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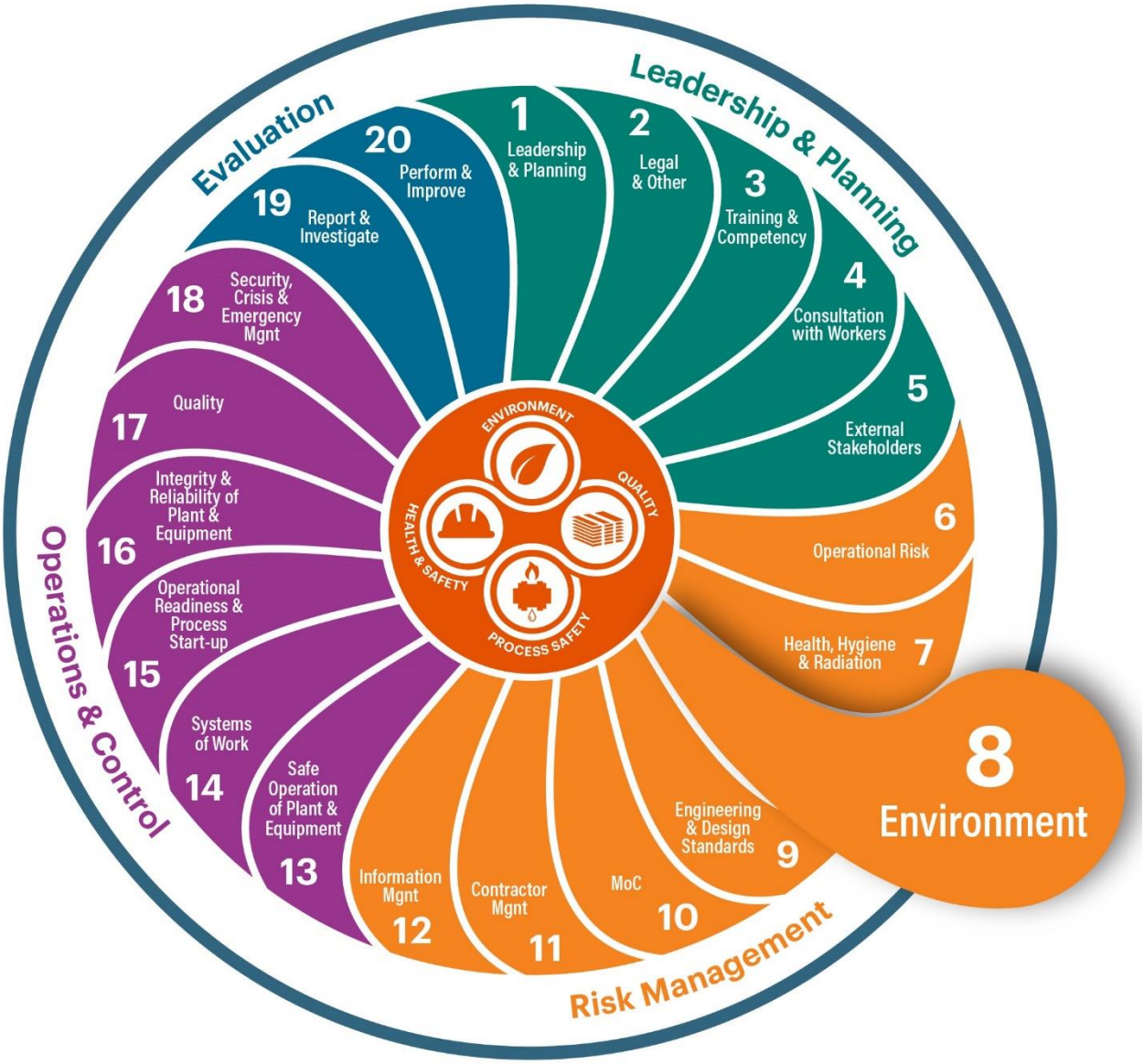

Contents

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 EM Program Targets, Actions and Major Changes;

The Monitoring Programs (MPs);

The Closure Management 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 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;

Self-improvement goals such as continuous improvement opportunities and actions which can assist in achieving **compliance criteria** and **environmental outcomes**; and targets to track achievement of these. (Performance against these, and leading indicators, is monitored, but failure to meet them is not a compliance issue).

Note: Management and operational controls and contingency options will be applied wherever practical, but in some circumstances operational flexibility will be needed to allow operations to take appropriate actions to meet environmental outcomes and compliance criteria. Non application of a control or contingency option will therefore not of itself be a compliance issue, but failure to meet environmental outcomes and compliance criteria will be dealt with as per the EMM.

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 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 (TSF). Also included are controls for waste rock storage, and the disposal and storage of radioactive and solid wastes.

5. Interaction with communities;

Covers community relations, social character and wellbeing of people.

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.

This document supports *IMS Element 8: Environment. Document No 012513194 Environment Standard*.

1 ID 1 USE OF NATURAL RESOURCES

1.1 ID 1.1 LAND USE AND REHABILIATION

1.1.1 Responsibility

- General Manager – Mining
- General Manager – Surface Execution
- General Manager – Engineering and Non-Processing Infrastructure
- Head of HSE
- Manager Environment
- Manager Safety, Radiation & Occupational Hygiene

1.1.2 Scope

All surface development activities for Olympic Dam 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 Land Use Permit (LUP).

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 Closure Management and Rehabilitation Plan (CMRP).

Where applicable, land disturbances that require removal of remnant native vegetation 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 at Gosse Springs and Emerald Springs. The Native Vegetation Assessment Panel endorsed the Emerald Springs SEB credit area and associated management plan on 2 April 2019 subject to conditions. BHP is working with the Native Vegetation Council to fulfil the attached conditions stated in the Native Vegetation Council approval letter dated 9 April 2019, including the execution of a Heritage Agreement over the SEB Credit area.

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. Factors that may lead to pest introduction and increases are ground disturbance, clearance of remnant native vegetation, movement of vehicles, the operation of waste facilities and the provision of water or other resources. The level of effort 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.

This EM Program applies to all land disturbance activities undertaken by, or on behalf of ODC.

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 which require the removal of remnant native vegetation.

The LUP (formerly EDP) system uses GIS software to map known locations and preferred habitats of threatened flora and fauna species. Where applicable the disturbance activity, the LUP will flag ‘no go’ areas for disturbance of remnant native vegetation and areas of ecological importance. 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 of remnant native vegetation when they are deemed to be required.

Management strategies aimed at reducing the risk of spreading, monitoring the abundance and through targeted control programs 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 where required.

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 Downs Council, **Arid Recovery**, government bodies and other relevant local land owners and organisations.

1.1.4 Key Legal and Other Requirement

- **Ratification Act** and the **Indenture**
- **Major Development Approval Conditions**
- Development Act 1993 (SA)
- Planning, Development and Infrastructure Act 2016 (SA)
- Native Vegetation Act 1991 (SA)
- Native Vegetation Regulations 2017 (SA)
- Aboriginal Heritage Act 1988 (SA)
- Heritage Places Act (SA) 1993
- National Parks and Wildlife Act 1972 (SA)
- Environment Protection and Biodiversity Conservation Act (EPBC Act) 1999 (Cth)
- Policy for Significant Environmental Benefit – Under the Native Vegetation Act 1991 and Native Vegetation Regulation 2003, Department of Environment Water and Natural Resources 2015.
- Guide for a Significant Environmental Benefit for the clearance of native vegetation associated with the Minerals and Petroleum Industry August 2017 Under the Native Vegetation Act 1991 and Native Vegetation Regulation 2017, Department for Environment Water.
- Radiation Protection and Control Act 1982 (SA)
- Landscape South Australia Act 2019
- Pastoral Land Management and Conservation Act 1989 (SA)
- 'Australian Weeds Strategy' published by the Invasive Plants and Animals Committee 2017-2027
- 'South Australian Arid Lands Biodiversity Strategy: Volume 4 Gawler Conservation Priorities' published by the SA Arid Lands NRM Board in 2009.
- South Australian Public Health Act 2011 (SA)

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

1.1.7 Environmental Outcome

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 a community of native species dependent on natural discharge of groundwater from the Great Artesian Basin, including ***Eriocaulon carsonii*****.**

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

- No loss of an **important population** of Plains Rat (***Pseudomys australis***).

1.1.9 Leading Indicators

None applicable.

1.1.10 Management Plan(s)

1. Native Vegetation Management Plans (includes 'The Gosse Springs Native Vegetation Management Plan' and 'The Emerald Springs Native Vegetation Management Plan') (Note that the Native Vegetation Assessment Panel endorsed the Emerald Springs SEB credit area and associated management plan on 2 April 2019 subject to conditions. BHP is working with the Native Vegetation Council to fulfil the attached conditions stated in the Native Vegetation Council approval letter dated 9 April 2019, including the execution of a Heritage Agreement over the SEB Credit area.):

- Describes the legislative requirements for vegetation clearance subject to an SEB at Olympic Dam;
- Describes the management of the SEB areas that is set aside to offset relevant clearance;
- Includes management actions to protect existing biodiversity within the SEB area.

2. Aboriginal Cultural Heritage Management Protocol:

- In situations where disturbance is unavoidable, the Olympic Dam Agreement requires ODC to discuss the matter with Traditional Owners 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 includes 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 Kokatha, Barngarla and Kuyani groups about environmental matters. These arrangements will continue for the remaining life-of-mine, including any expansion, and will also address rehabilitation issues. (SEIS 18.1). Representatives of the native title claimant groups have been trained and employed in heritage management and recording activities (SEIS 18.2).

3. Topsoil Management Plan, Document No. 000103108:

- Wherever possible, temporary sand and topsoil stockpiles will be placed in already disturbed areas that are previously cleared of remnant native vegetation, or areas proposed for future disturbance, to minimise additional vegetation clearance (DEIS 23.9.1; SEIS 5.4.5);
- The use of topsoil for rehabilitation 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).

4. Closure Management and Rehabilitation Plan (2020)

- A CMRP dated May 2020 was submitted as a part of the 2021 EPMP.

1.1.11 Monitoring Programs

1. Flora Monitoring Program, Document No. 000036331:

- Remotely sensed imagery is used annually to define the disturbance footprint of remnant native vegetation, of infrastructure, development, resource drilling and associated waste management activities. Annual disturbance records of remnant native vegetation are also used to account for SEB offset requirements.
- Records of known listed species locations have been included in the LUP GIS system which is reviewed prior to ground disturbance works that impact remnant native vegetation, this list and locations are reviewed annually and updated regularly.
- Areas of remnant native vegetation cleared are accounted for using the SEB points system to ensure that sufficient SEB points are available.
- The current distribution of declared weeds species is determined through periodic monitoring of sites and approved declared plant pest policies.
- 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 Landscape (formerly NRM) Boards.

2. Fauna Monitoring Program, Document No. 000036339:

- Monitoring of **Important Biodiversity and Ecosystems** is conducted to provide an indication of environmental change due to the operations, and allows for known locations of **listed species** to be included in the LUP GIS system.
- Targeted management actions as determined by an annual risk assessment in line with SAAL Landscape Board priorities and actions ensures that ODC protects native species in the region;
- An assessment of the abundance of specific feral and abundant species within the region;
- The results of management activities are publicly reported in the Annual EPMP Report.

1.1.12 Controls and Management Actions

1. Land disturbance is controlled through the site LUP system incorporating:

- Procedure for issue of a Land Use Permit, Document No. 000037027;
- Application for a Land Use Permit, Document No. 000052647;
- Olympic Dam Rehabilitation Strategy, Document No. 000067854;
- This system protects native vegetation and fauna habitat through the requirement to obtain a LUP 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.

2. This environmental offset was specifically designed to create enough SEB area to offset all expected clearance in the foreseeable future, both on and off the SML:

- The Native Vegetation Assessment Panel endorsed the Emerald Springs SEB credit area and associated management plan on 2 April 2019 subject to conditions. BHP is working with the Native Vegetation Council to fulfil the attached conditions stated in the Native Vegetation Council approval letter dated 9 April 2019, including the execution of a Heritage Agreement over the SEB Credit area.
- Once Emerald Springs offset areas are exhausted, BHP proposes (subject to approval) to establish additional offset areas at Bedourie, Black Swan and One Box paddocks as shown in the Flora Monitoring Program.
- The remainder of SEB credit at Gosse Springs has been converted to points to align with the updated guidelines ‘Guide for a Significant Environmental Benefit for the clearance of native vegetation associated with the Minerals and Petroleum Industry August 2017’.
- SEB Points remaining for Gosse Springs (25,747 SEB Points) and Emerald Springs (218,855 SEB Points) at June 30 2021 was 244,602 SEB Points.
- The Native Vegetation Council (NVC) has agreed that for native vegetation clearance on the SML an average of 58.3 SEB Points are required per hectare.
- The NVC have approved the use of Gosse Springs and the Emerald Springs paddocks as an SEB for clearances on the SML.

- Any clearance of remnant native vegetation off the SML will be subject to separate native vegetation clearance approval. The separate native vegetation clearance approval for any clearance off the SML will be required to approve to the use of Gosse Springs or Emerald Springs as an SEB in the approval conditions.

3. The SEB areas are chosen to contribute to the biodiversity conservation priorities of the Australian and South Australian Governments, particularly in respect of:

   - The selected SEB areas will increase representation of the Stony Plains Interim Biogeographic Regionalisation for Australia (IBRA) Regions (currently at 5.65 per cent) to 6.55 per cent and have been made with consideration to the national approach to developing landscape scale ecological linkages. The inclusion of 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 SEBs adjoining the Wabma KadarbuConservation Park. In total, a contiguous area of 15,650 square kilometres (km^2) of reserves will be created from these SEB areas;
   - 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, through targeted actions. These actions include the fencing of SEBs 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 support rehabilitation;
   - The selected offset areas include heritage sites at the Curdimurka Railway Siding contributing to the management and protection of cultural heritage;
   - 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.

4. Topsoil progressively stripped from the backfill limestone quarry is stockpiled in readiness for rehabilitation and ripped and seeded where required to minimise wind erosion.

5. 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).

6. The mitigation hierarchy is embedded into our processes and therefore threatened flora and fauna potential habitats are mapped and avoided wherever possible. If these areas cannot be avoided, and meet the criteria of suitable habitat to support an important population, targeted surveys are undertaken to determine whether threatened species are present. If threatened species are found to be present and cannot be avoided, they may be relocated. Where **listed species** cannot be avoided, the justification for their removal is documented.

7. Standard engineering practices are applied to control erosion in areas with low and moderate erosion potential as defined in the 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).

8. 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).

9. The scope change for the Olympic Dam Project announced in August 2012 led ODC to undertake a review of potential impacts to the environment resulting from the change. A number of activities were identified for consideration to address potential impacts identified in this review. Actions have been incorporated into the site Rehabilitation Strategy and include the ongoing monitoring of surface areas for erosion and re-vegetation.

10. Declared pest plant species are controlled in accordance with the Landscape South Australia Act 2019.

11. Weed management is undertaken by ODC. ODC continues to work with regional land managers, **Arid Recovery**, Roxby Council and relevant Landscape Boards (DEIS 15.5.11, 15.6; SEIS 16.7, 29.4).

12. A LUP, Document No. 000037027, is required before undertaking any construction activities:
    - Field surveys for final infrastructure locations are undertaken to determine the presence / absence of declared and priority weed species;
    - During the LUP process the Weed Management Database is cross referenced for known pest plant locations;
    - LUP 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.
13. An equipment hygiene policy is applied to earth moving equipment brought to site.
14. Trapping is conducted in areas that targeted feral animal species are known to frequent.
15. Collaborate with Roxby Council to support the management of feral cats and dogs in the township (DEIS 15.5.11; SEIS 16.3).

1.1.13 Contingency Options

Rehabilitate land as soon as practicable following any unplanned disturbance.

Seek approval for further SEB offset areas in the event that clearance greater than that allowed for by the currently approved offset areas is required.

Implement a dedicated eradication plan for declared species in accordance with the Landscape South Australia Act 2019 requirements.

1.2 ID 1.2 AQUIFER LEVEL DRAWDOWN

1.2.1 Responsibility

General Manager Mine

General Manager Surface Execution

General Manager Engineering and NPI

Head of HSE

Manager Environment

Manager Safety, Radiation & Occupational Hygiene

1.2.2 Scope

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 5.3 megalitres per day (ML/d) from Wellfield A and 28 ML/d from Wellfield B. Total groundwater abstraction, including pastoral abstraction, within the vicinity of the Olympic Dam wellfields is approximately 45 ML/d.

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.

A number of monitoring programs are aimed at assessing aspects of GAB and spring health in the vicinity of the wellfields, and collectively provide an assessment of the impacts to GAB spring dependent listed

species and threatened ecological communities. These include measurement of GAB spring flow rates, surveys of aquatic spring invertebrates and surveys of an endemic plant (the Salt Pipewort).

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

1.2.3 Management Strategy

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.

1.2.3.1 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.

Third party users' rights to water and how they are affected.

The **Indenture** does not stipulate 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 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.

1.2.3.2 Stuart Shelf

Local depressurisation of the Stuart Shelf aquifer is required for underground mining activities. No impacts are expected to third-party users during the operating period of the mine. However, as with the GAB, the management of drawdown is achieved through monitoring of groundwater levels.

1.2.4 Key Legal and Other Requirement

- **Ratification Act** and the **Indenture**
- **Special Water Licence**
- **Special Water Licence** No. 2
- Environment Protection Act 1993 (SA)

1.2.5 Values

- Water resources of the GAB and Stuart Shelf.
- GAB spring-dependent **listed species or ecological communities**.

1.2.6 Key Risks

- Impacts to GAB spring-dependent **listed species or ecological communities**.
- Potential impacts to third-parties on the Stuart Shelf from excessive drawdown.

1.2.7 Environmental Outcome

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.

1.2.8 Compliance Criteria

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.

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.

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.

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

1.2.9 Leading Indicators

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 km2.

A hydraulic gradient between wells in the NESB and HH2 exceeding 0.0009 m/m calculated as the six-monthly moving mean hydraulic gradient between HH2 and NESB wells GAB7, GAB8, GAB10, GAB11 and GAB19.

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

1.2.10 Management Plan(s)

None applicable

1.2.11 Monitoring Programs

- Groundwater Monitoring Program, Document No. 000036173:
  - groundwater abstraction, for comparison with groundwater levels;
  - Groundwater levels across the monitoring bore network.
- Great Artesian Basin (GAB) Monitoring Program, Document No. 000036081:
  - abstraction volumes, groundwater levels and artesian pressures;
  - GAB spring flow rates.
- Flora Monitoring Program, Document No. 000036331:

- Great Artesian Basin (GAB) springs wetland vegetation composition assessment; abundance of the Salt Pipewort, *Eriocaulon carsonnii*, in GAB springs.

- Fauna Monitoring Program, Document No. 000036339 :
  - Presence/absence of endemic aquatic invertebrates in GAB springs.

1.2.12 Controls and Management Actions

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.

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.

Triennial qualitative comparison of GAB spring data from management programs Great Artesian Basin (GAB) (section 2.4), Flora (sections 2.5 and 2.6) and Fauna (section 2.5), to assess evidence of drawdown impacts on GAB springs and threatened ecological communities.

1.2.13 Contingency Options

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:

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).

2 ID 2 STORAGE TRANSPORT AND HANDLING OF HAZARDOUS MATERIALS

2.1 ID 2.1 CHEMICAL AND HYDROCARBON SPILLS

2.1.1 Responsibility

General Manager – Surface Execution

General Manager – Mining

General Manager – Engineering and Non-Processing Infrastructure

Head of HSE

Manager Environment

Manager Safety, Radiation & Occupational Hygiene

2.1.2 Scope

ODC handles a variety of chemical products and hydrocarbon materials within the operation, some of these are classified as hazardous or dangerous materials (generally referred to as hazardous materials or hazardous substances).

These include but are not limited to chemical products classified as acids, ammonia, calcium hydroxide, flocculants, sodium chlorate, sodium cyanide, sodium hydroxide, xanthates; Hydrocarbon based materials including diesel, metallurgical coal, oils and grease. These hazardous materials are used to operate and maintain mobile plant and equipment, furnaces, manufacture of explosives for underground mining and surface blasting within the quarry as well as processing concentrate.

Spillage of chemicals and/or hydrocarbons during transport, storage or use may lead to the contamination of soils, surface water and groundwater and may impact on surrounding ecosystems. Bunding, purpose built chemical storage and transfer systems are in use where possible as per Australian Standards and EPA Guidelines.

This document consolidates the relevant information and commitments that are in place to manage chemical and hydrocarbon spills associated with the operation of Olympic Dam mining and mineral processing activities.

2.1.3 Management Strategy

Spill management of hazardous materials incorporates:

Transporting chemicals and hydrocarbons to site in accordance with the requirements of the Australian Code for the Transport of Dangerous Goods by Road & Rail (ADG Code);

Maintaining the integrity of pipelines and equipment through planned maintenance and design features for new infrastructure;

All chemicals or chemical products are stored, loaded or unloaded in an appropriately bunded area/s as per the EPA's Bunding and Spill Management Guidelines (EPA 1301.3(S-5));

Emergency spill kits are maintained on the premises at all times in locations where chemicals and hydrocarbons are stored, loaded or unloaded;

Bund inspections are conducted within the operational areas to review compliance and ensure maintenance programs are in place and effective.

2.1.4 Key Legal and Other Requirement

Ratification Act and the Indenture

Development Act 1993 (SA);

Planning, Development and Infrastructure Act 2016 (SA);

Environment Protection Act 1993 (SA);

Environment Protection (Water Quality) Policy 2015 (SA);

The Australian Code for the Transport of Dangerous Goods by Road & Rail (Edition 7.6);

Work Health and Safety Regulations 2012 (SA);

EPA Guideline – Bunding and Spill Management 2016 (SA);

National Environmental Protection (Assessment of Site Contamination) Measure 1999;

Australian Standard AS 1940 The Storage and Handling of Flammable and Combustible Liquids (2017);

EPA Licence 1301;

Explosives Act 1936 (SA);

Dangerous Substances Act 1979 (SA);

Dangerous Substances (General) Regulations 2017 (SA);

Mines and Works Inspection Act 1920 (SA).

BHP Olympic Dam Safety Case Reference No. MHF25165

Licence to Operate: Major Hazard Facility No. 587632

Dangerous Substances Licence

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

No significant site contamination of soils, surface water or groundwater, as a result of the transport, storage or handling of chemical or hydrocarbon substances associated with ODC's operational activities.

2.1.8 Compliance Criteria

No site contamination leading to **material environmental harm** (as defined in the Environmental Management Manual) arising from a loss of containment of a chemical substance or hydrocarbon material within the SML and/or Wellfields **Designated Areas**.

Note: Measurement and monitoring is carried out in response to a specific event, and in accordance with the National Environment Protection (Assessment of Site Contamination) Measure 1999 or Environment Protection (Water Quality) Policy 2015. Remediation and monitoring programs are in place for historical contaminated sites.

2.1.9 Leading Indicators

None applicable

2.1.10 Management Plan(s)

Hazardous Materials Management (Standard), Document No. 000083644:

Defines the requirements for training, equipment and systems to be designed and implemented to protect personnel (employees, contractors and visitors) from exposure to hazardous materials (DEIS 22.6.8);

Outlines requirements for the storage and maintenance of hazardous materials areas to reduce the risk of a loss of containment and in the event of a spill, contain the hazardous material (DEIS 22.6.8).

2.1.11 Monitoring Programs

1. Monitoring Program – Groundwater, Document No. 000036173:

Routine groundwater quality monitoring around the operations.

2. Event Reporting, Investigations and Action Management, Document No. 000049638:

- Outlines requirements for reporting, investigating and communicating events.

3. External Reporting of Environmental Incidents (procedure), Document No. 000038847:
    - Outlines external reporting requirements under Section 83 & 83A of the EP Act 1993.
4. HSEC Event Impact Level Determination (procedure), Document No. 000118631:
    - Supports the event classification and recording of spill events into the Global Event Management System ((G)EMS).

2.1.12 Controls and Management Actions

Fuel lines supplying hydrocarbons are located above ground in bunded racks to prevent deterioration of fuel lines and to enable rapid identification of leaks. Some pipelines remain underground in nylon coated steel pipes.

All new hydrocarbon storage tanks and distribution lines are located above ground except in some instances; such as at road crossings where they may be placed underground. In these cases controls for leakage detection or containment are required.

All hazardous substance storage areas are designed to ensure that substances are stored in bunded areas (AS 1940-2017) capable of preventing the escape of material to soil, surface water or groundwater. This may also include restricted access to storage areas.

Site wide records of hazardous materials (manifest) is maintained and utilised across site (The ADG Code).

All chemicals or chemical products are stored, loaded or unloaded in an appropriately bunded area/s as per the EPA's Bunding and Spill Management Guidelines (EPA 1301.3(S-5)).

Emergency spill kits are maintained on the premises at all times in locations where chemicals and hydrocarbons are stored, loaded or unloaded (EPA 1301.3(S-7)).

Stormwater retention ponds that contribute to the tertiary containment system in the case of hazardous material spills are designed and constructed to prevent loss of material into the soil, surface water or groundwater.

Trucks are to be washed at facilities with a wastewater collection system (EPA 1301.3.13 (34-39)).

Regular operational area inspections (including storages) are to be undertaken and completed to ensure storage and use facilities comply with EPA Bunding and Spill Management Guidelines.

Where reasonably practicable, hazardous materials are substituted for less toxic substances of similar processing application.

Citect process alarm systems and level indicators are installed on most tanks, including CAF Plant silos, to prevent overflow events (EPA 1301.3.11 (S-90)). Preventative maintenance plans are in place to ensure plant and equipment remains in serviceable condition.

Hazardous material management procedures and standards outlining the processes in place to effectively manage these materials are all available via the quality document system (TEMPO).

A procedure for External Environment Incident Reporting (38847) outlines the process for managing and reporting the loss of containment which has or may have the potential to cause serious or material environmental harm under Section 83 & 83A of the EP Act 1993.

Any chemical and/or hydrocarbon substance spill 10L or greater on the outside of a bunded area are reported via the EMS. This incident tracking and reporting system allows for asset performance against Compliance Criteria.

Relevant senior management personnel must provide annual bund maintenance plans and upgrades to the environment department to report on.

All new plant is designed to meet the appropriate legislation and standards as a minimum (e.g. AS 1940-2004). HAZOP studies are undertaken (Hazardous Materials Management (Standard) 000083644) prior to construction to identify the potential for spills and the likelihood of spillages and identify the operating procedures to be developed (SEIS 11.1.2, 11.4.3).

2.1.13 Contingency Options

A site Emergency Response Team with Emergency Service Officers (ESOs) is in place to attend emergency situations; including spills associated with ODC operation (in accordance with IMS Element 18: Emergency Response).

Assess for the presence of site contamination resulting from spills that trigger the EPA material environmental harm clause in accordance with the National Environment Protection (Assessment of Site Contamination) Measure 1999 (or as amended) (commercial/industrial land-use).

Remediate site contamination found to be present in accordance with the requirements of the Environmental Protection Act 1993.

2.2 ID 2.2 RADIOACTIVE PROCESS MATERIAL SPILLS

2.2.1 Responsibility

General Manager – Surface Execution

General Manager – Mining

General Manager – Engineering and Non-Processing Infrastructure

Head of HSE

Manager Environment

Manager Safety, Radiation & Occupational Hygiene

2.2.2 Scope

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 remain actively in place.

BHP is currently required to report 'reportable spills' as defined by the Criteria and Procedures for Recording and Reporting Incidents at SA Uranium Mines (DEM), known as the 'Bachmann Criteria'. The Bachmann Criteria requires spills above a certain volume to be reported and the clean-up measures implemented to return the impacted area to a safe condition.

EM Program IDs 3.4 and 4.5 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.

2.2.3 Management Strategy

The approach to the management of radiation (including radioactive waste) at Olympic Dam is based on the recommendations of the International Commission on Radiological Protection (ICRP), which outlines a system of dose limitation for the protection of humans and the environment from the harmful effects of radiation. 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 Radioactive Waste Management in Mining and Mineral Processing (ARPANSA 2005). This **Mining Code** elaborates on the ICRP and IAEA requirements and is generally adopted in its entirety in state legislation throughout Australia.

ODC 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;

Spill reporting requirements according to the Bachmann Criteria are communicated to area supervisors and managers. It is the responsibility of the area management to ensure spills are reported in a timely manner;

Implementing External Reporting of Environmental Incidents, Document No. 000038847 and the Event Reporting, Investigations and Action Management Procedure, Document No. 000049638.

Although spills have minimal potential to cause radiological **significant impact**, as a measure of the effectiveness of the management controls, ODC monitor all radioactive process spills outside a bund via our SAP system. Spill tracking highlights areas that possibly need further controls and where Environment Improvement Plans might be required to improve process controls and maintenance.

2.2.4 Key Legal and Other Requirement

Ratification Act and the **Indenture;**

Environment Protection Act 1993 (SA);

Environment Protection (Water Quality) Policy 2015 (SA);

Radiation Protection and Control Act 1982 (SA);

National Environment Protection (Assessment of Site Contamination) Measure 1999;

Dangerous Substances Act 1979 (SA);

Dangerous Substances (General) Regulations 2017 (SA);

The Australian Code for the Transport of Dangerous Goods by Road & Rail (Edition 7.6);

EPA Licence 1301;

Licence LM1;

EPA Guideline – Bunding and Spill Management 2016 (SA);

Code of Practice and Safety Guide for Radiation Protection and Radioactive Waste Management in Mining and Mineral Processing (ARPANSA, 2005) (The Mining Code);

Criteria and Procedure for Recording and Reporting Incidents at SA Uranium Mines (DPC), Bachmann Criteria.

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

No adverse impacts to public health as a result of radioactive process material spills from ODC's activities.

No **significant adverse impacts to populations** of **listed species** or **ecological communities** as a result of radioactive process material spills from ODC's activities.

2.2.8 Compliance Criteria

A dose limit for radiation doses to **members of the public** of 1 mSv/y above natural background.

No significant radioactive contamination arising from uncontrolled loss of radioactive material to the natural environment.

*Note: Significant is defined as requiring assessment and remedial action in accordance with the National Environment Protection (Assessment of Site Contamination) Measure 1999 or Environment Protection (Water Quality) Policy 2015 and the **Mining Code.** Measurement and monitoring is carried out in response to a specific event.*

2.2.9 Leading Indicators

None applicable

2.2.10 Management Plan(s)

1. Hazardous Materials Management (Standard), Document No. 000083644:

Defines the requirements for training, equipment and systems to be designed and implemented to protect personnel (employees, contractors and visitors) from exposure to hazardous materials (DEIS 22.6.8); and

Outlines requirements for the storage and maintenance of hazardous materials areas to reduce the risk of a loss of containment and in the event of a spill, contain the hazardous material (DEIS 22.6.8).

2. Event Reporting, Investigations and Action Management, Document No. 000049638:

Outlines requirements for reporting, investigating and communicating events.

3. External Reporting of Environmental Incidents, Document No. 000038847:

Outlines requirements for external reporting of events which have or may have the potential to cause serious or material environmental harm under Section 83 & 83A of the EP Act 1993.

4. HSEC Event Impact Level Determination (procedure), Document No. 000118631:

Supports the event classification and recording of spill events into the EMS and reporting performance against the compliance criteria.

2.2.11 Monitoring Programs

1. Monitoring Program - Environmental Radiation, Document No. 000036332:

Monitoring of frequency, location, causes, and remedial actions from radioactive spill events in order to identify and implement improved process controls.

2.2.12 Controls and Management Actions

(MC 2.10.1(h), 2.10.1(i))

HAZOP studies are undertaken prior to construction of a process which will contain; transfer or store radioactive process material, to identify the potential and likelihood of a spill occurring and are used in the development and construction of operating procedures.

The maintenance department has routine preventative maintenance activities and condition monitoring programs in place.

Pressure sensors and routine plant inspections are used to ensure timely identification and reporting of loss of containment and leak detection.

A procedure for External Reporting of Environmental Incidents, Document No. 38847 for reporting events which have or may have the potential to cause serious or material environmental harm under Section 83 & 83A of the EP Act 1993, this includes radioactive process material spills;

A company-wide incident reporting and tracking system, Event Management Solution (EMS) is utilised. This incident tracking and reporting system allows for tracking of asset performance against Compliance Criteria and Bachmann Criteria.

2.2.13 Contingency Options

(MC 2.8.2(f))

A site Emergency Response Team, ESOs and procedures are in place to attend emergency situations related to spills of radioactive process material.

Assess for the presence of site contamination resulting from spills of radioactive process material in accordance with the National Environment Protection (Assessment of Site Contamination) Measure 1999 and the Site Contamination Management, Document No. 000110097.

Remediate site contamination found to be present in accordance with the requirements of the Environment Protection Act 1993.

3 ID 3 OPERATION OF INDUSTRIAL SYSTEMS

3.1 ID 3.1 PARTICULATE EMISSIONS

3.1.1 Responsibility

General Manager – Surface Execution

General Manager – Mining

General Manager – Engineering and Non-Processing Infrastructure

Head of HSE

Manager Environment

3.1.2 Scope

Olympic Dam is currently one of Australia's largest underground mines, with on-site metallurgical processing facilities to convert the mined ore into the final products including 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; and

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 by surface operations at Olympic Dam have the potential to result in the generation of fugitive dust emissions. Processing and operational activities which contribute to fugitive emissions include crushing rock, blasting at the backfill limestone quarry, vehicular movement on roadways, construction activities and the stockpiling of materials. These emissions are managed through the Monitoring Program - Airborne Emissions, Document No. 00036322 (EPA Licence 1301.1 & 1301.4).

Particulates are monitored through the placement and maintenance of in stack monitoring instrumentation and continuous particulate monitoring system (dust) at background and sensitive receptor sites located off the SML. These systems are utilised to inform operational activities of particulate loading vented from stacks and within the ambient air some distance from the surface operations.

Both types of monitoring systems (point source and fugitive) include data collection of particulate loading to ensure that dust concentrations at sensitive receivers remain within acceptable levels.

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

3.1.3 Management Strategy

Management strategies are implemented to address particulate emissions both from 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;

Off-gas from Smelter 2 Flash Furnace is directed via the Waste Heat Boiler to the Electrostatic Precipitator to remove particulate matter for recycling to the furnace or Tails Leach for copper recovery. Particulates are carried over from the Flash Furnace due to incomplete combustion of the feed material 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 from operations is achieved through 'at source' minimisation of emissions, or through active operational control to ensure ground-level particulate concentrations at sensitive receivers remains below Compliance Criteria. This includes incorporating scheduled preventative maintenance activities of emission control equipment.

For Fugitive emissions operational control is based around managing the scale of dust-generating activities and the timing of such activities to limit potential exceedance events. The management response to support this method consists of a hierarchy of control measures of increasing effect, such as:

Relocating or delaying some or all surface and underground blasting activities;

Manage the loading and unloading activities of dust generating materials a greater distance from the sensitive receivers until meteorological conditions are more favourable

Redirecting mine rock haulage activities and increasing the frequency of dust suppression activities where necessary.

Postponing or limiting dust generating activities during occasions of inclement weather events (example; during a dust storm);

3.1.4 Key Legal and Other Requirement

Ratification Act and the **Indenture;**

Environment Protection Act 1993 (SA);

Environment Protection (Air Quality) Policy 2016 (SA);

EPA Licence 1301;

EPA Ambient Air Quality Assessment Guideline (2016);

Radiation Protection and Control Act 1982 (SA);

National Environment Protection (Ambient Air Quality) Measure (Cth).

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

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

3.1.8 Compliance Criteria

Ground level PM_{10} dust concentrations at Roxby Downs and Olympic Village, derived from construction and/or operational sources at Olympic Dam must not exceed the PM_{10} 24-hour average of 50 $\mu g/m^3$.

3.1.9 Leading Indicators

None applicable

3.1.10 Management Plan(s)

1. Dust and Emissions Management Plan, Document No. 000103229:

Outlines dust management measures and the 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 Programs

1. Monitoring Program - Airborne Emissions, Document No. 000036322:
    - Routine monitoring of particulate emissions from point sources within the operations, as well as ambient air monitoring to determine impacts to sensitive receptors; and
    - A real-time monitoring system used to monitor the weather and fugitive particulates from the mine and towards the sensitive receptors of Roxby Downs and Olympic Village.
2. Monitoring Program - Environmental Radiation, Document No. 000036332:
    - Routine monitoring of dust and radionuclide deposition for non-human biota radiological assessment and member of the public dose assessment.
3. Monitoring Program - Flora, Document No. 000036331:
    - Monitoring of long-term changes in perennial flora communities surrounding the operation to determine impacts (if any) from operational atmospheric emissions.

3.1.12 Controls and Management Actions

The Calciners, Feed Preparation Dryers, Smelter 2 furnaces, CAF Plant silos and the Slimes Treatment Plant roaster are fitted with emission reduction systems to remove particulate material.

Particulate emissions for the Flash Furnace, Acid Plant, Anode and Electric Furnace Bypass Stacks are managed to less than 100 mg/Nm^3 (EPA 1301.1(U-1068)).

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.

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 Dryer Baghouse stack and the CAF Plant silos are managed to less than 250 mg/Nm^3.

Appropriate filters are connected to each silo to minimise dust emissions, Process controls exist to prevent overfilling of silos (EPA 1301.3.10 (S-89)).

Maintain a pollution control register showing that pollution control equipment is maintained with planned maintenance programs to ensure effective operating of the gas cleaning systems (EPA 1301.3.8(S-2)).

Clean scrap is used in the 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 CAF Plant silos are not overfilled (EPA Licence 1301.3.11(S-90)).

Blasting is not conducted within the quarry during adverse weather conditions to minimise dust loading in the ambient air.

Dust is minimised by regular application of saline water to active haul roads, roadways, excavated backfill limestone quarry blasted material and crushed material stockpiles. The water application effectiveness is monitored through daily watering records (DEIS 5.5.4 and 13.4.2).

The Environment Protection (Air Quality) Policy 2016, EPA Ambient Air Quality Assessment Guideline will be met through design and operational management controls of mining operations at Olympic Dam (DEIS 13.3.2).

Dry abrasive blasting activities are undertaken within a blast chamber and all blast material is contained. Pollution control equipment is used within the chamber to ensure dust emissions are minimised. For those items that are too large to be accommodated within a blast chamber or cannot otherwise be relocated all reasonable and practicable measures must be taken, including an appropriate enclosed area, to ensure dust emissions are minimised. Only silica-free abrasive is used and all blast material is removed after blasting (EPA 1301.3.4(S-60)).

When undertaking wet abrasive blasting all reasonable and practicable measures are taken to prevent wastewater from entering groundwater or stormwater; and corrosion inhibitors containing chromate, nitrate or nitrite are not used in any wet abrasive blasting operation (EPA 1301. 3.14 (S-61)).

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

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).

3.2 ID 3.2 SULPHUR DIOXIDE EMISSIONS

3.2.1 Responsibility

General Manager – Surface Execution

Head of HSE

Manager Environment

3.2.2 Scope

This program applies to sulphur dioxide emissions from Smelter 2 operations at ODC. Smelter 2 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 copper concentrate into copper anodes which are then transported to the refinery for further processing.

This document consolidates the relevant information and ODC's commitments that are in place to manage sulphur dioxide (SO_2) emissions from the Olympic Dam operation.

3.2.3 Management Strategy

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 recovered and converted to sulphuric acid (H_2SO_4) for re-use back into the processing of ore. The sulphuric acid (H_2SO_4) is predominantly utilised within the hydrometallurgical plant area for leaching. Residual SO_2 present within 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 low-level 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 1301.4.5.1(U-1073)).

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 1301.1.1(U-1068), EPA 1301.4.3(U-1072), EPA 1301.1.2(U-1065), EPA 1301.4.1(U-1066), EPA 1301.4.2(U-1067), EPA 1301.4.4(U-1064)).

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 1301.4.5.1(U-1073)).

3.2.4 Key Legal and Other Requirement

Ratification Act and the **Indenture;**

EPA Licence 1301;

Environment Protection Act 1993 (SA);

Environment Protection (Air Quality) Policy 2016 (SA);

National Environment Protection (Ambient Air Quality) Measure (Cth);

Native Vegetation Act 1991 (SA);

Native Vegetation Regulations 2017 (SA);

SA EPA Emission Testing Methodology for Air Pollution, Version 2, August 2012.

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

No adverse impacts to public health as a result of sulphur dioxide (SO_2) emissions from ODC's operations.

3.2.8 Compliance Criteria

(EPA 1301.4.1 (U-1066), 1301.4.2 (U-1067), 1301.4.4 (305-142), 1301.4.5.1 (U-1073)

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.

3.2.9 Leading Indicators

None applicable

3.2.10 Management Plan(s)

1. Dust & Emission Management Plan. Document No. 000103229:

Outlines the dust and emission management measures.

3.2.11 Monitoring Programs

1. Monitoring Program - Airborne Emissions, Document No. 000036322:

Routine in-stack monitoring of SO_2 emissions from Smelter 2 and the Acid Plant combined with SO_2 measurement to determine impacts to ambient air quality and sensitive receivers.

2. Monitoring Program - Flora , Document No. 000036331:

Monitoring of long-term changes in perennial flora communities surrounding the operation to determine impacts (if any) from operational atmospheric emissions.

3.2.12 Controls and Management Actions

The Acid Plant and Smelter ventilation system captures all SO_2 generated by Smelter 2, 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 1301.1.1.2(U-1068)).

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 1301.1.1.3(U-1068)).

For the purpose of planned maintenance activities, the Acid Plant and the Flash Furnace Bypass Stacks are not used until two hours following the cessation of concentrate feed to the Flash Furnace.

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 1301.4.4(305-142), 1301.1.2(U-1065)).

Operational controls, procedures and practices seek to minimise SO_2 emissions not treated in the Acid Plant.

Maintain a pollution control register showing that pollution control equipment is maintained with regular planned maintenance programs to ensure effective operating of the gas cleaning systems (EPA 1301.3.8(S-2)). Citect process system alarms activate when limits are exceeded or a bypass events occurs, with daily reports generated.

Negative pressure is maintained to prevent gases from venting to atmosphere.

Time-weighted or cumulative average alarm identifies when SO_2 is rising toward compliance limit threshold so action can be taken to alleviate emission event.

3.2.13 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. Emissions from the Acid Plant Tail Gas Stack may exceed 3,000 mg/Nm^3 of total acid gases during cold plant start-up and abnormal or emergency situations.

Cease operations until plant and operating parameters are under control.

3.3 ID 3.3 SALINE AEROSOL EMISSIONS

3.3.1 Responsibility

General Manager – Mining

Head of HSE

Manager Environment

3.3.2 Scope

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.

3.3.3 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.

3.3.4 Key Legal and Other Requirement

Ratification Act and the **Indenture;**

Environment Protection Act 1993 (SA).

3.3.5 Values

Quality of regional soils.

Diversity of ecological communities.

3.3.6 Key Risks

Increase in soil salinity due to saline emissions.

Loss and/or displacement of ecological communities.

3.3.7 Environmental Outcome

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

3.3.8 Compliance Criteria

No loss of an **important population** of Plains Rat (***Pseudomys australis***) due to habitat loss.

3.3.9 Leading Indicators

None applicable

3.3.10 Management Plan(s)

None applicable

3.3.11 Monitoring Programs

1. Airborne Emissions Monitoring Program, Document No. 000036322:
    - Monitoring of saline aerosol emissions from raise bore ventilation shafts to provide data for determining impacts to sensitive receptors.
2. Monitoring Program - Flora, Document No. 000036331:
    - Monitoring of long-term changes in perennial flora communities surrounding the operation to determine impacts (if any) from operational atmospheric emissions.

3.3.12 Controls and Management Actions

All new exhaust raise bores have salt interception devices installed which consist of an inverted exhaust outlet and a ~ 20m splash pond which is surrounded by solid barricading.

General dewatering of the local aquifer via mine dewatering.

Maintain a watching brief on improvements or changes to saline emission interception devices.

Ensure approved salt interception device standards are applied consistently to all new exhaust raise bore sites.

3.3.13 Contingency Options

Implement immediate plans to rectify physical barricades to intercept saline aerosols if condition deteriorates.

3.4 ID 3.4 RADIOACTIVE EMISSIONS

3.4.1 Responsibility

- General Manager – Surface Execution
- General Manager – Mining
- Head of HSE
- Manager Environment

- Manager Safety, Radiation & Occupational Hygiene

3.4.2 Scope

The principal activity at Olympic Dam 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 the commencement of operations.

Potential impacts of radioactive emissions include exposure to the residents of Olympic Village and/or the Roxby Downs Township. ODC aims to ensure exposure is monitored and maintained within or below threshold levels.

Recent adoption by the ICRP of its Publication 108 – Environmental Protection: the Concept and Use of Reference Animals and Plants (2009) – notes that assessments for radiological impacts to non-human biota (flora and fauna) should be undertaken.

Where appropriate, BHP will undertake such assessments with the guidance of Australian Radiation Protection and Nuclear Safety Agency (ARPANSA) published preliminary guidelines for assessing radiological impacts to non-human biota. The ARPANSA document outlines the management measures for radioactive emissions for the existing operations.

3.4.3 Management Strategy

The approach to the management of radiation (including radioactive waste) at Olympic Dam is based on the recommendations of the International Commission on Radiological Protection (ICRP), which outlines a system of dose limitation for the protection of humans and the environment from the harmful effects of radiation. This 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 within Australia is guided by the Code of Practice and Safety Guide for Radiation Protection and Radioactive Waste Management in Mining and Mineral Processing (ARPANSA 2005 – known as the **Mining Code**). The **Mining Code** elaborates on the ICRP and IAEA requirements and is generally adopted in its entirety through state legislation throughout Australia.

The **Mining Code** contains a specific requirement to develop a Radioactive Waste Management Plan (RWMP) which includes 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.

Environmental radiation is therefore unique within the ODC Olympic Dam **Environmental Management System**, with specific aspects of the program integrated into other monitoring programs. For example, radionuclide concentrations in groundwater is incorporated into the Monitoring Program – Groundwater, Document No. 36173, whilst radioactive airborne emissions are integrated into the Airborne Emissions Monitoring Program, Document No. 36322.

3.4.4 Key Legal and Other Requirement

- **Ratification Act** and the **Indenture;**
- Radiation Protection and Control Act 1982;
- Radiation Protection and Control (Ionising Radiation) Regulations 2015(SA));
- Environment Protection Act 1993 (SA);
- Radiation Protection and Control Act, **Licence LM1;**
- Code of Practice and Safety Guide for Radiation Protection and Radioactive Waste Management in Mining and Mineral Processing (ARPANSA 2005);
- Code of Practice for the Safe Transport of Radioactive Material (ARPANSA 2019);
- Relevant ICRP and IAEA recommendations and codes.

3.4.5 Values

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

3.4.6 Key Risks

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

3.4.7 Environmental Outcome

- No adverse impacts to public health as a result of radioactive emissions from ODC's activities.
- No **significant adverse impacts to populations** of **listed species** or **ecological communities** as a result of radioactive emissions from ODC's activities.

3.4.8 Compliance Criteria

- Radiation doses to **members of the public** less than 1 mSv/y above natural background.
- Deposition of project originated ^{238}U less than 25 Bq/m^2/y at the non-human biota assessment sites.

3.4.9 Leading Indicators

- Indications that a **dose constraint** of 0.3 mSv/y to **members of the public** above natural background will be exceeded.
- Indications that a reference level of 10 µGy/h for impacts on non-human biota above natural background will be exceeded.

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

3.4.10 Management Plan(s)

1. Tailings Retention System Management Plan FY2022-2023, Document No. 000070039:

Provides details of the operating procedures for the TRS, including measures to minimise emissions.

2. Dust & Emission Management Plan, Document No. 000103229:

Details the location and systems for the monitoring of radionuclides in dust (via high-volume sampling) and active radon decay product monitoring.

3.4.11 Monitoring Programs

1. Monitoring Program - Environmental Radiation, Document No. 000036332:

Assessment of doses from monitoring results for:

- Members of the public dose assessment;
- Non-human biota radiological assessment.

Monitoring and data collection including:

- Airborne radioactive dust monitoring;
- Radioactive dust deposition monitoring;
- Radon decay product monitoring.

2. Monitoring Program - Airborne Emissions, Document No. 000036322

Monitoring of control systems (such as baghouse efficiencies and stack emissions).

3. Monitoring Program - Groundwater, Document No. 000036173:

Radionuclide concentrations in groundwater monitoring.

4. Monitoring Program - Waste, Document No. 000049183:

Monitoring of radioactive waste production and methods of waste control.

3.4.12 Controls and Management Actions

(MC 2.8.2(c))

3.4.12.1 Radiation protection systems

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 as they become available.

3.4.12.2 Controls in existing operations

The operation currently maintains a number of control systems, these include:

- Exhaust gas cleaning on the two calcining furnaces, the feed preparation dryers, the flash furnace and the slimes treatment plant roasters;
- 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.

3.4.12.3 Optimisation in design

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 within 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.

3.4.12.4 Radioactive emissions from the TSF:

The following controls primarily aim at reducing radioactive emissions through seepage to groundwater:

- 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.

3.4.13 Contingency Options

- Review of airborne emission controls and technologies as they become available.

- Review of tailings disposal and liquor management if required.

3.5 ID 3.5 GREENHOUSE GAS EMISSIONS

3.5.1 Responsibility

- General Manager – Surface Execution
- General Manager – Mine
- General Manager – Engineering & NPI
- Head of Asset Projects
- Head of HSE
- Manager Environment

3.5.2 Scope

Olympic Dam consumes fossil fuels directly and indirectly as part of its activities, including its on-site operations and associated off-site activities including materials transport and the operation of off-site infrastructure. Major sources of greenhouse gas (GHG) include:

- The use of electricity;
- The combustion of liquefied petroleum gas (LPG), natural gas, diesel and fuel oil;
- The use of coke, soda ash and soderberg paste within the metallurgical plant;
- The use of ammonium nitrate fuel oil (ANFO) and other explosives;
- The consumption of acid in the metallurgical plant and neutralisation of acidic liquor within the TSF.

The National Greenhouse and Energy Reporting Act 2007 (Cth) (NGER Act) outlines the greenhouse emissions that are to be publicly reported. ODC reports annually as per the requirements of the NGER 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's approach to climate change is multi-faceted. ODC addresses the BHP-wide goals via this EM Program and the Energy Use and Greenhouse Gas Emissions MP.

3.5.3 Management Strategy

Recognising climate change as a global issue, greenhouse gas emissions are managed at Olympic Dam in the context of BHP's overall strategy and response to climate change. BHP's climate change strategy focuses on reducing our operational greenhouse gas (GHG) emissions, investing in low emissions technologies, promoting product stewardship, managing climate-related risk and opportunity and working with others to enhance the global policy and market response. As a BHP group asset, ODC operates under the BHP group strategy. Following on from BHP's success in maintaining absolute GHG emissions at 21 per cent below the adjusted FY2006 baseline during the previous 5 year target period (FY13-FY17), BHP's current short term target for FY22 is to maintain total operational GHG emissions at or below FY17 levels while we continue to grow our business. In addition, BHP has set a long term target, in line with international commitments, to achieve net-zero operational emissions by 2050 and a medium-term target to reduce operational GHG emissions (Scope 1 and Scope 2 from our operated assets) by at least 30% from FY2020 levels by FY2030.

ODC contributes to the strategy and targets through compliance with the Our Requirements for Environment and Climate Change standard, including through the quantification and tracking of the current greenhouse gas emissions performance of the existing operation, as well as the identification, investigation and where viable implementation of greenhouse gas reduction and abatement opportunities.

Monitoring and reporting of emissions performance, as well as quantification of any emission reduction opportunities and achievements is done in accordance with the Energy Use and Greenhouse Gas Emissions MP (Document No. 000067616).

3.5.4 Key Legal and Other Requirement

- **Ratification Act** and the **Indenture**
- National Greenhouse and Energy Reporting Act 2007 (Cth)
- National Greenhouse and Energy Reporting Regulations 2008 (Cth)
- National Greenhouse and Energy Reporting (Measurement) Determination 2008 (Cth)
- National Greenhouse and Energy Reporting (Safeguard Mechanism) Rule 2015 (Cth)
- Climate Change and Greenhouse Emissions Reduction Act 2007 (SA)
- BHP Climate Change Position

3.5.5 Values

- Global atmospheric greenhouse gas concentrations.

3.5.6 Key Risks

- Excessive contribution to global greenhouse gas concentrations.

3.5.7 Environmental Outcome

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

3.5.8 Compliance Criteria

- Progress on GHG and energy reduction and abatement opportunities that contribute to BHP strategy and response to climate change, and OD's contribution to that strategy, reported annually.

3.5.9 Leading Indicators

None applicable

3.5.10 Management Plan(s)

None applicable

3.5.11 Monitoring Programs

1. Energy Use and Greenhouse Gas Emissions Monitoring Program, Document No. 000067616:

Data collection and reporting of energy use and greenhouse gas emissions.

3.5.12 Controls and Management Actions

- 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.

3.5.13 Contingency Options

None

4 ID 4 GENERATION OF INDUSTRIAL WASTE

4.1 ID 4.1 EMBANKMENT STABILITY OF TSF

4.1.1 Responsibility

- General Manager – Surface Execution
- Head of HSE
- Manager Environment

4.1.2 Scope

(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 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 is pumped to evaporation ponds for storage and disposal. Some liquor is recycled to the metallurgical plant to recover metals and acid contained in the liquor.

Key aspects of the stability of the embankments are the quality of construction techniques, strength of 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, ongoing upstream embankment raises and the placement of tailings. 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;
- Complying with the Global Industry Standard for Tailings Management (GISTM) by August 2023
- 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;
- Conducting regular stability analyses, including geotechnical investigations and testing.
- Installing buttresses, filter zones and interception trenches to increase the factor of safety as required;
- Installing an embankment movement monitoring system (Maptek Sentry) at critical locations;
- Construction of new tailings dams and evaporation ponds as necessary to control tailings storage height and TSF pond volumes respectively;
- Construction of support buttresses.

4.1.4 Key Legal and Other Requirement

- **Ratification Act** and the **Indenture**
- Radiation Protection and Control Act 1982 (SA)
- Code of Practice and Safety Guide for Radiation Protection and Radioactive Waste Management in Mining and Mineral Processing (ARPANSA, 2005)
- Australian National Committee on Large Dams (ANCOLD) guidelines
- Global Industry Standard for Tailings Management (GISTM) requirements

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

- No significant TSF embankment failure.

4.1.8 Compliance Criteria

- 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.

4.1.9 Leading Indicators

- Indications that the rate of rise of tailings will exceed an average of 2 m per annum
- Indications that the rate of rise of pore pressures within or adjacent to the TSF embankment will exceed the rate of rise of tailings
- Indications that the maximum supernatant pond area of individual TSF cells will exceed 15ha for TSF1, 23ha for TSF2/3, 90ha for TSF4, 135ha for TSF5 and 135ha for TSF6.

Note: Each TSF has been assigned a maximum supernatant pond size which is calculated using critical operating parameters, surface contours and an allowance for significant rainfall events. Operating beyond these ponds sizes may not result in embankment failure but are considered an appropriate leading indicator in which operational processes should be reviewed.

4.1.10 Management Plan(s)

TRS Management Plan, Document No. 000070039:

- Details loss control measures, current and critical design and operating parameters, monitoring and surveillance requirements including piezometer level monitoring and observed perimeter features.

BHP is currently preparing a Tailings Management System that will sit over the top of the TRS management plan as part of GISTM compliance. This will be implemented once finalised.

4.1.11 Monitoring Programs

1. Waste Monitoring Program, Document No. 000049183:

- 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

(MC 2.8.2(c))

- The size of supernatant ponds is minimised and the location of ponds controlled by management practices (EPA 31543.U - 535).
- 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 can be rock armoured to minimise erosion.
- An annual operational audit, 2-yearly design safety review, 2-yearly geotechnical investigation, and 2-yearly stability review are performed for the TSFs by third parties.
- A barrier wall has been constructed between the TSF and mining and surface operations, to reduce health and safety consequences in the unlikely event of a significant TSF wall failure.

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.

4.2 ID 4.2 TAILINGS SEEPAGE

4.2.1 Responsibility

- General Manager – Surface Execution
- Head of HSE
- Manager Environment

4.2.2 Scope

(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 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 is pumped to evaporation ponds for storage and disposal. Some liquor is recycled to the metallurgical plant to recover metals and acid contained in the liquor. 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 **Environment Protection (Water Quality) Policy 2015**, ANZECC and ARMCANZ (2000). The high salinity of the groundwater makes it unsuitable for consumption by humans or stock, or for irrigation, and is currently 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 Draft Environmental Impact Statement 2009 (**EIS)**.

4.2.3 Management Strategy

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-U-535);
- An underdrainage system that includes a HDPE liner installed in portions of TSF Cells 4, 5 and 6.
- 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 occur.
- Lateral seepage in cells 5 and 6 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 and the TSF5 dewatering wells to provide a useful addition to site water supply.

4.2.4 Key Legal and Other Requirement

- **Ratification Act** and the **Indenture**
- **Environment Protection Act** 1993 (SA)
- Radiation Protection and Control Act 1982 (SA)
- Environment Protection (Water Quality) Policy 2015
- 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 (DPC), Bachmann Criteria

4.2.5 Values

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

4.2.6 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.

4.2.7 Environmental Outcome

- No significant adverse impact on vegetation as a result of seepage from the TSF.
- No compromise of current and future land uses on the SML or adjoining areas as a result of seepage from the TSF.
- No compromise of the **environmental values** of groundwater outside the SML as a result of seepage from the TSF.

4.2.8 Compliance Criteria

- Maintain groundwater level (attributable to seepage from the TSF) outside the external perimeter road of TSF Cells 1 to 6 to not higher than 80 mAHD (20 m below ground level)..
- All TSF seepage attenuated within the SML, as demonstrated by a numerical geochemical model and confirmed by monitoring.

4.2.9 Leading Indicators

- A measurement of groundwater level outside the external perimeter road of the TSF that exceeds 70 mAHD (30 m below ground level) as a result of seepage.
- A numerical geochemical model trend that indicates that all TSF seepage may not be attenuated within the SML should the trend continue.

4.2.10 Management Plan(s)

Tailings Retention System Management Plan, Document No. 000070039:

- Details loss control measures, current and critical design and operating parameters, monitoring and surveillance requirements including observed perimeter features and groundwater level monitoring.

BHP is currently preparing a Tailings Management System that will sit over the top of the TRS management plan as part of GISTM compliance. This will be implemented once finalised.

4.2.11 Monitoring Programs

1. Groundwater Monitoring Program, Document No. 000036173:
    - Routine groundwater level monitoring around the TSFs and evaporation ponds; and
    - Routine groundwater quality monitoring around the TSFs and evaporation ponds (EPA 31543.U-519).
2. Waste Monitoring Program, Document No. 000049183:
    - A liquor balance of each evaporation pond is conducted to highlight potential significant leaks (EPA 31543.U-518).

4.2.12 Controls and Management Actions

(MC 2.8.2(c))

- Monitoring and review of performance data relating to the TSFs.
- The size of supernatant ponds are minimised and the location of ponds controlled by management practices (EPA 31543.500-U-535).
- 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.
- An operational review of the TSF is undertaken annually by a third party.
- A water balance is used to assist in the management of the TSFs and enable future tailings and plant liquor disposal or recycle requirements to be assessed (EPA 31543.U-518).
- 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.U-536).
- Perimeter seepage interception trench is installed around TSF Cells 5 and 6
- Construction of support buttresses on TSF4 and TSF5, and other buttresses as required to maintain factors of safety within the target range.
- The TSF5 buttress will include a toe drain to replace the existing toe drain that will become buried under the buttress.
- Installation of seepage interception trenches at the eastern wall of TSF 1-3.
- Underdrainage system including HDPE liner is installed in TSF Cells 4, 5 and 6.
- 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.

4.2.13 Contingency Options

(MC 2.8.2(f))

The TRS Operation, Maintenance and Surveillance Manual (Document No. 000083204) 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; and
- Explains remediation options.

4.3 ID 4.3 FAUNA INTERACTIONS WITH THE TAILINGS RETENTION SYSTEM

4.3.1 Responsibility

- General Manager – Surface Execution
- General Manager – Planning and Development

- Head of HSE
- Manager Environment
- Manager Safety Radiation & Occupational Hygiene

4.3.2 Scope

Open ponds of acidic liquor and wet beach environments at the TRS present a risk of attracting fauna, particularly waterbirds and some mammals. Large numbers of these species are regularly recorded using 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.

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

4.3.3 Management Strategy

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:

- Reducing wildlife attraction to the TRS environment;
- Preventing access to areas of the TRS, where possible;
- Managing fauna that do enter the area to minimise impact;
- Annual review of technology for deterring fauna from the TRS

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.

4.3.4 Key Legal and Other Requirement

- **Ratification Act** and the **Indenture**
- National Parks and Wildlife Act 1972 (SA);
- Environment Protection and Biodiversity Conservation Act 1999 (Cth)

4.3.5 Values

Listed species and / or ecological communities.

4.3.6 Key Risks

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

4.3.7 Environmental Outcome

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

4.3.8 Compliance Criteria

- No significant adverse impact on the size of an **important population** of Banded Stilt (***Cladorhynchus leucocephalus***) 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**.

4.3.9 Leading Indicators

None Applicable

4.3.10 Management Plan(s)

TRS Management Plan, Document No. 000070039.

4.3.11 Monitoring Programs

1. Fauna Monitoring Program, Document No. 000036339:

Routine monitoring of fauna interaction within the TRS.

4.3.12 Controls and Management Actions

Since the implementation of the TRS fauna project a wide range of control and management actions have been trialled and/or 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 have been undertaken in partnership with Deakin University. A project studying the ecology of the Banded Stilts was completed in FY18 and was able to demonstrate that Banded Stilts attempt to breed more often than originally assumed and travel longer distances than originally assumed. Other valuable information has also been gained from investigations into waterbird movement patterns and their response to visual light 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 covered 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.
- Sound Identification activated deterrent – trials to date indicate that the large areas are a limiting factor in the design.
- Randomly activated audio and light deterrents – trials demonstrated that these were ineffective.
- Minimise pond size – decreases available habitat (EPA 31543.U - 535). Analysis found that this control was ineffective at reducing waterbird numbers over the test period.
- Management of minimum water depth – maintain a minimum liquor depth to discourage wading birds. Analysis found that this control was ineffective at reducing waterbird numbers over the test period.

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):

- 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.

4.3.13 Contingency Options

None applicable.

4.4 ID 4.4 SOLID WASTE DISPOSAL

4.4.1 Responsibility

- General Manager – Surface Execution
- General Manager - Mine
- General Manager – Engineering and Non-Processing Infrastructure
- Head of HSE
- Manager Environment

4.4.2 Scope

As an operational mine site, Olympic Dam produces waste. While we take steps to reduce the volume we produce, some waste is a necessary aspect of our operation. Olympic Dam operates under an Environment Protection Licence (1301) which is issued under the South Australian *Environment Protection Act 1993*. As part of our licence, we are required to collect, segregate, recycle and safely dispose of all waste types generated on site, this includes surface and underground mining operations.

The processes to do this have been developed in accordance with national and state regulatory requirements. Dedicated areas within the Resource Recovery Centre (RRC) allow waste streams to be segregated and certain items to be reused or recycled.

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. The main means of segregating waste products includes the implementation of site wide training and a colour coded bin system for segregation of products at the source prior to being collected by the RRC.

Waste types currently collected onsite include:

- Paper and cardboard
- Hard and soft plastics
- Timber and wood products

- Ferrous and non-ferrous metals
- Organic food wastes
- Controlled substance packaging (e.g: empty Ammonium nitrate bags)
- Controlled wastes including waste oils and tailings

For those wastes that are not reused or recycled, the RRC has a general waste 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. Hazardous waste unsuitable for disposal within the SML is transported off-site to an appropriately licenced treatment or disposal facility. 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 disposal under a separate licence.

Wastes generated within the township of Roxby Downs, the Charlton Road industrial area and Olympic Village, are sent to the Opal Road Landfill, which operates and is registered as a transfer station only. Wastes are transported and disposed of at appropriately licenced facilities in Dublin or Adelaide. The Opal Road Landfill is managed and operated by the Roxby Downs Municipal Council.

Note: Radioactive wastes are covered in ID 4.5 and the risks associated with the management of tailings waste are covered in ID 4.2 and 4.5.

4.4.3 Management Strategy

ODC operates a system based on the waste management hierarchy, where the prevention and minimisation of waste generation is preferred over direct disposal to landfill. This includes minimising packaging material sent to site, identifying waste types, recycling and not stockpiling recoverable products on site.

4.4.4 Key Legal and Other Requirement

- **Ratification Act** and the **Indenture**
- Environment Protection Act 1993 (SA)
- Environment Protection (Waste to Resources) Policy 2010
- EPA guideline environmental management of landfill facilities -solid waste disposal 2019
- Environment Protection waste to resources policy guide on handling wastes banned from landfill
- EPA guideline for stockpile management
- EPA guidelines waste transport certificates
- **EPA Licence 1301**

4.4.5 Values

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

4.4.6 Key Risks

- Personnel and public exposure to hazardous substances;
- Contamination of soil, surface water or groundwater;
- Unsustainable use and depletion of resources and materials.

4.4.7 Environmental Outcome

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

4.4.8 Compliance Criteria

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

4.4.9 Leading Indicators

None applicable

4.4.10 Management Plan(s)

1. Landfill Environmental Management Plan (LEMP), Document No. 000072375:

Outlines the 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.

2. Tailings Retention System Waste Management Plan, Document No. 000120151:

Outlines the disposal considerations and evaluation of waste products prior to disposal to the TRS via a waste finger.

4.4.11 Monitoring Programs

1. Monitoring Program - Waste, Document No. 000049183:

Outlines routine monitoring of general and industrial waste disposal, collates the collection of data including quantities for waste tracking, recovery for recycling and annual reporting.

4.4.12 Controls and Management Actions

- Waste streams, including hydrocarbons and batteries are segregated and recycled offsite, this includes limiting the quantities stored on site at any one time. An EPA approved Landfill Environmental Management Plan is maintained and reviewed at regular intervals (EPA 1301.3.3 (T-1036)).
- All waste sent offsite is subject to a radiation clearance check prior to leaving site to limit as far as practicable the risk of radioactive waste leaving site.
- Listed and/or controlled wastes are tracked during transport using the EPA waste tracking system and supporting guidelines (EPA 1301.2.1 (S-166)). If in the event listed or controlled waste is sent interstate for treatment or disposal appropriate authorisation is sought prior to the waste leaving site with all records maintained.
- Liquid wastes are stored within an appropriately bunded area until transported offsite for disposal or treatment (EPA Licence 1301.3.1(S-5)).
- Wastes are only transported by appropriately licensed contractors to licenced facilities that are licenced to receive, treat or dispose of such waste types (EP Act 1993).
- Appropriate emergency spill kits are kept on site at all times, in locations where listed wastes are stored, loaded or unloaded. They must be appropriately used in the event of a spill (EPA 1301.3.5 (S-22)).
- Any new landfill facility is designed and operated in accordance with the relevant sections of the EPA guideline management of landfill facilities -solid waste disposal (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 standard for production and use of waste derived fill (DEIS 5.6.2).
- 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 sewer lagoons are undertaken by dedicated site teams. Sewer lagoon embankments and liners are inspected for the presence of any abnormalities (EPA Licence 1301.3.6(S-122)). Samples are also taken quarterly to ensure sewer lagoons are operating effectively.
- The integrity of the sewer lagoon structure and liner is maintained to minimise seepage to land and groundwater and lagoon walls and capacity are maintained to prevent uncontrolled overflow (EPA Licence 1301.3.7(S-163)).
- Ensure all sewer lagoons constructed with a leak detection system undergo quarterly inspections (EPA Licence 1301.3.7(S-163)).
- The ODV sewer lagoon system is a regulated structure governed by EPA Licence 3054 and has been designed and managed in accordance with relevant guidelines and standards.

- Any drying, storage, disposal or reuse of sludge and biosolids is carried out in a manner to prevent or minimise environmental harm and any leachate from the sludge and biosolids must be directed to the wastewater management system (EPA Licence 1301.3.12. (S-143))

4.4.13 Contingency Options

- All chemicals and chemical products are stored, loaded or unloaded in an appropriately bunded area (EPA 1301.3.1(S-5)),
- ODV Sewage System Monitoring and Contingency Plan, Document No. 90848 has been developed which outlines the plan of action to be taken in the event of emergency or abnormal situations (EPA Licence 3054.1.2(315-458)).

4.5 ID 4.5 RADIOACTIVE WASTE

4.5.1 Responsibility

- General Manager – Surface Execution
- General Manager – Mining
- General Manager – Engineering and Non-Processing Infrastructure
- Head of HSE
- Manager Environment
- Manager Safety Radiation & Occupational Hygiene

4.5.2 Scope

(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** being items of plant and equipment that have become contaminated during processing and cannot be cleaned and recycled economically;
- 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.

The Radioactive Waste 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.

The Radioactive Waste management program applies to the management measures for the existing ODC operations.

Radiation impacts as a result of emissions from radioactive waste are addressed in the EM Program ID 3.4 Radioactive Emissions.

4.5.3 Management Strategy

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 (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;
- 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 Radioactive Waste Management in Mining and Mineral Processing (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).

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

4.5.4 Key Legal and Other Requirement

- **Ratification Act** and the **Indenture;**
- Environment Protection and Biodiversity Conservation Act 1999 (Cth);
- Environment Protection Act 1993 (SA);
- Radiation Protection and Control Act 1982 (SA);
- Radiation Protection and Control (Ionising Radiation) Regulations 2015 (SA);
- Code of Practice and Safety Guide for Radiation Protection and Radioactive Waste Management in Mining and Mineral Processing (ARPANSA 2005).

4.5.5 Values

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

4.5.6 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.

4.5.7 Environmental Outcome

- No adverse impacts to public health as a result of radioactive waste from ODC's activities.
- No **significant adverse impacts to populations** of **listed species** or **ecological communities** as a result of radioactive waste from ODC's activities.

4.5.8 Compliance Criteria

- Radiation doses to **members of the public** less than 1 mSv/y above natural background.
- Deposition of project originated ^{238}U less than 25 Bq/m^2/y at the non-human biota assessment sites.

4.5.9 Leading Indicators

- Indications that a **dose constraint** of 0.3 mSv/y to **members of the public** above natural background will be exceeded.
- Indications that a reference level of 10 µGy/h for impacts on non-human biota above natural background will be exceeded.

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

4.5.10 Management Plan(s)

1. Tailings Retention System Management Plan, Document No. 000080791:
   - 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.
2. Tailings Retention System Waste Management Plan, Document No. 000120151:
   - Details the requirements associated with the disposal of hazardous solid wastes to the TSF.
3. Contaminated Waste Management Plan, Document No. 000114827:
   - Management and disposal of contaminated waste within the SML.

4.5.11 Monitoring Programs

1. Monitoring Program - Environmental Radiation, Document No. 000036332:

Assessment of doses from monitoring results, for:

- Members of the public dose assessment;
- Non-human biota radiological assessment.

2. Monitoring Program - Waste, Document No. 000049183:

Records of radioactive waste produced;

- Methods of control.

4.5.12 Controls and Management Actions

(MC 2.8.2(c))

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.
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;
     - A register is maintained of waste material other than tailings disposed of in the TSF.
3. General radioactive waste management:
   - Off - site Laboratory waste is stored at the pilot plant and disposed to TSF.
   - Plant and equipment that is contaminated with process material is disposed in the permanent contaminated waste disposal facility (CWDF) and managed according to the Contaminated Waste Management Plan, Document No. 000114827.
   - A register of contaminated waste disposal is maintained. All structural contaminated waste to be disposed to the CWDF must be cleaned to ensure an activity concentration below exemption levels as defined in schedule 4 of the National Directory for Radiation Protection.

- A register of contaminated waste is also maintained for waste stored at the CWDF that's activity is above exemption levels defined in schedule 4 of the National Directory for Radiation Protection.
- The radionuclide content (^{238}U and ^{226}Ra) of mine water used for dust suppression on surface roads is tested to ensure it remains below 50 Bq/l (^{238}U) and 5 Bq/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.

4.5.13 Contingency Options

(MC 2.8.2(f))

Redesign; re-engineer or modify the management procedures of the TSF and CWDF should it be deemed necessary.

5 ID 5 INTERACTION WITH COMMUNITIES

5.1 COMMUNITY INTERACTION

5.1.1 Responsibility

- Manager Corporate Affairs

5.1.2 Scope

The involvement of stakeholders, including the community and traditional owners, is critical to BHP's licence to operate. Maintaining positive 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.

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, Woomera 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;
  - 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;
  - Provision 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.

5.1.4 Key Legal and Other Requirement

- **Ratification Act** and the **Indenture**
- **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

- Residents in Roxby Downs, Andamooka and Woomera have a favourable view of ODC.

5.1.8 Compliance Criteria

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

5.1.9 Leading Indicators

None applicable

5.1.10 Management Plan(s)

None applicable

5.1.11 Monitoring Programs

1. Social Effects Monitoring Program, Document No. 000110687:
    - Residents' view of BHP;
    - Residents' perceptions of safety, quality of life, services and facilities and social fabric in Roxby Downs, Andamooka and Woomera.

5.1.12 Controls and Management Actions

5.1.12.1 Community relations

1. ODC continues to have regular communication with stakeholders including:
    - Maintains a list of key stakeholders and their interests in the current operation and future projects at Olympic Dam;
    - Undertakes stakeholder engagement activities that are appropriate to the needs of different stakeholders;
    - Records interactions with stakeholders and outcomes where appropriate, including responses to concerns and complaints (EPA 1301.S-1, 3054.300-20).
2. 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 (EPA 1301.S-1, 3054.300-20).
3. Under the **Olympic Dam Agreement** between ODC and three Aboriginal groups, Barngarla, Kokatha and Kuyani, who all held active native title claims over the Olympic Dam area at the time of negotiating the agreement:
    - A trust is maintained to manage payments by ODC to support community 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.
4. 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 Social character, amenity and wellbeing

1. ODC contributes to the provision of essential services in Roxby Downs so they are maintained at a reasonable standard.
2. 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.

5.1.13 Contingency Options

None