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PREAMBLE

This **Environmental Management Program** (EM Program) forms part of the Environmental Protection and Management Program (EPMP). The EPMP comprises the following:

- the Environmental Management Manual (EMM);
- this EM Program;
- the Monitoring Programs (MPs);
- the Mine Closure and Rehabilitation Plan.

The EM Program addresses the potentially significant **environmental aspects and impacts** that have been identified through an analysis and prioritisation of the **environmental risks**, legal obligations and community concerns relevant to BHP Billiton Olympic Dam Corporation Pty Ltd (ODC) Olympic Dam Operations. It documents the processes, systems, criteria and other requirements designed to manage the prioritised **aspects and impacts**, including (as appropriate):

- **environmental values**, and the key risks to those **values**;
- **environmental outcomes** that ODC aims to achieve relating to potential **environmental impacts**;
- clear, specific and measurable **compliance criteria** that demonstrate achievement of the outcome(s);
- **leading indicator(s)** criteria, providing early warning of trends that indicate a compliance criterion may not be met;
- management and operational controls designed to deal with the **environmental risk** (of the impact), including any regulatory conditions (where specified);
- contingency options to be used in the event that identified risks are realised;
- Continuous Improvement and Development Opportunities identified that can assist in achieving **compliance criteria** and **environmental outcomes**;
- environmental **improvement targets** and possible actions to achieve those targets.

The EM Program is divided into five distinct categories or 'IDs', each related to an area of the operation for which specific environmental management measures are required. Each ID is further subdivided into the specific EM Programs focused on one specific **aspect and impact**. The five top level IDs are:

1. use and disturbance of natural resources;
   - Measures for dealing with **environmental impacts** associated with land clearing and disturbance, spread of weeds and other pest species, and groundwater level drawdown.
2. storage, transport and handling of hazardous materials;
   - Prevention and mitigation of **environmental impacts** as a result of spills involving chemicals, hydrocarbons or radioactive process materials.
3. operation of industrial systems;
   - Control and prevention measures for emissions associated with the operation of the Olympic Dam mine and processing facility. These include particulate (dust) and radioactive emissions, sulphur dioxide and greenhouse gases.
4. generation of industrial wastes;
   - Measures for dealing with **environmental impacts** resulting from waste generation and storage. This includes issues associated with the storage of tailings, such as seepage to groundwater, embankment wall stability, and impacts to native fauna (birds) arising from contact with the tailings storage facilities. Also included are controls for waste rock storage, and the disposal and storage of radioactive and solid wastes.
5. interaction with communities;
   - Covers the employment and accommodation of people and measures for social cohesion.

This EM Program also refers to a number of MPs. The MPs describe how data is collected to support the outcomes and criteria of each ID in this EM Program. The relevant MPs associated with each ID are listed under that ID. In some instances, MPs cover a broader scope of monitoring than that required by the specific ID, so where appropriate specific elements of the MPs are described.

ID 1 USE OF NATURAL RESOURCES

ID 1.1 Land disturbance and rehabilitation

1.1.1 Responsibility

- Head of HSEC
- Manager Environment
- General Manager – Mining
- Senior Manager – Non Process Infrastructure
- Head of Resource Planning and Development

1.1.2 Scope (State 17a)

All surface development activities for Olympic Dam and any expanded operations require the disturbance of land. **Environmental impacts** associated with land disturbance may include loss of habitat for local flora and fauna, increased opportunity for introduced flora and fauna to become established, soil erosion, or loss/damage of indigenous heritage sites. In order to minimise impacts occurring as a result of construction and development work, ODC has developed an internal Environmental / Indigenous Heritage Clearance Permit (EIHCP) system for Olympic Dam which has been updated to address the expanded activities.

Rehabilitation of disturbed areas is progressive or when that site ceases to be used. Rehabilitation is conducted in accordance with the agreed land use as described in the Olympic Dam Mine Closure and Rehabilitation Plan.

Where applicable, land disturbances will be allocated an appropriate Significant Environment Benefit (SEB) offset ratio. Each offset area will then be subtracted from the total Olympic Dam SEB area, either at Gosse Springs or the newly determined areas.

This EM Program applies to all land disturbance activities undertaken by, or on behalf of ODC including activities associated with the expanded Olympic Dam.

1.1.3 Management strategy

ODC has developed several key documents cited in this EM Program that provide a basis for avoiding, minimising impacts to, compensating for and rehabilitating areas proposed for land disturbance activities.

The EIHCP permit system uses GIS software to map known locations and preferred habitats of threatened flora and fauna species and to flag ‘no go’ areas for disturbance. Erosion and Soil Control Plans (ESCP) and Topsoil Management Plans are used to guide construction practices in a manner that minimises the impacts of disturbance.

1.1.4 Key legal and other requirements

- **Ratification Act** and the **Indenture** (or as amended by the **Amendment Act** and the **Amended Indenture**)
- **EPBC Act Approval Conditions**
- **Major Development Approval Conditions**
- *Native Vegetation Act 1991* (SA)
- Native Vegetation Regulations 2003 (SA)
- *Heritage Act 1993* (SA)
- *Heritage Places Act (SA) 1993*
- *National Parks and Wildlife Act 1972* (SA)
- *EPBC Act*
- Draft EPBC Act Policy Statement – ‘Use of environmental offsets under the EPBC Act’

- Guidelines for a Native Vegetation Significant Environmental Benefit Policy for the clearance of native vegetation associated with the minerals and petroleum industry, published by the South Australian Department of Water, Land and Biodiversity Conservation in September 2005.
- *Radiation Protection and Control Act 1982* (SA)
- *Aboriginal Heritage Act 1988* (SA)
- *Natural Resources Management Act 2004* (SA) (NRM Act)

1.1.5 Values

- Diversity of ecological communities.
- **Listed species.**
- Significant cultural (Aboriginal and non-Aboriginal) sites.
- Current and future land uses.

1.1.6 Key risks

- Loss of listed fauna habitat.
- Loss of **listed flora species or ecological communities**.

1.1.7 Environmental outcome (State 17b)

- No **significant adverse impacts to populations** of **listed species** (South Australian, Commonwealth) as a result of the construction, operation and closure of Olympic Dam.

1.1.8 Compliance criteria

- No significant impact to the size of an **important population of** Category 1a **species** (State 17c, 17kiii).

*Note: Significant impact is as defined in the **Significant Impact Guidelines** and greater than predicted in the **EIS**.*

- No loss of an **important population of** Category 1b **species** (State 17c, 17kiii).
- Clearing of vegetation not to exceed the total area of 17,269 hectares as indicated in the **EIS** (DEIS and SEIS) (State 4, 17c, 17kiii).

1.1.9 Leading indicators (State 17d)

- None applicable.

1.1.10 Management plan(s)

- SEB Gosse Springs Paddock Native Vegetation Management Plan:
  - identifies the vegetation clearance activities likely to be undertaken during the Olympic Dam expansion project and the associated legislative requirements of this clearance;
  - allows for the clearance of 1,370 hectares (ha), assuming an 8:1 ratio;
  - describes the interim SEB area at Gosse Springs that will be set aside to offset this clearance;
  - includes management actions to protect existing biodiversity within the interim SEB area.
- Aboriginal Cultural Heritage Management Protocol:
  - a program of ongoing archaeological investigations has been agreed to by the Kokatha, Barngarla and Kuyani groups. The program includes the participation of Aboriginal archaeological field trainees nominated by the groups accompanying qualified archaeologists (DEIS 17.5.3; SEIS 18.2).
  - the Kokatha, Barngarla and Kuyani groups have agreed to a salvage program in areas where impacts to heritage sites are unavoidable (DEIS 17.5.3).

- in situations where disturbance is unavoidable, the **Olympic Dam Agreement** requires ODC to discuss the matter with Aboriginal custodians prior to making an application to the South Australian Government for permission to disturb sites (DEIS 17.5.4; SEIS 18.3, 18.4).
- if it is necessary to disturb archaeological or ethnographic sites (with relevant approvals), a site disturbance mitigation plan will be developed in consultation with the appropriate Aboriginal groups (DEIS 17.3.3).
- workforce induction training will include heritage awareness of known heritage sites and the need to comply with laws relating to their protection (DEIS Appendix U; SEIS 18.4).
- the **Olympic Dam Agreement** includes arrangements for regular consultation between ODC and the groups about environmental matters. These arrangements will continue for the remaining life-of-mine, including its expansion, and will also deal with rehabilitation issues. (SEIS 18.1). Representatives of the native title claimant groups would be trained and employed in heritage management and recording activities (SEIS 18.2).

- Topsoil Management Plan, Document No. 111269:
  - wherever possible, temporary sand and topsoil stockpiles will be placed in already disturbed areas, or areas proposed for future disturbance, to minimise additional vegetation clearance (DEIS 23.9.1; SEIS 5.4.5);
  - the reuse of topsoil within one to two years will be targeted to maximise the potential for biological stock to remain within the soil (DEIS 23.9.1; SEIS 5.4.5).
- Mine Closure and Rehabilitation Plan, Document No. 99232:
  - the existing Mine Closure and Rehabilitation Plan is to be updated within two years from the date of **Major Development Approval** (10 October 2011), or before construction of the expanded TSF, whichever date is the earliest.

1.1.11 Monitoring program(s)

- Flora Monitoring Program, Document No. 2664:
  - remotely sensed imagery is used annually to define the disturbance impact footprint of infrastructure, development, resource drilling and associated waste management activities. Annual disturbance records are also used to account for SEB offset requirements.
  - records of known **listed species** locations have been included in the EIHCP GIS system which is reviewed prior to ground disturbance works.
  - areas of vegetation cleared are compared against SEB offset areas to ensure the area of SEB is sufficient (Aus 82a, 82k).
- Fauna Monitoring Program, Document No. 2663:
  - routine monitoring of avifauna, small mammals, reptiles, amphibians, feral and abundant species, and Category 1a, 1b and 2 species is conducted as indicators of environmental change due to the operations, and allows for known locations of **listed species** to be included in the EIHCP GIS system;

1.1.12 Controls and management actions

- Land disturbance is controlled through the site EIHCP system (State 17g) incorporating:
  - Procedure for issue of an Environmental / Indigenous Heritage Clearance Permit, Document No. 512;
  - Application for an Environmental / Indigenous Heritage Clearance Permit, Document No. 56830;
  - Rehabilitation Strategy 2012, Document No. 78220;
  - This system protects native vegetation and fauna habitat through the requirement to obtain an EIHCP before any surface disturbing project and associated works begin. All permits are assessed by authorised environment personnel and signed off by the Project Manager of the proposed activity.
- A 10,963 ha SEB area has been established at Gosse Springs on the edge of Lake Eyre South (DEIS 15.5.1, 15.4.2) to offset the residual impact of vegetation clearance required for

the existing Olympic Dam operation and associated infrastructure. This also initiates the SEB offset requirements for the expansion project (State 17g).

- Additional SEB offset areas, bringing the total to the approved maximum of 139,781 ha, will be progressively developed to compensate for vegetation clearance and other **environmental impacts** associated with the expansion and operations (State 17g). The SEB offset is comprised of the following elements:
  - An SEB totalling 138,153 ha is to be established in the Arid Lands NRM region, including Gosse Springs, Emerald Springs, Bedourie, Black Swan and One Box paddocks as shown in Appendix C of the Flora Monitoring Program – Document No. 2664. The delivery of these SEB areas is funded and managed by BHP Billiton's ongoing operations. Detailed management strategies and actions for each of the SEB areas are detailed in the Native Vegetation Management Plan (see section 1.1.10). This plan is approved by the Native Vegetation Council. Monitoring of the delivery of these actions is provided as part of the Flora MP. The Native Vegetation Management Plan provides details on the delivery and funding arrangements for each SEB area (Aus 82i, 82k). New SEB areas and native vegetation management plans are progressively developed and implemented as vegetation clearance occurs and to ensure the SEB area is always greater than the SEB obligation.
- The SEB areas are chosen to contribute to the biodiversity conservation priorities of the Australian and South Australian Governments, particularly in respect of (Aus 82b):
  - The selected SEB areas will increase representation of the Stony Plains IBRA Regions (currently at 5.65 per cent) to 6.55 per cent (Aus 82bi) and have been made with consideration to the national approach to developing landscape scale ecological linkages. The inclusion of Emerald Springs and One Box as an SEB area will connect Lake Eyre National Park with Wabma Kadarbu Conservation Park. In addition the inclusion of Bedourie and Black Swan as SEB areas will create an additional area of managed reserves adjoining the Wabma Kadarbu Conservation Park. In total, a contiguous area of 15,650 square kilometres (km^2) of reserves will be created from these SEB areas (Aus 82bi, 82biv, 82c).
  - Development strategies for SEB areas incorporate good land management practices such as weed management and erosion control, and also contribute to the protection and recovery of biodiversity, including 21 listed fauna and 18 listed flora species (Aus 82bi, 82d), through targeted actions (Aus 82j).These actions include the fencing of reserves and removal of cattle and pest animals, the closure and rehabilitation of stock watering points, and the designation of tracks and parking bays to minimise disturbance and aid rehabilitation (Aus 82bii, 82biii).
  - The selected offset areas include heritage sites at the Curdimurka Railway Siding contributing to the management and protection of cultural heritage (Aus 82e, 82h).
  - In accordance with the Native Vegetation Management Plan approved by the South Australian Government, each SEB area is placed under a Heritage Agreement with the South Australian Government, legally securing the obligation to conserve and manage native flora and fauna in these areas in perpetuity (Aus 82i).
- A 500 metre (m) buffer is maintained between the mining (RSF) and processing operations and the existing footprint of **Arid Recovery** (DEIS 9.7.2).
- Topsoil progressively stripped from the backfill limestone quarry is stockpiled in readiness for rehabilitation, and ripped and seeded where required to minimise wind erosion.
- ODC continues to provide funding, land and other in-kind support for the **Arid Recovery** Project. This includes scientific, managerial and professional support by ODC (DEIS 15.3.10) and research support (SEIS 32.2.1) (Aus 82f).
- ODC provides support to the Spencer Gulf Ecosystem and Development Initiative. This initiative is a collaboration between industry investors and the University of Adelaide, with the South Australian Research Development Institute and Marine Innovation South Australia as partners. The objective of this initiative is to develop programs that provide all stakeholders with access to independent and credible information about the Spencer Gulf (Aus 82g).
- Threatened flora and fauna habitats are avoided where ever possible. All threatened species habitats are mapped and these areas are avoided wherever possible. If these areas cannot

be avoided, targeted surveys are undertaken to determine whether threatened species are present. If threatened species are found to be present and cannot be avoided, they are relocated. When appropriate, EIHCP permit conditions include the identification and flagging of 'no go' areas prior to disturbance (DEIS 15.5.4) (State 6, 7). Where **listed species** cannot be avoided, the justification for their removal is documented (Aus 29a; State 17g).

- Standard engineering practices are applied to control erosion in areas with low and moderate erosion potential as defined in the Olympic Dam Expansion Draft Environmental Impact Statement 2009 (DEIS). In areas of high and very high erosion potential additional measures are applied as part of an ESCP as either a stand-alone document or as part of the Construction Environmental Management Plan. The ESCP is developed before disturbance works begin (DEIS 10.5.1; SEIS 6.2.1, 10.1). Monitoring of disturbed areas and erosion control structures (if installed) occur during construction activities, particularly after high rainfall and wind events, and continue after construction until the disturbed areas are stabilised (DEIS 10.5.1; SEIS 10.1). Clearing of vegetation will not exceed the total area of 17,269 ha as indicated in the **EIS** (State 4). Any disturbance activities outside those assessed in the native vegetation management plan(s) are to gain the appropriate regulatory approvals (State 4, 17g).
- The scope change for the Olympic Dam Project announced in August 2012 has led ODC to undertake a review of potential impacts to the environment resulting from the change. A number of activities have been identified for consideration to address potential impacts identified in this review. Actions have been incorporated into the site Rehabilitation Strategy.

1.1.13 Contingency options

- Rehabilitate land as soon as practicable following any unplanned disturbance.
- Increase the area under the SEB in the event of clearing beyond that described in the **EIS**.

1.1.14 Continuous improvement / development opportunities

Limited management of short-term surface rehabilitation has occurred on site due to the small areas involved, planned areas for expansion of the operations, and the low level of risk associated with these areas. A Rehabilitation Strategy was developed to address the rehabilitation requirements of short-term surface disturbance permitted under the Olympic Dam EIHCP System, including backfill areas, sand acquisition facilities, exploration areas, temporary storage facilities, temporary access routes and maintenance facilities.

- Opportunity: Implement actions and research as identified in the Olympic Dam Rehabilitation Strategy.

The Olympic Dam Mine Closure and Rehabilitation Plan was reviewed in 2013. Risk workshops have been conducted annually using BHP Billiton's Risk Management methodology to evaluate the closure risks for all operational areas, and the accounting provision for closure is recalculated each year.

- Opportunity: Clarify closure risks and assumptions identified in the Olympic Dam Mine Closure and Rehabilitation Plan.

ODC has accrued an SEB debt through the development of residential, industrial and infrastructure areas. An interim Native Vegetation Management Plan (NVMP) has been developed and approved for a substantial area inclusive of the Gosse Springs complex as an SEB offset area. Management of the offset area and calculation of SEB debt / credit is required as part of future operations.

- Opportunity: Implement actions as identified in the delivery plan for the management of the Gosse Springs SEB offset area and establish a new SEB to offset the proposed clearance for the Olympic Dam expansion.

1.1.15 Action plan FY14

- Implement FY14 actions identified in the site Rehabilitation Strategy.
- Review closure risks and assumptions through annual workshop.
- Implement a delivery plan for the management of the Gosse Springs SEB offset area.

1.1.16 Target FY14

- Implement an SEB offsets plan (Document No. 111271) to compensate for the clearance of vegetation and other **environmental impacts** occurring during the life of the mine, providing

an offset of at least 8 ha of vegetation for every hectare cleared by the end of the project (2052), (Aus 82a).

ID 1.2 SPREAD OF PEST PLANTS AND ANIMALS

1.2.1 Responsibility

- Head of HSEC
- Manager Environment
- General Manager – Mining

1.2.2 Scope (State 17a)

Pest plant and animal species cause a range of environmental and economic impacts throughout Australia and across a spectrum of industries. While many pest species may be present in an area prior to development, the numbers may increase or new species may be introduced as a result of the operation at Olympic Dam. Factors that may lead to this are ground disturbance, movement of vehicles, the operation of waste facilities and the provision of water or other resources. The level of control required for a particular species correlates to the level of environmental and / or economic risk that the species may cause, and the likelihood that control options will be effective.

The scope of this document covers the existing mining and processing works conducted at Olympic Dam, and construction and pre-mining activities relevant to the Expansion, on the **Special Mining Lease** (SML), at Roxby Downs, the Port Augusta pre-assembly yard (if used) and along existing infrastructure corridors.

1.2.3 Management strategy

Management of pest plant and animal species is achieved by implementing strategies aimed at reducing the risk of spread, monitoring the abundance of pest species and through targeted control programs for species considered to be high risk.

Management strategies for pest plants and animals include:

- Implementing controls to prevent the introduction and / or spread of declared weed species;
- Implementing controls for priority weed species where there is a likelihood of success;
- Controlling feral animal species around project infrastructure and landfill sites;
- Monitoring pest plant and animal species to determine the effectiveness of controls and the need for additional control actions.

To promote the effective management of pest plants and animals, control actions are typically undertaken on a local and regional scale and as such, control programs are conducted by ODC in collaboration with the Roxby Council, **Arid Recovery**, government bodies and other relevant local land owners and organisations.

1.2.4 Key legal and other requirements

- **Ratification Act** and the **Indenture** (or as amended by the **Amendment Act** and the **Amended Indenture**)
- **EPBC Act Approval Conditions**
- **Major Development Approval Conditions**
- *Natural Resources Management Act 2004* (SA) (NRM Act)
- *Pastoral Land Management and Conservation Act 1989* (SA)
- 'Australian Weeds Strategy – A national strategy for weed management in Australia' published by the Natural Resource Management Ministerial Council (Cth) in 2007
- Kingoonya NRM District Weed Strategy 2010 (SA)
- *Public and Environmental Health Act 1987* (SA)

1.2.5 Values

- Diversity of ecological communities.
- Current and future land uses.

1.2.6 Key risks

- Spread or local introduction of declared pest plant species.
- Spread or local introduction of pest animals.

1.2.7 Environmental outcome (State 17b)

- No significant increase in the areas of infestation or abundance of declared pest plants, plant pathogens or pest animal populations (Aus 29b).

1.2.8 Compliance criteria (State 17c, 17kiii)

- No significant increase (relative to control locations remote to and / or prior to operations) in abundance of pest animals (cats and foxes) on the SML that can be attributed to ODC's activities.
- No significant increase (relative to control locations remote to and / or prior to operations) in abundance or infestation area of declared pest plants and plant pathogens that can be attributed to ODC's activities within the SML and GAB wellfields area.

NOTE: A significant increase is defined as the introduction of a new self sustaining population of a species, which has not previously been recorded in operational areas, or a 100 per cent increase above the 12 month rolling average in the abundance or known infestation area.

1.2.9 Leading indicators (State 17d)

- None applicable.

1.2.10 Management plan(s)

- Weed Management Strategy (2010), Document No. ENV-TR-038:
  - Weed control is conducted for declared and priority species on a regular basis;
  - Incorporation of the expanded operation prior to component construction (DEIS 15.5.11; SEIS 16.3);
  - Regular meetings are held with relevant land managers representing ODC, **Arid Recovery**, the Andamooka Progress and Opal Miners Association and the Roxby Council to co-ordinate a holistic approach to the management of priority species.

1.2.11 Monitoring program(s)

- Flora Monitoring Program, Document No. 2664:
  - The current distribution of extreme risk and high risk weeds species is determined through periodic monitoring of sites (every 18 months) and seasonal routine monitoring of known high risk habitats;
  - Construction sites are surveyed prior to construction activities, 12 months after the completion of works and/or after significant rains;
  - Should a material increase in the abundance of invasive species be detected during post-construction monitoring surveys, control measures are implemented in consultation with respective NRM Boards;
- Fauna Monitoring Program, Document No. 2663:
  - Animal track transects, are conducted every three months to monitor the presence of kangaroos, rabbits, cats and foxes;
  - Opportunistic feral animal control programs are currently undertaken by ODC in the Olympic Dam region;
  - The results of monitoring and management activities are publicly reported in the annual Environmental Management and Monitoring Report.

1.2.12 Controls and management actions

- Declared pest plant species are controlled in accordance with the *NRM Act 2004*.
- A collaborative weed management strategy is maintained between the key regional land managers, including ODC, **Arid Recovery**, Roxby Council and the Andamooka Progress and

Opal Miners Association, in consultation with relevant NRM Boards (State 17g) (DEIS 15.5.11, 15.6; SEIS 16.7, 29.4).

- An Environmental / Indigenous Heritage Clearance Permit (EIHCP), Document No. 512, is required before undertaking any construction activities (State 17g):
  - Field surveys for final infrastructure locations are undertaken to determine the presence / absence of declared and priority weed species.
  - During the EIHCP process the Weed Management Database is cross referenced for known pest plant locations.
  - EIHCP procedure details controls for the spread of soil in known areas of weed infestation.
  - Vehicle hygiene practices are conditional to all land disturbance activities in areas of known weeds.
  - Disturbance caused by construction and operational activities is minimised wherever practicable.
  - Vehicles are restricted to designated tracks to minimise ground disturbance and spread of weeds.
- An equipment hygiene policy is applied to earth moving equipment brought to site and vehicle and plant washdown facilities are provided at operational areas for the expanded Olympic Dam and at the Port Augusta pre-assembly yard (when in use) (State 17g, 112).
- Opportunistic trapping is conducted in areas that targeted feral animal species are known to frequent (State 17g).
- Collaborate with Roxby Council to support the management of feral cats and dogs in the township (DEIS 15.5.11; SEIS 16.3).

1.2.13 Contingency options

- Implement a dedicated eradication plan for declared species in accordance with the NRM Act requirements.

1.2.14 Continuous improvement / development opportunities

Considerable work has been undertaken to formalise weed monitoring and management at Olympic Dam, including the development of the Weed Risk Assessment (2007) and Weed Management Strategy (2010).

- Opportunity: Continue to undertake a regional approach to weed management through the coordination of biennial meetings with relevant land owners and logistical or financial support where required.
- Opportunity: Develop a regional database, in collaboration with the wider SAAL NRM, to record areas of known weed infestations and management actions.

Innocent Weed (*Cenchrus longispinus*) is a Category 2 declared plant species under the NRM Act that is present on ODC owned land within the Roxby Downs township. Various provisions of the NRM Act apply to this species.

- Opportunity: Continue to destroy and control all outbreaks of Innocent Weed on BHP Billiton land with a plan to eradicate.
- Opportunity: Implement highest standard of vehicle hygiene in collaboration with the SAAL NRM Board where development is planned in known Innocent Weed infestation locations.

During the Weed Risk Assessment (2007), Buffel Grass was identified as a priority weed species within the Roxby Downs and Andamooka region. It is also a recognised environmental weed of northern Australia.

- Opportunity: Continue to progress control of Buffel Grass within the expanded SML and Roxby Downs Municipality through ongoing control in the weeks following rain.
- Opportunity: Actively engage with SAAL NRM and implement actions from their draft Buffel Grass Management Strategy (2007) and the draft State Buffel Grass Strategy (2012 to 2017) where appropriate.

Ongoing education of BHP Billiton employees and residents of the local Roxby Downs community is important to improve understanding of pest plants and animals and their associated impacts in the region.

- Opportunity: Continue to improve community knowledge about the impacts of pest plants and animals in the Roxby Downs region.

1.2.15 Action plan FY14

- Continue to monitor and control all known Innocent Weed infestations. Address any new infestations as required.
- Continue to progress control of Buffel Grass within the SML and Roxby Downs Municipality.
- Continue to improve community knowledge of local pest plant and animal species.

1.2.16 Target FY14

- None applicable

ID 1.3 AQUIFER LEVEL DRAWDOWN

1.3.1 Responsibility

- Head of HSEC
- Manager Environment
- General Manager – Mining
- Senior Manager – Non Process Infrastructure
- Head of Resource Planning and Development

1.3.2 Scope (Aus 5a; State 17a)

The water supply for the current Olympic Dam operation and the Roxby Downs township is sourced from two wellfields (Wellfields A and B) located on the south-western edge of the Great Artesian Basin (GAB). A number of pastoral properties in the wellfields area also rely on artesian pressure to distribute water along extensive private water supply piping networks and to maintain artificial wetlands.

Olympic Dam groundwater extraction is currently approximately 5 megalitres per day (ML/d) from Wellfield A and 27 ML/d from Wellfield B. Total groundwater abstraction, including pastoral abstraction, within the vicinity of the Olympic Dam wellfields is approximately 47 ML/d. The Far North Prescribed Wells Area Water Allocation Plan anticipates long term demand for mining as 120 ML/d in the South Australian GAB .

Groundwater modelling of the areas of the GAB that include the Olympic Dam **Special Water Licences** predicts that Olympic Dam abstractions are mainly sourced from storage and induced through-flow from the north. Both are reversible processes, as predicted by modelled recovery (following cessation of mining) of drawdown to the north and south-east of Wellfield B. At forecast abstraction rates, drawdown at Wellfield A will remain similar to current observed drawdown.

Abstraction of water from the GAB locally reduces artesian pressure around the points of abstraction and in some circumstances has the potential to affect environmental flows to artesian springs. Reduction of artesian pressure may also lead to changes in the quality of water flowing from springs. The communities of native species dependent on GAB springs are listed as endangered under the EPBC Act.

Water recovered from dewatering and depressurisation activities for the future open pit will be recycled and reused. A supplementary water supply, primarily for dust suppression, will also be sourced from a primary saline wellfield (Motherwell) in the Andamooka Limestone, around 30 km north of Olympic Dam, and from various satellite wellfields within and close to the SML. Total groundwater extraction is expected to be up to 15 ML/d from the Tent Hill aquifer and up to 18 ML/d from the Andamooka Limestone aquifer.

Groundwater modelling of the Stuart Shelf undertaken for the expansion (the regional groundwater model) shows that dewatering and depressurisation of the open pit and extraction of groundwater for water supply would result in an overall loss of groundwater from the system and drawdown in the Andamooka Limestone and Tent Hill aquifers.

The effects of changes in groundwater levels will be most prominent south of Olympic Dam because groundwater flowing from the Arckaringa Basin (across the northern part of the Stuart Shelf) acts as a buffer between Olympic Dam and groundwater systems to the north. Groundwater drawdown would not affect the northern boundary of the Stuart Shelf and there would be no impact on the artesian aquifers of the GAB and the corresponding springs. Monitoring in the vicinity of Yarra Wurta Springs will be carried out, although any impact is considered unlikely during the life of operation of the open pit.

No residual impact to third-party groundwater users is expected in the Stuart Shelf area.

1.3.3 Management strategy (Aus 5biv, 5k; State 17g)

Aquifer drawdown potentially affects both the GAB and the Stuart Shelf. These two areas have different characteristics, and a different management approach is applied to each.

1.3.3.1 Great Artesian Basin

Within the GAB wellfield areas, the management strategy is focussed on the protection of GAB springs through preservation of artesian pressures and flows, protection of the water resource by maintaining overall sustainability, and the management of impacts to third parties. This is primarily achieved through the monitoring, modelling and management of drawdown.

The **Indenture** provides for the designation of an area for each special water license under the **Indenture**. These designated areas serve several purposes, including:

- ODC has monitoring obligations in relation to the designated area, including water pressures and levels
- ODC is afforded certain rights in relation to water abstraction and certain inconsistent land uses are restricted within the designated areas
- Wells within the designated areas must be prescribed and water resources within the areas are afforded certain protections
- Affects third party users rights to water.

The **Indenture** does not specify specific or require any specific drawdown limits in relation to the designated areas. However, under clauses 13(8)(c)(ii) and 13(8)(c)(iv) of the **Indenture** the Water Minister may restrict abstraction from a designated area where the continued abstraction of water will be detrimental to the water resource, there is a reasonable possibility of a complete or partial failure of the water supply from the resource, or an emergency situation exists.

The **Amended Indenture** includes new provisions (Clause 13(8A)) in relation to abstraction of water from the GAB. To ensure the sustainability of the GAB, the provisions of clause 13(8A) are adopted by this EM Program until the **Amended Indenture** comes into effect or the deed to introduce the **Amended Indenture** ceases to have effect.

The monitoring and assessment of wellfield performance reflects the management strategy by using a multi layered approach to protect the key values:

- The use of specific drawdown criteria in the south where springs may potentially be impacted.
- The measurement of a drawdown footprint area for wellfield B. The extent and rate of change of the footprint provides a measure of resource sustainability and impact to third parties, and provides an additional indicator to potential spring impacts.
- Leading indicators to the drawdown limits and drawdown footprint that prompt action before any limits are reached.

The quantification of the magnitude of drawdown is achieved through an extensive monitoring network, and through regular flow measurement and ecological surveys of GAB springs. In the event that monitoring indicated that a potential risk may be realised, a contingency plan specifies the measures that may be taken.

1.3.3.2 Stuart Shelf

Groundwater modelling of the Stuart Shelf shows that broad regional changes to groundwater level would mostly occur post-closure due to the flow of groundwater into the future open pit. No impacts are expected to either third-party users or the nearest obligate groundwater-dependent ecosystem, Yarra Wurta Springs, during the operating period of the mine. However, as with the GAB, the management of drawdown is achieved through monitoring of groundwater levels and spring parameters. Similarly, contingency measures may be adopted should monitoring indicate that impacts are greater than expected.

1.3.4 Key legal and other requirements

- **Ratification Act** and the **Indenture** (or as amended by the **Amendment Act** and the **Amended Indenture**)
- **EPBC Act Approval Conditions**
- **Major Development Approval Conditions**
- **Special Water Licence**
- **Special Water Licence** No. 2

- **Environment Protection Act** 1993

1.3.5 Values

- Water resources of the GAB and Stuart Shelf.
- GAB spring-dependent **listed species or ecological communities**.
- Lake Torrens saline spring communities (e.g. Yarra Wurta Springs).

1.3.6 Key risks

- Potential impacts to third-parties on the Stuart Shelf from excessive drawdown.
- Impacts to GAB spring-dependent **listed species or ecological communities**.
- Excessive drawdown of potentiometric heads at Yarra Wurta Springs.

1.3.7 Environmental outcome (State 17b)

- No significant adverse impacts to existing third-party users' right to access water from within the GAB wellfield **Designated Areas** for the proper development or management of the existing use of the lands as a result of ODC activities.
- No significant adverse impacts to the availability and quality of groundwater to existing Stuart Shelf third-party users as a result of groundwater drawdown associated with ODC activities.
- No significant adverse impact on groundwater-dependent **listed species or ecological communities** as a result of groundwater drawdown associated with ODC activities (Aus 5c, 22a, 22b, 27).

1.3.8 Compliance criteria (State 17c, 17kiii)

- A 4 m drawdown limit at the point on the **designated area** for Wellfield A that is mid-way between GAB8 and HH2 based on the 12-month moving average (Aus 5d, 24a, 28a).
- A 4 m drawdown limit for Wellfield B at the point between monitoring bores S1 and S2 (measured as the average drawdown of the two bores) and based on the 12-month moving average (Aus 5d, 24a, 28a).
- A drawdown footprint for Wellfield B, measured as the area contained within the 10 m drawdown contour, that is less than or equal to 4,450 km^2 (Aus 5d, 24a, 28a).
- No significant decline in groundwater flow rate to Yarra Wurta Springs due to the operation of the Motherwell wellfield (Aus 5d, 24b).

Note: Significant decline is defined as a decline in flow that would lead to a failure of the groundwater-dependent ecosystems.

- No material change in the availability and quality of groundwater at existing bores in the Stuart Shelf area operated by third-party users.

1.3.9 Leading indicators (State 17d)

- A drawdown trend at monitoring bore S1 that may exceed 4.5 m in the next 12 months.
- A drawdown footprint for Wellfield B, measured as the area contained within the 10 m drawdown contour that is greater than 4,000 km^2.
- A combination of the following factors that can be attributed to water extraction from Wellfields A and B:
    - Evidence that flow reductions at GAB springs in the vicinity of the wellfields may exceed the predictions made in the Olympic Dam Environmental Impact Statements of 1982 and 1997;
    - Evidence of water quality change (measured as pH or conductivity) at GAB springs.
- A continuing drawdown trend at GAB pastoral bores that may exceed the predictions of the Olympic Dam Environmental Impact Statement of 1997.
- A declining trend in groundwater flow rates at Yarra Wurta Springs that may lead to significant adverse impacts to groundwater-dependent ecosystems.

- A drawdown trend or changes in groundwater quality in the Stuart Shelf area that may impact on existing third-party users.

1.3.10 Management plan(s)

- None applicable.

1.3.11 Monitoring program(s)

- Groundwater and Surface Water Monitoring Program, Document No. 2791 (State 28):
  - groundwater abstraction and injection volumes, and pit dewatering rates, for comparison with groundwater levels;
  - groundwater levels across the monitoring bore network;
  - flow rates at Yarra Wurta Springs.
- Great Artesian Basin (GAB) Monitoring Program, Document No. 2789 (Aus 28b; State 28):
  - abstraction volumes, groundwater levels and artesian pressures;
  - GAB spring flow rates.

1.3.12 Controls and management actions (Aus 5biv, 5k; State 17g)

- A regional GAB groundwater flow model is used to predict the outcomes of various management options that may be applied to the GAB wellfields and third-party activities. Application of these options to minimise drawdown impacts.
- The Stuart Shelf regional groundwater model, used to predict regional groundwater drawdown, is reviewed and updated every three years (Aus 23a; State 26).
- Water use budgets are maintained for all major sections of the operation, and an active water efficiency program is in place to drive water savings across site.
- Water use efficiency is reported throughout the operation.
- ODC owned pastoral properties are managed to conserve water, including flow reductions of large flowing bores to reduce GAB abstraction.

1.3.13 Contingency options (Aus 5biv, 5k; State 17g)

- In accordance with a condition of the December 1997 assessment report (Assessment of the Environmental Impact Statement for the proposed expansion of the Olympic Dam Operations at Roxby Downs) the Wellfield Contingency Plan (Document No. ODENV034) for the existing GAB Wellfields (Aus 28c):
  - defines the action triggers that initiate management action;
  - provides the response plan, including communication to identified stakeholders;
  - explains remediation options.
- If monitoring shows that drawdown is affecting current Stuart Shelf third-party users, alternative water supply options will be investigated. These may include relocating or deepening existing groundwater wells, or providing an alternative water supply. Options will be considered in consultation with the third-party user (DEIS 12.6.3) (State 27).

1.3.14 Continuous improvement / development opportunities

Within the GAB, pastoral abstraction may influence the reported drawdown. The elimination of pastoral flow at Jackboot Bore has resulted in drastically reduced drawdown, previously incorrectly attributed to Wellfield B operations. Some of the declining trends observed in current reported drawdown at D2 and Tarkanina 2 may also be influenced by antecedent pastoral flow and temperature effects.

- Opportunity: Eliminate or minimise the influence of pastoral flow on reported drawdown.

Within the deeper GAB the combination of high temperatures (> 60°C) and the depth of the aquifer (north of Wellfield B > 700 m) makes the monitoring of GAB groundwater heads challenging. Opportunities exist for improving the quality of data collected and the accuracy of interpreted drawdown by reviewing the methods used for measurements and the way drawdown is calculated.

- Opportunity: Establish Practical Reference Heads (PRHs) for GAB monitoring bores where possible.

Protection of GAB resource sustainability to the north of Wellfield B relies on an accurate estimate of the drawdown footprint area of Wellfield B. This in turn is facilitated by the availability of reliable drawdown values from monitoring wells and the contouring and calculation of the drawdown footprint area. Georgia Bore, currently the most northerly monitored well in the central-north part of the wellfield, is a pastoral well. Poonarunna (White Bull) bore, approximately 90 km further north, is currently unsuitable for monitoring. An additional dedicated monitoring well between the two could provide valuable data, but the area is very remote with very difficult access.

- Opportunity: Investigate the need and possibility for future establishment of a well in the area between Georgia and Poonarunna.

The new assessment of wellfield performance is based on a whole of wellfield approach with specific drawdown criteria near springs. This provides an opportunity to review the monitoring of drawdown around Wellfield B, especially the frequency of monitoring at each site.

- Opportunity: Review the monitoring of drawdown around Wellfield B.

The use of alternative water sources and implementation of water conservation initiatives can help minimise aquifer pressure reduction caused by abstraction from the GAB.

- Opportunity: Investigate opportunities for end users to change to non-GAB water sources around site.

As a result of comprehensive hydrogeological investigations an improved regional (Stuart Shelf) groundwater model was presented in the **EIS** and used to predict regional groundwater drawdowns. Subsequent improvements to the understanding of hydrogeology and therefore improving model performance will be incremental, similar to the process BHP Billiton experienced through 20+ years of investigations and model improvements in the GAB. The methods listed for the groundwater investigation programme for the Stuart Shelf, Torrens Hinge Zone and Yarra Wurta Springs are therefore preliminary and will need to be reviewed and amended as more data and information become available.

An improved understanding of regional hydrogeology and hydrogeological parameters can be used to update the model and better understand the impacts on the groundwater system resulting from the Motherwell wellfield and open pit void. A better understanding will lead to more certainty in understanding the impacts and the sensitivities of those to changes in various input variables.

The groundwater investigation programme will be completed within three years of the variation date (as defined in the **Amendment Act).**

- Opportunity: Conduct a workshop, involving appropriate expertise, and develop further the work program to confirm conceptual understanding of the hydrogeology of the Torrens Hinge Zone and Stuart Shelf, and to improve understanding of Yarra Wurta Springs.
- Opportunity: Further enhance the groundwater simulation model and understanding of the regional hydrogeological and hydrological regime (Aus 23a; State 26):
    - The regional Stuart Shelf groundwater model, as presented in the EIS and used to predict regional groundwater drawdowns, is reviewed and updated every three years, taking into account data collected through the Groundwater Monitoring Program. These data will include, but will not be limited to, groundwater abstraction, managed aquifer recharge, and groundwater level and quality.
    - The review will be undertaken by an independent expert and in accordance with the Murray Darling Basin Commission groundwater flow modelling guideline (2000, or as amended), or alternative guidelines specified in writing by the Federal Environment Minister.
    - The updated model will include new data collected as a result of the supplementary investigations aimed at improved hydrogeological understanding of the flow system, aquifer parameterisation and inputs/outputs from the system when they become available. The focus of improving the hydrogeological understanding will be on three areas: Yarra Wurta Springs, the Torrens Hinge Zone and Stuart Shelf.
- Opportunity: Improve the understanding of hydrogeology and ecology of Yarra Wurta Springs. (Aus 23b)

- Understanding of the water source(s) that support Yarra Wurta Springs. Methods will include hydrogeological mapping, cross-sections, spring flow and quality monitoring, groundwater level and quality monitoring, and numerical modelling. Methods may also include hydrograph analysis, drilling new bores including nested piezometers, appropriate geophysical surveys, hydrogeochemical studies, wetland area monitoring as well as workshops with invited experts to determine the most appropriate and cost effective tools to be used.
- Determine the significance that potential declines in groundwater levels in the Andamooka Limestone (ALA) may have on the springs. Methods may include analysis of selected groundwater heads/drawdown, hydrogeological cross-sections and modelling.
- Further developing understanding of the way in which Lake Torrens aquifers interact with the ALA. The main tool to achieve this is envisaged to be numerical modelling. Drilling and construction of new exploration bores may also be required.
- Further develop an understanding of the structural controls that exist between the springs and the open pit. Methods may include analysis of selected groundwater heads/drawdown, appropriate geophysical investigations and modelling.

- Opportunity: improve the understanding of the hydrogeology of the Torrens Hinge Zone (THZ). (Aus 23c; State 26a, 26b)
  - Confirm the existence of a groundwater divide interpreted in the **EIS**. The main tools are envisaged to be hydrogeological mapping and cross-sections, the analysis of hydrochemical and geophysical data, and the analysis of monitoring of selected Stuart Shelf, THZ and GAB bores. Drilling and the installation of monitoring bores may also be required.
  - Determine the aquifer parameters for the THZ. The main methods planned are data analysis, drilling and aquifer testing.
- Opportunity: Improve the understanding of the Stuart Shelf hydrogeology. (Aus 23d; State 26c, 26d)
  - Undertaking studies focused on throughflow (from the Arckaringa Basin) and rainfall recharge mechanisms for the Stuart Shelf, in particular that part over which the Andamooka Limestone extends. Methods for through-flow analysis may include analysis of selected groundwater heads using maps and hydrogeological cross-sections and modelling. For rainfall recharge, water balance studies, hydrograph analysis, modelling and hydrochemical methods are the most likely to be used.
  - Improve understanding of the impacts to the regional groundwater system resulting from the open pit void. The main tool to achieve this is envisaged to be numerical modelling.

The Yarra Wurta Spring complex is a groundwater-dependent ecosystem located about 45 km north-east of Olympic Dam. Groundwater drawdown associated with the expansion of Olympic Dam is not expected to impact the springs, however monitoring will be conducted at the spring to confirm there is no loss to its **environmental value**.

- Opportunity: Develop appropriate bioindicators for a future ecological monitoring program at Yarra Wurta Springs.

1.3.15 Action plan FY14

- Complete a review of Wellfield B drawdown monitoring.
- Continue work on establishing Practical Reference Heads (PRHs).
- Continue implementation of water use conservation and recycling initiatives.
- Continue substitution of saline water for high quality water where possible.

1.3.16 Target FY14

- Maintain an industrial water efficiency of 1.18 kL/t at the budgeted production rate.
- Maintain a domestic water use target of 3.2 ML/day average

ID 2 STORAGE, TRANSPORT AND HANDLING OF HAZARDOUS MATERIALS

ID 2.1 CHEMICAL / HYDROCARBON SPILLS

2.1.1 Responsibility

- Head of HSEC
- Manager Environment
- Head of Production

2.1.2 Scope (Aus 5a; State 17a)

ODC handles a variety of chemicals and hydrocarbons for use within the operation.

Chemicals used include acids, xanthates, flocculants, sodium chlorate, sodium cyanide, ammonia and calcium hydroxide. Hydrocarbons are used as fuel in vehicles, mobile equipment, furnaces and boilers and to manufacture explosives for use underground and in the open pit.

Primary, secondary and tertiary containment systems (tanks, bunds and on-site drainage collection ponds) exist to minimise the risk of spills entering the environment beyond the boundaries of the operation. Spillage of chemicals and hydrocarbons during transport, from storage facilities or underground fuel lines can lead to the pollution of soils, contamination of groundwater, and impacts on ecosystems.

This document consolidates the relevant information and ODC's commitments that are in place to manage chemical and hydrocarbon spills associated with both the existing Olympic Dam operation and the expansion.

2.1.3 Management strategy (Aus 5bii, 5k)

Management of hazardous materials spillage is achieved by:

- transporting hydrocarbons and chemicals to site in accordance with the requirements of the Australian Dangerous Goods Code;
- maintaining the integrity of pipelines and equipment through planned maintenance and design features for new infrastructure.

New installations or modifications to existing chemical and hydrocarbon facilities are planned and constructed in accordance with relevant EPA guidelines such as the EPA Guidelines – Bunding and Spill Management (2007) (EPA 1301.330-168). Bund inspections and audits are conducted to review compliance and ensure maintenance programs are in place and effective.

2.1.4 Key legal and other requirements

- **Ratification Act** and the **Indenture** (or as amended by the **Amendment Act** and the **Amended Indenture**)
- **EPBC Act Approval Conditions**
- **Major Development Approval Conditions**
- ***Environment Protection Act*** *1993*
- *Environmental Protection (Water Quality) Policy 2003*
- Australian Dangerous Goods Code (7th Edition)
- EPA Guideline – Bunding and Spill Management 2007
- National Environmental Protection (Assessment of Site Contamination) Measure 1999
- **EPA Licence 1301**
- *Explosives Act 1936* (SA)
- *Dangerous Substances Act 1979* (SA)
- Dangerous Substances Regulations 2002 (SA)
- *Mines and Works Inspection Act 1920* (SA)

- GLD.009 Environment – 2: Hydrocarbon Management

2.1.5 Values

- Human health and amenity.
- Quality of soil and water resources.
- Diversity of ecological communities.

2.1.6 Key risks

- Adverse impacts to human health.
- Contamination of soil, surface water or groundwater.
- Loss and / or displacement of ecological communities.

2.1.7 Environmental outcome (State 17b)

- No significant site contamination of soils, surface water or groundwater, as a result of the transport, storage or handling of hazardous substances associated with ODC's activities (Aus 5c, 16).

2.1.8 Compliance criteria (State 17c, 17kiii)

- No site contamination leading to **material environmental harm** arising from hydrocarbon/chemicals spills within the SML and Wellfields **Designated Areas** (Aus 5d, 16).

Note: Measurement and monitoring is carried out in response to a specific event and in accordance with the NEPM 1999 or EPP 2003, as appropriate. (State 17ki, 17kii, 17kiv)

2.1.9 Leading indicators (State 17d)

- Soil concentrations above NEPM investigation levels (Health Investigation Levels (HILs) for Commercial/Industrial uses (Scenario F) for metals/metalloids, organics and other substances) that indicate a likelihood of adverse effects on human health values based on a meaningful and appropriate site-specific health risk assessment (Aus 5e, 17).

2.1.10 Management plan(s)

- Spill Management Plans exist for different areas of the operation.
- Hazardous Materials Management, Document No. 100614:
  - defines requirements for training, equipment and systems to be designed to protect personnel (employees, contractors and visitors involved in controlled activities) from exposure to hazardous materials (DEIS 22.6.8);
  - outlines requirements for operations, storage and maintenance of hazardous materials to avoid and contain hazardous material spills (DEIS 22.6.8).

2.1.11 Monitoring program(s)

- Groundwater Monitoring Program, Document No. 2791:
  - routine groundwater quality monitoring around the operations.

2.1.12 Controls and management actions (Aus 5bii, 5k; State 17g, 24)

- Fuel lines supplying hydrocarbons are located above ground in shielded racks to prevent deterioration of pipes and to enable rapid identification of leaks. There are some pipelines located underground in nylon coated steel pipes.
- All new hydrocarbon storage tanks and distribution lines are located above ground except in some instances where lines go underground at road crossings etc. In these cases controls for leakage detection or containment will be installed (EPA 1301.330-168).
- All hazardous and dangerous substances storage areas are designed to ensure that substances are stored in bunded and sealed compounds or areas capable of preventing the escape of material into the soil, surface waters or groundwater resources (State 24). The EPA Guidelines are used for all new installations, which require bund sizes to be 120 per cent of

the net capacity of the largest tank within the bund (or the sum of the capacity of any interconnected tanks) or 133 per cent for flammable liquids) (EPA 1301.330-168).

- Stormwater retention ponds that constitute a component of the tertiary containment system for chemical spills are designed and constructed to prevent the escape of material into the soil, surface waters or groundwater (State 25).
- Trucks are washed at facilities with a wastewater collection system (EPA 1301.34-39).
- Regular area environmental inspections are undertaken to ensure facilities comply with EPA Guidelines.
- Major chemical storages are routinely integrity tested.
- Where reasonably practicable, hazardous materials are substituted with non-toxic or less toxic substances.
- Restricted access to some chemical storage areas such as the supply and reagents yards.
- Citect process alarm systems and level indicators are installed on most tanks, including CAF Plant silos, to prevent overflow (EPA 1301. 34-71).
- Preventative maintenance plans are in place to ensure plant and equipment is in good condition.
- Hazardous materials management procedures and standards outlining the systems in place to effectively manage these materials.
- A procedure for Environmental Incident Reporting documents the process for managing and reporting spills.
- A company-wide system for incident reporting and tracking allows fast and comprehensive analysis of performance.
- Relevant senior management personnel have personal KPIs for improving the performance of spill management. Regular environment updates which include spill performance are emailed to relevant personnel. Regular updates on spill performance are presented to site management. Annual reports also include discussion on spill performance.
- Regular audits of hydrocarbon and chemical transport contractors.
- All new plant is designed to meet the appropriate legislation and standards as a minimum (e.g. AS 1940). HAZOP studies are undertaken prior to construction to identify the potential for spills and the likelihood of spillages and operating procedures are developed for use by plant personnel. (SEIS 11.1.2, 11.4.3)

2.1.13 Contingency options (Aus 5bii)

- A site Emergency Response Team with Emergency Service Officers (ESOs) and procedures is in place to attend emergency situations related to spills.
- Assess for the presence of site contamination resulting from spills in accordance with the *National Environment Protection (Assessment of Site Contamination) Measure 1999* (or as amended) (Scenario F – Commercial and industrial).
- Remediate site contamination found to be present in accordance with the requirements of the ***Environmental Protection Act*** *1993.*

2.1.14 Continuous improvement / development opportunities

An audit of all existing bunds has been undertaken to determine compliance against the EPA Guidelines. An action plan has been developed as a result.

- Opportunity: Progress action plan to close gaps with regard to existing bunds to ensure the requirements of the EPA Guidelines are met.

All stormwater retention ponds that are designed to constitute a component of a tertiary containment system for chemical spills should be designed and constructed to prevent the escape of material into the soil, surface waters or underground water resources.

- Opportunity: Identify any gaps and, if necessary, develop an action plan to ensure existing stormwater retention ponds are constructed to prevent the escape of material into the soil, surface waters or groundwater.

Trucks should be washed at facilities with a wastewater collection system to prevent the escape of material into the soil, surface waters or underground water resources.

- Opportunity: Identify any gaps and, if necessary, develop an action plan to ensure existing truck wash facilities have wastewater collection systems.

Regular environmental inspections allow issues to be identified and resolved early and promote continuous environmental improvement. Operational personnel undertake regular inspections; however inspections by environment personnel have previously been undertaken on an ad hoc basis.

- Opportunity: Undertake scheduled area environmental inspections.

2.1.15 Action plan FY14

- Undertake scheduled area environmental inspections.

2.1.16 Target FY14

- Total recordable spills of chemicals and hydrocarbons to be less than or equal to 28 events

Note: An internally recordable spill of chemicals and/or hydrocarbons is defined as a spill of 10 litres or greater, outside of a bund, in a single event.

ID 2.2 RADIOACTIVE PROCESS MATERIAL SPILLS

2.2.1 Responsibility

- Head of HSEC
- Manager Environment
- Manager Health
- Head of Production

2.2.2 Scope (Aus 5a; State 17a)

The principal activity of the Olympic Dam operation is the mining and processing of ore containing copper, gold, silver and uranium. The existing operation has maintained systems for the control of radioactive material spills since operations began and these systems will continue.

BHP Billiton is currently required to report 'reportable spills' as defined by the Criteria and Procedures for Recording and Reporting Incidents at SA Uranium Mines (DMITRE), known as the 'Bachmann Criteria'. This requires spills above a certain volume to be reported and the cleanup measures documented.

EM Program IDs 3.5 and 4.6 provide further detail on radiological control and the handling of any soils contaminated by radioactive spills.

This EM Program refers to spills of radioactive materials, applicable to both the existing and expanded operations.

2.2.3 Management strategy (Aus 5bii, 5k)

The approach to management of radiation (including radioactive waste) at Olympic Dam is based on the recommendations of the International Commission on Radiological Protection (ICRP), which outline a system of dose limitation for the protection of humans and the environment from the harmful effects of radiation (Aus 15; State 34). It includes:

- justifying any practice that results in radiation exposure
- optimising protection by ensuring that doses are as low as reasonably achievable
- establishing limits on individual doses.

The ODC approach also takes into account the standards and guidance published by the International Atomic Energy Agency (IAEA) in its Safety Standards Series.

Radiation management in mining in Australia is guided by the Code of Practice and Safety Guide for Radiation Protection and Waste Management in the Mining and Processing of Radioactive Ores (ARPANSA 2005). This **Mining Code** elaborates on the ICRP and IAEA requirements and is generally adopted in its entirety in state legislation throughout Australia.

BHP Billiton aims to prevent spills primarily through effective design and control measures, including:

- providing systems of multiple containment, including primary, secondary and tertiary containment systems (tanks, bunds and on-site drainage collection ponds) to minimise the risk of spills
- locating tailings pipelines within a secondary containment system (bunded corridors)
- maintaining the integrity of pipelines and equipment through planned maintenance
- conducting inspections and regular maintenance programs to ensure integrity of controls (Aus 15).

Spill fact sheets and spill response awareness sessions are rolled out during toolbox meetings to ensure that the production teams are aware of the spill response procedure. Radioactive process material spills on undisturbed land are remediated (Aus 16, 29c).

Although spills have minimal potential to cause radiological **significant impact**, as a measure of the effectiveness of the management controls, BHP Billiton sets internal performance targets to drive improvement. An upper limit target for the number of spills is set for each area in the operation for the financial year. This target is set by historical spill event data analysis and serves as an environmental performance measurement for each area. It also highlights areas that need better controls (State 17g).

Analysis of historical radioactive spill events and Environmental Improvement Planning workshops provides additional information for improved control.

2.2.4 Key legal and other requirements (MC 2.10.1(h))

- **Ratification Act** and the **Indenture** (or as amended by the **Amendment Act** and the **Amended Indenture**)
- **EPBC Act Approval Conditions**
- **Major Development Approval Conditions**
- ***Environment Protection Act 1993***
- *Environmental Protection (Water Quality) Policy 2003*
- *Radiation Protection and Control Act 1982* (SA)
- National Environmental Protection (Assessment of Site Contamination) Measure 1999
- **EPA Licence 1301**
- *Radiation Protection and Control Act*, **Licence LM1**
- EPA Guideline – Bunding and Spill Management 2007 (SA)
- Code of Practice and Safety Guide for Radiation Protection and Radioactive Waste Management in Mining and Mineral Processing 2005 (ARPANSA)
- Criteria and Procedure for Recording and Reporting Incidents at SA Uranium Mines (DMITRE)

2.2.5 Values

- Human health and amenity.
- Quality of soil and water resources.
- Diversity of ecological communities.

2.2.6 Key risks

- Harm to human health as a result of unexpected exposure of personnel to radioactive substances.
- Radioactive contamination of soil, surface water or groundwater.
- Harm to, loss and / or displacement of ecological communities.

2.2.7 Environmental outcome (State 17b)

- No adverse impacts to public health as a result of radioactive process material spills from ODC's activities (Aus 5c, 13, 16).
- No **significant adverse impacts to populations** of **listed species** or **ecological communities** as a result of radioactive process material spills from ODC's activities (Aus 5c, 13, 16).

2.2.8 Compliance criteria (State 17c, 17kiii)

- A dose limit for radiation doses to **members of the public** of 1 mSv/y above natural background (Aus 5d, 6, 13).
- No significant radioactive contamination arising from uncontrolled loss of radioactive material to the natural environment (Aus 5d, 16).

*Note: Significant is defined as requiring assessment and remedial action in accordance with the NEPM 1999 or EPP 2003 and the **Mining Code.** Measurement and monitoring is carried out in response to a specific event. (State 17ki, 17kii, 17kiv)*

2.2.9 Leading indicators (State 17d)

- Soil concentrations above NEPM investigation levels (Health Investigation Levels (HILs) for Commercial/Industrial uses (Scenario F) for metals/metalloids, organics and other substances) that indicate a likelihood of adverse effects on human health values based on a meaningful and appropriate site-specific health risk assessment (Aus 5e, 17).

2.2.10 Management plan(s)

- Spill Management Plans exist for different areas of the operation (contains Bachmann Criteria reporting requirements).
- Hazardous Materials Management, Document No. 100614:
  - defines requirements for training, equipment and systems to be designed to protect personnel from exposure to hazardous materials
  - outlines requirements for operations, storage and maintenance of hazardous materials to avoid and contain hazardous material spills.

2.2.11 Monitoring program(s)

- Environmental Radiation Monitoring Program, Document No. 2790:
  - monitoring of frequency, location, causes, and remedial actions from radioactive spill events in order to identify and implement preventative actions.

2.2.12 Controls and management actions (Aus 5bi, 5bii, 5k; State 17g) (MC 2.10.1(h), 2.10.1(i))

- HAZOP studies are undertaken prior to construction to identify the potential and likelihood of spills and are used in the development of operating procedures (SEIS 11.1.2, 11.4.3).
- The maintenance department has routine preventative maintenance and condition monitoring programs in place.
- Pressure sensors and routine plant inspections are used to ensure timely spill and leak detection.
- A procedure for Environmental Incident Reporting which documents the process for managing and reporting radioactive process material spills.
- A company-wide system for incident reporting and tracking allows fast and comprehensive analysis of performance. Regular reports on spill performance are emailed to all personnel and presented to site management. Annual reports also include discussion on spill performance.
- Relevant senior management personnel have personal KPIs for improving the performance of spill management.

2.2.13 Contingency options (Aus 5bii) (MC 2.8.2(f))

- A site Emergency Response Team, ESOs and procedures are in place to attend emergency situations related to spills.

2.2.14 Continuous improvement / development opportunities

The majority of spill events occur in areas within secondary and tertiary containment systems and have minimal potential to cause significant **environmental impact**. The data from these incidents are reviewed to identify root causes and reduce the potential for further spill events.

- Opportunity: Review data to identify actions to be included in the area Environmental Improvement Plans

An audit of all existing bunds has been undertaken to determine compliance against EPA Guideline – Bunding and Spill Management (2007). An action plan has been developed as a result.

- Opportunity: Progress action plan to close gaps with regard to existing bunds to ensure the requirements of the EPA Guideline – Bunding and Spill Management (2007) are met.

2.2.15 Action plan FY14

- Continue with area Environment Improvement Plans.
- Progress actions identified in bund audit.

2.2.16 Target FY14

- Total recordable spills of radioactive process material to be less than or equal to 52 events
- Externally reportable spills of radioactive process material to be less than or equal to 2 events

Note: Reportable spills of radioactive process material as defined by the Criteria and Procedures for Recording and Reporting Incidents at SA Uranium Mines (DMITRE), known as 'Bachmann Criteria'.

ID 3 OPERATION OF INDUSTRIAL SYSTEMS

ID 3.1 PARTICULATE EMISSIONS

3.1.1 Responsibility

- Head of HSEC
- Manager Environment
- Head of Production
- Head of Resource Planning and Development

3.1.2 Scope (State 17a)

Olympic Dam is currently Australia's largest underground mine, with on-site metallurgical processing facilities to convert the mined ore through to the final products of copper, gold, silver and uranium.

The current point sources of particulate emissions are as follows:

- Uranium Calciner A and B Stacks;
- Feed Preparation Dryer Stack;
- Slimes Treatment Plant Roaster Scrubber Stack;
- CAF Plant Silo Filters;
- Smelter 2 Stacks.

ODC maintains an environmental authorisation under the ***Environment Protection Act*** *1993*, which establishes legal limits on the quantity of particulate emissions from the operation.

In addition, activities undertaken at Olympic Dam have the potential to result in the generation of fugitive dust emissions, including rock crushing and blasting at the backfill limestone quarry, vehicular movement on roadways, tailings wall raises and the stockpiling of materials. These emissions are controlled through a number of control measures.

The undertaking of open pit mining, including the development of supporting infrastructure and the Rock Storage Facility (RSF) also has the potential to result in the emissions of fugitive dust.

Particulate emissions will change with time as the open pit develops, with initial dust being from soils, clays and sand, followed by more hard rock-originated dusts as the pit deepens and material is placed onto the RSF. Particulates are monitored at nearby sensitive receivers through a real-time dust management and control system that will ultimately be used to inform operational activities to ensure that dust concentrations at sensitive receivers remain within acceptable levels.

The sensitive receivers in the vicinity of operations include the residents of Olympic Village and Roxby Downs and the local ecological communities.

3.1.3 Management strategy (State 17g)

Particulate emissions are managed from both point and fugitive sources at Olympic Dam.

For point source emissions, exhaust gas cleaning systems are installed throughout the process to remove particulates from gas streams venting to the atmosphere. These systems include:

- Off-gases from the Calciners are passed through venturi, droplet separator-based scrubbers to remove particulates before release to the atmosphere.
- Off-gases from the Feed Preparation Dryers are passed through baghouses to remove particulates before being released to the atmosphere.
- Slimes Treatment Plant emissions are scrubbed by either the roaster scrubber system, which utilises impaction scrubbing, or the nitrogen oxides (NO_x) scrubber.
- CAF Plant silos are fitted with particulate filters (EPA 1301.34-70).
- Off-gas from the Smelter 2 Flash Furnace is directed to the Electrostatic Precipitator to remove particulate matter for recycling to the furnace. Particulates are formed in the Flash Furnace by incomplete combustion of the feed in the reaction shaft. Off-gas from the Electric

and Anode Furnaces are directed to individual off-gas cleaning systems which comprise a quench tower and venturi scrubber to remove particulates.

Management of fugitive particulates for the mining operations is achieved either through 'at source' minimisation of emissions, or through active operational control to ensure ground-level particulate concentrations at sensitive receivers do not exceed the criteria. Such active operational control is based around managing the scale of dust-generating activities and the timing of such activities. The management response consists of a hierarchy of control measures of increasing effect, such as:

- relocating some or all blasting, loading and unloading activities to points at a greater distance from the sensitive receivers until meteorological conditions are more favourable;
- redirecting mine rock haulage activities;
- increasing the frequency of dust suppression activities (EPA 1301.34-72);
- ceasing operations during adverse weather conditions (i.e. when strong winds are blowing dust to sensitive receivers).

3.1.4 Key legal and other requirements

- **Ratification Act** and the **Indenture** (or as amended by the **Amendment Act** and the **Amended Indenture**)
- **Major Development Approval Conditions**
- ***Environment Protection Act*** *1993*
- Environment Protection (Air Quality) Policy 1994
- **EPA Licence 1301**
- **EPA Exemption 3014**
- EPA Air Quality Impact Assessment Guideline (2006)
- *Radiation Protection and Control Act* 1982
- National Environment Protection (Ambient Air Quality) Measure (2003)

3.1.5 Values

- Human health and amenity.
- Diversity of ecological communities.

3.1.6 Key risks

- Adverse impacts to human health
- Loss and / or displacement of ecological communities.

3.1.7 Environmental outcome (State 17b)

- No adverse impacts to public health as a result of particulate emissions from ODC's activities.

3.1.8 Compliance criteria (State 17c, 17kiii, 49a)

- Ground level PM_{10} dust concentrations at Roxby Downs derived from construction and operational sources at Olympic Dam must not exceed the PM_{10} 24-hour average of 50 µg/m^3.
- Ground level $PM_{2.5}$ dust concentrations at Roxby Downs derived from construction and operational sources at Olympic Dam must not exceed the $PM_{2.5}$ 24-hour average of 25 µg/m^3.
- Ground level $PM_{2.5}$ dust concentrations at Roxby Downs derived from construction and operational sources at Olympic Dam must not exceed the $PM_{2.5}$ annual average of 8 µg/m^3.

3.1.9 Leading indicators (State 17d)

- None applicable.

3.1.10 Management plan(s) (State 48, 48a)

- Dust Management Plan. Document No. 111276:

- Outlines the dust management measures and integration of the dust monitoring network into operational activities. The results of the monitoring provide a real-time measure of dust concentrations so that appropriate management can be implemented as required.

3.1.11 Monitoring program(s) (State 48c)

- Airborne Emissions Monitoring Program, Document No. 2788:
  - routine monitoring of particulate emissions from point sources within the operations, as well as dust and radionuclide deposition and ambient air monitoring to determine impacts to sensitive receptors;
  - a real-time response system used to monitor the weather and fugitive particulates around the mine and towards the sensitive receptors of Roxby Downs, Olympic Village and Hiltaba Village (DEIS 13.4.2).
- Flora Monitoring Program, Document No. 2664:
  - routine monitoring of flora in particular indicator species sensitive to atmospheric emissions to determine impacts associated with airborne emissions from the operations.
- Fauna Monitoring Program, Document No. 2663:
  - routine monitoring of fauna in particular indicator species and functional groups to determine the nature, extent and degree of impacts from the operations.

3.1.12 Controls and management actions (State 17g)

- The Calciners, Feed Preparation Dryers, Smelter 2 furnaces, CAF Plant silos and the Slimes Treatment Plant roaster are each fitted with gas cleaning systems to remove particulate material.
- Particulate emissions are managed to less than 100 mg/Nm^3 (EPA 1301.37-43).
- The Flash Furnace, Acid Plant, Anode and Electric Furnace Bypass Stacks may be operated when the particulate concentration is greater than 100 mg/Nm^3 in emergency or abnormal situations (EPA 3014.500-36).
- Particulate emissions from the Slimes Treatment Plant Roaster Scrubber are managed to less than 100 mg/Nm^3.
- Particulate emissions from the Calciners, Feed Preparation and the CAF Plant silos are managed to less than 250 mg/Nm^3 (EPA 1301.34-70).
- Regular planned maintenance programs are in place to ensure effective operating of the gas cleaning systems (EPA 1301.330-162).
- Clean scrap is used in anode furnaces to limit particulate emissions.
- Citect process system alarms exist for some gas cleaning systems to indicate when limits are exceeded. Process control information is available for trending to indicate the effectiveness of the systems.
- Citect process system level alarms ensure that ECAF Plant silos are not overfilled (EPA 1301.34-71).
- Blasting is not conducted in the quarry or open pit areas during adverse wind conditions to minimise dust.
- Dust is minimised by regular application of saline water and / or suitable dust suppressants to active haul roads, roadways, the backfill limestone quarry blasted material and crushed material stockpiles and the active areas of the open pit mine. The water application effectiveness is monitored through daily watering records (DEIS 5.5.4 and 13.4.2).
- The National Environment Protection (Ambient Air Quality) Measure (NEPM) ground-level dust concentration and EPA Air Quality Impact Assessment Guideline will be met through design and operational management controls of mining operations at Olympic Dam (DEIS 13.3.2).
- A dust data system that permits operational control to meet particulate criteria (State 50a).

- A 500 m separation between the RSF and **Arid Recovery** to minimise direct impacts from particulate matter (DEIS 13.3.4).
- Abrasive blasting activities are undertaken within the blasting booth located at the Resource Recovery Centre except for those items that are too large to be accommodated within the booth or cannot otherwise be relocated. A particulate scrubbing system is fitted to the booth, and when blasting outside of the booth, silica-free abrasive is used and enclosures assembled to minimise the potential for the distribution of dust (EPA 1301.30-10).
- The borrow pits excavated to provide material for the construction of the ODP-related infrastructure use water carts and mobile sprinklers to suppress dust during operations and prevent adverse impacts on the sensitive receivers. After excavation of the pits is finished, the pits will be ripped and left to revegetate (DEIS 13.3.5).
- Areas disturbed during construction of off-site infrastructure but no longer required will be rehabilitated in order to minimise the number of ongoing dust sources (DEIS 13.3.5).

3.1.13 Contingency options (State 17g)

- Increase the frequency of dust suppression activities on haul roads.
- Relocate some or all blasting / loading or unloading activities to more favourable areas of the mining operation.
- Redirect mine rock haulage activities.
- Modify planned blasting activities.
- Cease operations (DEIS 13.3.5).

3.1.14 Continuous improvement / development opportunities (State 17g)

Identifying improvements with regards to particulate emissions monitoring and measurement, and the evaluation of potential impacts to the environment, can provide information as a basis for determining the most appropriate methods of at-source particulate mitigation.

- Opportunity: Determine the most appropriate methods of at-source particulate mitigation and include air quality management options into the Dust Management Plan.

To ensure dust levels at sensitive receivers do not exceed compliance criteria, a detailed understanding of the relationship between operational activities, background dust concentrations and local meteorology is required to be developed. This understanding will inform the operational response/control element of the dust management system, the exact nature of which is also to be investigated

- Opportunity: Continue to refine the operation of the installed dust monitoring system and develop an understanding of the relationships between the factors that influence dust concentrations at sensitive receivers.
- Opportunity: Investigate the most appropriate and effective means of implementing an operational control regime to ensure the compliance criteria is not exceeded.

A proactive way of improving environmental performance is to hold area environmental improvement planning workshops with the relevant stakeholders to identify environmental improvements that can be implemented in the current financial year.

- Opportunity: Implement the improvements identified in the Environmental Improvement Plan.

3.1.15 Action Plan FY14 (State 17g)

- Refine the dust monitoring system and investigate options for providing appropriate and effective operational control.
- Continue with area Environmental Improvement Plans.

3.1.16 Target FY14

- None applicable

ID 3.2 NOISE AND VIBRATION EMISSIONS

3.2.1 Responsibility

- Head of HSEC
- Manager Environment
- Head of Production
- Head of Resource Planning and Development

3.2.2 Scope (State 17a)

The Olympic Dam operation has been operating within existing noise criteria for 20 years including monitoring at nearby sensitive receivers (Roxby Downs and Olympic Village residences). Undertaking open pit mining operations progressively introduces additional noise and vibration sources. The most significant of these is the use of surface haul trucks and the eventual commencement of open pit blasting activities.

The noise and vibration sources likely to have the greatest impact on nearby sensitive receivers and ecological communities surrounding Olympic Dam are:

- haul trucks mechanical noise (radiator fan and engine/transmission)
- vehicle air horns
- vehicle reversing alarms
- open pit and underground blasting

This EM Program covers noise generating activities associated with the Olympic Dam operations and Olympic Dam expansion activities on the Special Mining Lease, and includes noise and vibration impacts at Roxby Downs.

Note: Occupational noise management is outside the scope of this EM Program

3.2.3 Management strategy (State 17g)

The management of noise to ensure amenity and ecological values are not compromised will take one of two approaches; at-source noise control or at-receiver noise mitigation or attenuation. These methods are both equally legitimate to control noise impacts. At-source noise control is applied preferentially, however there are often significant cost implications associated with engineering reduced noise levels. At-source noise control options can also result in considerable reductions in plant operability (for example, fitting noise suppression kits to haul trucks may result in a decrease in vehicle reliability, or time between services).

The use of at-receiver noise mitigation, including the use of noise bunding or barriers, double glazing or enhanced insulation in buildings is often as effective, simpler and more cost-effective than at-source control of noise. These two methods of noise control are both used at Olympic Dam to ensure compliance with the nominated noise criteria.

3.2.4 Key legal and other requirements

- **Ratification Act** and the **Indenture** (or as amended by the **Amendment Act** and the **Amended Indenture**)
- **Major Development Approval Conditions**
- ***Environment Protection Act 1993***
- Environment Protection (Noise) Policy 2007 (SA)
- World Health Organisation Guidelines for Community Noise 1999
- Australian Standard AS2187.2:2006 (Explosives – Storage and Use – Use of Explosives)

3.2.5 Values

- Human health and amenity.
- Diversity of ecological communities.

3.2.6 Key risks

- Adverse impacts to human health.
- Loss and / or displacement of ecological communities.

3.2.7 Environmental outcome (State 17b)

- No significant adverse impacts to public health or amenity as a result of noise and vibration emissions from ODC's activities.

3.2.8 Compliance criteria (State 17c, 17kiii)

- Maintain noise from the operations at Olympic Dam to less than 47 dBL_{Aeq} between 7am and 10pm and 40 dBL_{Aeq} between 10pm and 7am when measured at the facade of the nearest residence at Roxby Downs, in accordance with the Environment Protection (Noise) Policy 2007.
- Maintain vibration levels at Roxby Downs as a result of blasting activities to less than 5 mm/s for 95 per cent of blasts, with a maximum of 10 mm/s for any one blast, in accordance with Australian Standard AS2187.2:2006 (State 23).

3.2.9 Leading indicators (State 17d)

- None applicable.

3.2.10 Management plan(s)

- Noise and Vibration Management Plan, Document No. 111274:
  - outlines the strategy associated with ensuring that the **compliance criteria** will be met, including management processes for the open pit operations when they are occurring and blasting activity.

3.2.11 Monitoring program(s)

- Noise and Vibration Emissions Monitoring Program, Document No. 110685:
  - monitoring for noise at key receiver locations in Roxby Downs is undertaken post the commencement of blasting activities in the open pit to assess compliance with the noise assessment criteria; and
  - monitoring of vibration and blast overpressure associated with open pit blasting activities at key receiver locations in Roxby Downs is undertaken post the commencement of blasting activities in the open pit to assess compliance with the vibration assessment criteria.

3.2.12 Controls and management actions (State 17g)

- A noise model is used to determine how changes in process will impact on sensitive receivers. Blast noise and vibration at the surface mining operations is managed by:
  - controlling the blast hole spacing and burden, blast hole stemming length, charge per delay and the size of each blast to minimise noise, vibration and fly rock;
  - a blast vibration monitoring system to control blast vibrations; and
  - a buffer distance for blasting of 500 m from the toe of the TSF to manage the blast vibration interaction with TSF wall stability.

3.2.13 Contingency Options (State 17g)

3.2.13.1 Roxby Downs

- Response to unexpected noise and/or vibration levels as a result of mining activities at Olympic Dam may include:
  - relocating some or all blasting/loading or unloading activities to more favourable areas of the mining operation;
  - redirecting mine rock haulage activities;
  - modifying planned blasting activities;
  - ceasing operations.

3.2.14 Continuous improvement / development opportunities (State 17g)

The impact of noise-generating activities undertake at Olympic Dam on the accommodation units at Olympic Village is not well understood.

- Opportunity: Undertake acoustic monitoring within and external to Olympic Village accommodation units during typical mining and processing operations to determine the potential impacts with respect to the WHO Guidelines for Community Noise.

Acoustic consultants will be used to monitor the vibration and overpressure associated with blasting within the open pit post the commencement of blasting activities. This is new monitoring associated with new activities and as such will require review to ensure it is being conducted appropriately and monitoring results are acceptable.

- Opportunity: Review vibration and blast overpressure monitoring methodology and data collected during the year.

Technology exists to continuously monitor vibration and overpressure levels, and the applicability of this technology to Olympic Dam could be assessed.

- Opportunity: Investigate the benefits of, and need for, continuous blast vibration and overpressure monitoring technologies, and their applicability to Olympic Dam.

3.2.15 Action plan FY14 (State 17g)

- Review vibration and blast overpressure monitoring methodology and data collected during the year.
- Undertake acoustic monitoring within and external to Olympic Village accommodation units

3.2.16 Target FY14

- None applicable

ID 3.3 SULPHUR DIOXIDE EMISSIONS

3.3.1 Responsibility

- Head of HSEC
- Manager Environment
- General Manager – Smelter Refinery

3.3.2 Scope (State 17a)

This program applies to Smelter 2, which is the single largest source of sulphur dioxide (SO_2) emissions at Olympic Dam and comprises a Flash Furnace, Electric Slag Reduction Furnace, two Anode Furnaces and an Acid Plant. Smelter 2 is used to process the copper concentrate into copper anode.

This document consolidates the relevant information and ODC's commitments that are in place to manage sulphur dioxide emissions from the Olympic Dam operation.

3.3.3 Management strategy (State 17g)

Management of SO_2 emissions from the Flash Furnace is achieved by directing off-gas to the Acid Plant, where the majority of SO_2 is converted and absorbed to produce sulphuric acid for use, predominantly in the hydrometallurgical plant. The residual SO_2 in off-gas is directed to the Acid Plant Tails Stack.

Electric furnace off-gas is directed to a quench tower and venturi scrubber gas cleaning system before release to the atmosphere via the Main Smelter Stack. Anode furnace off-gas is treated in gas cleaning systems similar to that of the Electric Furnace, with the exception of SO_2-rich oxidation gases being directed to the Acid Plant for conversion to sulphuric acid. All furnaces have bypass stacks in addition to the Main Smelter Stack and the Acid Plant Tails Stack, for use in abnormal or emergency situations. In addition, the Acid Plant also has a bypass stack for use in the event of an Acid Plant abnormal or emergency situation.

During normal operations the above processes remove most of the SO_2 from the stack emissions, with recovery rates of 95 per cent to 99 per cent. The majority of SO_2 is released as a result of Acid Plant bypasses and through continuous Acid Plant tail gas emissions.

Inline analysers in the Main Smelter Stack and Acid Plant Tails Stack continuously monitor SO_2 concentrations emitted from the stacks (EPA 1301.305-137).

All information on bypass and exceedance emission events is reported as per licence conditions and ambient ground level SO_2 concentrations are assessed as required (EPA 1301.305-138, 305-139, 305-140, 305-141).

Additionally, independent stack testing is undertaken annually on the Main Smelter Stack and Acid Plant Tails Stack, providing data on SO_2 and other off-gas concentrations. This assists in identifying the percentage of SO_2 in the off-gas, and verifies the accuracy of the SO_2 analysers within the Main Smelter and Acid Plant Tails Stacks (EPA 1301.305-137).

3.3.4 Key legal and other requirements

- **Ratification Act** and the **Indenture** (or as amended by the **Amendment Act** and the **Amended Indenture**)
- **Major Development Approval Conditions**
- **EPA Licence 1301**
- **EPA Exemption 3014**
- ***Environment Protection Act 1993***
- Environmental Protection (Air Quality) Policy 1994 (SA)
- National Environment Protection (Ambient Air Quality) Measure 2003 (Cth)
- *Native Vegetation Act 1991* (SA)
- Native Vegetation Regulations 2003 (SA)

3.3.5 Values

- Human health and amenity.
- Diversity of ecological communities.

3.3.6 Key risks

- Adverse impacts to human health.
- Loss and / or displacement of ecological communities.

3.3.7 Environmental outcome (State 17b)

- No adverse impacts to public health as a result of sulphur dioxide emissions from ODC's activities.

3.3.8 Compliance criteria (State 17c, 17kiii) (EPA 1301.305-139, 305-140, 305-141)

- Annual average SO_2 concentration of less than 0.02 ppm at sensitive receivers, Olympic Village and Roxby Downs.
- 24 hour average SO_2 concentration of less than 0.08 ppm at sensitive receivers, Olympic Village and Roxby Downs.
- One hour average SO_2 concentration of less than 0.2 ppm at sensitive receivers, Olympic Village and Roxby Downs.

3.3.9 Leading indicators (State 17d)

- None applicable.

3.3.10 Management plan(s)

- Air Emissions Management Plan, Document No. 77234:
  - an inventory of the main sources of air emissions (both point and diffuse source emissions) and the location of sensitive receivers is maintained, along with an impact assessment. Controls are also identified which reduce impacts to sensitive receivers, along with the associated monitoring programs.

3.3.11 Monitoring program(s)

- Airborne Emissions Monitoring Program, Document No. 2788:
  - routine monitoring of SO_2 emissions from Smelter 2 and the Acid Plant combined with SO_2 modelling and measurement to determine impacts to ambient air quality and sensitive receivers.
- Flora Monitoring Program, Document No. 2664:
  - routine monitoring of flora, in particular indicator species sensitive to atmospheric emissions to determine impacts associated with airborne emissions from the operations.
- Fauna Monitoring Program, Document No. 2663:
  - routine monitoring of fauna, in particular indicator species and functional groups to determine the nature, extent and degree of impacts from the operations.

3.3.12 Controls and management actions (State 17g)

- The Acid Plant and Smelter ventilation system captures all SO_2 generated by the Smelter, with emissions of total acid gases not exceeding concentrations of greater than 3,000 mg/Nm^3 from the Acid Plant Tail Gas Stack and Main Smelter Stack under normal operating conditions (EPA 1301.37-43)
- Operation of the Flash Furnace, Anode Furnace and Electric Furnace Bypass Stacks only when emissions of sulphuric acid and/or sulphur trioxide are less than 100 mg/Nm^3, except in emergency or abnormal situations (EPA 1301.37-43).
- For the purpose of planned maintenance activities, the Acid Plant and Flash Furnace Bypass Stacks are not used until two hours following the cessation of concentrate feed to the Flash Furnace (EPA 3014.500-40)

- The off-gas from the Anode Furnaces is not directed to the Main Smelter Stack until the sulphur content of the metal in the furnace is less than 0.005% weight per weight, except in emergency or abnormal situations (EPA 1301.305-142).
- Operational controls, procedures and practices seek to minimise SO_2 emissions not treated in the Acid Plant.
- Regular planned maintenance programs are in place to ensure effective operating of the gas cleaning systems (EPA 1301.330-162).
- Citect process system alarms activate when limits are exceeded or bypass events occur.
- Negative pressure maintained to prevent gases from venting to atmosphere.
- Time-weighted or cumulative average alarm identifies when SO_2 is rising toward compliance limit so action can be taken.

3.3.13 Contingency options

- The Flash Furnace, Anode Furnace and Electric Furnace Bypass Stacks may be operated when the sulphuric acid and/or sulphur trioxide concentrations exceed 100 mg/Nm^3 in abnormal or emergency situations (EPA 3014.500-37).
- Emissions from the Acid Plant Tail Gas Stack may exceed 3,000 mg/Nm^3 of total acid gases for a period of less than five hours during cold plant start-up (EPA 3014.500-39).
- Cease operations until plant and operating parameters are under control.

3.3.14 Continuous improvement / development opportunities

Sampling has identified Acid Plant bypasses as being the emission most likely to result in **environmental impact**.

- Opportunity: Investigate options to reduce acid plant bypasses through the Smelter Environmental Improvement Plan.

Sampling has indicated that the greatest source of chronic SO_2 emissions is the Acid Plant Tails Stack.

- Opportunity: Investigate options to reduce Acid Plant Tails Stack exceedances through the Smelter Environmental Improvement Plan.

3.3.15 Action plan FY14

- Continue with the Smelter Environmental Improvement Plan.
- Implement the use of an ambient SO_2 analyser at Olympic Village.

3.3.16 Target FY14

- Reduce the total EPA notifiable emission events by 5% of the FY12 target (less than 176 events).

ID 3.4 SALINE AEROSOL EMISSIONS

3.4.1 Responsibility

- Head of HSEC
- Manager Environment
- General Manager – Mining

3.4.2 Scope (State 17a)

Olympic Dam currently operates an underground mine that is ventilated via up-cast and down-cast raise bore ventilation shafts. These shafts pass through two saline groundwater aquifers between the mine and the surface. Groundwater flows passively into the unlined raise bores during normal operation. Saline water entering the shaft is collected by the updraft of air leaving the mine and is emitted at the surface as saline aerosols.

This document consolidates the relevant information and ODC's commitments that are in place to manage saline aerosol emissions for the Olympic Dam operations.

3.4.3 Management strategy

At raise bores where saline aerosols are produced, control measures have been implemented to capture the aerosols before they are emitted into the atmosphere. The emission of saline aerosols has the potential to result in soil contamination and may result in death, stress or displacement of flora and fauna in the vicinity of the ventilation shaft.

Saline emission trends identified from data collected for the Airborne Emissions Monitoring Program are used as indicators of the performance of saline emissions preventative controls. Management of saline aerosol emissions includes raise bore discharge design, splash ponds and enclosures. In extreme cases, drill holes have been sunk into the underlying aquifer to dewater the area and minimise saline emissions. Emissions diminish as the aquifer in the vicinity of the raise bores is dewatered. All raise bores discharge into an enclosed splash pond, and the most problematic of 'wet' raise bores, RB21, has been fitted with a mist eliminator. This limits the transfer of saline aerosol emissions beyond the confines of the enclosure (State 17g).

3.4.4 Key legal and other requirements

- **Ratification Act** and the **Indenture** (or as amended by the **Amendment Act** and the **Amended Indenture**)
- **Major Development Approval Conditions**
- ***Environment Protection Act 1993***

3.4.5 Values

- Quality of regional soils.
- Diversity of ecological communities.

3.4.6 Key risks

- Increase in soil salinity due to saline emissions.
- Loss and / or displacement of ecological communities.

3.4.7 Environmental outcome (State 17b)

- No **significant adverse impacts to populations** of **listed species** (South Australian, Commonwealth) as a result of ODC's activities.

3.4.8 Compliance criteria (State 17c, 17kiii)

- No loss of an **important population** of Category 1b **species**.

3.4.9 Leading indicators (State 17d)

- None applicable.

3.4.10 Management plan(s)

- Air Emissions Management Plan, Document No. 77234:
  - an inventory of the main sources of air emissions and the location of sensitive receptors is maintained, along with an impact assessment. Controls are identified which reduce impacts to sensitive receptors, along with the associated monitoring programs.

3.4.11 Monitoring program(s)

- Airborne Emissions Monitoring Program, Document No. 2788:
  - monitoring of saline aerosol emissions from raise bore ventilation shafts to provide data for determining impacts to sensitive receptors.
- Flora Monitoring Program, Document No. 2644:
  - monitoring of flora in particular indicator species sensitive to atmospheric emissions to provide data for determining impacts associated with saline aerosol emissions from the operations.
- Fauna Monitoring Program, Document No. 2663:
  - monitoring of fauna, in particular indicator species and functional groups, to provide data for determining the nature, extent and degree of impacts from the operations.

3.4.12 Controls and management actions (State 17g)

- Inverting the exhaust outlet over a dam and erecting fencing around the outlet to intercept aerosols after emission.
- General dewatering of the local aquifer via mine dewatering.
- Fencing barricades around ‘wet’ raise bores located close to Category 1b species to intercept saline aerosols.
- Drainage rings within the bore outlet in some raise bores.
- Set standards for raise bore design, and ensure that controls are applied consistently to all new exhaust raise sites.

3.4.13 Contingency options

- Implement immediate plans to rectify physical barricades to intercept saline aerosols if condition deteriorates.
- Remediate contaminated area as much as reasonably achievable.

3.4.14 Continuous improvement / development opportunities

Saline aerosols emitted from raise bores impact on surrounding flora and fauna. As such standards have been produced for implementing controls on new and existing raise bores to minimise the emissions of saline aerosols to the surrounding environment.

- Opportunity: Install and repair controls as per the standards around raise bores to improve capture of saline aerosol emissions.

3.4.15 Action plan FY14

- Install and repair controls as per the design standard around raise bores.

3.4.16 Target FY14

- Reduce the deposition of salt from saline aerosol emissions at RB21 salt jars by 10% of the FY13 target (less than 1,179 mg/m^2/day).

ID 3.5 RADIOACTIVE EMISSIONS

3.5.1 Responsibility

- Head of HSEC
- Manager Environment
- Manager Health
- Head of Production

3.5.2 Scope (Aus 5a; State 17a)

The principal activity of the Olympic Dam operation is the mining and processing of ore containing copper, gold, silver and uranium. The existing operation has maintained effective systems for the control of radioactive emissions since commencement of operations.

The first stage of the Expansion includes the initial development of the open pit, the establishment of the Rock Storage Facility (RSF) and construction of associated infrastructure.

There are not expected to be any radioactive airborne emissions as a result of the first stage of the Expansion, until the pit development reaches mineralisation. This is not expected to occur within the period of this EPMP and is therefore not covered in this EM Program. The main sources of radioactive emissions are from the existing operations and are expected to remain at current levels.

Potential impacts of radioactive emissions include exposure to the residents of Olympic Village and the Roxby Downs township and the aim is to ensure exposure is monitored and maintained within acceptable levels.

Recent adoption by the ICRP of its Publication 108 – Environmental Protection: the Concept and Use of Reference Animals and Plants – notes that assessments for radiological impacts to non human biota (flora and fauna) should be undertaken. Where appropriate, BHP Billiton will undertake such assessments with the guidance of ARPANSA's published preliminary guidelines for assessing radiological impacts to non human biota.

This document outlines the management measures for radioactive emissions for the existing operations.

3.5.3 Management strategy (Aus 5bi, 5k)

The approach to management of radiation (including radioactive waste) at Olympic Dam is based on the recommendations of the International Commission on Radiological Protection (ICRP), which outline a system of dose limitation for the protection of humans and the environment from the harmful effects of radiation (Aus 15; State 34). It includes:

- justifying any practice that results in radiation exposure;
- optimising protection by ensuring that doses are as low as reasonably achievable;
- establishing limits on individual doses.

The ODC approach also takes into account the standards and guidance published by the International Atomic Energy Agency (IAEA) in its Safety Standards Series.

Radiation management in mining in Australia is guided by the Code of Practice and Safety Guide for Radiation Protection and Waste Management in the Mining and Processing of Radioactive Ores (ARPANSA 2005 – known as the **Mining Code**). This **Mining Code** elaborates on the ICRP and IAEA requirements and is generally adopted in its entirety in state legislation throughout Australia.

The **Mining Code** contains a specific requirement to develop a Radioactive Waste Management Plan (RWMP) covering environmental radioactive emissions. Due to the integrated Environment Management System that ODC implements at Olympic Dam, the specific requirements of the RWMP have been incorporated into the broader EPMP documentation (Aus 15, 29c; State 34).

Environmental radiation is therefore unique within the ODC Olympic Dam **Environmental Management System**, with specific aspects of the program integrated into other EM Programs or monitoring programs (e.g. radionuclide concentrations in groundwater are covered under the Groundwater Monitoring Program and radioactive airborne emissions are integrated into the air quality management documentation).

3.5.4 Key legal and other requirements

- **Ratification Act** and the **Indenture** (or as amended by the **Amendment Act** and the **Amended Indenture**)
- **EPBC Act Approval Conditions**
- **Major Development Approval Conditions**
- *Radiation Protection and Control Act 1982* (Radiation Protection and Control (Ionising Radiation) Regulations 2000) (SA)
- ***Environment Protection Act 1993***
- Radiation Protection and Control Act, **Licence LM1**
    - Code of Practice and Safety Guide for Radioactive Waste Management in Mining and Mineral Processing (ARPANSA 2005) (State 34)
    - Code of Practice for the Safe Transport of Radioactive Material (ARPANSA 2008 known as the Transport Code) (State 34)
- Relevant ICRP and IAEA recommendations and codes.

3.5.5 Values

- Human health and amenity.
- Diversity of ecological communities.

3.5.6 Key risks

- Radiation exposures higher than predicted at sensitive receivers.
- Dust and radon release from the operation greater than predicted.

3.5.7 Environmental outcome (State 17b)

- No adverse impacts to public health as a result of radioactive emissions from ODC's activities (Aus 5c, 13; State 34).
- No **significant adverse impacts to populations** of **listed species** or **ecological communities** as a result of radioactive emissions from ODC's activities (State 34).

3.5.8 Compliance criteria (State 17c, 17kiii)

- Radiation doses to **members of the public** less than 1 mSv/y above natural background (Aus 5d, 6, 13; State 34).
- Deposition of project originated ^{238}U less than 25 Bq/m^2/y at the non-human biota assessment sites.

3.5.9 Leading indicators (State 17d)

- Indications that a **dose constraint** of 0.3 mSv/y to **members of the public** above natural background will be exceeded (Aus 5f, 6, 14; State 34).
- Indications that a reference level of 10 µGy/h for impacts on non-human biota above natural background will be exceeded (Aus 5f, 6, 14; State 34).

Note: The reference level for non-human biota is set as an interim criteria until such time as an agreed national approach is determined.

3.5.10 Management plan(s)

- Tailings Retention System Management Plan, Document No. 80791:
    - provides details of the operating procedures for the TRS, including measures to minimise emissions
- Dust Management Plan, Document No. 111276:
    - details the location and systems for the monitoring of radionuclides in dust (via high-volume sampling) and active radon decay product monitoring.

3.5.11 Monitoring program(s) (State 17g)

- Environmental Radiation Monitoring Program, Document No. 2790:
  - Assessment of doses from monitoring results for:
    - members of the public dose assessment;
    - non-human biota radiological assessment.
  - Monitoring and data collection including:
    - number of radioactive process spills;
- Airborne Emissions Monitoring Program, Document No. 2788:
  - airborne radioactive dust monitoring;
  - radioactive dust deposition monitoring;
  - radionuclide emissions monitoring;
  - radon decay product monitoring;
  - monitoring of control systems (such as baghouse efficiencies).
- Fauna Monitoring Program, Document No. 2663:
  - fauna distributions (for non-human biota assessment).
- Flora Monitoring Program, Document No. 2664:
  - vegetation distributions (for non-human biota dose assessment).
- Groundwater Monitoring Program, Document No. 2791:
  - radionuclide concentrations in groundwater monitoring.
- Waste Monitoring Program, Document No. 2792:
  - monitoring of radioactive waste production;
  - methods of waste control.

3.5.12 Controls and management actions (Aus 5bi, 5k; State 17g) (MC 2.8.2(c))

3.5.12.1 Radiation protection systems

- The existing site management processes and practices for radiological protection have been proven to work effectively. On occasion they will be upgraded through proven and tested improvements in technology or systems.

3.5.12.2 Controls in existing operations

- The operation currently maintains a number of control systems, including:
  - exhaust gas cleaning on; the two calcining furnaces, the feed preparation dryers, the flash furnace and the slimes treatment plant roaster;
  - preventative maintenance programs for pollution control equipment;
  - the process control system incorporates alarms to identify failures in key control systems such as ventilation systems;
  - process control information is reviewed to determine the effectiveness of the control systems;
  - regular application of water to roadways and stockpiles to minimise dust emissions;
  - dust suppression equipment installed on crushing infrastructure;
  - engineering design standards for raise bore exhausts to minimise particulate emissions;
  - tailings deposition is managed to minimise radon emanation and the potential for dusting;
  - appropriate training and education for operational personnel, with specialist training as required for personnel involved in specific tasks such as tailings disposal and servicing of emission controls;

- appropriate training and education for supervising personnel involved in other tasks to ensure appropriate management of process materials.

3.5.12.3 Optimisation in design (Aus 15; State 34)

- **ALARA** is built into the design of the operation. This means that all reasonable efforts are made to ensure that radiation and radioactive emissions are controlled and managed in the design of new plant. To achieve this, the following controls are applied:
  - Radiation protection design criteria established and are mandatory for all facilities.
  - Appropriate radiation protection training for personnel.
  - Regular provision of monitoring data for operations personnel to assist in minimising radiological impacts.
  - An optimisation (**ALARA**) study will be conducted for selection and definition phases of the expansion with findings incorporated into designs.
  - Design engineers, metallurgists, mining engineers, chemists and other specialist personnel participate in targeted “radiation in design” training

3.5.12.4 Radioactive emissions from the TSF:

- Tailings are placed to achieve competent consolidation to minimise dusting and radon emanation.
- A liquor balance / inventory for the evaporation pond operation is maintained.
- An audit of operational procedures for the TSF is conducted annually.
- Minimisation of free standing liquor on tailings through decant systems.

3.5.13 Contingency options (Aus 5bi, 5k; State 17g)

- Review of airborne emission controls.
- Review of tailings disposal and liquor management if required.

3.5.14 Continuous improvement / development opportunities (State 17g)

International and national standards, guidance and codes are subject to change from time to time, to ensure effective protection of humans and the environment from the harmful effects of radiation. Any new recommendations or revisions should be reviewed and implemented as necessary.

- Opportunity: Maintain a watching brief on ICRP and IAEA recommendations and any new or revised national Codes and implement as necessary.
- Opportunity: Consider impacts of potential changes to ICRP recommended dose conversion factors for radon decay products and implement as required.
- Opportunity: Develop the scope for the Features, Events, Processes (FEP) study for future TSF expansions, consistent with IAEA guidelines on radioactive waste.

The fundamental basis of radiation protection is the ALARA principle. To date BHP Billiton has implemented operational programs to ensure that occupational and public doses remain low. Radiation impacts are best controlled through good design and as the project expands, it is appropriate to better formalise the company’s approach to ALARA to ensure that radiological impacts are managed.

- Opportunity: Develop and implement optimisation in design process.

Excess or uncontrolled radioactive waste can lead to emissions from the project leading to potential exposures to people and the environment. As the project expands, more permanent low level radioactive waste management becomes important

- Opportunity: Continue to develop, update and implement a strategy towards management of radioactive waste on site (including the waste minimisation philosophy).

As part of the expanded air quality monitoring network, BHP Billiton installed new generation radon and radon decay product monitors. The monitors provide real time data.

- Opportunity: Utilisation of the new generation radon and radon decay product monitors to improve understanding of radiological impacts of the operation.

3.5.15 Action plan FY14

- Develop an FEP (features, events, processes) study proposal related to the TSF (as noted in the Supplementary EIS (Section 26.3)). This is not yet a mature area of analysis and would need to be undertaken in consultation with appropriate experts.
- Develop a proposal for education and training directed at optimization of protection in design.

3.5.16 Target FY14 (State 17e)

- Maintain radiation doses as low as reasonably achievable, as assessed through the annual adequacy and effectiveness review.

ID 3.6 GREENHOUSE GAS EMISSIONS

3.6.1 Responsibility

- Head of HSEC
- Manager Environment
- Head of Production
- Head of Resource Planning and Development

3.6.2 Scope (State 17a)

Olympic Dam consumes fossil fuels directly and indirectly as part of its activities, including its on-site operations and associated off-site activities, specifically materials transport and the operation of off-site infrastructure. Major greenhouse generating sources include the use of electricity and/or gas as major energy sources, combustion of LPG and/or natural gas, diesel, fuel oil and petrol, use of coke, soda ash and soderberg paste within the metallurgical plant and through the use of ANFO and other explosives. The consumption of acid in the metallurgical plant, neutralisation of acidic liquor within the TSF and chemical reactions within the RSF also generate carbon dioxide.

The *National Greenhouse and Energy Reporting Act 2007* (Cth) (NGER Act) outlines the greenhouse emissions that are to be publicly reported, and the *Energy Efficiency Opportunities Act 2006* (Cth) (EEO Act) aims to improve identification and evaluation of energy efficiency opportunities by large energy using businesses and, as a result, encourages the implementation of cost-effective energy efficiency measures. The EEO Act requires organisations to submit five-year plans that set out proposals for assessing their energy usage and to identify efficiency projects. ODC currently reports as per the requirements of the NGER Act and the EEO Act.

The *Climate Change and Greenhouse Emissions Reduction Act 2007* (SA) aims to promote action by developing specific targets for various sectors of the State's economy, and developing policies and programs to reduce greenhouse gas emissions.

BHP Billiton's Climate Change Position is a multi-faceted approach to tackling climate change. Olympic Dam addresses the BHP Billiton-wide position goals via this EM Program, the Energy Use and Greenhouse Gas Emissions MP and the supporting Carbon Emissions Management Plan.

3.6.3 Management strategy (State 17g)

Greenhouse gas emissions are managed at Olympic Dam through the quantification and tracking of the current greenhouse gas emissions performance of the existing operation and the identification, investigation and implementation of greenhouse gas reduction and abatement opportunities. ODC maintains a comprehensive approach to greenhouse gas abatement, integrated into the asset 5-year planning processes, as required by BHP Billiton Corporate Alignment Planning. The BHP Billiton Group Management Committee Letter of Intent (LOI) identifies priority areas for incorporation into the 5-year planning process. The FY2013 LOI recognises Energy Efficiency as a priority area, including that:

- Plans should assess and demonstrate reductions in the carbon intensity of our operations. Our project hubs must continue to ensure our future operations are engineered and constructed in a more energy efficient and environmentally sustainable way. (State 11ci)
- Demand and supply-side reduction opportunities are assessed, implemented and monitored during the design, construction and operational phases of the project to ensure viable, cost-effective opportunities for energy efficiency, renewable energy and greenhouse gas abatement are maximised by (State 11ci):
- Preparing a Marginal Abatement Cost Curve analysis that outlines the approach to identifying, assessing and prioritising mitigation opportunities;
- Obtaining approval and implementing projects considered viable in accordance with the requirements of BHP Billiton Major Capital Projects, as detailed in the BHP Billiton Project Development Manual (Document No. PDM-001), the Olympic Dam Small Project Framework (Document No. 80177) and relevant Customer Sector Group (CSG) standards. Together, these documents detail the requirements and processes for the approval and implementation of all projects. Project implementation follows the following process:

- Identification and Selection – identification of project opportunities that align with BHP Billiton's strategic objectives, the LOI, potential business benefits and project deliverables, and the selection of the best options
- Definition – definition of the project scope, schedule, estimate and execution plan, and prepare funding submission for internal authorisation
- Execution – implementation of the project and delivery of the defined business benefits and project outcomes
- Operation – integration of the outcomes into 'business as usual' (State 11ci);

- Monitoring the performance of implemented mitigation projects in accordance with the Energy Use and Greenhouse Gas Emissions MP (Document No. 67616).

A requirement of the Identification and Selection and the Definition phases of project implementation is the application of the Health, Safety and Environment (HSE) Design Criteria (Document No. 47198), and the development of HSE-specific risk and opportunity registers. Various 'gates' are present throughout the project implementation schedule, points at which projects are independently reviewed against BHP Billiton standards, HSE requirements and the strategic goals of BHP Billiton. Projects cannot progress to the following phase without passing the respective gate review. (State 11cii)

Approval of all projects, including greenhouse gas abatement opportunities, is provided subject to the project meeting BHP Billiton's business needs, with consideration to:

- alignment of the project to BHP Billiton's overall strategic plan and identified priorities
- capital cost of the proposed project
- complexity of the proposed project, including the project location, capability, technological complexity, **environmental impact** and regulatory environment
- operational considerations, including the operating costs, operability, industrial relations requirements and effects on production
- joint-venture partners, including their experience and their relationship to BHP Billiton
- risk management, including business and reputational risks
- net present value and the total life cycle cost of the proposed project.(State 11cii)

The goal of implementing identified abatement opportunities is to reduce Olympic Dam emissions reportable under the National Greenhouse Gas and Energy Reporting (Measurement) Determination (2008). It is aimed to reduce emissions from the operation to an amount equivalent to at least a 60 per cent reduction (i.e. to an amount equal to or less than 40 per cent) of 1990 emissions, by 2050.

3.6.4 Key legal and other requirements

- **Ratification Act** and the **Indenture** (or as amended by the **Amendment Act** and the **Amended Indenture**)
- **Major Development Approval Conditions**
- *Renewable Energy (Electricity) Act 2000* (Cth)
- Renewable Energy (Electricity) Regulations 2001 (Cth)
- *Energy Efficiency Opportunities Act 2006* (Cth)
- Energy Efficiency Opportunities Regulations 2006 (Cth)
- ***National Greenhouse and Energy Reporting Act 2007*** (Cth)
- National Greenhouse and Energy Reporting Regulations 2008 (Cth)
- National Greenhouse and Energy Reporting (Measurement) Determination 2008
- *Climate Change and Greenhouse Emissions Reduction Act 2007* (SA)
- BHP Billiton Climate Change Position

3.6.5 Values

- Global atmospheric greenhouse gas concentrations.

3.6.6 Key risks

- Excessive contribution to global greenhouse gas concentrations.

3.6.7 Environmental outcome (State 17b)

- Contribute to stabilising global atmospheric greenhouse gas concentrations to minimise **environmental impacts** associated with climate change.

3.6.8 Compliance criteria (State 11a, 17c, 17kiii)

- A reduction in greenhouse gas emissions to an amount equivalent to at least a 60% reduction of 1990 emissions, by 2050.

3.6.9 Leading indicators (State 17d)

- None applicable.

3.6.10 Management plan(s) (State 11)

- Carbon Emissions Management Plan, Document No. 61598:
    - Outlines BHP Billiton's internal policies and commitments to greenhouse gas reduction as well as the external regulations and policies impacting the approach. The Plan highlights BHP Billiton's goal to reduce greenhouse gas levels by at least 60% of 1990 levels by 2050 (State 11a, 11ci).
    - Details the greenhouse gas emissions associated with the operation, and identifies the mitigation measures and opportunities that will be investigated as potential emissions reduction projects (State 11ci).
    - Describes the approach that BHP Billiton will take to setting interim targets and outlines BHP Billiton's methodology for assessing and executing on identified mitigation projects (State 11cii).
    - Details the approach to the development and implementation of greenhouse gas offsets (State 11cii).

3.6.11 Monitoring program(s)

- Energy Use and Greenhouse Gas Emissions Monitoring Program, Document No. 67616:
    - Data collection and reporting of energy use and greenhouse gas emissions.

3.6.12 Controls and management actions (State 17g)

- Implementation of a Smelter 1 operating strategy that optimises the operation of the furnace and reduces LPG consumption.
- Continue dialogue to facilitate improving energy efficiency and reduce GHG emissions as a result of site activities.
- Program to assess and implement improvement opportunities identified during energy balance/audits.
- Implementation of the HSE Design Criteria document (Document No. 47198), providing high-level guidelines for the consideration of greenhouse gas and energy efficiency during project design.

3.6.13 Contingency options (State 17g)

- ODC will comply with the relevant requirements of the Clean Energy Legislative Package, including the carbon pricing mechanism defined within this legislation. Where carbon reduction options are not available or feasible, BHP Billiton will purchase permits as required under the legislation.

3.6.14 Continuous improvement / development opportunities (State 17g)

ODC recognises that both supply-side technologies (such as geothermal and solar thermal electricity generation) and demand-side technologies (such as the use of waste oil as a blasting medium, the development of hybrid or LNG-powered heavy and light vehicles and the use of biofuels) may provide a viable method of mitigating emissions as they mature, and commits to staying up-to-date with the

progress of these (and similar) technologies, with this to be documented in the Carbon Emissions Management Plan as necessary.

- Opportunity: Keep up-to-date with emerging renewable and low-carbon energy sources and their applicability to and viability for Olympic Dam.
- Opportunity: Keep up-to-date with demand-side emissions reduction technologies and their applicability to and viability for Olympic Dam

ODC also recognises that improving the understanding of energy use within the operation is important to identify further energy efficiency projects.

- Opportunity: Improve measurement and analysis of internal energy use.

ODC continues to understand and utilise GHG emissions targets.

- Opportunity: Establish appropriate GHG emissions targets in line with forecast mine and processing production rates.

Scope 3 (indirect) emissions which are considered significant in volume or which ODC may be able to influence, as per the guidance provided by the World Sustainable Business Council, also contribute to global CO2 levels. These are currently not tracked.

- Opportunity: Analyse energy use data in order to gain a better understanding of the Scope 3 emissions associated with the Olympic Dam operation. These Scope 3 emissions may be associated with energy consumed in transport to and from the site and operated by third parties; energy consumed in employee or contractors' accommodation or townships; chemical reactions during the metallurgical processing of the ore and embedded energy (e.g. in construction materials associated with site projects).

3.6.15 Action plan FY14 (State 11b, 17g)

- Continue to identify and implement energy efficiency projects for the existing operation, using information collected from completed energy mass balances and audits, particularly those identified opportunities that do not require capital expenditure.
- Investigate further the viability of biodiesel.
- Continue dialogue with future electricity suppliers, in particular emerging renewable energy companies.
- Continue to improve the energy and greenhouse gas emission measurement, data collection and forecasting.
- Establish an appropriate Scope 1 and 2 GHG emissions target for the combined mining and processing operations for FY15.

3.6.16 Target FY14 (State 11b)

- Scope 1 and 2 GHG emissions for the combined mining and processing operations, and associated activities, of 0.96 Mt of CO_2-e, equal to the FY13 target.

ID 4 GENERATION OF INDUSTRIAL WASTES

ID 4.1 EMBANKMENT STABILITY OF TSF

4.1.1 Responsibility

- Head of HSEC
- Manager Environment
- General Manager – Processing

4.1.2 Scope (State 17a) (MC 2.8.2(c))

Tailings generated from hydrometallurgical processes are pumped to the TSF as slurry. The tailings are discharged onto the TSF Cells 4 and 5 through off-takes from the tailings distribution pipes located at the crest of the perimeter embankments of the TSF. Supernatant liquor collects in ponds in the centre of each TSF cell and the excess is pumped to evaporation ponds for storage and disposal. Some liquor is recycled to the metallurgical plant for recovery of contained metals and acid.

Key aspects of the stability of the embankments are the strength of construction materials and deposited tailings, as well as the pore pressures within and adjacent to the embankments, which can reduce the effective strength of the materials.

4.1.3 Management strategy (MC 2.8.2(c))

Management of embankment stability is achieved by using quality assurance and quality control measures during construction of the original embankments and ongoing upstream embankment raises. Adequate factors of safety for stability are maintained by:

- applying Australian National Committee on Large Dams/International Commission on Large Dams (ANCOLD/ICOLD) design and construction standards which ensure stability under static and seismic loading and minimise erosion on the outer face;
- ensuring the rate of rise of tailings is limited to an average of 2 m per annum or less, which has been shown to provide adequate drying and consolidation of tailings to ensure adequate strength development;
- monitoring the pore pressures within the tailings and embankments on a regular basis using an extensive network of piezometers;
- installing buttresses, filter zones and interception trenches to increase the factor of safety as required.

4.1.4 Key legal and other requirements

- **Ratification Act** and the **Indenture** (or as amended by the **Amendment Act** and the **Amended Indenture**)
- **Major Development Approval Conditions**
- *Radiation Protection Control Act 1982* (SA)
- Code of Practice and Safety Guide for Radiation Protection and Radioactive Waste Management in Mining and Mineral Processing (ARPANSA, 2005)

4.1.5 Values

- Diversity of ecological communities.
- Quality of soil and water resources.

4.1.6 Key risks

- Loss and / or displacement of ecological communities.
- Contamination of soil, surface water or groundwater.

4.1.7 Environmental outcome (State 17b)

- No significant TSF embankment failure.

4.1.8 Compliance criteria (State 17c, 17kiii)

- No significant radioactive contamination arising from uncontrolled loss of radioactive material as a result of an embankment failure to the natural environment.

Note: Any embankment failure that leads to a reportable spill under the Bachmann Criteria will be considered significant. Significant is defined as requiring assessment and remedial action in accordance with the NEPM or EPP and the Mining Code. Measurement and monitoring is carried out in response to a specific event. (State 17ki, 17kii, 17kiv)

4.1.9 Leading indicators (State 17d)

- Pore pressures within or adjacent to the TSF embankment which are greater than the pore pressures used in the slope stability assessment demonstrating compliance with ANCOLD guidelines.

4.1.10 Management plan(s)

- Tailings Retention System Management Plan, Document No. 80791:
  - details loss control measures, current and critical design and operating parameters, monitoring and surveillance requirements including piezometer level monitoring and observed perimeter features.

4.1.11 Monitoring program(s)

- Waste Monitoring Program, Document No. 2792:
  - routine monitoring of the size and location of the supernatant liquor ponds in each TSF cell;
  - routine monitoring of pore pressures within tailings adjacent to the external walls of the TSF.

4.1.12 Controls and management actions (State 17g) (MC 2.8.2(c))

- The size of supernatant ponds is minimised and the location of ponds controlled by management practices (EPA 31543.500-433).
- Locations of active tailings discharge are progressively cycled around the perimeter of the cell, depositing in thin layers on each rotation.
- The rate of rise of tailings is kept to an average of 2 m per annum or less for all cells to ensure adequate drying and consolidation of tailings material.
- The external walls of the TSF are rock armoured to minimise erosion.
- A desktop geotechnical review and operational review of the TSF is undertaken annually by a suitably qualified geotechnical engineer.

4.1.13 Contingency options

- Install buttress to the toe of embankments to increase the factor of safety for slope stability.
- Install filter blankets in areas of high seepage to prevent migration of fines and reduce the risk of a piping failure.
- Install liquor interception systems to collect liquor in areas of high seepage for TSF Cells 1 to 4. TSF Cell 5 East has a toe drain and collection system to intercept and collect any lateral seepage.

4.1.14 Continuous improvement / development opportunities

Maintaining an adequate monitoring network of piezometers is essential to confirm pore pressures are within design criteria for an adequate factor of safety for slope stability. Considerable work has been done on evaluating the reliability of vibrating wire piezometers, which have rapid response times and will not be impacted by ongoing perimeter embankment raising.

- Opportunity: Review the network of piezometers to identify any areas for additional or replacement piezometers.

Several contingency options exist to maintain slope stability and reduce the risk of potential piping failures.

- Opportunity: Identify, design and install contingency options as required.

The operation of TSF Cells 1 to 4 has highlighted areas where the initial design and ongoing operation can be improved. The installation of vibrating wire piezometers in the base of TSF Cell 5 is one example.

- Opportunity: Monitor the commissioning and initial operation of TSF Cell 5 East, including vibrating wire piezometers.
- Opportunity: Utilise the lessons from the operation of the existing cells to improve the design for future tailings storage areas.

4.1.15 Action plan FY14

- Monitor the commissioning and initial operation of TSF Cell 5 East including the vibrating wire piezometers.

4.1.16 Target FY14

- Rate of rise of tailings at an average of 2 m per annum or less.
- Total TSF pond area of 35 ha or less.

ID 4.2 WASTE ROCK CONTAINMENT AND SEEPAGE

4.2.1 Responsibility

- Head of HSEC
- Manager Environment
- General Manager – Mining
- Head of Resource Planning and Development

4.2.2 Scope (State 17a) (MC 2.8.2(c))

The expansion of the Olympic Dam mine requires a Rock Storage Facility (RSF) to be built from overburden and waste rock, in order to access the ore body below. The ore body also includes mineralised rock, currently uneconomic to process, that would be directed to a low-grade stockpile for future processing. During the pre-strip and pre-mine phases of the open pit development, approximately 300 to 350 m of overburden will be removed prior to reaching the ore. Almost all of this material will be transported to the RSF, except for those materials set aside for use in construction or able to be used in underground mine backfill operations. As the mine rock consists of material with different geochemical and geotechnical performance properties, the RSF design incorporates features to achieve particular performance outcomes. These include minimising the exposure of sulphide bearing rock to rainfall and oxygen, hence minimising leaching of those more reactive materials.

Commencement of the open pit involves the removal of sand, clay and unconsolidated material, and deposition into the RSF, forming the necessary base characteristics to meet the design parameters, followed by the blasting and removal of waste. Some of this material will be used in the backfill plant and other construction purposes, with the remainder placed in the RSF. At full project scope as described in the Draft EIS 2009, approximately 390 Mt/annum (more than 1Mt per day) was expected to be added to the RSF during the first 6 years.

This document consolidates the relevant information and ODC's commitments that will be implemented to manage the containment of the RSF for the expanded Olympic Dam operation. Although not required in the initial stages of the development, specific reference is made to the containment of runoff and waste rock for the prevention of erosion, and to the encapsulation of potentially reactive waste rock to ensure effective management in the latter stages of development.

4.2.3 Management strategy (MC 2.8.2(c))

In the long term, the primary issues related to the storage of waste rock are ensuring the stability of the structure, and limiting lateral and base seepage due to the infiltration of stormwater. Since the two issues have different characteristics, a different management approach is required for each. The management strategy outlined below describes the long term approach. A number of the measures, particularly those related to reactive mine rock and stormwater, will not feature in the initial stages of development due to the substantially reduced mining rate (relative to that described in the EIS) resulting in low placement tonnages of unreactive and non-radioactive material

Management of containment of waste rock in storage facilities is achieved by implementing strategies aimed at achieving a safe and stable landform, which can maintain that stability in the long term. The RSF is considered safe if the contents retained within the facility are not released in an uncontrolled manner.

Management strategies for containment of waste rock include:

- planning and design of the RSF as an engineered structure and incorporating known risk factors;
- scheduled surveys and geotechnical inspections;
- maintaining a suitable buffer distance to key infrastructure and **Arid Recovery**;
- maintaining the overall slope of the RSF (including berms) to not more than 35 degrees;
- limiting the RSF overall maximum height at 250 metres with respect to Australian Height Datum (mAHD);
- controlling the movement of stormwater over the surface of the RSF.

The infiltration of stormwater through mineralised rock storages can result in the release of metal-rich and acidic seepage from the base of the structure. This is due to interaction with sulphides and sub-economic mineralisation within the waste rock. Strategies to minimise and manage seepage include:

- constructing the RSF on a base layer of benign mine rock placed over the top of a sand dune/clay pan foundation to provide a stable base and disrupt preferential leachate pathways within the base of the RSF;
- implementing traffic compacted layers that prevent infiltration and provide stability;
- blending and encapsulating potentially reactive mine rock with benign and neutralising material, to minimise the potential for the release of metal-rich and acidic leachate;
- containing stormwater within the RSF footprint.

Note that radioactive material is not expected to be placed onto the RSF within the timeframe of this EPMP. However, the strategies to manage metal rich seepage noted above will be valid for any radionuclides in potential future seepage.

4.2.4 Key legal and other requirements

- **Ratification Act** and the **Indenture** (or as amended by the **Amendment Act** and the **Amended Indenture**)
- **Major Development Approval Conditions**
- *Radiation Protection and Control Act 1982* (SA)
- ***Environment Protection Act 1993***
- Environment Protection (Water Quality) Policy (2003) (SA)

4.2.5 Values

- Diversity of ecological communities.
- Quality of soil and water resources.

4.2.6 Key risks

- Loss and / or displacement of ecological communities.
- Contamination of soil, surface water or groundwater.

4.2.7 Environmental outcome (State 17b)

- No significant adverse impact on local drainage patterns and water quality that would compromise existing water use and water-dependent ecosystems (State 32).
- No significant adverse impact on vegetation as a result of seepage from the RSF (State 32).
- No compromise of current and future land uses on the SML or adjoining areas as a result of seepage from the RSF (State 32).

4.2.8 Compliance criteria (State 17c, 17kiii)

- All RSF seepage captured by the final open pit, as demonstrated by a numerical groundwater simulation model confirmed by monitoring (State 32).
- All RSF seepage attenuated within the SML, as demonstrated by a numerical geochemical model confirmed by monitoring (State 32).
- Maintain groundwater level outside the toe perimeter of the RSF not higher than 80 mAHD (20 m below ground level), based on contoured monitoring results
- Overall slope of the RSF (including berms) to not exceed 35 degrees.
- RSF overall maximum height at 250 mAHD.

4.2.9 Leading indicators (State 17d)

- A groundwater model trend that indicates that all RSF seepage may not be captured by the final open pit, should the trend continue.

- A numerical geochemical model trend that indicates that all RSF seepage may not be attenuated within the SML, should the trend continue.

4.2.10 Management plan(s)

- On-site Stormwater Management Plan, Document No. 111273:
  - introduces a preliminary design for stormwater management within the RSF, including dams, by incorporating runoff from the RSF regions and low grade ore area.
- Mine Closure and Rehabilitation Plan, Document No. 99232:
  - the objective of the mine closure and rehabilitation plan is to describe how the Olympic Dam operation will be successfully closed and rehabilitated to achieve the agreed post-closure land use, and the performance criteria that will be used to measure successful closure and rehabilitation.
- Erosion and Soil Control Plan, Document No. 111275:
  - Measures for minimising erosion and maintaining soil control, for maintaining stability of the RSF.

4.2.11 Monitoring program(s)

- Groundwater Monitoring Program, Document No. 2791:
  - describes the environmental monitoring activities that are undertaken by ODC for the purpose of quantifying any change in the extent or significance of impacts of the operation on groundwater;
  - assesses the performance of the control measures employed to limit these impacts, and to meet relevant legal and other requirements.
- Waste Monitoring Program, Document No. 2792:
  - describes environmental monitoring activities undertaken by ODC for the purpose of quantifying any change in the extent or significance of impacts of the operation on soil and groundwater from waste facilities;
  - assesses the performance of the control measures employed to limit these impacts, and to meet relevant legal and other requirements.

4.2.12 Controls and management actions (State 17g) (MC 2.8.2(c))

- The final RSF cover is to be constructed out of benign rock such as sandstone, quartzite and limestone, to resist erosion in the long term.
- An engineered structure, such as a berm, catch bank or similar, is to be designed to contain stormwater for a 1-in-100-year event within the sub-catchments intersected by the ultimate footprint of the RSF.
- Non-reactive rock is used for the outermost walls of the RSF (no reactive material is placed under outer slopes).
- Stormwater is controlled within defined management areas and there would be no discharge of stormwater from the SML.
- The following Design Controls are applied to the RSF:
  - all surfaces are traffic-compacted (except the ultimate inner and outer RSF slopes) to minimise rainfall infiltration;
  - a layer of benign and/or neutralising material (overburden) is placed at the base of the RSF to increase the potential for neutralisation and natural attenuation of metals and radionuclides in seepage fluid.
- Growth of indigenous plants (generally salt-tolerant) is encouraged around the base of the RSF.
- The final footprint of the RSF will not alter and/or encroach on the existing footprint of **Arid Recovery**.

4.2.13 Contingency options

- To be developed as required.

4.2.14 Continuous improvement / development opportunities

International and national standards are in place to ensure the effective protection of humans and the environment from the harmful effects of radiation. For facilities such as the RSF, designed to contain very low level radioactive material in the future, this will involve a radiation risk review in the form of a Features, Events, Processes (FEP) study.

- Opportunity: Develop the scope for the Features, Events, Process (FEP) study for the RSF.

The regional Stuart Shelf groundwater model, as presented in the EIS and used to predict regional groundwater drawdowns, is reviewed and updated every three years, taking into account the data collected through the Groundwater Monitoring Program. Updates to the model will be used to confirm that all movement of RSF seepage will be captured by the final open pit, with geochemical attenuation within the SML.

- Opportunity: Review the groundwater simulation model with a specialised consultant to ensure that it will adequately meet the requirement to predict RSF seepage and geochemical attenuation.

For operational management of the RSF, a management plan is required that describes the implementation of management strategies for the RSF. The management strategies will be designed to achieve performance outcomes and incorporate design features to minimise leaching of reactive materials.

- Opportunity: Develop the RSF Management Plan and Operational Manual

4.2.15 Action plan FY14 (State 17g)

- Develop the scope for the Features, Events, Process (FEP) study for the RSF.
- Review the groundwater simulation model with a specialised consultant to ensure that it will adequately meet the requirement to predict RSF seepage and geochemical attenuation.
- Develop an RSF Operations Manual to comply with operational basis criteria.

4.2.16 Target FY14

- None applicable

ID 4.3 TAILINGS SEEPAGE

4.3.1 Responsibility

- Head of HSEC
- Manager Environment
- General Manager – Processing

4.3.2 Scope (Aus 5a; State 17a) (MC 2.8.2(c))

Tailings generated from hydrometallurgical processes are pumped to the TSF as slurry. The tailings are discharged onto the TSF Cells 4 & 5 through off-takes from the tailings distribution pipes, located at the crest of the TSF perimeter embankments. Supernatant liquor collects in ponds in the centre of each TSF cell and excess is pumped to evaporation ponds for storage and disposal. Some liquor is recycled to the metallurgical plant for recovery of contained metals and acid. Seepage occurs in two main forms, comprising base seepage, which is essentially vertical flow through the floor of the TSF, and lateral seepage, which is horizontal flow through or below embankments. Base seepage includes seepage from the supernatant pond and seepage from the tailings beach.

Natural groundwater in the vicinity of the operation is of poor quality and is unable to support **environmental values** (aquatic ecosystems, primary industries, recreation and aesthetics, drinking water and industrial water) as defined by ANZECC and ARMCANZ (2000). The high salinity of the groundwater makes it unsuitable for consumption by humans or stock, or for irrigation, and is classified as having no desired water quality conditions for ore processing at Olympic Dam.

Geochemical investigations and groundwater monitoring have supported the concept that any seepage of tailings liquor is effectively neutralised in the soils below the TSF. This is reported in the **EIS**.

4.3.3 Management strategy (Aus 5biv, 5k; State 17g) (MC 2.8.2(c))

Seepage occurs as a function of the normal operation of the TSF and is minimised as far as practicable by:

- providing effective drying and consolidation of deposited tailings;
- minimising liquor area on the TSF as far as practicable by decanting to lined evaporation ponds (EPA 31543.500-433);
- an underdrainage system which includes a HDPE liner installed in portions of TSF Cells 4 and 5.

A lysimeter installed in Cell 5 is used to help quantify base seepage through the tailings beach. Lateral seepage is captured in interception trenches and returned to the TSF or evaporation ponds.

A network of groundwater monitoring bores provides warning of any significant seepage that may be occurring.

Recharge of the Andamooka Limestone aquifer beneath the TSF with neutralised tailings liquor reduces the salinity of the groundwater and is at times extracted from LP2 to provide a useful addition to site water supply.

4.3.4 Key legal and other requirements

- **Ratification Act** and the **Indenture** (or as amended by the **Amendment Act** and the **Amended Indenture**)
- **EPBC Act Approval Conditions**
- **Major Development Approval Conditions**
- ***Environment Protection Act 1993***
- *Radiation Protection Control Act 1982* (SA)
- Code of Practice and Safety Guide for Radiation Protection and Radioactive Waste Management in Mining and Mineral Processing (ARPANSA 2005)
- Criteria and Procedure for Recording and Reporting Incidents at SA Uranium Mines (DMITRE)

4.3.5 Values

- Diversity of ecological communities.
- Quality of soil and water resources
- Current and future land use.

4.3.6 Key risks

- Impacts to native vegetation from seepage-induced mounding beneath the TSF.
- Contamination of soil, surface water or groundwater as a result of seepage greater than predicted.
- Impacts from seepage that compromise future land uses of the SML or adjoining areas.

4.3.7 Environmental outcome (State 17b)

- No significant adverse impact on vegetation as a result of seepage from the TSF (Aus 5c, 26; State 32).
- No compromise of current and future land uses on the SML or adjoining areas as a result of seepage from the TSF (State 32).
- No compromise of the **environmental values** of groundwater outside the SML as a result of seepage from the TSF (Aus 5c, 22c).

4.3.8 Compliance criteria (State 17c, 17kiii)

- Maintain groundwater level outside the external perimeter road of TSF Cells 1 to 5 to not higher than 80 mAHD (20 m below ground level) (Aus 5d, 6, 26; State 32).
- All TSF seepage captured by the final open pit, as demonstrated by a numerical groundwater simulation model confirmed by monitoring (Aus 5d, 6, 24c; State 32).
- All TSF seepage attenuated within the SML, as demonstrated by a numerical geochemical model confirmed by monitoring (State 32).

4.3.9 Leading indicators (State 17d)

- An increasing trend in the groundwater level outside the external perimeter road of the TSF that indicates 80 mAHD (20 m below ground level) may be exceeded within 12 months.
- A groundwater model trend that indicates that all TSF seepage may not be captured by the final open pit should the trend continue.
- A numerical geochemical model trend that indicates that all TSF seepage may not be attenuated within the SML should the trend continue (Aus 5e, 25).

4.3.10 Management plan(s)

- Tailings Retention System Management Plan, Document No. 80791:
  - details loss control measures, current and critical design and operating parameters, monitoring and surveillance requirements including observed perimeter features and groundwater level monitoring.

4.3.11 Monitoring program(s)

- Groundwater Monitoring Program, Document No. 2791:
  - routine groundwater level monitoring around the TSF and evaporation ponds;
  - routine groundwater quality monitoring around the TSF and evaporation ponds (EPA 31543.500-436).
- Waste Monitoring Program, Document No. 2792:
  - a liquor balance of each evaporation pond is conducted to highlight potential significant leaks (EPA 31543.500-435).

4.3.12 Controls and management actions (Aus 5biv, 5k) (MC 2.8.2(c))

- Monitoring and review of performance data relating to the TSF.
- The size of supernatant ponds are minimised and the location of ponds controlled by management practices (EPA 31543.500-433).
- Locations of active tailings discharge are progressively cycled around the perimeter of the cell, depositing in thin layers on each rotation to ensure effective drying and consolidation.
- The rate of rise of tailings is kept to an average of 2 m per annum or less for all cells to ensure adequate drying and consolidation of tailings material.
- A desktop geotechnical review and operational review of the TSF is undertaken annually by an independent tailings consultant.
- A water balance is used to assist in the management of the TSF and enable future tailings and plant liquor disposal or recycle requirements to be assessed (EPA 31543.500-435).
- Stormwater collected within the TSF is evaporated and/or redistributed as necessary to maintain the water balance and minimise risks associated with the collection of water on the TSF (EPA 31543.500-434).
- Perimeter seepage interception trench is installed around TSF Cell 5.
- Underdrainage system including HDPE liner is installed in TSF Cells 4 and 5.
- Regular inspections around the perimeter of the TSF identify any new areas of lateral seepage. Existing perimeter features are also monitored to determine if there is any change in size, location and appearance.

4.3.13 Contingency options (Aus 5biv) (MC 2.8.2(f))

- The TSF Groundwater Contingency Plan (Document No. ODENV030) as per approval conditions for TSF Cells 4 and 5 (EPA 31543.500-407):
  - defines the action triggers that initiate management action;
  - provides the response plan, including communication to identified stakeholders;
  - explains remediation options.

4.3.14 Continuous improvement / development opportunities

Regular inspections around the perimeter of the TSF identify any new areas of lateral seepage. Existing perimeter features are also monitored to determine if there is any change in size, location and appearance.

- Opportunity: Install a liquor interception system where seepage of liquor has potential to impact native vegetation.

The operation of TSF Cells 1 to 4 have highlighted areas where the initial design and ongoing operation can be improved. The installation of the lysimeter to directly measure base seepage in TSF Cell 5 is one example.

- Opportunity: Monitor the commissioning and initial operation of TSF Cell 5 East, including the lysimeter.

4.3.15 Action plan FY14

- Identify and install additional liquor interception systems as required.
- Monitor the commissioning and initial operation of TSF Cell 5 East, including the lysimeter.

4.3.16 Target FY14

- None applicable

ID 4.4 FAUNA INTERACTION WITH TAILINGS RETENTION SYSTEM

4.4.1 Responsibility

- Head of HSEC
- Manager Environment
- General Manager – Processing

4.4.2 Scope (Aus 5a; State 17a)

Open ponds of acidic liquor and wet beach environments at the Tailings Retention System (TRS) present a risk of attracting fauna, particularly waterbirds and small to medium-sized mammals. Large numbers of these species are regularly recorded utilising non-toxic water storages, such as process water and sewage ponds, in the vicinity of the operation. Acidic liquor ponds and wet beach environments within the TRS offer poor-quality habitat for fauna, but a number of animals are inadvertently attracted to the facilities due to their resemblance to natural water habitats.

'At-risk' fauna species (mainly waterbirds) are recorded in the Olympic Dam area regularly. There is potential for several of these 'at-risk' species to visit the TRS, which may result in fauna losses due to the hazardous nature of the liquor.

4.4.3 Management strategy (Aus 5biii, 5k)

Management of fauna interaction with the TRS is achieved by implementing strategies aimed at reducing the likelihood of fauna accessing the TRS and reducing the risk that fauna will be harmed after accessing the area. Management strategies focus on:

- Making environments within the TRS less attractive to fauna;
- Where possible, preventing access to areas of the TRS;
- Actively deterring fauna from entering the area;
- Managing fauna that do enter the area to minimise impact;
- Committing to not constructing further evaporation ponds (Aus 19).

Operational targets and control actions are applied to the TRS to ensure, in particular, that impacts to migratory species are limited and comply with significant impact guidelines, even though current impacts on these species are very low.

4.4.4 Key legal and other requirements

- **Ratification Act** and the **Indenture** (or as amended by the **Amendment Act** and the **Amended Indenture**);
- **EPBC Act Approval Conditions;**
- **Major Development Approval Conditions;**
- *National Parks and Wildlife Act 1972* (SA);
- *Environment Protection and Biodiversity Conservation Act 1999*. (Cth)

4.4.5 Values

- **Listed species and / or ecological communities.**

4.4.6 Key risks

- Impact to populations of **listed species** interacting with the TRS.

4.4.7 Environmental outcome (State 17b)

- No significant adverse impacts to **listed species** (South Australian, Commonwealth) as a result of interactions with the Olympic Dam TRS (Aus 5c, 18).

4.4.8 Compliance criteria (State 17c, 17kiii)

- No significant adverse impact on the size of an **important population of** Category 1a and 1b fauna **species** as a result of interactions with the Olympic Dam TRS.

*Note: Significant impact is as defined in the **Significant Impact Guidelines** and greater than predicted in the **EIS**.*

4.4.9 Leading indicators (State 17d)

- None applicable

4.4.10 Management plan(s)

- None applicable.

4.4.11 Monitoring program(s)

- Fauna Monitoring Program, Document No. 2663:
  - routine monitoring of fauna interaction within the TRS;
  - routine monitoring of waterbirds on the TRS, compared to clean water bodies on the SML and Roxby Downs Municipality.
- Waste Monitoring Program, Document No. 2792:
  - monitor the size and location of the supernatant liquor ponds in each TSF cell on a monthly basis – pond sizes above threshold trigger remedial action.

4.4.12 Controls and management actions (Aus 5biii, 5k; State 17g)

Since the implementation of the TRS fauna project a wide range of control and management actions has been reviewed. The size and functional design of the TRS impose significant constraints on proposed fauna management strategies, making many of them unfeasible. Constraints comprise; the large size of individual ponds and the system as a whole; the requirement for evaporation due to positive water balance; the highly acidic liquor within cells; and cells holding large volumes of water, which in an arid region with very few other permanent water bodies makes the TRS an attractive option for fauna.

The list below summarises a range of control and management practices reviewed to date, their status and the justification for their status. In an attempt to maintain **best practicable technology** for management, regular review and investigation of these and any potential new options is undertaken, to determine suitability and potential efficacy for use at the TRS. In addition to the actions listed below, a number of research projects are currently underway that may assist in the management of fauna interaction with the TRS. Through a partnership with Deakin University, investigations are being made into the ecology of the Banded Stilt (Aus 18), and a project due for completion in FY13 (at the time of reviewing this EMP) is investigating the movements of waterbirds in arid regions and the visual physiology of local species with the aim to develop more effective deterrents.

Control and management actions reviewed under the TRS fauna project which were rejected, with the following justifications, include:

- Neutralisation of liquor – difficult from an engineering perspective and costly, remaining liquor will still contain toxicants, continuous and large volumes of reagent required with additional disposal requirements.
- Detoxification of liquor – costly and difficult to remove all toxicants, some may remain, continuous reagent requirement, little value without neutralisation.
- Netting/ covering ponds/cells – ponds within the existing TRS are too large (extremely difficult to engineer solution), impractical, potential to decrease evaporation.
- Reduction of cell size in the evaporation pond system – expensive, impractical and will significantly reduce evaporation potential and footprint of facilities.
- Central thickened discharge disposal – expensive, impractical; requiring radical change to tailings deposition system, excess liquor will still require evaporation ponds.
- Sprinklers – health and safety issues, maintenance issues acidic degradation of sprinklers and clogging with jarosite, overspray of acidic liquor.
- Olfaction reagents and dyes – not proven, TRS already significantly coloured with an unpleasant odour.

- Predators – labour intensive, not practical at night, predator birds may be affected themselves; not consistent with hands-off approach.
- Effigies – habituation of resident species, unlikely to be effective over large distances, unlikely to survive harsh environment.
- Chemical repellents – health and safety issues, spraying not practical on sustained basis.
- Pyrotechnics – labour intensive, use during the day is against the hands off approach and may be counter-productive; not consistent with hands-off approach, scale of area limits effectiveness.
- Radio controlled devices – labour intensive, not practical at night, unlikely to survive well in harsh environment; not consistent with hands-off approach.
- Boats – health and safety issues with operators on acidic liquor, maintenance issues, not consistent with hands-off approach.
- Hovercrafts – health and safety issues with operators on acidic liquor, maintenance issues not consistent with hands-off approach.
- Helicopters – costly, health and safety issues; not consistent with hands-off approach.

Deterrents reviewed under the TRS fauna project that were trialled and rejected, with the following justifications, include:

- Active deterrence by staff in the area – ineffective, not viable at night.
- Laser deterrent – ineffective.
- Radar activated deterrent – false activations, software issues, overheating of equipment.

The most effective controls, and those upon which management is based, are those that reduce the attractiveness of the facility to fauna, and in particular waterbirds. Deterrents of this type limit available wading habitat and provide more attractive alternatives elsewhere. The following measures have been implemented (including measures for non-waterbird fauna):

- Minimise pond size – decreases available habitat (EPA 31543.500-433).
- Management of minimum water depth – maintain a minimum liquor depth to discourage wading birds.
- Provision of good water storages away from TRS – watering points maintained away from TSF for kangaroos, sewer ponds and process water dams act as alternate stop-overs for waterbirds.
- Randomly activated audio and light deterrents – trials demonstrated some positive results.
- 1.8 m chain mesh fencing with small-gauge wire footing around evaporation ponds – prevents access by medium-large terrestrial animals.
- Minimal disturbance ‘hands off approach’ – individuals that are not disturbed become less stressed, are less likely to interact with the system and more likely to move on.
- Sound Identification activated deterrent – trials to date indicate some potential to form the basis of on-demand deterrent.

4.4.13 Contingency options

- None applicable.

4.4.14 Continuous improvement / development opportunities

The TRS fauna project was instigated after an increase in numbers of birds interacting with the TRS became apparent in 2004. This project manages research, on-ground work and monitoring relating to the interaction of fauna with the TRS.

- Opportunity: Identify new opportunities to reduce fauna mortalities through ongoing research into management practices relating to fauna interaction with tailings storage systems.

Investigations and trials of various deterrent systems have continued since the implementation of the TRS fauna project.

- Opportunity: Implement trials of on-demand deterrents triggered by SoundID (bird call recognition software, in an effort to develop the most effective deterrent systems possible.
- Opportunity: Where possible, incorporate recommendations from Deakin University research project on the visual physiology of local bird species into existing TRS deterrent systems.

Opportunistic and standardised monitoring of fauna interactions at the TRS has occurred since the implementation of the TRS fauna project.

- Opportunity: Continue to assess the impact to fauna and the efficacy of various management tools through monitoring.

4.4.15 Action plan FY14

- Coordinate the design and development of a trial on–demand SoundID deterrent system for testing at local waterbodies and the TRS.
- Continue the trial of high-density poly-ethylene (HDPE) netting potential within the TRS, for possible application to the expanded TRS.
- Where possible, incorporate deterrent measures listed as recommendations in the Deakin University research project on visual physiology of local bird species.

4.4.16 Target FY14

- Total TSF pond area of 35 ha or less (Aus 5f, 20).
- A minimum liquor depth on operating TRS evaporation ponds of 250 mm (Aus 5f, 20).

Note: Operating ponds are those in normal operational use and excludes ponds that are out of service, ponds being dried for maintenance, embankment raising or other purposes, and ponds required for temporary management of excess liquids as a result of rain.

ID 4.5 SOLID WASTE DISPOSAL

4.5.1 Responsibility

- Head of HSEC
- Manager Environment
- Senior Manager – Non Process Infrastructure

4.5.2 Scope (State 17a)

The activities undertaken at Olympic Dam from mining and surface operations generate a series of waste streams, including electrical cables, paper/cardboard, poly pipe, scrap metal, tyres, conveyor belt, wooden pallets, general waste and hazardous wastes. Dedicated areas within the Resource Recovery Centre (RRC) allow waste streams to be segregated and certain items to be reused or recycled. Waste streams currently reused or recycled include: air filters, batteries, paper/cardboard, chemical containers, lead plates, mill liners, scrap metal, wooden pallets and waste oil.

For those wastes that are not reused or recycled, the RRC has a landfill facility for final disposal. This landfill is operated to ensure that wastes are adequately contained and isolated from the environment. Olympic Dam maintains systems and processes to control and administer the disposal of hazardous waste. Designated HSEC personnel provide advice on the disposal of hazardous waste and authorise disposal within the SML, primarily to the TSF. Hazardous waste unsuitable for disposal within the SML is transported off-site to an appropriate depot for further treatment, recycling or disposal. Sewage wastes are disposed of to an on-site sewage facility, with sewage waste generated at Olympic Village directed to a dedicated sewage plant for treatment.

Appropriate systems are in place to ensure the hierarchy of eliminate, reduce, reuse, recycle is adopted and that wastes are managed in accordance with regulatory requirements.

Wastes generated within the township of Roxby Downs, the Charlton Road industrial area and Olympic Village, are disposed of in the Opal Road Landfill, which is managed and operated by the Roxby Downs Municipal Council.

Note: Radioactive wastes are covered in ID 4.6 and the risks associated with the management of tailings waste are covered in ID 4.1,.

4.5.3 Management strategy (State 17g)

ODC operates a system based on the waste management hierarchy, where the prevention and minimisation of waste generation is preferred over the reuse and recycling of materials, which in turn are favoured over disposal options. In practice, this takes the form of procurement processes which place greater responsibility on suppliers to reduce the volume of imported materials which would contribute to waste, improved waste segregation at the source and ways to prolong the life of major landfill contributors.

4.5.4 Key legal and other requirements

- **Ratification Act** and the **Indenture** (or as amended by the **Amendment Act** and the **Amended Indenture**)
- **Major Development Approval Conditions**
- ***Environment Protection Act 1993***
- Environmental Management of Landfill Facilities Guideline 2007
- **EPA Licence 1301**

4.5.5 Values

- Human health and amenity.
- Quality of soil and water resources.
- Sustainable use of resources and materials.

4.5.6 Key risks

- Personnel and public exposure to hazardous substances.

- Contamination of soil, surface water or groundwater.
- Unsustainable use and depletion of resources and materials.

4.5.7 Environmental outcome (State 17b)

- No significant adverse impacts as a result of management of solid waste.

4.5.8 Compliance criteria (State 17c, 17kiii)

- No site contamination leading to **material environmental harm** arising from the operation of the Resource Recovery Centre.

4.5.9 Leading indicators (State 17d)

- None applicable.

4.5.10 Management plan(s)

- Waste Management Plan, Document No. 83202:
  - outlines the general approach to waste management at Olympic Dam, including details regarding segregation of wastes and the role of the RRC in the transfer, segregation, storage, recycling and disposal of wastes;
  - identifies and forms the basis of investigation of various used tyre recycling and disposal alternatives in accordance with the waste hierarchy.
- Tailings Retention System Management Plan, Document No. 80791:
  - details the requirements associated with the disposal of hazardous solid wastes to the TSF.

4.5.11 Monitoring program(s)

- Waste Monitoring Program, Document No. 2792:
  - routine monitoring of general and industrial waste disposal and recovery to identify opportunities to minimise resource use.

4.5.12 Controls and management actions (State 17g)

- Waste streams, including hydrocarbons and batteries, are segregated and stored appropriately, in accordance with the relevant Australian Standards that apply to the specific waste type, at the RRC (EPA 1301.80-18).
- All waste sent offsite is subject to a radiation clearance before it leaves site.
- Listed wastes are tracked during transport using the EPA waste tracking system (EPA 1301.80-43).
- Controlled wastes are not transported interstate without obtaining approval from the appropriate environmental agency in the destination state or territory, and the EPA waste tracking system is used for tracking waste during transport (EPA 1301.80-44).
- Wastes are transported by appropriately licensed contractors (EPA 1301.80-18).
- Any new landfill facility is designed and operated in accordance with the relevant sections of the SA EPA Environmental Management of Landfill Guidelines (2007) (DEIS 5.6.2; SEIS 5.4.1).
- Cover for the landfill facility is provided on a daily basis, with construction of the waste cells in accordance with EPA guidelines (DEIS 5.6.2).
- Spent catalyst is disposed of in the TSF (DEIS 5.6.6; SEIS 5.4.2).
- Temporary tyre storage is consistent with the requirements of the EPA Guidelines for Waste Tyres and the SA Fire Services General Guidelines for the Outdoor Storage of Used Tyres (SEIS 5.4.3).
- Regular visual inspections of the sewage facilities are undertaken. Pond walls are inspected for any abnormalities. Samples are also taken monthly to ensure sewer ponds are operating effectively.

- The ODV Sewage system is designed and managed in accordance to relevant guidelines and standards.

4.5.13 Contingency options (State 17g)

- Emergency spill kits are available at the listed waste loading and collection points (EPA 1301.80-18).
- A Sewage Treatment Works Contingency Plan has been developed which outlines the plan of action to be taken in the event of emergency or abnormal situations (EPA 3054.315-458).
- ODV Sewage System Monitoring and Contingency Plan. Document No. 108929

4.5.14 Continuous improvement / development opportunities (State 17g)

The opportunity to reuse and recycle materials would be greater if more waste materials were segregated at their source. This would prevent contamination and double handling and enable more accurate tracking of waste streams. During FY13 a trial was conducted in the Concentrator Hydromet area which involved the implementation of four waste segregation stations (each station housed six waste stream disposal bins; steel; wood; plastic; oily waste; cardboard/paper and general waste). Data was collected on a regular basis, to determine correct segregation compliance and the general sustainability of the stations (housekeeping, maintenance, resource recovery centre upkeep).

- Opportunity: Following the completion of the trial of waste segregation stations in the Concentrator Hydromet, roll out recycling/waste transfer stations to other departments.

No site-standard recycling program exists for office-based waste.

- Opportunity: Develop an office-based recycling program to enhance recycling of paper/cardboard and refundable drink containers.

The Environmental Management of Landfill Facilities Guideline 2007 details the minimum standards required for landfill operations regarding engineering, monitoring and management. The development of a Landfill Environmental Management Plan (LEMP) is one component of the Landfill Guidelines.

- Opportunity: Integrate requirements from the Landfill Guidelines into the Waste Management Plan.
- Opportunity: Expand the Waste Monitoring Program and Groundwater Monitoring Program to include assessment of specific impacts from the landfill operations.

One of the largest volumes of waste generated on site is rubber tyres. Used tyres are already reused on site where possible, as road berms and for area demarcating. Reducing the quantity of waste tyres is key to reducing the volume of landfill. Investigations regarding initiatives to increase tyre life will be progressed during detailed design of the project (DEIS 5.6.3; SEIS 5.4.3).

- Opportunity: Investigate ways to increase tyre life for haul trucks.

Spent catalyst (acid plant catalyst containing vanadium pentoxide) is a hazardous waste produced on site and is currently disposed of into the TSF. Investigations into the radiological components of the waste product have been undertaken in the past to aid in determining if alternative disposal or treatment methods are available. Historically, recycling has not proved to be viable in Australia.

- Opportunity: Investigate alternative treatment methods for spent catalyst (DEIS 5.6.6).

A doline has developed in the secondary pond of the site sewage lagoon. A project is underway to rectify this issue and ensure that seepage from the site sewage lagoon is minimised.

- Opportunity: Re-engineer the site sewage lagoons to minimise seepage.

4.5.15 Action plan FY14 (State 17g)

- Integrate the requirements from the Landfill Guidelines into the Waste Management Plan.
- Progress a project to re-engineer the site sewage lagoons to minimise seepage.

4.5.16 Target FY14

- Increase the proportion of resources diverted from landfill from the FY13 baseline.

ID 4.6 RADIOACTIVE WASTE

4.6.1 Responsibility

- Head of HSEC
- Manager Environment
- Manager Health
- Head of Production

4.6.2 Scope (Aus 5a; State 17a; MC 2.8.2(c))

The principal activity of the Olympic Dam operation is the mining and processing of ore containing copper, gold, silver and uranium. The existing operation has maintained effective systems for the control of radioactive waste since operations began and these systems will continue.

Radioactive waste is defined in the **Mining Code** (ARPANSA 2005) as material that contains or is contaminated with radionuclides at concentrations or activities greater than clearance levels as established by the relevant authorities and for which no use is foreseen.

Material covered under this management program includes:

- processing tailings and liquors which are stored in the TSF;
- **low-level radioactive waste** from the laboratory and other areas of the metallurgical plant;
- **contaminated waste** are items of plant and equipment that have become contaminated during processing and cannot be cleaned and recycled economically; and
- soil contaminated by spills of process materials.

The overall aim of the management plan is to ensure that all radioactive waste is contained and controlled.

Radioactive wastes may result in emissions from the SML that have the potential to cause impact outside the SML. Potential impacts of radioactive emissions include exposure to the public living in Olympic Village and in the Roxby Downs township.

This management program incorporates recent developments at an international level, which have been adopted in Australia and that require the radiological assessment of impacts to non-human biota.

This document applies to the management measures for the existing operations.

Radiation impacts as a result of emissions from radioactive waste are addressed in the EM Program ID 3.5 Radioactive Emissions.

4.6.3 Management strategy (Aus 5bi, 5k)

The approach to management of radiation (including radioactive waste) at Olympic Dam is based on the recommendations of the International Commission on Radiological Protection (ICRP), which outline a system of dose limitation for the protection of humans and the environment from the harmful effects of radiation (Aus 15; State 34) (MC 2.8.2(c)). It includes:

- justifying any practice that results in radiation exposure;
- optimising protection by ensuring that doses are as low as reasonably achievable; and
- establishing limits on individual dose.

The ODC approach also takes into account the standards and guidance published by the International Atomic Energy Agency (IAEA) in its Safety Standards Series.

Radioactive waste management in mining in Australia is guided by the Code of Practice and Safety Guide for Radiation Protection and Waste Management in the Mining and Processing of Radioactive Ores (ARPANSA 2005 – known as the **Mining Code**). The **Mining Code** elaborates on the ICRP and IAEA requirements and is generally adopted in its entirety in state legislation throughout Australia. There is a specific requirement to develop a Radioactive Waste Management Plan (RWMP). (Aus 15, 29c; State 34)

Due to the integrated Environment Management System that ODC implements at Olympic Dam, the specific requirements of the RWMP have been incorporated into the broader EPMP.

4.6.4 Key legal and other requirements

- **Ratification Act** and the **Indenture** (or as amended by the **Amendment Act** and the **Amended Indenture**)
- **EPBC Act Approval Conditions**
- **Major Development Approval Conditions**
- ***Environment Protection Act 1993***
- *Radiation Protection and Control Act 1982* (Radiation Protection and Control (Ionising Radiation) Regulations 2000) (SA)
- Code of Practice and Safety Guide for Radioactive Waste Management in Mining and Mineral Processing (ARPANSA 2005) (State 34)
- Environmental Management of Landfill Facilities Guideline (SA EPA 2007)

4.6.5 Values

- Human health and amenity.
- Diversity of ecological communities.
- Quality of soil and water resources.

4.6.6 Key risks

- Radioactive contamination of soil or groundwater.
- Dust and radon release from the operation greater than predicted.
- Human exposure to radioactive material as a result of accidental release from site of contaminated material or equipment.

4.6.7 Environmental outcome (State 17b)

- No adverse impacts to public health as a result of radioactive waste from ODC's activities (Aus 5c, 13; State 34).
- No **significant adverse impacts to populations** of **listed species** or **ecological communities** as a result of radioactive waste from ODC's activities (State 34).

4.6.8 Compliance criteria (State 17c, 17kiii)

- Radiation doses to **members of the public** less than 1 mSv/y above natural background (Aus 5d, 6, 13; State 34).
- Deposition of project originated ^{238}U less than 25 Bq/m^2/y at the non-human biota assessment sites.

4.6.9 Leading indicators (State 17d)

- Indications that a **dose constraint** of 0.3 mSv/y to **members of the public** above natural background will be exceeded (Aus 5f, 6, 14; State 34).
- Indications that a reference level of 10 µGy/h for impacts on non-human biota above natural background will be exceeded (Aus 5f, 6, 14; State 34).

Note: The reference level for non-human biota is set as an interim criterion until such time as an agreed national approach is determined.

4.6.10 Management plan(s)

- Tailings Retention System Management Plan, Document No. 80791:
  - details loss control measures, current and critical design and operating parameters, monitoring and surveillance requirements including piezometer level monitoring, groundwater monitoring and observed perimeter features;
  - provides detailed operating instruction for the TSF; and
  - details the requirements associated with the disposal of hazardous solid wastes to the TSF.

- Waste Management Plan, Document No. 83202:
  - guidance on disposal and tracking of all waste at the operations.

4.6.11 Monitoring program(s) (State 17g)

- Environmental Radiation Monitoring Program, Document No. 2790:
  - Assessment of doses from monitoring results, for:
    - **members of the public** dose assessment; and
    - non-human biota radiological assessment.
  - Monitoring and data collection, including:
    - number of radioactive process spills.
- Waste Monitoring Program, Document No. 2792:
  - records of radioactive waste produced
  - methods of control

4.6.12 Controls and management actions (Aus 5bi, 5k; State 17g, MC 2.8.2(c))

4.6.12.1 Radiation protection systems

- The existing site radiation protection and radioactive waste management systems, processes and practices have been proven to work effectively. On occasion they will be updated with proven and tested improvements.
- Radiation protection design criteria have been established and are mandatory for all facilities (Aus 15; State 34).

4.6.12.2 Management of the TSF

- The management of the existing TSF draws on a number of programs, which include:
  - A management method that is designed to deposit the tailings in thin layers, allowing liquor to evaporate and the solid tailings to consolidate and compact;
  - Monitoring of pressure across the tailings pipeline via the process control system to identify potential failures in the tailings pipeline;
  - A water/liquor balance across the TSF is conducted annually;
  - An audit of operational procedures for the TSF is conducted annually; and
  - A register is maintained of waste material other than tailings disposed of in the TSF.

4.6.12.3 General radioactive waste management

- Laboratory waste and PPE is stored at the pilot plant until appropriate long-term disposal is developed.
- Plant and equipment that is contaminated with process material is stored in the temporary Contaminated Waste Disposal Facility.
- A register of hazardous waste disposal is maintained (including radioactive wastes, disposed of within the SML).
- The radionuclide content (^{238}U and ^{226}Ra) of mine water used for dust suppression is tested to ensure it remains below 50 Bq/l (^{238}U) and 5Bq/l (^{226}Ra).
- The established ‘radiation clearance’ process is used, which ensures that all material sent for recycling (or leaving site) meets appropriate radiation release criteria.

4.6.13 Contingency options (Aus 5bi; State 17g, MC 2.8.2(f))

- Continuous monitoring during design and construction of waste facilities to ensure that design criteria have been met, and redesign, re-engineering or modification of management procedures of the TSF, if necessary.

4.6.14 Continuous improvement / development opportunities (State 17g)

International and national standards, guidelines and codes are subject to change from time to time, to ensure effective protection of humans and the environment from the harmful effects of radiation. Any new recommendations or revisions should be reviewed and implemented as necessary.

- Opportunity: Maintain a watching brief on ICRP and IAEA recommendations and any new national Codes of Practice and implement as necessary.

International and national standards are in place to ensure the effective protection of humans and the environment from the harmful effects of radiation. For facilities such as the RSF, designed to contain very low level radioactive material in the future, and for the future TSF expansion, this will involve a radiation risk review in the form of a Features, Events, Processes (FEP) study.

- Opportunity: Develop the process for the Features, Events, Processes (FEP) study for the RSF and future TSF expansions.

ALARA is built into the design of the operation. This means that all reasonable efforts are made to ensure that radiation and radioactive emissions are controlled and managed in the design of new plant. Radiation protection design criteria have been established and are mandatory for all facilities. An optimisation (**ALARA**) study will be conducted for all phases of the future expansion with findings incorporated into designs.

- Opportunity: Develop and implement optimisation in design process.

Olympic Dam produces waste of various streams as a result of normal operations. A facility specifically designed for storing contaminated waste has been established. Maximising the capacity whilst minimising the volume of waste deposited at the facility, is a key factor in reducing the environmental impact through land disturbance and improved resource recovery.

- Opportunity: Continue to develop, update and implement a strategy towards managing radioactive waste produced at the site (including waste minimisation strategy).

4.6.15 Action plan FY14

- Develop FEP process for the RSF and future TSF expansions.
- Implement components of a strategy towards minimising radioactive waste management.

4.6.16 Target FY14 (State 17e)

- Maintain radiation doses as low as reasonably achievable, as assessed through the annual adequacy and effectiveness review.
- Ensure that all radioactive waste is adequately contained and managed.

ID 5 INTERACTION WITH COMMUNITIES

ID 5.1 COMMUNITY INTERACTION

5.1.1 Responsibility

- Head of HSEC
- Head of External Affairs
- Manager – Community

5.1.2 Scope (State 17a)

The involvement of stakeholders, including the community, is critical to BHP Billiton's licence to operate. Maintaining good stakeholder relations is based on understanding stakeholder interests, regular dialogue and communication, and responding to stakeholder concerns and complaints. The company recognises that the workforce and the community are an important part of the operation, and that consideration and management of social interactions are necessary for a safe, content community and workforce.

A Social Management Partnership has been established (but is currently in abeyance) to provide a forum for ODC, the State Government, the Roxby Downs Council and other community stakeholders to discuss and respond to potential social effects of the expansion. After the Variation Date (as defined in the Amendment Act), the Partnership would be re-activated, and would collaboratively prepare and monitor a Joint Social Plan to address the social effects arising from the Expansion. The Joint Social Plan would also establish the roles and responsibilities of ODC, the State Government, stakeholders and communities in addressing social effects and maintaining the amenity of affected communities. (State 15, 16)

5.1.3 Management strategy

The strategy to manage community interactions is intended to maximise the social benefits and minimise the social impacts in Roxby Downs, Andamooka and other relevant communities associated with the operations at Olympic Dam. This will be achieved by:

- ensuring opportunities are provided for regular and ongoing dialogue and communication between key stakeholders and ODC; (State 14i)
- providing for the effective, timely and consistent delivery of commitments, management actions/controls and other management measures by ODC;
- identifying a broad set of social indicators to measure and monitor the quality of life and social wellbeing within Roxby Downs and Andamooka; (State 14d)
- providing for reporting on the implementation and performance of the social management actions and the social effects of Olympic Dam operations.

The approach to managing community interactions will be based on consultation and collaboration between ODC, the South Australian Government, Roxby Council and other key stakeholders and, after the Variation Date, would involve the Social Management Partnership and the preparation and implementation of a Joint Social Plan.

5.1.4 Key legal and other requirements

- **Ratification Act** and the **Indenture** (or as amended by the **Amendment Act** and the **Amended Indenture**)
- **Major Development Approval Conditions**
- ***Environment Protection Act 1993***

5.1.5 Values

- Living conditions, working conditions and desired lifestyle.
- Community and workforce safety and contentment.

5.1.6 Key risks

- Imbalance in housing supply and demand.

- Cost of living becomes unaffordable for low income households in Roxby Downs.

5.1.7 Environmental outcome (State 17b)

- Residents in Roxby Downs, Andamooka and Woomera trust ODC to act in their best interests.

5.1.8 Compliance criteria (State 17c, 17kiii)

- Community concerns are tracked and all legitimate complaints are addressed where reasonably practical.

5.1.9 Leading indicators (State 17d)

- None applicable.

5.1.10 Management plan(s)

- None applicable

5.1.11 Monitoring program(s) (State 14c, 14d, 14e, 14f)

- Social Effects Monitoring Program, Document No. 110687:
  - community complaints;
  - key stakeholders, their interests and engagement methods;
  - residents' trust in BHP Billiton;
  - profile of the workforce at Olympic Dam
  - contracts awarded to South Australian and Aboriginal owned businesses;
  - rental costs;
  - rental rates, rental availability and housing stress;
  - residents' perceptions of safety, quality of life, services and facilities and social fabric (State 14g).

5.1.12 Controls and management actions (State 17g)

5.1.12.1 Community relations

- ODC continues to have regular dialogue and communication with stakeholders and:
  - maintains a list of key stakeholders and their interests in the current operation and expansion of Olympic Dam;
  - undertakes stakeholder engagement activities that are appropriate to the needs of different stakeholders;
  - records interactions with stakeholders and outcomes, including responses to concerns and complaints (State 14i) (EPA 1301.300-20, 3054.300-20).
- A series of tools are maintained for managing community complaints and grievances, including:
  - a complaints register for managing complaints and grievances;
  - a telephone number for receiving complaints and grievances;
  - a designated email address for receiving complaints and grievances;
  - a postal address for receiving complaints and grievances (State 14h) (EPA 1301.300-20, 3054.300-20).
- Under the **Olympic Dam Agreement** between ODC and three native title claimant groups (Barngarla, Kokatha and Kuyani):
  - a trust is maintained to manage payments by ODC to support community and business development initiatives for Aboriginal communities in northern South Australia (as defined in the Agreement);
  - a Heritage Management Protocol is established to protect the Aboriginal ethnographic and archaeological values of the region.

- Cross cultural training of staff is undertaken as a part of the induction program for all new employees and contractors at Olympic Dam.

5.1.12.2 Employment and training:

- After the Variation Date, ODC would prepare an Industry and Workforce Participation Plan to enhance local employment and business opportunities (State 14f).
- ODC supports a number of Australian and South Australian Government employment and training initiatives, including:
  - initiatives targeting employment and skills formation for Aboriginal people;
  - traineeship, apprenticeship and new graduate intakes;
  - support to TAFE SA programs in Roxby Downs;
- ODC offers scholarships to support a number of students studying mining-related disciplines (such as engineering, metallurgy, geology and physics) at various Adelaide universities.

5.1.12.3 Business development

- The activities that ODC undertakes to enhance local businesses opportunities include:
  - continuing to support the on-site Contractor Framework Implementation Team to provide a forum for communication and engagement with contract companies;
  - maintaining an online project supplier database, in conjunction with the Industry Capability Network South Australia, to enable potential suppliers to register their interest in supplying goods and services to Olympic Dam;
  - funding the Olympic Dam Indigenous Participation Program to develop the capacity of Indigenous companies and contractors to supply goods and services to Olympic Dam;
  - working with Government, regional economic development boards, and education and training providers to support capacity building, meet skills requirements, and link existing or potential suppliers to improve local competition.

5.1.12.4 Crime and anti-social behaviour

- ODC liaises with police management and provides updates of workforce schedules.
- ODC continues to implement the workforce induction and education information strategies to communicate safety and security expectations and to promote responsible social and environmental behaviour and ethics.
- ODC continues to implement the ‘Fitness for Work’ program, including routine drug and alcohol monitoring of workers.

5.1.12.5 Housing

- ODC provides a minimum of 7% affordable rental and home purchase opportunities within all new developments in Roxby Downs, as part of any infill developments or greenfield or broad-acre subdivision (State 14b).

5.1.12.6 Social character, amenity and wellbeing

- ODC contributes to the provision of essential services in Roxby Downs so they are maintained at a reasonable standard.
- ODC promotes community identity and cohesion in Roxby Downs by:
  - maintaining the Olympic Dam Community Development Program;
  - having regular dialogue with stakeholders in Roxby Downs, Andamooka and Woomera;
  - working with the council and local service providers to provide an ongoing and proactive new residents’ program and community-building activities to facilitate positive cultural and social interaction.
- After the Variation Date, ODC, in collaboration with the State Government, would make all reasonable effort to reactivate, and would participate in, the Joint Social Partnership to:
  - provide a forum for key stakeholders to discuss and respond to potential social effects; (State 15)

- collaboratively prepare a Joint Social Plan that establishes the roles and responsibilities of ODC, the State Government, stakeholders and communities in addressing social effects of the expansion; (State 15 and 16)
- monitor the implementation of the Joint Social Plan and adjust strategies and actions to respond to changes in social conditions (State 15).

5.1.13 Contingency options

- Expand village accommodation as interim accommodation for the workforce.
- Collaborate with the State Government to respond to housing affordability issues for low-income households.

5.1.14 Continuous improvement / development opportunities

Olympic Dam provides opportunities for employment and businesses locally, regionally and state-wide and for specific target groups such as Aboriginal people. These opportunities would increase with any future expansion at Olympic Dam. ODC is also committed to increasing Aboriginal employment in the Olympic Dam workforce and to enabling Aboriginal enterprises to secure contracts at site.

- Opportunity: Maximise opportunities for South Australian and Aboriginal employment and business participation at Olympic Dam:
  - Develop and implement a local procurement plan with targets to maximise the participation of local, regional and State businesses and employment in supplying goods and services to Olympic Dam (State 14f).
  - Continue to explore opportunities to build the capacity of Aboriginal people and businesses to participate in Olympic Dam.

ODC is committed to maintaining and enhancing the amenity and lifestyle of Roxby Downs. This requires a good understanding of the social and economic environment and the factors that influence amenity, such as the social cohesion, living costs, housing and social services. It is also recognised that responsibility for some social matters lies outside of the authority of ODC, and as such, will need to be managed collaboratively with the State Government and other key stakeholders.

- Opportunity: Maintain and enhance the amenity and lifestyle of Roxby Downs as a desirable place to live and work.
  - Undertake a regular (three-yearly) social baseline assessment of Roxby Downs, Andamooka and Woomera.
  - Continue to build on best practice and learnings from other remote Australian mine sites to enhance liveability and build sustainable relationships between the residential community and non-resident workforce.
  - In collaboration with the South Australian Government and key stakeholders, identify indicators to assist in planning, delivering and monitoring social infrastructure provision (State 14e).
  - Work collaboratively with the South Australian Government and key stakeholders to investigate and deliver appropriate social services and infrastructure.
- Opportunity: Maintain a balanced supply of housing to meet demand and contribute to housing affordability:
  - Develop a schedule to deliver housing in Roxby Downs to meet demand from the operational and non-operational workforce.

5.1.15 Action plan FY14

- Develop an Employment, Training and Business Development Strategy as part of the Olympic Dam Agreement
- Develop a housing and accommodation strategy to meet future demand from the residential and non-residential workforce.

5.1.16 Target FY14

- A long-term desirable trend towards a minimum housing rental vacancy rate in Roxby Downs of 5% (State 14a).