

# BEST PRACTICE GUIDELINES

Reducing Impacts of  
Tailings Storage Facilities  
on

**Avian**

**Wildlife**

in the  
Northern Territory of  
Australia

October 1998

## Objectives of the Guidelines

*To enable best practice management to reduce native bird mortalities at mining operations*



*To assist mine planners and operators to understand the issue of bird visitations and mortalities on tailings storage facilities*



*To help planners incorporate features into new operations that will minimise bird mortalities*



*To assist with the assessment of risk for different mining operations*



*To raise the awareness of bird usage of water impoundments*



*To assist with the development of effective monitoring programs*



## Need for Guidelines: Assessing the Risk

Bird mortality on cyanide-bearing tailings storage facilities has been the subject of much public discussion, particularly since the broadcast of television reports concerning bird deaths at the Northparkes mine in western New South Wales. The considerable costs involved included damage to the company's (and industry's) reputation and an estimated \$2 million in remedial actions (Sinclair, *et al* 1997).

*Birds can be resuscitated with oxygen, leading to recovery after 24 hours.*



Consequently, the Senate referred a preliminary inquiry to the Environment, Recreation, Communications and the Arts Reference Committee relating to 'the need for governments to work together with industry to avoid the death of wildlife, risk to groundwater and destruction of native vegetation caused by the toxic tailings dams of the gold mining industry' (Hansard 1995).

The community's perception of environmental management in the mining industry determines, to a large extent, industry regulation (Satchwell 1997). Legislative regulation for the control of cyanide concentrations in tailings storage facilities varies within Australia and until now the industry has had no guidelines to help it reduce the impacts of tailings storage facilities on native birds.

In 1996 several Northern Territory gold mining operations and the Northern Territory Department of Mines and Energy initiated a study to "identify the impacts on wildlife caused by toxic tailings" (Bird Usage of Tailings Storage Facilities Coordinating Group, 1998). A coordinating group was established to investigate all aspects of bird usage of tailings facilities and management strategies used in the Northern Territory. Results from the study form the basis for the development of these guidelines.

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*Recognising the gap in understanding of the impacts of tailings storage facilities on avian wildlife, Northern Territory gold mining operations and the Northern Territory Department of Mines and Energy initiated a study to identify the impact on wildlife caused by toxic tailings*

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## Industry Initiatives: Outcomes of the Northern Territory Study

A number of outcomes derived from the Northern Territory Study are given below:

1. The level of risk of having mortality events on a tailings storage facility is a function of:
  - The location of the tailings facilities along migration pathways for birds.
  - The appearance and attractiveness of the facilities to birds.
  - Toxicity of discharge, supernatant and decant water.
  - The degeneration behaviour of cyanide species after discharge.
  - The physical characteristics (size and shape) of the facility.
  - High risk periods due to climatic conditions or seasonal effects.
2. The significant measure for toxicity is the Weak Acid Dissociable (WAD) cyanide level at discharge into the tailings storage facility, supernatant and decant.
3. Reducing the toxicity of cyanide waste will reduce mortalities. Bird Usage of Tailings Storage Facilities Coordinating Group (1998) and Kay (1990) suggest that, at levels of exposure below 50 mg/L WAD cyanide concentration, mortalities approach zero.
4. Significant mortality events can occur above 100 mg/L WAD cyanide discharge.
5. Mining operations that dispose of tailings above 50 mg/L WAD cyanide discharge can expect mortalities and need to monitor bird utilisation of the tailings storage facilities.
6. The birds that use tailings storage facilities and other impounded water bodies on mining leases are primarily non-passerines, ie. Laridae (terns); Anatidae (ducks); Charadiidae and Recurvirostridae (waders); Glareolidae (pratincoles); and Accipitridae (kites). These susceptible species accounted for more than 90% of all identified mortalities in the study.
7. A significant number of mortalities can occur over a short period (hours or days) so contingency plans must be implemented and effective with minimal delay.
8. Most susceptible species are attracted to supernatant on tailings storage facilities.
9. Mortalities can occur on decant or mill ponds.
10. Some susceptible species are attracted to the bare ground on the walls of tailings storage facilities.
11. Particular seasons, environmental conditions and migratory movements can correspond with significant mortality events.
12. Hazing techniques have included: propane gas guns, loud music, flying kites with goshawk silhouettes, flagging tape, and fishing line strung across dams. These techniques have not reduced mortalities to acceptable levels.
13. The greatest impact of toxic tailings is on avifauna.

## Who Can Use These Guidelines?

*Environmental Professionals and Consultants*



*Mine Planning Engineers*



*Metallurgists*



*Geologists*



*Geotechnical Engineers*



*Mine Managers*



*Feasibility Teams*



*Avoid the formation of shallow beach habitats which attract waders.*

## International Treaties for the Protection of Birds and Their Habitats

Some of the susceptible species that have suffered mortalities are international migrants from the Northern Hemisphere and are protected under the following international agreements. These conventions and agreements are administered by Environment Australia, Canberra.



Marsh Sandpiper (*Tringa stagnatilis*)  
B. Chudleigh/Nature Focus.

International Treaty	Aims of Treaty
<p>The China–Australia Migratory Bird Agreement (CAMBA)</p> <p>Japan–Australia Migratory Bird Agreement (JAMBA)</p>	<p>This agreement between The People's Republic of China and the Commonwealth of Australia entails a number of obligations including:</p> <ul style="list-style-type: none"> <li>preventing damage to migratory birds and their habitats;</li> <li>prohibiting the removal, sale, purchase or destruction of birds; and</li> <li>reporting on progress towards protection.</li> </ul>
<p>Bonn Convention</p>	<p>This agreement between Japan and the Commonwealth of Australia entails a number of obligations including:</p> <ul style="list-style-type: none"> <li>preventing damage to migratory birds and their habitats;</li> <li>prohibiting the removal, sale, purchase or destruction of birds; and</li> <li>reporting on progress towards protection.</li> </ul>
<p>(Conservation of Migratory Species)</p>	<p>An intergovernmental treaty that aims to conserve avian species by:</p> <ul style="list-style-type: none"> <li>adopting strict measures for endangered species;</li> <li>creating agreements for the conservation of species that would benefit from international management; and</li> <li>undertaking research.</li> </ul>
<p>Ramsar Convention</p>	<p>An intergovernmental treaty that aims at:</p> <ul style="list-style-type: none"> <li>halting the worldwide loss of wetlands and to conserve those that remain; and</li> <li>encouraging sustainable use of wetlands.</li> </ul>
<p>CITES Convention (Convention on International Trade in Endangered Species of Wild Fauna and Flora)</p>	<p>This treaty aims at:</p> <ul style="list-style-type: none"> <li>controlling the trade of agreed threatened species.</li> </ul>



Caspian Tern (*Sterna caspia*)  
B. Chudleigh/Nature Focus.

### Some of the susceptible bird species in the Northern Territory of Australia:

A total of 77 species has been recorded utilising tailings storage facilities in the Northern Territory. Some of the most susceptible species are listed below:

- Whiskered Tern (*Chlidonias hybrida*)
- Gull-billed Tern (*Sterna nilotica*)
- Caspian Tern (*Sterna caspia*)
- Pacific Black Duck (*Anas superciliosa*)
- Grey Teal (*A. gracilis*)
- Hardhead (*Aythya australis*)
- Pink-eared Duck (*Malacorhynchus membranaceus*)
- White-faced Heron (*Egretta novaehollandiae*)
- Great Egret (*Ardea alba*)
- Marsh Sandpiper (*Tringa stagnatilis*)
- Common Greenshank (*Tringa nebularia*)
- Common Sandpiper (*Actitis hypoleucos*)
- Red-necked Stint (*Calidris ruficollis*)
- Black-winged Stilt (*Himantopus himantopus*)
- Red-necked Avocet (*Recurvirotra novaehollandiae*),
- Black Kite (*Milvus migrans*)
- Whistling Kite (*Haliastur sphenurus*)
- Australian Pratincole (*Stiltia isabella*)
- Oriental Pratincole (*Glaucola maldivarum*)
- Cockatiel (*Nymphicus hollandicus*)
- Budgerigar (*Melopsittacus undulatus*)



*Black-winged Stilt (Himantopus himantopus)*  
M. Wright/Nature Focus.



*Great Egret (Ardea alba)*  
T&P Gardner/Nature Focus.



*Common Greenshank (Tringa nebularia)*  
B. Chudleigh/Nature Focus.



Avoid the formation of islands and other roosting features within tailings storage facilities.



Beaching against walls may allow granivorous birds to access tailing liquor.



Nearby roosting trees allow easy access to beached areas.

## Preparing a Baseline Study: Pre Mine and Existing Mine Considerations

Mine planners can reduce the risk of bird mortalities in a number of ways.

### Define Sensitive Areas

1. Collate available information regarding local bird behaviour and habitat requirements.
2. Understand the conservation significance of all fauna and particularly bird species.
3. Conduct baseline studies at nearby waterholes or wetlands to identify possible susceptible species.
4. Understand cyanide in the tailings environment:
  - break down behaviour of cyanide complexes and derivatives; and
  - the influence of copper, nickel, zinc, and other cyanide-consuming metals.

### Design Of Tailings Storage Facilities

4. Define susceptible species by using the following criteria:
  - birds that use large open water bodies;
  - birds that use bare ground;
  - flocking species;
  - species that inhabit shallow shoreline waters; and
  - carcass feeders.
5. Identify migration paths and seasonal movements of birds in the area in order to identify high risk seasons ask:
  - local bird enthusiasts; or
  - mill personnel.

1. Minimise dimensions of tailings cells. Large tailings cells should be avoided as they:
  - attract large numbers of birds;
  - allow birds to find safe roosting on large expanses of supernatant; and
  - make supernatant and tailings difficult to manage.
2. Locate causeways and modify cell dimensions so that a bird flight operator is never greater than 75m from the birds.
3. If metallurgical test work shows that decant water will be at WAD cyanide levels greater than 50mg/l concentration, management options are:
  - screening or netting decant ponds; and
  - placing decant ponds near mining infrastructure to discourage bird presence.

### Metallurgical Test Work

1. Monitor (or predict for new operations) free, WAD and total cyanide concentration of discharge and supernatant water.
2. Analyse ore body for cyanide consuming metals, particularly copper, nickel and zinc.
3. Conduct a cyanide speciation analysis of discharge and supernatant water in order to assess cyanide complex persistence and toxicity.

## Management Strategies to Reduce Bird Mortalities on Tailings Dams

### Cyanide Management

Reduce cyanide toxicity in any of the following ways:

- Convert cyanide to the gaseous form;
- Remove cyanide from solution;
- Install a cyanide degradation plant into the process;
- Ensure efficiency in the use of cyanide to minimise discharge levels; or
- Use other metallurgical techniques that will accelerate cyanide breakdown.

*If it is not possible to reduce cyanide discharge concentration to an appropriate level, mining operators should implement a combination of the following options*

*These techniques may reduce the risk to bird life, but mortalities are still possible.*

### Improving Tailings Storage Facilities

The most susceptible species are attracted to supernatant on tailings storage facilities. The removal or reduction of supernatant and wet supernatant/slurry will greatly reduce visitation of these species and their exposure to toxicity. The active decanting of supernatant to screened or netted decant ponds will significantly reduce supernatant size, increase cyanide recovery and deny access to toxic supernatant.

Some susceptible species are attracted to the bare ground of tailings storage facility walls. Black lining on dam walls - as used for heap leach process ponds - will provide a deterrent.

When constructing tailings storage facilities, avoid an uneven floor so that islands (favoured roosting sites) do not form as tailings are deposited.

Avoid having supernatant resting against dam walls as this provides additional habitat for waders and drinking access for granivorous birds.

Remove vegetation so that no nearby roosting trees are available.

### Short Term Contingency Option

If significant mortalities are being experienced, the use of patrolling staff discharging bird fire ammunition with shotguns, may be a short-term solution on small tailings storage facilities. Hovercrafts are useful to carry out this strategy.

### Other Management Strategies

Carcasses should always be removed so as not to attract raptors or carnivores.

Birds suffering mild cyanosis can be easily resuscitated with oxygen. They can be housed quietly in hospital cages and can usually be released the next day.

Be aware of high risk periods. Birds often travel considerable distances at night during the migratory season, particularly at full moon, or during extended dry periods in arid regions.

## Is there a Concern at Your Mining Operation?

There may be a concern at mining operations if:

1. WAD cyanide discharge concentration is expected to be above 50 mg/L with environmentally persistent cyanide species.
2. There is sufficient concentrations of copper, nickel or zinc in your gold ore to cause WAD cyanide levels to exceed 50 mg/L.
3. Fauna studies show that high visitations of recognised susceptible species are expected.
4. Mine location is within migratory flight paths of waders and terns.
5. Tailings storage facilities are large and have the following features:
  - large area of supernatant;
  - tailings discharge with low percentage of solids, resulting in a significant area of shallow beach/supernatant interface;
  - distance from the centre of cells is significant enough for birds to find safe roosting on supernatant; and
  - bare earth walls which provide view advantage for roost species.



*Carcasses should be removed quickly to prevent raptors or carnivores removing carcasses.*

## Further Reading

Bird Usage of Tailings Storage Facilities Coordinating Group, 1998. *Bird Usage Patterns on Northern Territory Mining Water Tailings and their Management to Reduce Mortalities*. D. Donato, Consultant, Darwin, NT.

Environment Australia, 1998. *Cyanide Management*, (A booklet in the Series on Best Practice Environmental Management in Mining). Environment Australia, Canberra.

Hansard, 1995. The Senate of the Commonwealth of Australia, 19 September 1995. Canberra, 12pp.

Kay, F.R. 1990. Nevada State Department of Wildlife Role: Past Present Future. In *Proceedings of the Nevada Mining/Wildlife Workshop*, 27-29 March 1990. Reno, Mining Association, Nevada Dept. Minerals and Nevada Dept. of Wildlife: Nevada, 9pp.

Satchwell, I. 1997. Community Reaction to Cyanide Use in Australia. In *Short Course Notes on Management of Cyanide Mining* 14-16 April 1997, Perth. ACMRR: Kenmore, Qld., 6pp.

Sinclair, G., McMullen, A., & Peters, R. 1997. A Case Study of Bird Mortality and Cyanide Management at Northparkes. In *Short Course Notes on Management of Cyanide Mining* 14-16 April, 1997, Perth. ACMRR: Kenmore, Qld, 24pp.

Smith, A., & Mudder, T.I. 1991. *Chemistry and Treatment of Cyanidation Wastes*. Mining Journal Books: London.

## Suggested Monitoring Program

1. Analyse discharge, supernatant and decant water for free, WAD and total cyanide concentration on a monthly basis for the first six months.
2. Depending on the level of variation found in results, adjust the frequency of your monitoring program. Samples should be collected and preserved in accordance with Appendix 3 of Cyanide Management (Environment Australia, 1998). This will reveal the toxicity of the different components of the system.
3. Analyse discharge, supernatant and decant water for cyanide speciation of all species. This should be conducted on a quarterly basis. This will show the cause of the toxicity and indicate inhibitors to cyanide breakdown.
4. Conduct Inductively Coupled Plasma Mass Spectrometry (ICP-MS) surveys of future ores to identify any changes in ore composition which may affect the toxicity of tailings.
5. Make up a simple identikit of common susceptible species of birds and distribute this to personnel who patrol the facility as part of their normal duties.
6. Provide data sheets and get relevant personnel to record mortalities and visitations during their regular patrols.
7. Conduct brief daily inspections of the facility to monitor bird (and other wildlife) activity. This is best conducted first thing in the morning.

*Undoubtably the most effective way to reduce mortalities is to reduce toxicity of the tailings. A discharge limit of 50 mg/L of WAD cyanide discharge concentration in exposed tailings storage facilities is a target that mines should endeavour to reach.*

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