable the bin lifter to be operated conveniently from the left hand side of the cab as the truck is driven when picking up refuse.

When locals had discovered the deceased was missing the local registered manager from a nearby mine was contacted. He then arranged for a truck to search the mine site when his truck was discovered some 42 hours after the driver was last known to be alive. The truck was positioned in the reversed position found part way down a pit slope with the rear door of the compactor open. It appeared the face of the slope had broken away underneath the weight of the truck. Tyres were found in the compactor and also in the bottom of the pit which was full of water. In an attempt to dispose of a number of unserviceable tyres it appeared the truck had rolled off the edge of the pit road.

The truck driver could not be found at the scene which resulted in an alarm being raised and a search initiated. At the time of finding the truck it was not certain if the driver had left the scene on foot or if he had fallen into the water contained in the pit. The deceased was found to have surfaced from the water contained within the pit at first light 3 days later.

Evaluation of the site showed the entry to the disused site was via a little used access road which was in good condition. The road had a series of signs indicating that entry to the area was restricted.

Upon arrival near at the pit a bund wall surrounding the pit was visible. By driving around the bund wall an opening to the pit area was located sufficiently wide enough to allow a truck through. The bund wall was approximately 1.6 – 1.7 metres high. At the time of the visit there were two gaps in the bund wall. The other opening was not wide enough to allow light

vehicle access. It had been suggested that the break may have been made by some contractors removing salvaged equipment from the former underground operation.

The bund gaps had been barricaded with star pickets and plastic tape following the recovery of the deceased. When entering the bunded area another barrier was located some 150 metres down the pit road. This barrier had also been temporarily reinstated. The second barrier had previously consisted steel posts and arc mesh. Parts of the weld mesh had been stolen since the registered manager's last visit to the site back some six months previously

Following the incident a new bund wall of a metre high had been installed across the pit road just above where the previous ARC mesh and post system had been employed where the pit road descends down to the bottom of the pit. Additionally the two bund wall openings away from the pit had been reinstated as had been discussed on site.

The pit access road entrance off the Great Northern Highway was to be equipped with a gate which was would be connected with the electric stock fence being installed on the pastoral lease. This work was to be done by the pastoral lease holder and was connected to the events at Kohinoor Pit.

Enquiries did not detect any documentation about the Kohinoor Pit being abandoned or suspended. The Registered Manager, had no specific awareness of the mine either being abandoned or suspended.

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APPENDIX D – OTHER RELEVANT MATERIAL

Commonwealth Department of Industry Tourism and Resources (Commonwealth DITR), 2006, *Leading Practice Sustainable Development Program for the Mining Industry – Mine Closure and Completion*, Commonwealth Government of Australia.

Commonwealth Department of Resources Energy and Tourism (Commonwealth RET), 2008, *Leading Practice Sustainable Development Program for the Mining Industry – Risk Assessment and Management*, Commonwealth Government of Australia.

International Council on Mining and Metals, *Planning for Integrated Mine Closure: Toolkit 2008*

Australian and New Zealand Minerals and Energy Council, Minerals Council of Australia, *Strategic Framework for Mine Closure 2000.*

Ministerial Council on Mineral and Petroleum Resources, Minerals Council of Australia, *Strategic Framework for Managing Abandoned Mines in the Minerals Industry 2010.*

Department of Mines & Petroleum. *Draft Guidelines for Preparing Mine Closure Plans.* 2011

WorkSafe WA. 2005. *Guidance Note: Occupational safety and health management and Contaminated Sites Work.*

SAI Global. 2001. *Australian Standard 2601 – Demolition of Structures.*

WorkSafe WA. 2005. *Code of Practice: Excavation.*

Department of Mines and Petroleum. 2010. *Guideline: Management of fibrous minerals in Western Australian Mining Operations.*

Department of Mines and Petroleum. 1997. *Safety Bund Walls around Abandoned Open Pit Mines.*

APPENDIX E – LIST OF REGULATORY AGENCIES THAT NEED TO BE CONTACTED IN THE EVENT OF MINE CLOSURE

State	Mine Safety	Environmental
Western Australia	Department of Mines & Petroleum Mineral House 100 Plain Street EAST PERTH WA 6004 www.dmp.wa.gov.au	Environmental Protection Authority The Atrium 168 St Georges Terrace Perth, Western Australia 6000 Telephone: +61-8-6467 5600 Facsimile: +61-8-6467 5556 Web site: www.epa.wa.gov.au Department of Environmental & Conservation *Head Office* The Atrium 168 St Georges Terrace, Perth WA 6000 Tel: +61-8-6467 5000 Fax: +61-8-6467 5562 Postal address Department of Environment and Conservation Locked Bag 104, Bentley Delivery Centre WA 6983
Queensland	Department of Employment, Economic Development and Innovation 61 Mary Street PO Box 15216 City East QLD 4002 Phone: 07 3237 1148 www.mines.industry.qld.gov.au	Department of Environment and Resource Management GPO Box 2454 Brisbane QLD 4001 Phone: 137468 info@derm.qld.gov.au www.derm.qld.gov.au
New South Wales	Department of Trade and Investment, Regional Infrastructure and Services Mineral Resources 516 High Street Maitland NSW 2320 PO Box 344 Hunter Regional Mail Centre NSW 2310 Phone: 02 4931 6666 Fax: 02 4931 6790 http://www.dtiris.nsw.gov.au/	Office of Environment and Heritage 59-61 Goulburn Street Sydney NSW PO Box A290 Sydney South NSW 1232 Phone: 02 9995 5000 info@environment.nsw.gov.au www.environment.nsw.gov.au
Victoria	WorkSafe Victoria 222 Exhibition Street Melbourne VIC 3000 Phone: 03 9641 1444 info@worksafe.vic.gov.au www.worksafe.vic.gov.au	Department of Sustainability and Environment 8 Nicholson Street East Melbourne VIC 3002 Phone: 03 5332 5000 www.dse.vic.gov.au Environment Protection Authority 200 Victoria Street, Carlton VIC 3053 GPO Box 4395, Melbourne VIC 3001 Phone: 03 9695 2722

		www.epa.voc.gov.au
South Australia	SafeWork SA Level 4, World Park A 33 Richmond Road Keswick SA 5035 GPO Box 465, Adelaide SA 5001 Phone: 1300 365 255 help@safework.sa.gov.au www.safework.sa.gov.au	Environment Protection Authority Level 8, 250 Victoria Square Adelaide SA 5000 GPO Box 2607 Adelaide 5001 Phone: 08 8204 2000 epainfo@epa.sa.gov.au www.epa.sa.gov.au Department of Environment and Natural Resources GPO Box 1047 Adelaide SA 5001 Phone: 08 8204 1910 www.environment.sa.gov.au
Northern Territory	NT WorkSafe GPO Box 1722 Darwin NT 0801 Phone: 1800 019 115 ntworksafe@nt.gov.au www.worksafe.nt.gov.au	Environment Protection Authority Level 5, Harbour View Plaza 8 McMinn Street Darwin, Northern Territory PO Box 496 Palmerston NT 0831 Phone: 08 8999 3747 epa@nt.gov.au www.epa.nt.gov.au Department of Natural Resources, Environment, The Arts and Sport Goyder Building 25 Chung Wah Terrace, Palmerston NT 0831 PO Box 496 Palmerston NT 0831 Phone: 08 8999 5511 www.nt.gov.au/nreta
Tasmania	Workplace Standards Tas PO Box 56 Rosny Park TAS 7018 Phone: 03 6233 7657 1300 366 322 wstinfo@justice.tas.gov.au www.wst.tas.gov.au	Environment Protection Authority GPO Box 1550 Hobart TAS 7001 Phone: 03 6233 6518 www.epa.tas.gov.au Department of Primary Industries, Parks, Water and Environment GPO Box 44 Hobart TAS 7001 Phone: 03 6233 8011 1300 368 550