Australian Government

Department of Sustainability, Environment, Water, Population and Communities

Olympic Dam expansion assessment report EPBC 2005/2270

Current Olympic Dam operation (photo: BHP Billiton)

September 2011

Contents

1. Project description

BHP Billiton (BHPB) is proposing a major expansion of the existing Olympic Dam copper, uranium, gold and silver mine in South Australia. If approved, the expansion would result in an increase in copper production from the current capacity of 235,000 tonnes per annum to an average annual production of 750,000 tonnes per annum plus associated products. BHPB has sought approval for a 40 year project and would need to seek further government approval if mining continues beyond that period.

The proposal includes development of an open pit which is anticipated to grow to 4.1 km long, 3.5 km wide and 1 km deep. The existing underground mine would also continue for the medium term. The existing smelter would be expanded and new concentrator and hydrometallurgical plants built to process the additional ore. Additional infrastructure to support the mine expansion would include:

- a waste rock storage facility that would cover approximately 6,720 hectares (ha) and eventually be approximately 150 m high
- expansion of the tailings storage facility by the addition of up to nine cells (to the existing four cells), that would eventually be 65 m high and cover approximately 4,400 ha.

Further major infrastructure items proposed to support the expanded mine include:

- a 280 megalitre per day (ML/d) coastal desalination plant (200 ML/d required for Olympic Dam and 80 ML/d available for other uses) at Point Bonython on the Upper Spencer Gulf (near Whyalla), and associated 320 km water supply pipeline to Olympic Dam
- saline wellfields providing up to 50 ML/d of groundwater suitable for dust suppression
- a new 270 km electricity transmission line from Port Augusta, or a new gas-fired power station supplied via a new gas supply pipeline from Moomba, or a combination of these facilities to meet an additional maximum electricity demand of 550 Megawatts (MW)
- a 105 km rail spur to connect Olympic Dam to the national rail network near Pimba to move product and supplies by rail instead of road
- a new rail/road intermodal freight terminal at Pimba to reduce construction related road traffic prior to the operation of the proposed rail spur
- a new airport to replace the existing airport at Olympic Dam
- a landing facility on the Upper Spencer Gulf (south of Port Augusta) to unload equipment from barges, and an access corridor to a pre-assembly equipment yard at Port Augusta
- a new accommodation village for workers (named Hiltaba Village)
- expansion of the Roxby Downs township, 14 km south of the mine, where most of Olympic Dam's operational workforce lives
- a sulphur handling facility at Outer Harbor at the Port of Adelaide
- additional port facilities in the Northern Territory at the Port of Darwin for export of copper concentrate.

Maps of the proposed activities are provided in Appendix 1 of this report.

2. Background

The proposal was referred under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) on 16 August 2005 by WMC (Olympic Dam Corporation) Pty Ltd (now BHP Billiton Olympic Dam Corporation Pty Ltd) who indicated that the proposal should be a controlled action. The proposal was determined a controlled action on 2 September 2005 with the following controlling provisions:

- sections 16 and 17B (Wetlands of international importance)
- sections 18 and 18A (Listed threatened species and communities)
- sections 20 and 20A (Listed migratory species)
- sections 21 and 22A (Protection of the environment from nuclear actions)
- sections 26 and 27A (Protection of the environment from actions involving Commonwealth land).

Key dates in the assessment were as follows:

Date	**Milestone**
8 November 2005	Decision that the proposal must be assessed by environmental impact statement (EIS)
18 November 2005	EIS draft guidelines released for public comment
10 February 2006	EIS guidelines finalised
24 October 2008	Acceptance of variation of the proposal to revise and clarify the scope of the action
1 May 2009	Draft EIS released for public comment (14 weeks)
7 August 2009	Closing date for public comments – 4,197 submissions received
9 June 2010	Acceptance of variation to allow Aboriginal Heritage Salvage Program to proceed
21 April 2011	Acceptance of final EIS
13 May 2011	Publication of final EIS

The draft EIS, published for public comment on 1 May 2009, with the supplementary EIS accepted on 21 April 2011 together form the final EIS for the project.

The proposal also requires approval from the South Australian (SA) and Northern Territory (NT) governments. All governments agreed to work collaboratively on the assessment. This included:

- preparing a joint set of guidelines to meet the requirements of all three jurisdictions
- BHPB preparing and exhibiting a single EIS against the guidelines
- joint review of the adequacy of the final EIS
- Australian Government input to the SA and NT government assessment reports.

Further details on the collaborative approach are in chapter 2 of the South Australian Government assessment report.

3. Preparation of assessment report

This assessment report is based on:

- Olympic Dam expansion draft environmental impact statement (BHPB 2009)
- Olympic Dam expansion supplementary environmental impact statement (BHPB 2011)
- South Australian Government Olympic Dam expansion assessment report (September 2011)
- Advice from Australian Radiation Protection and Nuclear Safety Agency (June/July 2011)
- Advice from Geoscience Australia (8 July 2011)
- Advice from other Australian Government departments
- Advice from within the Department of Sustainability, Environment, Water, Population and Communities.
- Department of Sustainability, Environment, Water, Population and Communities Environmental Reporting Tool (ERT) report.

As noted above, the Australian, SA and NT governments have worked collaboratively on this assessment. In particular, the department has reviewed the SA assessment report (SAAR) as it was being developed and provided comments to the SA Government. Rather than repeat this information, this assessment report summarises the conclusions in the SAAR in relation to each issue. As such, this report only provides a detailed assessment of issues which are outside the scope of the SAAR, specifically:

- the proposed sulphur handling facility at Outer Harbor in Adelaide (this component was not included in the SA Government Major Development Declaration under the *Development Act 1993*)
- nuclear security and safety issues.

Discussion of public submissions on the draft EIS is also provided in the SAAR and summarised in this report.

The department's assessment and recommendations are consistent with the conclusions in the SAAR. The conclusions in the SAAR have also been reviewed and confirmed by Geoscience Australia, ARPANSA, and the Supervising Scientist.

4. Approach to condition setting

Given the scale and complexity of the Olympic Dam expansion, an approval under the EPBC Act that sought to cover all components of the project and all potential impacts on the environment in detail would be duplicative of SA and NT regulation, create a significant monitoring and compliance burden, and involve the Australian Government in matters of state or local significance. For this reason, the department has recommended conditions in defined areas, where elements of the project will have likely or certain impacts (such as vegetation clearing) or present a long-term (even if low) risk to the environment.

5. Assessment of impacts on the environment

As noted in section 2, the proposed project is a 'nuclear action' as defined in the EPBC Act. This means that it is necessary to consider impacts on the whole environment in addition to specific matters to be considered under other relevant controlling provisions. Impacts on the whole environment are detailed in section 5 of this report, while impacts to particular controlling provisions are detailed in section 6.

The proposed expansion consists of a number of components:

- Mining and processing activities
- Desalination plant
- Barge landing facility
- Hiltaba village and airport
- Roxby Downs expansion
- Pimba intermodal facility
- Service corridors (gas, electricity, water)
- Road and rail corridors
- Sulphur handling facility
- Port of Darwin loading facility

The environmental impacts of each of these components are discussed in turn in this section of the report (below). This section also discusses broader project issues, including greenhouse gas emissions and nuclear security and safety.

This report provides a summary of the assessment and conclusions from the SAAR followed by the department's recommendations. The EIS and the SA draft assessment reports assess risks of impacts of the proposal. The principal certain or likely impacts relating to the proposed project are:

- Clearing of vegetation (principally associated with mining, service corridors, and road and rail corridors)
- Groundwater, both at the mine site and regional scale (principally associated with mining and processing)
- Bird deaths associated with exposure to the tailings storage facility (principally associated with mining and processing)

- Mining and processing will result in increased levels of radiation exposure above background levels.

While a number of other aspects of the proposed project (addressed below) involve risk, the department considers that those risks are low. Those risks would be further mitigated or reduced through the application of the recommended conditions. These aspects of the project relate to radiation; surface water; the desalination plant; infrastructure corridors; transport of copper concentrate and uranium oxide; the proposed loading facility in the Port of Darwin; nuclear security; and greenhouse gas emissions.

5.1 Mining and processing activities

5.1.1 Introduction

BHPB proposes to construct an open pit mine in addition to the existing underground mine at Olympic Dam. The open pit would create a permanent void approximately 1 km deep, 4.1 km long and 3.5 km wide covering an area of 1010 ha. BHPB is likely to take 5 to 6 years to remove the unmineralised overburden before reaching the ore body, approximately 300 to 350 m below the ground surface.

Waste rock from the open pit would be placed in a large pile, or rock storage facility (RSF), covering approximately 6,720 ha after 40 years at a height of about 150 m. The expansion would include a new metallurgical plant covering 690 ha to process the ore and a 600 MW gas fired power station. Waste material ('tailings') from processing of the ore would be placed in an expanded tailings storage facility (TSF). The size of the TSF would expand from the current 400 ha to approximately 4,400 ha.

A detailed description of the mining operation and associated infrastructure is in chapter 5 of the draft EIS and chapter 4 of the SAAR.

At mine closure, the TSF would be capped with benign material to minimise the risk of exposure of the public to acidic liquor and low level radioactive material. The open pit would not be back-filled but would remain as a void. Over time, a 350 m deep hypersaline lake would develop in the bottom of the pit. BHPB has indicated in the EIS that backfilling the pit is not a viable option at the end of the 40 year design life for this proposal as:

- it would sterilise the remaining mineral resource (i.e. prevent it from being mined). BHPB notes that the eventual mine life may be 100 years
- it would take a similar time to backfill the pit as the original mining operation (i.e. approximately 40 years) at a significant economic cost and increased greenhouse emissions.

Mining and processing present a number of risks to environmental values, including risks relating to:

- Radiation exposure
- Regional groundwater impacts
- Local groundwater impacts
- Impacts on flora and fauna
- Air quality
- Rehabilitation and decommissioning

5.1.2 Radiation

International best practice in radiation management, as established by the International Commission on Radiological Protection, has three elements:

- justification – a practice involving exposure to radiation should only be adopted if the benefits of the practice outweigh the risks associated with the radiation exposure
- optimisation – radiation doses received should be as low as reasonably achievable (known as the ALARA principle), taking into account economic, environmental and social factors.
- limitation – individuals should not receive radiation doses greater than the recommended limits.

Radiation limits used in Australia are those recommended by the International Commission on Radiological Protection and incorporated into the *Code of Practice for Radiation Protection and Radioactive Waste Management in Mining and Mineral Processing* (Australian Radiation Protection and Nuclear Safety Agency (ARPANSA) 2005). These are:

- 20 milliSieverts per year (mSv/y) for workers, averaged over 5 years (maximum of 50 mSv in one year); and
- 1 mSv/y for members of the public.

Regulation of radiation in South Australia is through the *Radiation Protection and Control Act 1982* (SA). This Act requires BHPB to prepare a Radiation Management Plan and a Radioactive Waste Management Plan consistent with the national *Code of Practice for Radiation Protection and Radioactive Waste Management in Mining and Mineral Processing* (ARPANSA 2005). The plans must be approved by the South Australian Environment Protection Authority (SA EPA). EPA regulation involves authorisations and approvals of the main stages of the operation, audits to determine compliance with approved management plans, and routine and incident reporting by the operators. The above radiation limits are also prescribed under the Act.

SA assessment

The South Australian Assessment Report (SAAR) provides a comprehensive assessment of the radiation aspects of the proposal. In undertaking the assessment, the SA EPA separately checked and verified BHPB's calculations for radiation doses. The proposed expansion has raised a number of matters relating to occupational, public and environmental radiation exposures during the operational and post–closure stages. The SAAR makes the following conclusions on those matters:

Radiation in the pit

Workers in the open pit would be exposed to gamma radiation, radioactive dust and radon decay products. Gamma radiation would be less than the current underground mine as workers would not be surrounded by ore. The SAAR concludes that the predicted gamma dose range estimate in the EIS is acceptable given the ore grade, pit geometry, worker exposure times, potential for shielding by large equipment, comparison with results from standard exposure geometry models and comparison with gamma doses from the Ranger uranium mine open pit operations.

Exposure to alpha emitting dust arises from ore breaking and crushing, and moving and stockpiling of ore. The SAAR concludes that estimates in the EIS of radioactive dust exposure within the pit are conservative (i.e. overestimated), and that the EIS adequately demonstrates that exposure from this source will be acceptable. The EIS estimates make no allowance for respiratory protection or filtered air in mobile equipment (such as trucks) – these would further reduce actual exposure.

The SAAR considers the greatest uncertainty regarding pit radiation lies in radon decay product exposure, as this depends on pit geometry, ore grades, radon emanation rate from ore, overall pit air changes, local air movement within the pit and available control options. The report considers the EIS has provided sufficient detail, incorporating a number of conservative exposure assumptions, for a cautious radon decay product dose estimate to be made for workers in the pit. Further, in the EIS, BHPB has stated that it will undertake an ALARA optimisation study during the detailed design phase of the open pit and metallurgical plant.

The SAAR, and expert review by ARPANSA, concludes that the total radiation dose to pit workers (combined radon decay products, gamma and dust doses) under unlikely 'worst case' conditions may be up to 12 mSv/y. This dose is well within the regulatory limit of 20 mSv/y, but would exceed the dose constraint of 10 mSv/y proposed by BHPB in the EIS. However, the SAAR notes that real time monitoring of radiation exposure would be expected to reduce total doses to below the 10 mSv/y dose constraint as the time that workers are exposed to increased levels of radiation can be controlled.

There is the potential for radionuclides in groundwater seeping from the base of the tailing storage facility (discussed further below), and from the underground mine workings post-closure, to accumulate in the pit and represent a radiological hazard to people and the environment. The EIS predicts that any seepage that does occur from the base of the tailing storage facility, post closure, will diminish over time and flow to the pit to be captured within a hypersaline lake that is predicted to form in the pit base within 100 years of mine closure. The SAAR concludes that the long term pit water and salt crust radionuclide content should not represent a significant radiological hazard to people or the environment.

Radiation exposure in the processing plant

The EIS predicted a slight increase in the average doses to plant workers due to the additional dust and radon sources associated with the pit, RSF and associated facilities (< 1 mSv/y combined). Gamma doses were not predicted to change significantly. The predicted average doses to hydrometallurgical and refinery workers were stated to range from 3 mSv/y to 5 mSv/y and up to 9 mSv/y for smelter workers. The SAAR considers that assumptions underlying the predicted doses to workers in the plant are reasonable, and the predicted doses are achievable. The report notes that BHPB has committed to an optimisation study to refine the design of the plant and proposed controls and ensure radiation exposure is as low as reasonably achievable.

Spills and accidental exposure

The SAAR notes that the number and size of environmentally significant spills of chemicals may be expected to increase from current levels, due to the expanded size of the operation. However, the report concludes that the design, operational controls and response procedures proposed in the EIS are appropriate to adequately manage accidental releases or spills. All of these measures will be subject to a detailed construction and operational authorisations process, and must be in accordance with a radioactive waste management plan, required to be provided by BHPB and approved by the South Australian Government under the *Radiation Protection and Control Act 1982*. The report notes that none of the reported spills or incidents from the current operation have resulted in significant impacts on people or the environment.

Tailings storage facility and rock storage facility

The SAAR considered the risk of lateral and vertical seepage of radionuclides from the TSF and RSF eventually leading to impacts on the human and non-human environment during operations and after closure. The report noted that while seepage is expected to occur from the base of the TSF, the contaminants (radionuclides and metals in the seepage) are precipitated (i.e. reduce in mobility and bind to surrounding rock) within five metres of the base. This is due to the neutralising effect of the acidic seepage interacting with underlying alkaline sediments. Construction of the RSF involves compartmentalisation of low grade and more reactive material to minimise acid generation. The proposed construction of the RSF also involves a base of benign or acid-neutralising rock to neutralise any acid bearing porewater which would be generated within the structure by percolation of rainwater.

The SAAR concluded that the TSF and RSF can be constructed as proposed and operated satisfactorily with minimal radiological impact on local aquifer systems. The report noted that the maximum lateral movement of seepage away from the TSF and RSF was predicted in the EIS to be 500 to 1500 m before the effect of drawdown from the open pit dominated and regional groundwater flowed towards the pit.

To ensure the long-term stability of the TSF and RSF, the SAAR recommended the need for a comprehensive decommissioning, rehabilitation and closure plan. When the existing tailings cells 1 to 3 are closed, the report recommended they be used to conduct long-term (decades) testing of seepage rate decline, modelled rehabilitation structures, and processes.

Radon and dust releases from the rock storage facility

The SAAR notes that the RSF would be the major source (~73%) of radon released from the expanded operations. However, the EIS concludes that the radiological impacts of dust emissions from the RSF would be low. Due to the low-grade material involved, dust produced by the operation of the RSF would present a health risk for other reasons before radiological impacts became significant. The SAAR concluded that radon and dust radiation exposures associated with the operation of the RSF can be managed with the controls proposed by BHPB in the EIS, noting that BHPB has committed to a dust management program and real time dust monitoring.

Post closure radiation exposure

The EIS provides a summary of expected radiation levels, based on current closure design objectives, aimed at ensuring doses to members of the public are consistent with existing background levels and less than the regulatory limit of 1 mSv/y. The SAAR concludes that the EIS has provided sufficient information to demonstrate that post closure radiation exposures can be kept to below 1 mSv/y. The closure strategy includes a rock cover over the TSF and low grade material in the RSF. The SAAR notes there will be enough inert material available to supply the cover required to minimise radon emanation, gamma dose rates and dust from the surface of both the TSF and RSF. BHPB has stated in the EIS that it will undertake a 'features, events and processes study', which is a structured safety assessment process for considering the long-term risks from radioactive waste disposal facilities. Such a study would support the final detailed design of closure and rehabilitation measures.

Risk to members of the public

The main pathways for exposure to the public are inhalation of radon decay products from radon gas released from the pit workings, ore stockpiles, tailings and RSF, and inhalation of dust from the pit, processing plant and RSF. The SAAR considers that sufficient information has been provided in the EIS to provide confidence that the radiation exposures estimated for members of the public living at Roxby Downs and Hiltaba will be a small fraction of the annual acceptable limit of 1 mSv/y for members of the public. The SAAR recommends setting an operational dose constraint of 0.3 mSv/y. This reflects the requirement for radiation exposure to be as low as reasonably achievable. A failure by the proponent to meet this target would not result in non-compliance but would require BHPB to review its practices and implement measures to reduce radiation exposure to this level.

Risks to the environment

The EIS uses the ERICA (Environmental Risk from Ionising Contaminants: Assessment and management) tool for estimating potential radiological risk to the terrestrial environment surrounding the Olympic Dam expansion area. This approach is recommended by ARPANSA. The principal pathway for ecological exposure was stated in the EIS to be from long-term dust deposition. The SAAR considers that the approach to estimating impacts on the non-human environment is appropriate and conservative, and confirms that a negligible impact can be expected on non-human biota, such as local fauna and vegetation.

Recommendations

The department engaged the ARPANSA to undertake an independent review of a draft of the radiation matters in the SAAR. Comments from ARPANSA have subsequently been addressed in the SAAR. ARPANSA agrees with the conclusions reached in the SAAR.

The department considers the radiation impacts of the proposal have been adequately addressed and can be acceptably managed. The radiation aspects of the expanded operations at Olympic Dam will be managed in accordance with the *Radiation Protection and Control Act 1982* (SA). As is currently the case for the existing operations, BHPB will be required under that Act to submit and obtain SA Government approval of a Radiation Management Plan and a Radioactive Waste Management Plan, to protect the environment and ensure radiation doses to workers and members

of the public are below relevant limits and are as low as reasonably achievable. The requirements for protection of workers are extensive and comprehensively regulated and monitored by the SA Government. Consequently, the department has not recommended conditions in relation to radiation protection for workers at the Olympic Dam mine site.

Given the scale of the Olympic Dam expansion and public concern about radiation, it is important to provide confidence that impacts on the public and the environment are minimal. The department recommends that BHPB be required to ensure that exposure of the public and non-human biota to radioactive releases is within the dose limits recommended in the *Code of Practice for Radiation Protection and Radioactive Waste Management in Mining and Mineral Processing* (ARPANSA 2005). This sets an annual limit for members of the public of 1mSv. The code notes that this limit is assumed to protect the environment, unless there are exceptional circumstances.

The department also recommends setting a dose constraint for members of the public and supports the recommendation in the SAAR of a dose constraint of 0.3 mSv per year, unless new information subsequently becomes available that would support a different constraint. The department also recommends that BHPB be required to achieve a reference level. A 'reference level' describes a limitation of exposure to non-human biota (plants and animals). National guidance on the setting of reference levels for non-human biota is being developed by ARPANSA and will be set out in the *Code of Practice for Radiation Protection and Radioactive Waste Management in Mining and Mineral Processing*. Consequently, the department has recommended a condition that requires BHPB to comply with any further amendments to the Code.

5.1.3 Regional groundwater impacts

The EIS describes the main components of the groundwater in the Olympic Dam region as:

- the Andamooka Limestone water table, typically occurring about 50 m below ground
- the Tent Hill aquifer at a depth of 160-200 m below ground

These aquifers sit within the Stuart Shelf strata. Both aquifers are saline and have no beneficial use other than for mining (i.e. they are not suitable for agricultural or other purposes). Groundwater flow is generally from west to east discharging predominantly at the northern margin of Lake Torrens. The closest known groundwater dependent ecosystem is the Yarra Wurta spring group at the northern end of Lake Torrens about 45 km from Olympic Dam.

The EIS indicates that the Stuart Shelf aquifers are not connected to the Great Artesian Basin (GAB), the southern boundary of which is 90 km north of Olympic Dam, an area known as the Torrens Hinge Zone. According to the EIS, this area forms a groundwater divide between the Stuart Shelf and the Great Artesian Basin. The Arckaringa Basin, around 100km north-west of Olympic Dam, flows into the Stuart Shelf.

The EIS indicates that dewatering for the open pit will result in drawdown affecting an area of 20 km in the Andamooka Limestone aquifer and up to 45 km in the Tent Hill aquifer. Post closure, the open pit would continue to act as a 'sink' creating ongoing drawdown effects.

During construction, BHPB propose to increase existing extraction of saline water from the Motherwell wellfield, approximately 30 km north of Olympic Dam. This would result in further drawdown in the Andamooka Limestone aquifer. BHPB has stated in the EIS that it will provide the South Australian Government with a monitoring program, including contingency measures, for the proposed extraction of groundwater from the Motherwell wellfield. The EIS notes that investigations of aquifer response to this extraction would be used to determine whether it would continue to be used following construction.

SA assessment

BHPB has developed a conceptual model of the groundwater system of the Stuart Shelf and its hydraulic interconnections with neighbouring groundwater systems. BHPB has also developed a regional groundwater model to predict the potential long term impacts of the mine pit dewatering and the permanent pit beyond the mine life on the Stuart Shelf aquifers, other groundwater users and other inter-related groundwater systems.

The SAAR notes that there is limited long term regional monitoring data with which to calibrate the groundwater model. To address this, BHPB has undertaken sensitivity analyses on the model to highlight potential groundwater drawdown impacts. This was done by adjusting the aquifer parameters in the model using values that reflect a credible worst case for each parameter. The SAAR supports this approach and concludes that the magnitude of water level declines as determined by the calibrated model are considered to be adequate. Long term regional modelling data to further calibrate the model would increase the level of certainty around groundwater impacts. For this reason, the SAAR recommends an ongoing monitoring system based on adaptive management.

The SAAR concludes that the Stuart Shelf groundwater system may not reach equilibrium for some thousands of years post mining due to the effect of ongoing drawdown. Drawdown will be greatest at the open pit and to the south of the pit with drawdown levels of 30+ m expected at the open pit within the Andamooka Limestone aquifer. Over the remainder of the area, drawdown levels of less than 4 m are anticipated. Drawdown levels within the Tent Hill aquifer are expected to extend approximately 50 km to the south and 80 km to the west of the open pit. Water levels in the Andamooka Limestone and Tent Hill aquifers will continue to decline (for at least 1000 years). This may result in the dewatering of these aquifers to such an extent that they will no longer be a viable water supply option for future developments that require large volumes of water. However, the natural high salinity of these aquifers means they are unlikely to have beneficial uses.

Great Artesian Basin mound springs

The SAAR considers the impact of drawdown in the Stuart Shelf on the GAB mound springs. The mound springs support the EPBC listed ecological community: ‘the community of native species dependent on natural discharge of groundwater from the Great Artesian Basin’. The report references information in the EIS which demonstrates that the hydrochemistry of groundwater from the artesian portion of the GAB (which supports the springs) is different to groundwater hydrochemistry in the Stuart Shelf. This supports the presence of a groundwater divide between the

Stuart Shelf and the GAB. This is supported by the conceptual model of the regional groundwater regime and field work by BHPB.

In addition, regional groundwater contours indicate the direction of groundwater flow is from the Torrens Hinge Zone northwards to the GAB as groundwater elevations in the GAB are 10 m lower than the Stuart Shelf. BHPB modelling indicates a drawdown of approximately 2 m may occur in the Andamooka Limestone adjoining the Torrens Hinge Zone 500 years after mine closure. Sensitivity analysis shows, in what is effectively a worst case, drawdown could be 8 m – this would still maintain a positive flow to the GAB. This means that if any connection did exist between the GAB and the Stuart Shelf, groundwater flow would be towards the GAB and, consequently, would be unlikely to affect GAB springs. The SAAR concludes that there is a low probability for hydraulic effects on the GAB springs.

Yarra Wurta Springs

The SAAR considered impacts on the Yarra Wurta Springs. The springs do not provide habitat for any listed species or communities. However, the resident Lake Eyre Hardyhead fish population has some genetic differences to other populations although research has shown it is not a different species or sub-species. Microbial mats, which are the precursors to stromatolites, and fossilised stromatolites are also present in the springs. BHPB considers these are not of significant scientific interest, however, the SAAR considers they have not been adequately studied to draw any conclusion on their significance.

The SAAR notes that modelling predicts a drawdown at the springs of 1 m 500 years after closure of the mine. Sensitivity analysis shows potential for a worst case drawdown of 4 m. The report indicates there is uncertainty over the impact that long term drawdown in the Andamooka Limestone will have on the springs. In particular, the BHPB groundwater model takes a conservative approach and assumes the springs are fully reliant on flows from the Andamooka Limestone. However, there is evidence to suggest that the springs may be supported, fully or partially, by groundwater flow from the Adelaide Geosyncline, which would be unaffected by drawdown from Olympic Dam. Therefore, the report concludes that there is a low risk of impact on the springs, but additional work is needed to improve understanding of the spring hydrogeology.

The SAAR recommends monitoring programs to measure drawdown against model predictions, determine impacts on the Yarra Wurta Springs and monitor abstraction from the Motherwell wellfield. The report also recommends that BHPB undertake further work (following approval) to improve understanding of the Yarra Wurta Springs, Torrens Hinge Zone and the hydrogeology of the Stuart Shelf.

Private wells

The SAAR notes that drawdown impacts from the mine could potentially occur at 12 private non-BHPB wells. BHPB modelling indicates, however, that no third party groundwater users are likely to be impacted by drawdown up to the year 2050. Well life expectancies are around 50-100 years and,

therefore, drawdown impacts are unlikely to occur until after the wells are replaced. This means that the potential for drawdown can be considered when wells are replaced. BHPB has committed to investigating alternative supplies in consultation with third party users if their water supply is affected. This could occur through relocating or deepening an affected well or providing an alternative water supply.

Given the long term effect of groundwater drawdown as a result of the proposal, the department engaged Geoscience Australia (GA) to undertake a review of the proposal and the SAAR. GA agreed with the conclusions in the SAAR. In relation to potential impacts on the GAB, GA concluded that the limited drawdown in the Andamooka Limestone aquifers at the most north-western part of the Stuart Shelf, combined with a probable minor connection between aquifers in this area will most likely result in minimal or no impacts on pressure levels in the GAB aquifers. GA agreed with the conclusions in the SAAR, that while the EIS provides sufficient information to conclude that groundwater impacts will be acceptable, there is a need for ongoing monitoring and studies to improve knowledge of hydrogeological interactions in the area and enhance the reliability of groundwater modelling.

An improved understanding of the hydrogeology of the Torrens Hinge Zone will assist in the long-term management of groundwater resources in this area of the GAB. This area is potentially affected by other groundwater users, including BHPB's current extraction from the GAB Basin and dewatering from the Prominent Hill mine in the Arckaringa Basin. It is possible that other mines will be developed over the next 40 years that may also impact on the GAB. Consequently, improved regional groundwater models will be essential for supporting decisions on water allocation.

In the unlikely event that further investigation of the Torrens Hinge Zone identified some connection between the GAB and the Stuart Shelf, it is expected that any drawdown impact from Olympic Dam would be manageable. BHPB currently extracts 37 ML of water per day from the GAB and this is monitored and has remained within agreed drawdown limits to protect the mound springs. As a comparison, BHPB estimates groundwater inflows from the Stuart Shelf into the open pit would be around 3.5 ML per day, or approximately one-tenth of BHPB's current extraction from the GAB. As such inflows would occur approximately 90 km from the GAB, it is likely that any impact on groundwater pressure in the GAB would be minor. In addition, BHPB indicated in the EIS that no additional water for the expansion would be obtained from the GAB beyond that which is available under current approvals from South Australia for existing mine operations.

Recommendations

The EIS and SAAR indicate that risks to Great Artesian Basin mount springs and the Yarra Wurta Springs is low. However, given the environmental significance of the mound springs and the potential significance of the Yarra Wurta Springs, the department recommends precautionary conditions to require that BHPB ensure there is:

- no adverse impact on groundwater dependent listed threatened species or ecological communities
- no significant adverse impact on the environmental values of the Yarra Wurta springs.

Given the areas of uncertainty identified in the SAAR (e.g. limited monitoring data) and the conclusions drawn by Geoscience Australia, the department also recommends conditions to require BHPB to undertake further studies to:

- improve understanding of the hydrology and ecology of the Yarra Wurta Springs
- confirm the conceptual understanding of the hydrogeology of the Torrens Hinge Zone
- confirm the conceptual understanding of the hydrogeology of the Stuart Shelf
- update, enhance and validate the groundwater simulation model.

The groundwater simulation model must be rerun after it is updated to confirm there will be no significant impacts on groundwater pressure in the GAB. If the minister is not satisfied that the model demonstrates the GAB mound springs will not be adversely impacted, BHPB can be required to develop and implement a response plan. A possible response measure may be to reduce other water extraction from the affected area of the GAB to compensate for any reduction in flows. The appropriate response measures would need to be determined according to conditions at the time, if such an event did arise.

5.1.4 Local groundwater impacts

The EIS indicates that seepage through the base of the TSF would be about 4000 litres per hectare per day reducing over the first two years (from first input to the TSF) to around 880 litres per hectare per day as steady-state conditions are developed. Seepage of around 50 litres per hectare per day would also occur from the RSF. Seepage would affect local groundwater and result in a groundwater mound below the TSF. The department considers there is a low risk of related impacts on vegetation dependent on groundwater.

Dewatering of the open pit during operation and natural dewatering post closure would create a cone of depression in the Andamooka Limestone and Tent Hill aquifer systems directing groundwater flow towards the pit. Modelling in the EIS indicates that seepage from the TSF and RSF would eventually flow into the open pit. Groundwater flow into the open pit would, over hundreds of years, create a permanent lake approximately 350 m deep and 650 m below ground surface, which is below both the Andamooka Limestone and Tent Hill aquifer systems.

SA assessment

The SAAR addresses the following matters in relation to risks of seepage:

- measures by BHPB to minimise seepage
- groundwater mounding below the TSF
- attenuation and lateral movement of tailings seepage and potential impact on environmental values and future uses.

Seepage minimisation

BHPB indicates in the EIS that it will decrease the amount of water going to the TSF by increasing the density of solids in the tailings from around 47% to 52-55%. South Australian agencies and the department sought further information from BHPB on why tailings could not be further thickened to reduce seepage. The SAAR notes the main limitation on thickening is the amount of water that can

be recycled and re-used in the processing operations. Increasing tailings density would result in a surplus of liquor (liquid waste) that would need to be disposed of in evaporation ponds. Due to risks of impacts on birds, as discussed below, the creation of new evaporation ponds is not recommended. The SAAR concludes that the proposed TSF design, which seeks to balance tailings density and water management, is acceptable for the site conditions of low rainfall and high evaporation rates at Olympic Dam.

The EIS indicates that the design of the TSF will minimise seepage. Measures proposed by BHPB to minimise seepage include increasing the volume of liquor recycled from the TSF; constructing larger cells with greater evaporation capacity; collecting liquor through a central decant pond in each tailings cell; installing a liner beneath the central decant system, and recycling water from the mound below the TSF. The SAAR supports these measures. While some public submissions argued the entire TSF should be lined to reduce seepage and groundwater impact, the SAAR noted the existing poor quality of groundwater and concluded that significant impacts from seepage on groundwater users and ecological communities was unlikely.

Groundwater mounding

Seepage from the TSF causes groundwater levels below the TSF to be elevated compared to the natural groundwater level, forming a groundwater mound. The mound below the existing TSF is 16-17 m above the natural groundwater level. Modelling by BHPB indicates that a groundwater mound of 6-8 m would be formed below the proposed TSF as a result of seepage. Groundwater pumping can be undertaken if the mound approaches a pre-determined maximum level. Currently, the regulated maximum level for the existing tailings storage facility is 80 m Australian Height Datum (AHD) i.e., approximately 20 m below ground level. This requirement has been set by the South Australian Government through the Groundwater Monitoring Plan, to ensure there is no interaction between seepage and roots from surface vegetation. The SAAR recommends that this requirement also be applied to the expansion.

Attenuation and lateral movement of seepage

Seepage from the TSF is highly acidic, however, the TSF overlies calcareous sediments and limestone (the Andamooka Limestone) with high acid neutralisation capacity. Most seepage would be neutralised within the underlying sediments but, in places, the acid front may continue into the Andamooka Limestone. Modelling in the EIS indicates that irrespective of any neutralisation that occurs in the overlying sediment, complete acid neutralisation would occur within 3-4 m of contact with the Andamooka Limestone. As neutralisation occurs, heavy metals and radionuclides in seepage would be attenuated. The SAAR notes, however, that ammonia instead becomes more mobile and toxic. The SAAR concludes, however, that, due to the drawdown from the open pit, any remaining contaminants in seepage will end up in the pit. The SAAR concludes that seepage can be appropriately managed using the approach in the EIS.

Recommendations

Due to its low acid generating potential, the department considers that seepage from the RSF presents a low environmental risk. The department agrees with the SAAR that BHPB has proposed adequate measures for reducing seepage from the TSF. The department also agrees that lining of the TSF is not warranted and notes that it could create geotechnical instability in the TSF. To prevent surface vegetation taking up radionuclides in tailings seepage, the department recommends conditions to require BHPB to ensure that mounding of groundwater does not result in any adverse impact on vegetation. The department recommends this be achieved by adherence to the criteria (which also apply to existing operations) that the groundwater level outside the perimeter of the TSF must not be higher than 80 metres AHD, unless otherwise agreed by the minister.

As a precaution, the department also recommends that BHPB be required to ensure that there is no compromise of the environmental values of groundwater outside the Special Mining Lease (SML) as a result of seepage from the tailings storage facility or rock storage facility. This must be demonstrated by monitoring and groundwater modelling continuing to show that all movement of seepage is towards the open pit. Monitoring of neutralisation of seepage must also be required to demonstrate that seepage that eventually ends up in the pit is of an acceptable quality and does not pose a risk to the environment.

5.1.5 Impacts on flora and fauna

The EIS indicates that eight EPBC listed fauna species and 21 listed migratory species may potentially be found in the area of the SML. No EPBC listed plant species were identified. Five of the eight fauna species listed are species reintroduced to the Arid Recovery site (see below). The three other species are the Thick-billed Grasswren, Plains Wanderer (recorded as a vagrant) and Plains Rat. Total clearing on the SML is estimated at approximately 13,000 ha.

SA assessment

The SAAR assesses the following impacts on flora and fauna:

- native vegetation impacts from plant and dust emissions
- impacts on listed species reintroduced to the Arid Recovery site
- impacts of the TSF on fauna and migratory species.

The SAAR notes that the areas at higher risk from plant and dust emissions would already have been extensively cleared of vegetation during construction of the open pit, RSF, TSF and metallurgical facilities.

Arid Recovery

Arid Recovery is an ecosystem restoration initiative based around an 8,600 ha area of land immediately north of the existing mine site. The area is fenced to protect native flora and fauna from invasive species and other threats. It was established by Western Mining Corporation Limited (now wholly owned by BHPB) and is managed by a board including BHPB, the South Australian Government and the University of Adelaide. In the EIS BHPB indicated it would provide continuing support for the Arid Recovery site by way of financial, scientific, managerial and professional support and that it would maintain a distance of 500 m between the RSF and Arid Recovery.

The SAAR notes the following protected fauna species have been re-introduced to, or have self established within, Arid Recovery: Greater Stick-nest Rat, Burrowing Bettong, Greater Bilby, Western Barred Bandicoot,Numbat, Woma Python, Spinifex Hopping Mouse and Plains Rat . The main project hazards identified for these species are noise, light, dust and other emissions from the proposed mine expansion. Noise and light effects are expected to reduce habitat value within at least two kilometres of the expanded mining operations.

The SAAR accepts BHPB's assessment in the EIS that impacts of the project will likely be mitigated by the recent northerly extension of the Arid Recovery fenced area to the north and maintenance of a buffer zone. The SAAR concludes that impacts to listed species reintroduced to the Arid Recovery area can be appropriately managed.

Impacts of the TSF on fauna and migratory species

The TSF poses the relatively largest threat to fauna (particularly birds) from the project within the SML. The existing tailings facility, which consists of around 400 ha of tailings storage and 133 ha of evaporation ponds, attracts fauna due to its location in an arid environment. Decant water in the TSF is usually toxic and can result in bird deaths. Since the monitoring of fauna deaths commenced in 1996, the mortalities of individuals from 49 different fauna species have been reported, including six migratory bird species listed under the EPBC Act. The EIS lists the species with the highest mortalities as the Banded Stilt, Red-necked Avocet, Whiskered Tern, Grey Teal, Black Swan, Hoary-headed Grebe, Little Pied Cormorant and the Silver Gull.

BHPB has made a number of changes to the proposed TSF design in the proposed expansion to reduce risks of impacts on birds. Most notably, evaporation ponds will not handle excess liquor from tailings. As the only open water body in the region, these ponds have been the major source of bird mortalities. The SAAR notes these changes will likely reduce the attractiveness of the area to fauna by removing large open water bodies and exposing a less attractive wet, muddy surface. The net effect of these changes for open water bird species would be beneficial in the longer term by directing tailings liquor from the existing operation to the expanded TSF.

The EIS considers the 3300 ha increase in wet beach area in the TSF may result in increased mortalities for shorebirds and other species attracted to the tailings beaches. However, it notes measures to eliminate the shore habitat on the new TSF cells will lessen the mortality increase. With these proposed changes, mortalities to common shore birds have been assessed as moderate, and assessed as high on two species of threatened or rare shorebirds. However as the impact is expected to comprise a small percentage of the local population, local viability of these species is not expected to be adversely affected.

Given the significant risk posed to flocking migratory wader bird species (such as Banded Stilts) by the TSF and the inability to predict when such large flocking events may occur, the SAAR recommends that BHPB investigate the development of a real-time continuous monitoring system to monitor for the arrival or presence of large flocks of listed migratory wader birds. The report recommends that BHPB also develop rapid response deterrent techniques to prevent birds from landing on the TSF. The SAAR recommends that BHPB be required to prepare and implement a Bird

Impact Management and Monitoring Plan relating to listed migratory species and Banded Stilts to minimise, record and report actual and extrapolated/modelled bird mortalities as a result of exposure to the TSF.

Recommendations

The department agrees with the SAAR conclusion that the proposal would impact on Arid Recovery. However, the extension of the fenced area would allow fauna species to move away from the impact area if necessary. Consequently the abundance and diversity of species in Arid Recovery is not likely to be adversely affected.

The department agrees with the SAAR that the expanded TSF may adversely affect birds including listed migratory species. The design of the new TSF cells is likely to reduce this impact as will the eventual closure of the evaporation ponds. However, to further reduce risks to birds, the department recommends a condition to require BHPB to undertake a review to identify further opportunities to decrease the attractiveness of tailings and evaporation ponds to birds, prevent and deter visits by large flocks of birds, improve monitoring methods and phase out the use of evaporation ponds as soon as practicable. The department also recommends that BHPB be required to ensure that impacts on birds are as low as reasonably achievable and to implement measures that ensure an ongoing reduction in the number of bird mortalities.

The EIS notes that bird deaths are generally a result of acid in the evaporation ponds contacting the plumage or sensory organs resulting in drowning. Birds surviving contact with the liquid would not pose an environmental hazard as any residue on these birds would be negligible.

To ensure the proposal does not result in broader impacts on flora and fauna, the department recommends that BHPB ensure that there is no significant adverse impact on the abundance and diversity of listed species outside the SML as demonstrated by baseline and ongoing flora and fauna surveys.

5.1.6 Air quality

The construction and operation of the proposed open cut mine (including the TSF and RSF) would generate dust, while the expanded processing plant would result in additional emissions of particulates, sulphur dioxide and other pollutants. This could impact on the health of humans and flora and fauna.

To respond to risks relating to air quality, BHPB indicates in the EIS that:

- the National Environment Protection (Ambient Air Quality) Measure (NEPM) ground level dust concentration (applied to operational dust contributions at Roxby Downs and Hiltaba Village) will be met through design and operational management controls of mining operations at Olympic Dam.
- good quality haul roads would be constructed and maintained with regular application of saline water and/or the application of suitable dust suppressants.
- a real-time dust and meteorological monitoring system would be installed at Olympic Dam to predict dust concentrations, to provide information for operational control of dust.

SA assessment

The SAAR concludes that potential health and environmental impacts of airborne emissions could be satisfactorily managed through development of an Air Quality Management Plan (AQMP), to cover impacts associated with all relevant emissions during construction and operation. The AQMP would include information on the siting and design of meteorological and air quality monitoring stations, process management, incident responses to exceedences or climatic conditions, community consultation and engagement, engagement with local health services and the continuing review of literature on the impact of emissions to inform both monitoring and response. The AQMP would address particulate management, dust and sulphur dioxide and other point source emissions and require approval by the SA Government.

The SAAR discusses impacts of sulphur dioxide on vegetation. It notes that sulphur dioxide emissions from the processing plant could potentially have an adverse impact on vegetation. However, these impacts would be largely confined within the SML, where most of the affected vegetation would be cleared for the open pit, RSF and TSF. The SAAR recommends that BHPB undertake a research study to determine threshold levels for effects of sulphur dioxide on vegetation of the region.

Recommendations

Impacts on air quality from mining operations are typically matters subject to detailed state regulation. Accordingly, the department does not recommend conditions be imposed in relation to air quality under the EPBC Act.

5.1.7 Soil contamination

The EIS notes that the handling, storage, transport and use of significantly higher volumes of chemical substances and contaminated stormwater at the Olympic Dam site poses increased risk of soil contamination. Such contamination could potentially affect the ability of the site to be effectively rehabilitated and used for other purposes post mine closure. It could also restrict current use of the site.

SA assessment

The SAAR notes that the mining operation at Olympic Dam will continue to require a large variety of chemical substances including hydrocarbons, sulphur, acids, reagents and other chemicals to be transported, handled, stored and used throughout the operation. The volume of polluted stormwater generated onsite will also increase significantly because of the increased scale of the operation.

The SAAR identifies the expanded processing and metallurgical operations as posing the greatest potential for site contamination. There have been a number of spills of material from the existing operations, including spillages of hydrocarbons, sulphuric acid and various processing liquors and reagents. Whilst most have been successfully contained within the secondary (bunding) system or tertiary (stormwater collection and storage) system, there have been instances of spills and leaks that have occurred outside these systems, causing localised site contamination until they were cleaned up by BHPB.

The report notes a degree of localised pollution is considered almost inevitable with any development of this scope, scale and nature. The issue is to what extent the inherent risks can be managed and

the degree of rigour which is applied to the post-closure assessment and remediation process at the site. BHPB has characterised the potential for residual impact of site contamination as low from the storage of chemicals, fuel and collected stormwater (draft EIS section 10.5.4).

The SAAR considers that pollution and potential site contamination risks associated with the proposed expansion at Olympic Dam are acceptable and can be successfully managed to ensure the following outcome: that the proposed development does not compromise current and future land uses within the Special Mining Lease or adjoining areas, or cause adverse impacts on human health as a result of soil contamination. The SAAR recommends conditions for bunding of chemical storages and activities, and construction of stormwater detention ponds, to confine waste water and spills.

Recommendations

To address residual risks to the environment, the department recommends a condition to require BHPB to ensure there is no site contamination on the SML as defined under the *Environment Protection Act 1993* (SA) and that assessment and remediation of any contamination from spills or leaks is undertaken in accordance with the National Environment Protection (Assessment of site contamination) Measure 1999 and the *Code of Practice and Safety Guide for Radiation Protection and Radioactive Waste Management in Mining and Mineral Processing (2005).*

The department recommends that BHPB be required to develop criteria that clearly specify, for each type of contaminant, investigation and response levels, as defined in the *National Environment Protection (Assessment of site contamination) Measure 1999* in the event that spills or leaks occur.

5.1.8 Rehabilitation and closure

The EIS outlines proposed closure and rehabilitation strategies. In particular:

- the open pit would not be backfilled but would essentially remain as is at the completion of mining
- the RSF and TSF would remain as permanent landforms that would contain potentially reactive (chemically and radiologically) material with self-sustaining final covers that minimise the potential for infiltration of water
- all surface infrastructure would be removed although the metallurgical plant could be used for research and education, tourism or further mineral processing.

For the closure of the proposed mine, BHPB indicates in the EIS that the closure criteria would include:

- waste landforms (RSF and TSF) remain stable over the long term
- stability of rehabilitated sites is consistent with adjacent terrain
- beneficial uses of groundwater and groundwater dependent ecosystems are protected
- there is a minimal risk of contaminated surface water harming fauna (particularly birds)
- soil quality is compatible with final land uses after closure
- exposure to gamma radiation, radionuclides in dust and radon and its decay products do not cause harm to the public or biota.

SA assessment

The SAAR concludes that the closure criteria specified in the EIS by BHPB generally cover the main risks relevant to rehabilitation and closure. As the project develops, additional information will become available to inform the decommissioning, rehabilitation and closure strategies for the project. In particular, the report recommends an updated risk assessment informed by:

- the likelihood of early, unplanned closure
- environmental values to be protected
- the need to avoid inheritance of ongoing liability for the mine by the state government
- the potentially latent nature of residual impacts post closure
- expectations that rehabilitation should be undertaken progressively wherever practical

The SAAR notes that the proposed covers for the TSF and RSF would need to resist degradation from erosion post closure to ensure acid-forming and/or radioactive materials stored in these facilities would not be discharged into the environment at a rate that would cause unacceptable impact. The report concludes there is ample material available to construct an adequate cap. However, the report considers the long term erosional stability of the TSF and RSF, to ensure the encapsulation strategy is effective, should be informed by further modelling as closure planning proceeds.

The SAAR recommends that BHPB be required to develop a mine closure and rehabilitation plan within two years of the approval decision or prior to construction of the TSF, whichever date is the earliest. The plan must set out the post closure environmental outcomes to be achieved indefinitely, the assessment criteria to demonstrate achievement of the outcomes, a comprehensive risk assessment of the project, and on-ground trials during operations to prove the feasibility and viability of the proposed remediation methods.

Recommendations

The department agrees with the conclusions and recommendations in the SAAR. The EIS demonstrates conceptually that the expanded mine can be closed and rehabilitated to a standard that would ensure long-term protection of the environment. Best practice mining standards require a comprehensive closure plan to be in place before mining commences. In particular, given that the TSF and, to a lesser extent, the RSF would retain above background radiation levels, a long term safety assessment is essential to support the detailed design of closure strategies and structures in the closure plan. The department recommends that BHPB be required to develop a closure and rehabilitation plan as recommended in the SAAR.

It is likely that the SA Government will require a rehabilitation bond or similar financial arrangement to ensure a rehabilitation liability is not left for the landholder (ultimately the SA Government).The department considers it is appropriate for the SA Government to set and administer a rehabilitation bond. However, as a precautionary measure, to ensure rehabilitation liabilities are fully addressed, the department recommends that the minister retain the option of requiring a bond from BHPB in favour of the Commonwealth for up to the full cost of the rehabilitation liability, in the event that the minister is not satisfied that the closure outcomes specified in the mine closure plan will be or are being achieved.

5.1.9 Environmental monitoring and management

BHPB has an existing Environment Protection and Monitoring Program which must be reviewed and approved by the SA Government every three years in relation to existing operations. An outline of its proposed Environmental Management Program for the proposed expansion can be found in Appendix U of the draft EIS.

SA assessment

The SAAR recommends that a new environmental management program be required for the expansion which includes agreed environmental outcomes and assessment criteria. This program would replace the existing Environment Protection and Monitoring Program. The SAAR recommends that the assessment criteria for the proposed program include:

- compliance criteria –to demonstrate that an outcome is being achieved. A failure to meet a compliance criteria would be a breach of approval conditions
- leading indicator criteria – to provide an early warning that compliance criteria may not be met. This would require BHPB to take remedial action to ensure that they remained in compliance.
- target criteria – these would be set below the levels in the compliance criteria and would provide a target or goal for BHPB to achieve that would reflect a level of impact that is as low as reasonably achievable. Target criteria would be used to drive continuous improvement and be subject to regular review.

The report recommends that the program provide details on parameters to be measured, baseline information, information on BHPB's management strategies and systems for ensuring compliance assessment criteria and protocols for reporting non-compliance.

Recommendations

A comprehensive monitoring and management plan is essential for ensuring that BHPB is achieving the required level of environmental performance. Therefore, the department recommends that BHPB be required to develop and submit for approval an environmental management and monitoring plan as recommended in the SAAR. This plan must be regularly reviewed, and the department considers, at least initially, a three yearly review of the plan is appropriate to ensure that it remains consistent with scientific developments and best practice.

The department also recommends that, where the proposed expansion would have a residual impact on the environment, a condition be imposed to require BHPB to actively seek to ensure impacts are minimised or as low as reasonably achievable. Consistent with recommendations in the SAAR, the department recommends the use of target criteria and a requirement that BHPB use best practicable technology to minimise environmental impacts and risks. Best practicable technology is defined in the *Code of Practice for Radiation Protection and Radioactive Waste Management in Mining and Mineral Processing* (Australian Radiation Protection and Nuclear Safety Agency (ARPANSA) 2005) and has been applied in the Ranger uranium mine. In relation to Olympic Dam, it can be defined as that technology which produces the maximum environmental benefit that can be reasonably achieved having regard to all matters including:

a. the environmental standards achieved by uranium operations elsewhere in the world and the extent to which environmental degradation is prevented
b. the level of environmental protection to be achieved by the application or adoption of the technology and the resources required to apply or adopt the technology so as to achieve the maximum environmental benefit from the available resources
c. the cost of the technology
d. evidence of detriment, or lack of detriment, to the environment
e. the physical location of the Olympic Dam mine
f. the age of equipment and facilities in use at Olympic Dam and their relative effectiveness in reducing environmental pollution and degradation
g. the extent to which the technology provides for continuous improvement
h. social factors including the views of the regional community and possible adverse effects of introducing alternative technology.

To ensure that BHPB is implementing technology improvements to reduce their level of impact, the department recommends that BHPB be required to undertake a review at least every ten years to confirm it is using best practicable technology.

5.1.10 Other issues

The SAAR discusses a number of other potential impacts in relation to impacts on flora and fauna, as follows:

Noise

The SAAR concludes that noise impacts from the proposal are acceptable. The department considers noise presents a low risk to the environment and would be subject to detailed state regulation. Consequently, no conditions are recommended.

Surface water and drainage

The SAAR recommends that BHPB prepare and implement a site groundwater and surface water monitoring program to ensure there is no adverse impact on local drainage patterns and surface water quality that would compromise existing use or water dependent ecosystems. The SAAR notes that licence conditions relating to monitoring and management of surface water containment facilities may be imposed under the SA *Environment Protection Act 1993*.

The department notes that the tailings storage facility has been designed to not require release of water under any conditions. Modelling by BHPB has considered the impact of a probable maximum precipitation event (the maximum amount of precipitation that could physically occur over a given area) event combined with a 1 in 100 year storm. The modelling shows that there would still be sufficient capacity in the tailings storage facility to accommodate a further maximum precipitation event. Consequently, it would be difficult to conceive of a circumstance where water would need to be released from the tailings storage facility.

The department considers that risks to surface water in the region are low and will be adequately addressed by detailed South Australian regulation.

Soil

The SAAR notes that BHPB has committed to developing erosion and sediment control plans for areas of high potential for soil erosion. The SAAR concludes that if the activities are undertaken and managed as described in the EIS, the residual impacts to soil would be minor and would not result in adverse impacts to the affected land systems. The department considers that risks to soils are low and will be adequately addressed by South Australian regulation.

Visual impact

The SAAR notes that the mine will be a dominant feature in the landscape. When viewed from a distance, the RSF and TSF may be similar to a mesa landform. These are characteristically flat-topped with steep sides. The SAAR considers the open pit, RSF and TSF could become potential tourist attractions both during operation and post closure of the mine.

While the large structures associated with the project would dominate the landscape, the department notes that these impacts would occur in an existing mining region. The department considers that visual impacts will be adequately addressed by the South Australian regulatory agencies.

Solid waste

The different types of waste that would be produced by the proposal are assessed comprehensively in the SAAR. The department considers this issue presents a low risk to the environment and would be adequately regulated by the SA Government. However, given the low but long-term risks relating to management of radioactive material, the department recommends a condition to require BHPB to ensure that management of radioactive substances and waste is consistent with the *Code of Practice for Radiation Protection and Radioactive Waste Management in Mining and Mineral Processing* (ARPANSA 2005 or, as amended).

Pest plants and animals

The SAAR notes that BHPB has made a number of commitments to address the potential spread of weeds and pest animals. The report concludes that reasonable measures have been demonstrated in the final EIS to manage potential impacts from the introduction and/or spread of weeds from expansion activities, subject to compliance with commitments made by BHPB and recommended conditions. These address vehicle and plant washdown and inspection facilities and reporting of weed outbreaks.

The SAAR concludes that reasonable measures (including extension of existing practices) have been demonstrated in the EIS to manage potential impacts from the exacerbation of pest and abundant species, subject to compliance with commitments made by BHPB and recommended conditions. These include updating the fauna monitoring program and working with natural resource management boards and the Roxby Downs Council to address vertebrate pest issues.

To address residual risks to the environment, the department recommends a condition to require BHPB to ensure there is no new or sustained increase in abundance or area of infestation of weeds,

plant pathogens and pest animal populations as demonstrated by baseline and ongoing flora and fauna surveys.

Heritage

The SAAR does not address heritage impacts from mining operations. The EIS notes that the Olympic Dam Agreement, signed in January 2008, sets out the terms and conditions upon which the Kokatha, Barngarla and Kuyani Aboriginal people have agreed to the Olympic Dam project. This includes a regime for ongoing protection and management of Aboriginal cultural heritage sites and values.

The EIS notes that while 675 archaeological sites were identified within the SML and its surrounds, the same types of sites in the same range of environmental settings continue in a north-south direction from Port Augusta to Lake Eyre. Consequently, only a small proportion of these sites would be affected by the proposal.

BHPB has agreed arrangements in place with Aboriginal groups claiming an interest in the Olympic Dam region covering cultural heritage sites and values. As such, the department does not recommend conditions to address indigenous heritage matters. There are no recognised non-Indigenous heritage values on the SML.

5.2 Desalination plant

5.2.1 Introduction

The Olympic Dam expansion would require a continuous supply of up to 200 ML per day of fresh water for the proposed metallurgic plant and other operational activities. BHPB would source this water from a proposed coastal desalination plant located at Point Lowly, near Port Bonython on the Upper Spencer Gulf, South Australia.

The desalination plant would employ reverse osmosis technology to produce both purified water (that would be pumped 320 km to the mine site) and a waste stream of saline water (brine). Raw water would be drawn from the Spencer Gulf and an outfall pipe extending into the marine environment would discharge the brine through a diffuser into the gulf where it would mix with ambient seawater and be dispersed by the strong currents off Point Lowly. This return (discharge) water would be approximately twice the salinity of seawater and contain small quantities of anti-scalant chemicals, used to prevent scale accumulating in the plant.

The amount of mixing of brine and ambient seawater that occurs in the immediate vicinity of the diffuser, known as the dilution factor, is important because it determines the extent of the impact area. This is affected by tidal and wind currents and other seasonal conditions. The SA *Environment Protection Water Quality Policy 2003* states that the area in which the majority of mixing occurs, i.e. the mixing zone, must have a radius no greater than 100 m. Outside of the mixing zone, water quality objectives must not be compromised. To determine key design parameters for the brine discharge, BHPB has undertaken:

- ecotoxicology testing – to determine the dilution factor that would be required to prevent adverse impacts on marine species; and
- hydrodynamic modelling – to determine the distance from the diffuser at which the required dilution factor would be achieved under a range of tidal and wind currents, and other seasonal conditions.

The key environmental values relevant to the desalination plant include:

- the Australian Giant Cuttlefish
- other native marine species, such as turtles and cetaceans
- water quality in the Upper Spencer Gulf

Most of the public comments on the Draft EIS focused on the proposed location for the desalination plant in an area of environmental sensitivity, including its proximity to a breeding aggregation of the Australian Giant Cuttlefish. In commenting on the Draft EIS, the department sought further justification from BHPB for the selection of the Point Lowly site. BHPB provided a detailed response in section 4.3.1 of the SEIS. In summary, while cost was a factor in the selection of Point Lowly, other sites have higher risks of environmental impacts in terms of vegetation clearance, increased energy requirements and the need for the pipeline to cross reserves and/or salt lakes. A major advantage of Point Lowly is that it offers access to relatively deep, fast flowing water in which to dilute and disperse return water (brine discharge). Accordingly, the department considers that, on balance, none of the alternative sites examined in the SEIS offer clear environmental advantages to the proposed site.

5.2.2 Australian Giant Cuttlefish

Whilst not an EPBC-listed threatened species, the Australian Giant Cuttlefish has conservation significance in the Upper Spencer Gulf as the area attracts the only known mass aggregation of spawning cuttlefish of this species in the world. At the peak of the breeding season (between May and September) the density of the species may exceed one cuttlefish per cubic metre. Cuttlefish are sensitive to changes in environmental conditions, including salinity, which suggests they may be vulnerable to brine discharge from the proposed desalination plant.

SA assessment

The SAAR notes that the Australian Giant Cuttlefish would be one of the most sensitive organisms to the brine discharge solution and, consequently, is an important species in determining the dilution factor (because, for example, a dilution factor that protects the cuttlefish would also be likely to protect other marine species).

The SAAR discusses the ecotoxicity testing undertaken by BHPB, and the independent reviews of this work, and notes the challenges associated with testing species from a naturally variable saline environment resulting in uncertainty in some of the results. To accommodate this uncertainty, the SAAR recommends a dilution factor of 1:70 (that is, one measure of brine to 70 measures of seawater) at 100m from the diffuser be required for initial design purposes. To allow for a safety margin, the SAAR recommends the dilution factor should be at least 1:85 at the nearest Australian Giant Cuttlefish habitat located 600 m from the diffuser. The report recommends that further ecotoxicity testing be undertaken on a minimum of five species from four different taxonomic groups,

including the Australian Giant Cuttlefish, before the desalination plant may commence. This data would be used by the SA EPA to develop licence conditions and by BHPB to optimise the diffuser design, if required. Results of this testing should be reviewed by the SA EPA and a panel of experts agreed by the SA EPA and funded by BHPB.

The SAAR also reviews the mid-field modelling (up to 4 km from the diffuser) of brine discharge dispersal used by BHPB and concludes that it is robust for tidal currents, temperature variations and timing of salinity variations, but underestimates the magnitude of salinity changes. To address this, the report recommends additional modelling with at least 12 months of real-time salinity and current flow data. It also recommends that near and mid-field modelling be undertaken for a range of flow scenarios during the diffuser design process, to ensure the design will achieve the required dilution factor.

The SAAR recommends that to mitigate impacts on cuttlefish from noise and vibration during construction of the desalination plant, marine blasting (associated with the construction of the desalination plant) should only occur outside of the cuttlefish breeding season.

Recommendations

Based on the expert review undertaken by the SA Government and review by ecotoxicology experts within the department, the department is satisfied that the ecotoxicology testing and hydrodynamic modelling undertaken by BHPB is sufficiently robust to demonstrate that the desalination plant can be constructed and operated in a way that will avoid impacts on the Australian Giant Cuttlefish. Consequently, the department recommends that a condition is imposed to ensure that the operation of the desalination plant has no adverse impact on the abundance and distribution of the Australian Giant Cuttlefish.

To address residual risks to the Australian Giant Cuttlefish, the department also recommends conditions requiring BHPB to demonstrate, through a comprehensive monitoring program, that it is achieving a dilution factor for the brine discharge that will avoid impacts on the cuttlefish, and also to require further ecotoxicity testing before commencement of the operation of the desalination plant. Further, the department recommends a condition to requiring an expert panel review of the ecotoxicity testing. The panel would provide recommendations to BHPB on the appropriateness of the species selected, the appropriateness of the experimental design and acceptable criteria for quality assurance/control for those species tests that do not have existing standards. Where a standard test is being used, the expert panel would need to confirm that the accompanying quality assurance/control criteria are adequate.

In accordance with recommendations in the SAAR, the department recommends that the diffuser be designed so as to achieve appropriate dilution factors at different points outside of the agreed mixing zone, specifically, 1:70 at 100 m from the diffuser, and 1:85 at the nearest cuttlefish habitat. BHPB modelling in the EIS indicates that the worst case dilution at cuttlefish habitat would be 1:107 and for 95 percent of the time, dilution would be above 1:258. This is well above the recommended design dilution factor of 1:85, providing confidence that the design dilution factors are achievable..

To ensure that operational criteria for the desalination plant are rigorous, the department recommends that the minister approve compliance and leading indicator criteria after receiving a report from BHPB on:

- the results of the ecotoxicology testing
- the findings of the expert panel
- the results of further near-field and mid-field modelling to demonstrate the ability of the proposed diffuser design to achieve compliance with the required dilution factor under all possible scenarios.

The department recommends that this report must be submitted prior to the commencement of construction.

In addition to meeting the dilution factor, the department recommends that the proponent be required to undertake targeted annual cuttlefish surveys to demonstrate compliance with the proposed condition. Due to the annual variation in cuttlefish numbers, this will take a number of years before any trend becomes apparent. For this reason, the dilution factor would remain the primary compliance measure. However, the annual surveys will also provide useful data for the long-term management of cuttlefish.

As construction on the intake pipe may disturb cuttlefish habitat, the department recommends that construction impacting on such habitat only be allowed to occur outside the breeding season, i.e. between 1 November and 1 May. Construction of the outfall pipe by trenching would be likely to have a significant impact on cuttlefish habitat, particularly as it would require blasting of rock within the alignment for the outfall pipe. Consequently, to avoid disturbance to the sea floor, the department recommends the outfall pipe be installed by tunnelling. No similar condition is recommended for the intake pipe, as the alignment for the intake pipe would require minimal, if any, blasting.

5.2.3 Other marine species

A range of marine fauna, including eight EPBC-listed threatened species, have been identified as potentially occurring in the Upper Spencer Gulf, including species of turtle, whale, sea-lion and shark (see page 494 of the Draft EIS for more details). It is noted in the EIS that these species are highly mobile and do not have any significant populations with foraging or breeding habitat in the project area. Two important sponge communities are also present in the Upper Spencer Gulf which rely on water movement for food supply, and may be potentially impacted upon by increases in turbidity.

In addition to the commitments above in relation to the Australian Giant Cuttlefish, the EIS indicates that the following will be implemented to prevent detrimental impacts to marine fauna:

- preparation of a silt and sediment management plan to minimise turbidity and silt deposition during the installation of intake and outfall pipes for the desalination plant
- installing the intake pipe may require the use of underwater blasting. Prior to each blast, a 600 m exclusion zone would be established and monitored to minimise the risk of marine mammals or listed marine species entering the blast zone
- a monitoring program will be developed to identify significant changes to marine flora and fauna communities and water quality around the desalination plant site

- real-time monitoring of salinity will be undertaken to confirm the dilution factor is being met and enable appropriate management responses, if necessary, such as by decreasing discharge flows.

SA assessment

The SAAR notes that impacts on marine fauna may result from noise and vibration from construction, and from impingement (i.e. where larger organisms become trapped and held on the mesh of the intake structure) and entrainment (where smaller organisms pass through the intake screen) at the inlet pipe. Moreover, as with the Australian Giant Cuttlefish, other marine species are susceptible to toxic effects of brine discharge. The SAAR considers that BHPB has demonstrated that the brine discharge would not result in harm to the marine environment beyond 100m of the diffuser.

The SAAR notes that if the design measures proposed by BHPB are implemented, risks of marine fauna impingement and entrainment in the intake pipe would not be significant. The report recommends that the lowest practicable intake velocity be used to minimise the risk posed by the desalination intake pipe. Additional site specific quantitative monitoring of marine organisms in the proposed intake area, and an analysis of best available technology to achieve the lowest possible intake velocity, are also recommended.

Recommendations in the SAAR to address the brine discharge were similar to those noted above for the Australian Giant Cuttlefish.

The SAAR notes that where blasting is required for installing the intake pipe, BHPB would use numerous small charges rather than fewer larger charges, reducing effects on marine fauna to 'marginally detectable' 600 m from the blast site. The SAAR recommends that a blast management plan should be approved by the EPA and include marine mammal surveys by trained personnel from a significantly elevated position to ensure that no marine mammals are located within an exclusion zone from the blast site of 600 m.

The SAAR notes that significant turbidity could be generated during the installation phase should a trenching method be used to install the intake pipe. Trenching would potentially impact on seagrass and macroalgal recruitment and sponge communities. The SAAR recommends BHPB use the best available practice to minimise release of suspended solids, particularly fine particles, and undertake extensive before, during and after turbidity and total suspended solids monitoring.

An ongoing monitoring program with good baseline information will be essential for determining whether the desalination plant has an adverse impact on marine species. The SAAR recommends the "Beyond BACI (Before After Control Impact)" scientific modelling assessment method. The "Beyond BACI" approach ensures that a comprehensive baseline assessment (Before) is undertaken which details the natural variability so that changes can be compared over time (After). The approach provides for monitoring to occur at multiple sites, to account for regional scale variability or site specific differences (Controls versus Impact). The SAAR recommends that all monitoring take into account and adhere to the "Beyond BACI" approach. The SAAR recommends that trigger levels and contingencies be developed and implemented in the event that the desalination plant construction or operation is found to have an adverse effect on a specified receptor.

Recommendations

As with the Australian Giant Cuttlefish, adherence to a defined dilution factor will be the key measure for minimising adverse impacts on other marine species. Consequently, the recommendations above for approving a dilution factor in relation to the Australian Giant Cuttlefish are equally relevant to other marine species.

As the diffuser would be located in a high current area of the gulf that is subject to scouring, the area around the diffuser would be unlikely to support significant habitat for marine flora or fauna. The South Australian Government *Environment Protection (Water Quality) Policy 2003* provides for a mixing zone of 100 m for the brine discharge. To address any residual risks, the department recommends a condition to require BHPB ensure that there are no adverse impacts on the condition and extent of marine species or their associated ecological communities beyond the 100 m mixing zone from the diffuser.

The department agrees with the SAAR that a comprehensive monitoring program is needed to demonstrate that BHPB is meeting the required environmental outcomes. The department recommends a monitoring program to include baseline or control data prior to construction, approval of detailed compliance criteria to demonstrate that outcomes are being met, ongoing monitoring and reporting and identification of response measures where monitoring indicates potential for non-compliance. The department recommends that the response measures identify the circumstances under which BHPB would cease discharging return water until a non-compliance issue was resolved.

The SAAR notes concerns about impacts of turbidity if the intake pipe is constructed using the trenching method proposed in the EIS. BHPB have committed to employing measures to reduce turbidity impacts during construction, to be detailed in their construction environmental management plan. This plan will require approval by the South Australian Government prior to construction commencing. Specifically, the SAAR recommends further monitoring near the proposed intake pipeline and the nearest (or likely depositional area) down current shallow subtidal reef habitat prior to the intake pipeline construction plan being submitted to ensure that turbidity can be adequately predicted and managed. BHPB will also be required to use construction techniques and management measures to avoid adverse ecological impacts. The department considers this requirement will be sufficient for ensuring there are no significant impacts on marine species.

5.2.4 Water quality in the Upper Spencer Gulf

The water quality in the Upper Spencer Gulf is critical to a healthy marine environment. Accordingly, in addition to specific measures aimed at protecting marine fauna and flora, it is important to understand and accurately predict the dynamics of the water in the gulf to ensure that important ecosystem functions are maintained. The Spencer Gulf is an inverse estuary, where salinity levels increase towards the head of the gulf due to the inflow of saline water from salt lakes in the catchment. BHPB undertook far-field hydrodynamic modelling to determine the risks the proposed desalination plant posed to the Upper Spencer Gulf.

The EIS indicates that the following controls/management actions will apply to monitor and protect the water quality of the Upper Spencer Gulf (Table 2.1 Supplementary EIS; page 35, Appendix U, Draft EIS):

- Monitoring (during the operation of the desalination plant) to identify significant changes to marine flora and fauna communities, and water quality.
- A detailed marine monitoring and management plan, incorporating habitat maps, to be developed in liaison with relevant stakeholders.
- Monitoring of salinity levels for comparison against species protection trigger values (dilution factors).
- Monitoring two years before the start of construction and during construction.
- Monitoring during operations to verify the return water dispersion modelling results (this would include times of dodge tides).
- If the return water discharge does not meet agreed regulatory thresholds for return water dispersion or monitoring identified unacceptable impacts, BHPB will cease discharging return water from the desalination plant into Upper Spencer Gulf until the issue was resolved.

SA assessment

The SAAR agreed with the validity of BHPB's far-field modelling which showed no significant long term increase in salinity in the northern Spencer Gulf due to the operation of the desalination plant. Calculations in the EIS suggested that annually 78% of water north of Point Lowly would need to be exchanged with water from further south in order to maintain the existing salinity gradients. The EIS indicated that 90% of the water north of Point Lowly would be exchanged annually, with 66-80% exchanged in 2-4 months.

To better predict the salinity impacts of the return water discharge at different locations in the Upper Spencer Gulf, the SAAR recommends that a real-time salinity, current monitoring system and biological monitoring system at Point Lowly be installed prior to detailed design of the desalination plant and diffuser, to collect both baseline data and undertake ongoing long-term monitoring.

Recommendations

The department notes the results of BHPB modelling which indicates that salinity levels would not increase by more than 0.15 g/L and that no further increase would occur after 12 months. The predicted increase would be negligible against the natural variation in salinity levels in the Upper Spencer Gulf. The department recommends a condition to require BHPB to comply with this limit.

5.2.5 Other issues

The SAAR also listed a number of other matters relating to the desalination plant as follows:

- Hazard and risk
- Air quality
- Terrestrial impacts
- Surface water
- Noise and vibration
- Heritage impacts
- Social impacts
- Visual amenity and landscape character
- Waste management

- Greenhouse gases and sustainability
- Road traffic impacts

Recommendations

These other matters were considered comprehensively within the SAAR. The department considers that these issues present a low risk to the environment and will be adequately managed by the South Australian regulatory agencies. Consequently, no conditions are recommended to address these matters.

5.3 Barge landing facility

5.3.1 Introduction

The proposed expansion will require a large amount of specialised equipment to be transported by ship. To avoid, to the extent possible, road transport from Adelaide and other ports and enable this movement to occur in an efficient manner, BHPB propose to construct a Barge Landing Facility (BLF) where equipment can be offloaded, held in a pre-assembly yard and taken directly to the project site without necessitating transport through built-up areas. The BLF would be developed near Port Augusta, in the Upper Spencer Gulf.

The BLF would include a pier jetty structure, an underwater rock pad, a two ha quarantine lay down area and a 25 ha pre-assembly yard. No dredging of the navigational channel in the Upper Spencer Gulf would be required. Roughly 13 ha of vegetation clearance would be required for the landing facility and pre-assembly yard combined.

5.3.2 Marine environment

There are three distinct marine communities within the potential impact zone of the BLF. These include an intertidal/upper subtidal community with adjacent mangroves, a shallow seagrass community and a mid-depth (6-10 m) muddy sediment community. These communities provide foraging habitat for several marine species of national importance, including several types of endangered or vulnerable whales, dolphins and turtles.

SA assessment

The SAAR notes that the construction of the BLF would likely cause some direct impacts to the local environment (from seabed disturbance) and indirect impacts (from shading and increased turbidity). Direct impacts would include the removal of 0.2 ha of mangroves, 0.1 ha of samphire and 0.5 hectares of the sea grass *Posidonia australis*. In addition, the construction of the pier would be expected to generate significant noise through pile driving, which was identified as having the potential to cause impacts on sensitive receivers, particularly whales and dolphins.

It was also noted that increased shipping could potentially increase the spread of exotic/pest species via transportation on ships. However, with appropriate safeguards in place and compliance with strict state and federal marine pest controls, the SAAR concluded that this risk was low.

The potential for impacts on marine mammals from ship strikes and underwater noise was also identified, along with increased turbidity resulting from the winnowing of sediments by ship movements in shallow water. The EIS states that these impacts would not be significant because of

the relatively few ship movements that are expected (about 35 per year) and the infrequent presence of whales in the Gulf. Collisions with dolphins and seals were considered to be unlikely as they are fast moving and could avoid slow moving vessels.

The SAAR recommends that an environment management plan be prepared and implemented for all site activities at the landing facility and pre-assembly yard. The plan would be required to address known and potential marine impact issues including turbidity management, underwater noise and management of marine pests.

Recommendations

Given the relatively low risk to the environment, the department does not recommend conditions in relation to the BLF, other than in relation to cetaceans. Cetaceans, including those which may be listed under the EPBC Act, are particularly sensitive to the noise and vibration that would be generated during the construction of the facility. Accordingly the department recommends a condition requiring BHPB to have no adverse impact on cetaceans as a result of noise or vibration, as demonstrated by maintenance of an exclusion zone and applying a maximum sound exposure level to any blasting or pile driving. The department recommends these requirements are incorporated into the environmental management plan that is prepared to meet the SA Government requirements.

5.3.3 Other issues

The SAAR listed a number of other matters relating to the construction and operation of the BLF which are as follows:

- Terrestrial ecology
- Topography, soils and site contamination
- Surface water
- Coastal processes
- Storage, transport and handling of hazardous material
- Air quality construction and operational impacts (dust)
- Noise and vibration (terrestrial)
- Social Impact
- Visual amenity
- Waste management
- Traffic and access impacts
- Rehabilitation and decommissioning
- Quarantine

Recommendations

These issues were considered comprehensively within the SAAR. The department considers that these issues present a relatively low risk to the environment and will be adequately managed by the South Australian regulatory agencies and the Australian Quarantine Inspection Service in relation to quarantine requirements. Consequently, no conditions are recommended to address these issues.

5.4 Airport and Hiltaba Village

5.4.1 Introduction

The Olympic Dam expansion proposal would require a new airport and a workers' accommodation facility for up to 10,000 construction workers, known as Hiltaba Village. These facilities would be located 17 km north-east of Roxby Downs and 5 km from the south-eastern edge of the proposed RSF. They would be located approximately 1 km apart, outside the proposed expanded SML. A detailed description of these facilities and the site selection rationale are outlined in Chapter 7 of the SAAR.

The land for the proposed development will be located on the Andamooka pastoral station, which contains sparse, low open shrubland. Clearing of 160 ha of vegetation would be required. Vegetation on the site is common to the region and unlikely to provide significant habitat for any listed species or communities.

5.4.2 Key issues

It is not considered likely that the development of either Hiltaba Village or the Airport would significantly impact on any key environmental values in the area.

5.4.3 Other issues

The SAAR listed a number of issues/impacts, which are as follows:

- Noise and vibration

The village would be located outside of the proposed aircraft flight path, and noise modelling undertaken by BHPB confirms that aircraft noise from the proposed new airport would not exceed acceptable levels for workers staying at the proposed Hiltaba Village.

- Social impacts

The SAAR recommends the development of a social management plan to monitor the impacts of the proposed village on workers and the broader community and to identify areas for action. This is discussed in more detail in Section 5.8 of this report.

- Surface water

The SAAR concluded that stormwater can be appropriately managed if the design measures in the EIS are adopted. It was also recommended that runoff should be reused for irrigation and landscaping areas around the village to reduce dust levels.

- Rehabilitation and decommissioning

The EIS states that at project cessation, as much as possible of the village infrastructure would be sold, reused or recycled at Roxby Downs, Andamooka and regional centres. All remaining material would either be removed from the site, or buried at Olympic Dam in an appropriate facility. Surfaces would be re-contoured and deep-ripped to facilitate natural revegetation. These rehabilitation and decommissioning procedures were considered to be appropriate.

Waste management, air quality, visual amenity, terrestrial impacts and traffic and access were also comprehensively considered within the SAAR.

Recommendations

These issues were considered comprehensively within the SAAR. The department considers that these issues present a low risk to the environment and will be adequately managed by the South Australian regulatory agencies. Consequently, no conditions are recommended to address these issues.

5.5 Pimba intermodal facility

5.5.1 Introduction

The Pimba intermodal facility would enable the transfer of goods between rail and road transport modes until a rail link to the mining operation was completed. It would be located on a 50 ha site, 1.1 km north of Pimba, and would include:

- A hardstand area for loading, unloading and temporary storage
- A small portable office and amenities building
- A small maintenance shed including a bunded fuel storage area
- An additional 400 m of rail allowing train access to the Port Augusta to Tarcoola line.

Whilst this facility may impact on Pimba and the nearby township of Woomera, the site consists of sparse low-lying vegetation and has minimal environmental values.

5.5.2 Key issues

It is not considered likely that the development of Pimba Intermodal facility will significantly impact any key environmental values in the area. Consequently, no conditions are recommended in relation to the facility.

5.5.3 Other issues

The SAAR lists a number of issues/impacts, which are as follows:

- Transport of hazardous materials

Hazardous materials including sulphur and diesel would be transported through the facility in large quantities. These materials would need to be appropriately handled to mitigate the risks associated with their transport and storage. This issue would be regulated by South Australia. Accordingly the department does not recommend any conditions be imposed to address this issue.

- Noise and air quality

It was concluded that if the facility were to operate 24 hours a day, audible impacts were likely to occur at nearby receivers. Such impacts can be managed through compliance with South Australian regulatory requirements.

- Radiation

The SAAR concludes that proposed material handling, containment and emergency response methods are appropriate to manage these risks, in conjunction with a monitoring program. The risks associated with copper concentrate and uranium oxide product transportation through the facility are covered in Section 5.7 of this report.

- Social impacts

Most staff required to operate the proposed facility are expected to be housed in Woomera, a Defence owned and managed facility. Defence has indicated its support in accommodating mining personal in the Woomera Village. Should insufficient housing be available, options to house employees locally may be explored in the Social Management Plan and further discussed with government, in advance of commencement of construction.

Visual amenity and landscape character, rehabilitation and decommissioning, surface water, waste management and traffic and access were also comprehensively considered within the SAAR.

Recommendations

The above issues were considered comprehensively within the SAAR. These issues present a low risk to the environment and will be adequately managed by the South Australian Government and Defence in relation to defence matters. Consequently, no conditions are recommended to address these issues.

5.6 Service Corridors

5.6.1 Introduction

The proposed Olympic Dam expansion would require additional gas, water and electricity infrastructure. Where practicable, the mains and transmission lines would align with existing infrastructure corridors to minimise environmental impacts and fragmentation.

A 320 km water pipeline would be required to deliver water from the proposed desalination plant at Point Lowly to the mining project area. Additional high capacity transmission lines would be required to strengthen the mine's electricity connection with the national electricity grid at Port Augusta, while the desalination plant would need to be connected with the Cultana substation.

A gas pipeline, running underground for the majority of its length, would connect Olympic Dam with natural gas supplies from the Moomba gas hub. BHPB has identified three alternative configurations as follows (see maps at Appendix 1):

- Option 1: 440 km directly from Olympic Dam to Moomba;
- Option 2: 400 km from Olympic Dam linked to the existing Moomba to Adelaide gas pipeline at the existing Compressor Station 2 (CS2); or
- Option 3: 560 km from Olympic Dam to Moomba via CS2 and a pipeline to Moomba from that point parallel with the Moomba to Adelaide Pipeline.

The key values potentially impacted by these proposed service corridors include:

- Department of Defence facilities
- Natural heritage sites listed on the Register of the National Estate
- Historic heritage sites listed on the Register of the National Estate
- Indigenous cultural sites listed on the Register of the National Estate.

5.6.2 Impacts on Defence land

The development of the proposed infrastructure corridors would impact on the Cultana Training Area (CTA) and the Woomera Prohibited Area (WPA). The CTA is located north-east of Whyalla, 10 km west of Port Augusta. It covers an area of approximately 48,000 ha, although the Department of Defence plans to extend its size by purchasing adjoining pastoral properties to the west. The proposed water pipeline, required to connect the desalination plant to the Olympic Dam operation, would be located in Crown land adjacent to the southern boundary of the existing CTA for approximately 9km and would traverse the proposed CTA expansion area for approximately 33 km.

The WPA is a 122,000 square kilometre weapons testing facility 450 km north of Adelaide. The proposed water pipeline electricity transmission line would traverse the WPA for approximately 15 km, aligning with BHPB's existing electrical transmission corridor (which is held in freehold title by BHPB). High impact testing of weapons could not occur in areas that support the water pipeline, but defence vehicles, including tanks, could continue to move over the pipeline.

SA assessment

The SAAR notes that the water pipeline would be laid in an easement directly adjacent to an existing liquid fuels pipeline and would therefore have minimal impact on Defence's future use of the CTA. Defence's interests would be protected under Defence Force Regulations once the CTA expansion area is declared a Defence Practice Area. However, Defence will need to be consulted in the creation of the easement and its terms of operation.

The route proposed through the WPA is currently used for electronic warfare testing, unmanned aerial vehicle flights and provides a safety buffer for weapon trials. The proposed infrastructure corridor should not affect these activities on the site provided. Defence retains the right to use the land for testing war material as necessary. A Deed of Access, similar to a mining deed as currently used for other operations, would be employed (between Defence and BHPB) to manage these service corridors.

Recommendations

The department notes that ongoing consultation between BHPB and Defence is integral to ensuring Defence operational capabilities are maintained. Moreover, such negotiations will provide surety to BHBP throughout their planning stages. The Deed of Access requirements would ensure that Defence interests were protected. However, given the importance of early consultation it is recommended that BHPB be required to consult with Defence where construction would impact on the CTA or the proposed expansion, or the WPA. The department also recommends that BHPB be required to comply with any Defence requirements to limit access to the WPA, in accordance with the Defence Force Regulations, as necessary for the protection of persons, property and official secrets.

5.6.3 Impacts to natural heritage sites

A number of sites on the Register of the National Estate (RNE) would potentially be impacted by the proposed gas pipeline. These include Lake Eyre and Environs, Finniss Springs Mission and Pastoral Station, *Eriocaulon carsonii* Sites and Lake Callabonna Reserve. Lake Callabonna Reserve is considered to be particularly significant as a fossil site of extinct Australian megafauna including Australia's largest fossil marsupial *Diprotodon australis*.

SA assessment

The SAAR notes that the proposed option 2 pipeline configuration occurs within one km of the Lake Callabonna Reserve. This route passes between Lake Callabonna and Lake Blanche and this area may potentially contain megafauna fossils. The gas pipeline would also create a new corridor through the Lake Eyre and Environs RNE site. The SAAR notes that BHPB would need to apply for a pipeline licence under the *Petroleum and Geothermal Energy Act 2000* (SA). This would require detailed information on the design, construction, operation and maintenance of the pipeline.

Recommendations

The proposed infrastructure corridors have generally been sited to avoid or minimise impacts on natural heritage sites. However, the proposed gas pipeline corridor is located near a number of sites listed on the RNE for their natural heritage significance. Accordingly, the department recommends that, due to the potential impact of on RNE values, a condition be imposed to require BHPB to undertake a more detailed assessment in finalising the gas pipeline alignment. In particular, the department recommends conditions requiring BHPB to:

- develop the water pipeline and electricity transmission lines in accordance with the preferred alignments shown in Figures N1.4 (a) – (f) of the *Olympic Dam expansion, Draft EIS 2009, Appendix N – Terrestrial ecology*
- prepare an infrastructure plan or plans detailing the proposed route for the gas line; and if changes to the water or electricity routes are proposed, details of any such changes. The plan(s) must demonstrate how the alignment has been selected to avoid or minimise, to the extent practicable, impacts on the value of places on the RNE.

If BHPB wishes to proceed with option 2, the department recommends that the section between Lake Callabonna and Lake Blanche be reviewed by an appropriately qualified megafauna palaeontologist and recommendations to minimise any impacts on fossils be addressed in the infrastructure plan.

5.6.4 Impacts to RNE listings for historic values

The Blanchewater Homestead Complex ruins and St Mary Pool sites are recognised on the RNE and South Australian Historic Register as exhibiting significant historic values. A permit from the South Australian Heritage Council is required to excavate in the vicinity of this site.

SA assessment

The SAAR notes the Blanchewater Homestead Complex ruins and nearby archaeological remnants occur near the proposed southern gas pipeline routes.

Recommendations

The proposed infrastructure corridors have generally been sited to avoid or minimise impacts on historic values. However, the proposed gas pipeline corridor is located near a number of sites listed on the RNE for their historic heritage significance. Accordingly, the department recommends that, due to the potential impact of on RNE values, a condition be imposed to require BHPB to undertake a more detailed assessment in finalising the gas pipeline alignment. In particular, the department recommends conditions requiring BHPB to:

- develop the water pipeline and electricity transmission lines in accordance with the preferred alignments shown in Figures N1.4 (a) – (f) of the *Olympic Dam expansion, Draft EIS 2009, Appendix N – Terrestrial ecology*
- prepare an infrastructure plan or plans detailing the proposed route for the gas pipeline; and if changes to the water or electricity routes are proposed, details of any such changes. The plan(s) must demonstrate how the alignment has been selected to avoid or minimise, to the extent practicable, impacts on the value of places on the RNE.

5.6.5 Impacts to RNE listings for Indigenous values

Archaeological and ethnographic surveys have identified a number of sites of Indigenous significance that may be impacted by the development of the proposed gas pipeline. These surveys, conducted in consultation with Aboriginal groups, identified amongst other things, artefact scatters, stone arrangements, quarries and a grave site occurring near the proposed gas pipeline. The EIS indicates that BHPB will conduct ethnographic surveys on areas affected by the projects, where it has not already done so. BHPB will also develop site disturbance plans in consultation with the appropriate Aboriginal group where it is necessary to disturb archaeological or ethnographic sites.

SA assessment

The SAAR notes that the proposed routes for gas, electricity and water have been sited to avoid ethnographic and archaeological sites identified during Aboriginal cultural heritage investigations where possible. The SAAR does not assess impacts on Indigenous values as these will be dealt with under separate SA legislation.

Recommendations

The proposed infrastructure corridors have generally been sited to avoid or minimise impacts on cultural heritage sites. However, the proposed gas pipeline corridor is located near a number of sites listed on the RNE for their Indigenous cultural heritage significance. Accordingly, the department recommends that, due to the potential impact of on RNE values, a condition be imposed to require BHPB to undertake a more detailed assessment in finalising the gas pipeline alignment. In particular, the department recommends conditions requiring BHPB to:

- develop the water pipeline and electricity transmission lines in accordance with the preferred alignments shown in Figures N1.4 (a) – (f) of the *Olympic Dam expansion, Draft EIS 2009, Appendix N – Terrestrial ecology*
- prepare an infrastructure plan or plans detailing the proposed route for the gas line; and if changes to the water or electricity routes are proposed, details of any such changes. The

plan(s) must demonstrate how the alignment has been selected to avoid or minimise, to the extent practicable, impacts on the value of places on the RNE.

5.6.6 Impacts to flora and fauna

The EIS assessed the proposed infrastructure corridors for the proposed water pipeline (from the proposed desalination plant at Point Lowly to Olympic Dam), electricity lines (from Port Augusta to Olympic Dam and from the CTA to the proposed desalination plant at Point Lowly), gas pipeline (from the Moomba gas fields) and rail line (from Pimba, on the Adelaide-Alice Springs line, to Olympic Dam). Preferred alignments within each corridor were identified by BHPB in the EIS. The development of these infrastructure corridors will result in habitat loss from vegetation clearance and pose risks to ground based fauna liable to become trapped in open trenches. Fauna caught in such trenches may be exposed to stress, predation and environmental extremes. The proposed corridor for the gas pipeline passes through an area containing mound springs from the GAB. These springs support listed threatened species and ecological communities.

SA assessment

The SAAR notes that overall, the threat posed to flora and fauna by the development of infrastructure corridors is low and that reasonable measures have been demonstrated to manage potential impacts. However, the SAAR recommends that BHPB be required to adhere to a range of specific measures designed to mitigate the residual risk of negative impacts, in addition to commitments made by BHPB in the EIS. Particular requirements recommended in the SAAR include:

- Electricity, rail and water pipeline must be constructed on alignment shown in EIS
- Preparation and implementation of a trench management plan
- Records kept of species recovered and removed from the pipeline easements;
- Placement of highly visible reflective markers at regular intervals on sections of the transmission line within 2km of ephemeral lakes
- Surveys for listed species prior to finalising alignment
- Fauna management plans for listed species

Recommendations

The proposed alignments for water and electricity avoid or minimise impacts on areas of environmental significance, including listed species and heritage sites. Consequently, the department recommends approval of the proposed alignments shown in the Draft EIS. Further studies and approvals would be required if BHPB proposes changes to the alignment. As noted above, the department recommends that BHPB further investigate the impact of the gas pipeline on heritage values in finalising the alignment. The department recommends that impacts on flora and fauna are considered at the same time. Consequently, the department recommends conditions to require BHPB to:

- develop the water pipeline and electricity transmission line in accordance with the preferred alignments shown in the DEIS with the alignments shown in Figures N1.4 (a) – (f) of the *Olympic Dam expansion, Draft Environmental Impact Statement 2009, Appendix N – Terrestrial ecology*

- prepare an infrastructure plan or plans detailing the proposed route for the gas line; and if changes to the water or electricity routes are proposed, details of any such changes. The plan(s) must demonstrate how the alignment has been selected to avoid or minimise, to the extent practicable, impacts on the value of places on the RNE
- submit plans for approval showing the final alignment of the gas pipeline route, including evidence of adequate consultation with Indigenous groups and how the alignment minimises environmental impacts
- avoid and/or minimise impacts on nationally listed species and ecological communities and other areas of environmental significance.

Construction of the gas pipeline has the potential to affect GAB mound springs through water extraction for construction and by altered hydrological flow patterns caused by open excavations. Consequently, the department recommends that BHPB be required to avoid impacts on groundwater dependent listed threatened species or ecological communities in the GAB.

5.6.7 Other issues

The SAAR listed a number of issues/impacts in relation to the service corridors, as follows:

- Hazard and risk
- Air quality
- Terrestrial impacts
- Surface water
- Noise and vibration
- Visual amenity and landscape character
- Waste management
- Impacts on pastoral uses.

Recommendations

These issues were considered comprehensively within the SAAR. The department considers that issues relating to the service corridors present a low risk to the environment and will be adequately managed by the South Australian Government. Consequently, no conditions are recommended to address these issues.

5.7 Road and rail transport infrastructure

5.7.1 Introduction

The proposed expansion of Olympic Dam requires the development of transport infrastructure corridors for road and rail. In addition to upgrades to the state arterial road network, proposed new road and rail corridors would connect Pimba and Hiltaba Village to the Olympic Dam site, and the Upper Spencer Gulf landing facility with the pre-assembly yard. A detailed description of these infrastructure requirements is provided in Chapter 11 of the EIS and in the SAAR.

5.7.2 Impacts to Defence land

The proposed alignment of the road and rail corridors would require land use changes and development on land owned by the Department of Defence, specifically the Cultana Training Area (CTA) and Woomera Prohibited Area (WPA).

SA Assessment

The SAAR notes that the proposed 15 m wide access corridor linking the landing facility near Port Augusta with the pre-assembly yard and Stuart Highway would be partially constructed on the CTA. The proposed rail corridors would also pass through approximately 25 km of the Woomera Prohibited Area. A Deed of Access (DoA), similar to a mining deed, would also be required for management of these service corridors. Whilst BHPB have not made specific commitments regarding impacts on Defence owned land, the EIS acknowledged the need to consult with Defence regarding leasing options for the affected portions of the CTA and WPA.

Recommendations

Defence has agreed in principle to the proposed road and rail transport infrastructure corridor between Olympic Dam and Pimba. Defence controls access to the WPA through the Defence Force Regulations and uses the area to conduct weapons testing and evaluation. BHPB has held discussions with Defence regarding the infrastructure corridors and a draft DoA to the WPA. Defence supports these discussions continuing with a view to finalising a DoA to the WPA. Defence has reserved the right, however, to limit access to the WPA.

Consequently, the department recommends a condition to require BHPB to consult with Defence where construction would impact on the CTA or the proposed expansion, or the WPA. The department also recommends that BHPB be required to comply with any Defence requirements to limit access to the WPA, in accordance with the Defence Force Regulations, as necessary for the protection of persons, property and official secrets.

5.7.3 Radiation

The proposed expansion of Olympic Dam would involve the transport of radioactive copper concentrate to the Port of Darwin, and of uranium oxide to both the Port of Darwin and the Port of Adelaide. BHPB has proposed the use of rail and road corridors to transport these materials to their respective export facilities and proposes to implement strict radiation controls including a ‘closed system’ design for copper concentrate transport from Olympic Dam to the Port of Darwin.

SA assessment

BHPB has proposed the transport of radioactive material in a closed system of sealed rail wagons and drums to prevent environmental exposure. The SAAR concludes that the procedures for transport of uranium oxide concentrate and handling and containment of copper concentrate are appropriate and, combined with routine monitoring, would prevent contamination. In order that this is clearly demonstrated, the SAAR recommends that BHPB conduct soil and gamma dose rate surveys along the corridor to establish background conditions.

In addition to South Australian requirements applying to transport between Olympic Dam and the SA-NT border, the transport of radioactive material through the Northern Territory must comply with the

NT *Radioactive Ores and Concentrate (Packaging and Transport) Act* and the *Transport of Dangerous Goods by Road and Rail (National Uniform Legislation) Act.*

Recommendations

Radiation risks associated with transport of uranium and copper concentrate are low. The EIS indicates that radiation exposure to full-time train drivers transporting copper concentrate is expected to be approximately 0.5 mSv/y. Current exposure for truck drivers transporting uranium oxide is estimated at 0.7 mSv/y (for a driver making 100 seven hour trips per year). Doses to train crews are expected to be considerably less due to the greater separation between the uranium oxide and the crew. These rates are well below the regulatory limits. The department considers it is important, however, that the public have confidence that radiation risks are comprehensively addressed. Accordingly, the department recommends a condition requiring that transport of uranium and copper concentrate:

- must not expose members of the public or non-human biota to radioactive releases above the dose limits recommended in the *Code of Practice for Radiation Protection and Radioactive Waste Management in Mining and Mineral Processing* (ARPANSA 2005 or, as amended)
- ensures exposure of members of the public and non-human biota to radioactive releases being as low as reasonably achievable.

The department also recommends a condition requiring that transport and loading of copper concentrate uses a no release containment system and that transport of both copper concentrate and uranium oxide concentrate is consistent with the *Code of Practice for the Safe Transport of Radioactive Material* (ARPANSA 2008, or as amended).

5.7.4 Other issues

The SAAR and the EIS listed a number of other issues in relation to road and rail transport infrastructure, as follows:

- Transport safety and emergency response
- Movement of over-dimensional loads
- Safety and delays at rail crossings, especially in Alice Springs
- Traffic management and impacts south of Port Augusta
- Infrastructure upgrading/augmentation
- Increased outback traffic
- Road safety
- Air quality (dust)
- Terrestrial impacts
- Surface water
- Noise and Vibration
- Rehabilitation and Decommissioning.

Recommendations

These issues were considered comprehensively within the SAAR and the EIS. The department considers that these issues present a low risk to the environment and will be subject to detailed regulatory oversight by South Australian and Northern Territory agencies. Consequently, no conditions are recommended to address these issues.

5.8 Communities

5.8.1 Introduction

Townships and communities located in the region of the proposed expansion would be affected by the influx of new workers (and their families) associated with the project. Roxby Downs, established in 1988 to service the original Olympic Dam operation, is expected to increase in size from 4,500 to approximately 10,000 residents.

In addition to Roxby Downs, several other regional communities are likely to be impacted (but to a lesser extent) by the enlarged workforce required by the proposed action. These include the townships of Andamooka, Woomera, Port Augusta, Pimba and Whyalla.

5.8.2 Workforce impacts

The proposed expansion would require a significant increase in labour to meet demands during the construction phase and the continued operational phase of the expanded mine. Such an increase in demand could cause a shortage of available labour in the region (raising costs for industry) and would attract new staff to the region. This would place a range of demands on housing and other social infrastructure.

In 2008, the Olympic Dam operation employed 1,700 staff, as well as 2,450 contractors (1,400 long-term and 1,050 short-term), of whom approximately 60% resided locally. The proposed expansion would require an additional short term workforce of between 4,000 and 6,000, as well as an increase of approximately 4,000 long term operational workers.

The key regional impacts are likely to be as follows:

- Andamooka and Woomera would likely attract workers who wish to reside outside of Roxby Downs or Hiltaba Village
- Port Augusta would also likely attract workers (and their families), as it is only a 3 hour drive from the mine site. Whilst on shift at the mine, these workers would reside in long distance commute (LDC) accommodation in Roxby Downs
- The construction workforce associated with the proposed landing facility, access road and pre-assembly yard would also likely reside in Port Augusta
- There would also be an impact on Whyalla during the construction period for the proposed desalination plant at Point Lowly (located 35km from Whyalla).

SA assessment

The SAAR acknowledged that the expansion would have an impact on local, regional and state-wide enterprises, particularly during the construction phase. Regional workers with appropriate qualifications, skills and businesses associated with the expansion are likely to benefit, while other businesses in the region may be left with skills shortages and recruitment challenges.

The SAAR recommends the preparation and implementation of a Social Management Plan (SMP) to manage issues related to employment and training. This SMP would set targets for Aboriginal employment, apprentices, trainees and graduates, as well as a target for employing South Australians as a percentage of total employees.

The SAAR concluded that most issues relating to regional growth would be addressed at the state and local government level through appropriate provision of services. However, to assist in the provision of services in this region, the SAAR recommended that BHPB assist the workforce to find accommodation in the affected regional towns, in consultation with relevant local governments.

Moreover, as part of the SMP, BHPB would be required to monitor housing demand in the regional towns of Andamooka, Woomera, Port Augusta and Whyalla during the construction period and the effects on local rental prices, rental availability and housing stress. Strategies would then be implemented, in conjunction with the state government, to address any issues detected.

Recommendations

These issues were considered comprehensively within the SAAR and the EIS. The department considers these social issues will be subject to detailed regulatory oversight by South Australian and Northern Territory agencies. Consequently, no conditions are recommended to address social impacts.

5.8.3 Other issues

In addition to social impacts, the expansion of Roxby Downs and other towns would have impacts on the following:

- Aboriginal communities
- Employment
- Flora and Fauna
- Air Quality
- Surface Water
- Visual Amenity and Landscape Character
- Traffic and access
- Waste Management.

Recommendations

These issues were considered comprehensively within the SAAR and the EIS. The department considers that these issues present a low risk to the matters covered by the controlling provisions and will be subject to detailed regulatory oversight by the South Australian and Northern Territory Governments. Consequently, no conditions are recommended to address these issues.

5.9 Offsets

Introduction

A broad scale impact associated with the Olympic Dam expansion is the clearance of native vegetation. As such, while specific impacts on vegetation are addressed in other sections of this report, this section addresses land clearance more generally.

Clearing of vegetation for the Olympic Dam expansion will mainly be associated with mining activities (rock storage facility, tailings storage facility, open cut) and occur within the Arid Lands Natural Resource Management (NRM) Region. Clearing will also occur for the desalination plant, barge landing facility and infrastructure corridors. Some areas will be revegetated following construction as shown below:

NRM region	**Activities**	**Total area of clearing (ha)**	**Area to be revegetated (ha)**
Arid Lands	Mine site, construction village, airport, Roxby Downs expansion, rail, infrastructure corridors	Approx 17,000	Approx 2,000
Northern and Yorke	Infrastructure corridors	165	68
Eyre Peninsula	Desalination plant, infrastructure corridors	100	53

In addition, the desalination plant and barge landing facility are expected to result in clearance of 3 ha of seagrass. As noted above, the service corridors would also potentially have an impact on sites of cultural and natural heritage significance.

SA assessment

The SAAR notes that the area of clearance presented in the EIS (approximately 17,000 ha) is the maximum conceptual clearance footprint based on proposed components and that the final clearance area will be determined when designs and location of project components, such as the water and gas pipeline alignments, are confirmed. In determining this final clearance area, the proponent will be required under the *Native Vegetation Act 1991* (SA), where practicable, to limit clearance to more degraded and less significant habitats.

The SA *Native Vegetation Act 1991* regulates the clearance of native vegetation in South Australia and aims to reverse long-term declines in the extent and quality of native vegetation cover. The SA *Native Vegetation Regulation 2003* requires the proponent to provide a Significant Environmental Benefit (SEB) to offset the loss of vegetation that occurs as a result of a development. A SEB ratio of 8:1 has been applied to clearance across the entire Olympic Dam expansion proposal. Based on the upper level of predicted clearance, this corresponds to 138,152 ha. This figure does not include

indirect impacts on vegetation (such as from dust or sulphur dioxide emissions). Adjustments are also made where cleared areas are revegetated following construction, such as in the infrastructure corridors.

Recommendations

Given the extent of clearing proposed for the project, the department recommends conditions for a substantial offset package to compensate for clearing and other direct impacts. The department considers the offset ratio determined under the requirements under the SA *Native Vegetation Act 1991* would provide an adequate offset. This ratio would be 8:1, corresponding to approximately 140,000 ha and reflects an offset ratio proposed by BHPB in the EIS. As the area to be cleared for the project has not been finalised, the department recommends a condition requiring the offset to be expressed as a ratio, rather than specifying a particular area required for the offset. Requiring an offset ratio would also encourage BHPB to minimise vegetation clearance, because a larger area of offset will be required for a corresponding area of clearance.

In the EIS, BHPB proposed to provide land offsets in the Arid Lands Region. While the proposed area for an offset does have some conservation benefits, the department considers, in its present form, the proposed offset may provide limited on-ground conservation benefits as:

- the areas offered by BHPB are grazed lightly or not at all, and are not subject to significant threatening processes (other than pest animals and plants)
- as a pastoral lessee, BHPB has a duty under the *Pastoral Land Management and Conservation Act 1989* to prevent degradation of the land proposed for offsets
- the areas proposed do not all reflect the conservation priorities of the Australian Government.

BHPB has, however, noted in the EIS that management plans would be developed for the offset areas. As no further details are provided, the conservation benefit that would be derived from these plans is not clear. Accordingly, the department recommends that the offset requirements address the specific impacts of the proposal, namely:

- broadscale clearing of vegetation
- potential impacts on EPBC listed species and ecological communities
- potential impacts on sites of heritage significance from the infrastructure corridors
- potential impacts on the marine environment from the desalination plant.

The recommended actions relate to management of landholdings in the affected region and other areas impacted, including the marine environment. In addressing the impacts of BHPB's clearing of approximately 17,000 ha, the department recommends that the offset contribute to the biodiversity conservation priorities of the Australian and South Australian governments. These priorities are identified in the Arid Lands Natural Resource Management Plan, the South Australian Arid Lands Biodiversity Strategy, the National Reserve System and the National Wildlife Corridors plan. To address the above impacts more specifically, the department recommends a condition that requires an offsets plan that will:

- contribute to landscape scale ecological linkages to increase resilience to climate change
- contribute to the protection and recovery of listed threatened species and communities and address key threatening processes. Of particular importance, and potentially impacted by the gas pipeline corridor, is 'the community of native species dependent on natural discharge of groundwater from the Great Artesian Basin'.
- support improved identification, protection, management and interpretation of sites of natural, historic or Indigenous heritage significance, including on existing sites on the RNE. Sites on the register that are either on, or immediately adjoining, the offset areas that BHPB has proposed are the Finniss Springs Mission and Pastoral Station and the Eriocaulon carsonii sites
- contribute to meeting the identified research objectives of the Arid Recovery initiative;
- support research to improve understanding and management of the marine environment in the Upper Spencer Gulf
- contribute, where practicable, to capacity building in natural resource and cultural heritage management in Aboriginal and other local communities
- provide a high degree of certainty that the agreed conservation outcomes will be achieved in a timely and transparent way and will be long-lasting
- deliver on-ground environmental outcomes that would not otherwise occur, noting that lessees have a general duty under the *Pastoral Land Management and Conservation Act 1989* (SA) to use good land management practices and prevent degradation of land
- include timeframes for undertaking activities identified in the offsets plan, funding arrangements, delivery mechanisms and criteria for measuring and evaluating the success of the plan
- provide for review of the offsets plan and its effectiveness at least every five years from the date of approval of the plan
- provide data in an appropriate format for inclusion in the department's database.

5.10 Sulphur handling facility

5.10.1 Introduction

Site and location

The expanded processing plant at Olympic Dam would require additional amounts of sulphur. BHPB has proposed development of a bulk sulphur offloading and handling facility in Port Adelaide's Outer Harbor, on the LeFevre Peninsula. The disturbance area of the handling facility, expected to be 20ha, would contain rail lines and embankments (12ha), a sulphur handling shed (4ha) and wharf side facilities and conveyer systems (4ha). The residential area of North Haven is located approximately 1km from the proposed handling shed and within close proximity to the shared rail line that services traffic from existing wharf facilities.

The Barker Inlet and St Kilda wetlands, located to the north and east of the proposed handling facility site, are listed on the Directory of Important Wetlands in Australia, but are not listed as wetlands of international significance under the EPBC Act. These wetlands are characterised by a wide belt of tidal mud flats and mangroves, fringing salt flats and low lying dunes. They hold significant environmental value as the largest area of mangroves in the Spencer Gulf and one of only a few

similar stands in a major city in Australia. They provide important migration paths, breeding habitat and foraging for nationally listed species, in addition to nursery areas for commercial and recreational marine fish and crustaceans. The area holds significant cultural importance to the Kaurna people and provides social benefits to the Adelaide region.

The Mutton Cove Conservation Reserve is also located approximately 1km east of the site. This reserve is fringed by tidal flats and hosts the last remaining area of saltmarsh and mangrove woodland on the LeFevre Peninsula.

Description of the proposal

The proposed handling facility would enable BHPB to import approximately 1.7 million tonnes per annum (Mtpa) of elemental sulphur, required for operation of the hydrometallurgical plant at Olympic Dam. This sulphur is proposed to be transported in the form of durable pellets (referred to as prill) in line with current operations. The handling facility would be designed to utilise existing rail infrastructure and would include a sulphur handling shed, ship-wharf unloader, conveyors, rail lines, office buildings and other onsite infrastructure. The facility is described in more detail in Chapter 5.7.1 of the SEIS.

South Australian Government requirements

The sulphur handling facility is not part of the Major Development Declaration for the Olympic Dam expansion that is being assessed by the South Australian Government under the SA *Development Act 1993*. Accordingly, it was not addressed in the SAAR. The facility would require separate approval under the SA *Development Act 1993* as well as a South Australian Environment Protection Authority licence and other permits.

Key environmental issues

The development of the proposed sulphur handling facility at Outer Harbor has been assessed in the EIS in relation to:

- Species and ecological communities
- Air quality
- Noise and vibration
- Surface water runoff
- Acid sulphate soils
- Rehabilitation and decommissioning

5.10.2 Species and communities

Eighteen EPBC-listed threatened species, one threatened ecological community (Peppermint Box Grassy Woodlands of South Australia) and 51 listed migratory species occur within two kilometres of the sulphur handling facility. Habitat for 86 listed marine species and 8 species of whales and cetaceans also occurs within two kilometres of the site.

Assessment

As the sulphur handling facility site is located within a degraded industrial zone it is unlikely to provide suitable habitat for any threatened species or communities. High quality terrestrial and marine habitat occurs within a kilometre of the proposed site, in Mutton Cove Conservation Reserve in conjunction with the Barker Inlet and St Kilda wetlands. The department also considers the risk of indirect impacts is low (e.g. relating to air quality, noise and vibration, etc) for the reasons outlined below in Sections 5.10.3 to 5.10.5.

The relatively minor increase in shipping traffic associated with the facility is not considered likely to significantly increase the potential for cetacean collisions in the area. Protection afforded under the SA *Adelaide Dolphin Sanctuary Act 2005* further mitigates the risk of cetacean collisions. Consequently, the facility is unlikely to have significant direct impacts on cetaceans and species or communities of national environmental significance.

Recommendations

The department considers that the protection of nearby wetlands is important to prevent impacts on species and ecological communities. Consequently, the department recommends a condition requiring BHPB to ensure there is no adverse impact on the ecological values of the Barker Inlet and St Kilda wetlands, and Mutton Cove Conservation Reserve.

5.10.3 Air quality

Assessment

BHPB has indicated from operational experience that sulphur prills do not generate dust unless broken down. In order to minimise abrasion and crushing of prills during transport and loading/unloading, a number of dust reduction measures were proposed (refer to Chapter 5.7.1 of the SEIS). These include an enclosed screw ship unloading system, covered conveyor transfer points, dust suppression systems, a telescopic chute and automatic reclamation system. The facility will also be required to comply with the *Dangerous Substances Act 1979, Environmental Protection (Air Quality) Policy 1994* and to follow the EPA Bunding and Spill Management Guidelines (SA). The department considers that detailed state regulatory requirements, coupled with the mitigation measures above, are sufficient to ensure that dust emissions are minimised.

Recommendations

The department considers that, with the measures described above, the risks relating to the sulphur handling facility are low. Residual risks relate primarily to matters of public health. As matters relating to public health are addressed by detailed state regulations, the department does not recommend additional conditions for the facility.

5.10.4 Noise and vibration

Assessment

The distance between the sulphur handling facility and residential areas is sufficient to minimise the impacts of vibration from facility operations. As the proposed sulphur handling facility would utilise existing rail lines within the LeFevre Peninsula industrial zone, an increase in impacts associated with additional rail freight is considered unlikely. Increases in noise are likely to result predominantly from the construction and operation of a closed conveyance system required as part of the new facility. The proposed facility occurs within the operating industrial zone of the Northern LeFevre Peninsula. Acoustic modelling undertaken by BHPB and outlined in Chapter 15.5 of the SEIS, indicates that the noise impacts would occur within the limits approved in the SA *Northern LeFevre Peninsula Industry and Open Space Development Plan Amendment*. The facility is required to comply with the SA *Environment Protection (Noise) Policy 2007*.

Recommendations

The department considers that, with the measures described above, the risks relating to the sulphur handling facility are low. Residual risks relate primarily to matters of public health. As matters relating to public health are addressed by detailed state regulations, the department does not recommend additional conditions for the facility.

5.10.5 Surface water runoff

Assessment

BHPB has identified that accidental sulphur spills associated with overfilling of rail wagons at the unloading wharf pose a risk to surface water quality associated with the operation. As any such spills would significantly affect local wetlands, it will be important for BHPB to implement measures to minimise the extent and likelihood of such spills.

The use of water during operation of dust suppression systems and wash down of conveyor belts may also lead to the accumulation of sulphur fines in runoff water. This water, if allowed to leave the site untreated, could adversely affect water quality. Management, control and reporting procedures to address such risks, prepared for the existing Olympic Dam operations would be extended to include the handling facility.

BHPB will be required to comply with the SA *Environment Protection (Water Quality) Policy 2003* and to follow the EPA Bunding and Spill Management Guidelines, among other protocols. The department considers that these requirements will effectively reduce the likelihood and extent of runoff and spillages from the site.

Recommendations

While surface water impacts will be addressed by detailed state regulation, it is important that offsite impacts on areas of environmental significance are addressed. Consequently, the department recommends a condition requiring BHPB to ensure there is no adverse impact to the ecological values of the Barker Inlet and St Kilda wetlands and Mutton Cove Conservation Reserve.

5.10.6 Rehabilitation and decommissioning

Assessment

Following the closure of Olympic Dam, BHPB expect that the sulphur handling site will either continue operating as a commercial port or be transferred to the South Australian Government for public use. Detailed decommissioning and rehabilitation measures for the facility would be required under the South Australian Government approval process to ensure compliance with the SA *Environment Protection (Site Contamination) Regulations 2008*. The department considers that these measures are sufficient to ensure appropriate rehabilitation of the site.

Recommendations

Under state regulation, BHPB will be required to prepare and implement detailed decommissioning and rehabilitation plans and seek approval of such plans from relevant state agencies. As recommended above, BHPB would need to ensure the sulphur handling facility has no adverse impact to the ecological values of the Barker Inlet and St Kilda wetlands and Mutton Cove Conservation Reserve. Therefore the department considers that adverse impacts associated with rehabilitation and decommissioning of the proposed facility are unlikely, and no conditions are recommended in this respect.

5.10.7 Other issues

- Hazard and risk

Sulphur prills are classified as a hazardous material because of their potential to combust, explode, form corrosive substances or highly toxic hydrogen sulphide gas. To mitigate these threats, BHPB propose to construct the facility with an impervious, compacted floor of crushed limestone and corrosion resistant concrete walls. These measures would prevent the escape of hazardous material or any loss of structural integrity to the sulphur handling shed. Combustion prevention methods include minimising the creation of sulphur fines and potential ignition sources. Installation of Australian standard fire suppression systems would mitigate the extent of a fire if combustion occurs. Should the facility proceed, BHPB will be required to meet South Australian occupational health and safety regulations and develop emergency response procedures to deal with potential contamination spills and combustion of sulphur at the facility.

- Heritage

Port Adelaide and the Gawler Reach, the region within which the site is contained, has been nominated for addition to the National Heritage list. Whilst this area has not been listed to date, the nomination focuses on Port Adelaide's heritage values as an example of a still operating port that reflects Australia's early settlement. The sulphur handling facility would not affect those values as it would be located within an existing industrial area.

- Visual amenity

The proposed site occurs within an existing industrial area. As such the department considers the sulphur handling facility will not affect the visual amenity of the surrounding area.

- Acid sulphate soils

The EIS does not identify acid sulphate soils within the site. Should these soils be discovered, however, the proponent would be required to follow South Australian regulatory requirements to address acid sulphate soils.

Recommendations

The department considers that these other issues relating to the sulphur handling facility present a low risk to the environment. Consequently, no conditions are recommended to address these issues.

5.11 Port of Darwin copper concentrate handling facility

5.11.1 Introduction

BHPB proposes to export copper concentrate and uranium oxide through the Port of Darwin. These materials would be railed to the Port of Darwin via the Adelaide to Darwin line, for export via an existing uranium oxide loading facility and a proposed copper concentrate handling facility. The proposed handling facility would be located within the Darwin Port Corporation (DPC)-owned East Arm Wharf area. However the exact site for the handling facility within this area is subject to negotiation between BHPB and the DPC. A description of the proposed handling facility and potential locations is provided in Appendix E4.1 of the DEIS.

Construction of the DPC's East Arm Wharf facilities and dredging of the Port are not part of the proposed action, and are being assessed under a separate EPBC approval process (EPBC 2010/5304). Similarly, impacts of any land reclamation activities including the removal of shoal and wetland communities are outside the scope of this assessment.

Key issues associated with the proposed handling facility relate to:

- Port Darwin wetlands
- Radiation
- Nuclear security
- Rehabilitation and decommissioning

5.11.2 Port Darwin wetlands

The Port Darwin wetlands occur within 1km of the proposed site and represent the closest high conservation value environment. The wetlands are listed on the Directory of Important Wetlands of Australia (but are not listed under the Ramsar Convention). The wetlands are one of the largest discrete examples of a shallow branching embayment and mangrove swamp in the top end region. The diversity of landform and geological settings provide a range of habitats for listed threatened and migratory species and deliver important ecological functions including nursery environments for estuarine and offshore fish and crustaceans. The intertidal mangroves that fringe the Port Darwin wetlands also play an important hydrological role in the area, protecting the coast from climatic extremes and storm surges. The wetlands and broader harbour also contain numerous historical

wreckages from World War 2 and sites of cultural importance to the Larrakia Aboriginal people's annual hunting and gathering cycle.

Assessment

The proposed handling facility poses risks to marine species and the Port Darwin wetlands associated with surface water runoff, spillages, dust emissions and containment loss during extreme weather. Mitigation strategies noted in the EIS include closed system designs, water management policies and spill response protocols. The closed system design aims to mitigate environmental release by transporting product from sealed rail carts, into enclosed storage facilities before loading onto designated vessels using a closed conveyor system. The handling facility would be required to comply with Northern Territory building codes and would incorporate design measures to reduce the risk of damage during extreme weather conditions, as outlined in the EIS. The concentrate consists of copper sulphides which are not likely to be water-soluble and are unlikely to be absorbed by organisms. Therefore, if a spill did occur, impacts would be limited to smothering of organisms by product, which would only be considered significant in the event of large spills.

As the site for the proposed handling facility has not been finalised, the Northern Territory Government has not yet undertaken a detailed assessment of the proposal or determined the specific environmental requirements that would apply.

Recommendations

The department considers that implementation of the above mitigation strategies would reduce the potential for impacts on the Port Darwin wetlands as a result of handling facility operations. It is likely that risks would be reduced further through Northern Territory Government requirements. However, as these requirements have not yet been determined, and to avoid any residual risks, the department recommends a condition requiring BHPB to prepare an environmental management plan setting out details on the design of the facility, construction schedule and methodology and measures to avoid or mitigate adverse impacts on the environment. The department also recommends that BHPB be required to transport and load copper concentrate using a closed system consistent with that described in chapter 5 of the DEIS.

5.11.3 Radiation and dust impacts

Radiation controls specific to the handling facility, relate to the storage and handling of radioactive product (copper concentrate) at the proposed East Arm Wharf facilities. Handling of concentrate and associated potential dust generation at the facility may also impact on human health. Section 5.7 of this report provides greater detail regarding compliance requirements for the transport for radioactive materials. In addition to these requirements, the Northern Territory *Radiation (Safety Control) Act* imposes requirements for potential occupational, public and environmental radiation exposure rates.

Assessment

The modelling presented in Appendix E4.10.3 of the DEIS provides an adequate assessment of the potential radiation exposure from transport and the handling facility, to workers and the public. The closed system design proposed by BHPB would ensure radiation limits are maintained in line with the internationally acceptable dose rates. The measures relating to the handling facility are discussed in greater detail in the EIS. The department considers that the potential for impacts on the surrounding

environment from radiation would be low, and the closed system design would be sufficient to mitigate the potential for dust impacts.

Recommendations

Regulation of radiation in the Northern Territory is undertaken through the *Radiation (Safety Control) Act.* This act outlines specific compliance requirements for occupational exposure rates, which would be comprehensively regulated and monitored by the NT Government. Consequently, the department considers it is unnecessary for the Australian Government to regulate occupational exposure to workers at the Port Darwin nuclear handing facility through specific radiation-related conditions of approval under the EPBC Act. The department recommends a condition requiring BHPB to ensure exposure of members of the public and non-human biota to radioactive releases is within the dose limits recommended in the *Code of Practice for Radiation Protection and Radioactive Waste Management in Mining and Mineral Processing* (ARPANSA 2005 or, as amended) and is as low as reasonably achievable.

5.11.4 Decommissioning and site condition

The EIS provides limited information regarding decommissioning of the handling facility, as the exact site location is yet to be confirmed. Detailed rehabilitation and decommissioning plans will be required for development assessment prior to approval, under the Northern Territory *Environmental Assessment Act 1982* and *Planning Act 2009.*

Assessment

The EIS indicates that, after the handling facility is decommissioned, the site would continue to be used for commercial shipping as required. The assessment of appropriate decommissioning and rehabilitation plans would be undertaken by Northern Territory regulatory agencies.

Recommendations

The department notes that Northern Territory regulatory agencies would be responsible for the decommissioning and rehabilitation plan approvals. Therefore adverse impacts associated with rehabilitation and decommissioning are considered unlikely. The recommended condition above, to require BHPB to ensure there is no adverse impact to the ecological values of the Port Darwin wetlands, will also be relevant to decommissioning and rehabilitation activities.

5.11.5 Other issues

Other issues/impacts relevant to the proposed handling facility include:

- Rail impacts

The EIS identified the potential for impairment to NT emergency service response times associated with blocked rail crossings, particularly in Alice Springs. Management of rail transport incidents is subject to detailed NT regulation and management by NT regulatory agencies.

- Terrestrial impacts

The Charles Darwin National Park is located in proximity to the proposed handling facility, but is separated from the facility by the Port Darwin wetlands. Consequently, the proposed conditions for

protection of these wetlands are considered sufficient to also protect significant terrestrial environments and species from risks relating to runoff and airborne emissions.

- Impacts of shipping traffic

The principal environmental risks relating to shipping traffic concern risk of vessel strike to marine megafauna, particularly involving cetaceans. There would be only a small change in port traffic associated with the handling facility (one additional ship approximately every two weeks). As such, the department considers it is unlikely that there would be a significant increase in the number of cetacean ship strikes.

- Noise and amenity

The facility site is located within an industrial zone, 3km from the nearest urban receivers, with planned freight operating on existing rail corridors. Management of noise issues is subject to detailed NT regulation and management by NT regulatory agencies. Accordingly, the department does not recommend additional conditions to address noise and amenity.

- Cultural and historical values

The EIS concludes that no significant cultural and historical values are present within the area identified for siting of the proposed concentrate handling facility. As such, the department considers significant impacts on historic or cultural values are unlikely.

Recommendations

The department considers that these other issues relating to the Port of Darwin facility present a low risk to the environment and are regulated by Northern Territory regulatory agencies. Consequently, no conditions are recommended to address these issues.

5.12 Greenhouse impacts

Introduction

The Olympic Dam expansion would be a significant emitter of greenhouse gases, due mainly to electricity and diesel use. The EIS estimates that greenhouse gas emissions will peak at approximately 4.7 million tonnes per annum (Mtpa) at full operating capacity, representing approximately 9 per cent of South Australia's forecast total emissions in 2030. Emissions relating to project activity in the NT will be relatively minor. In the EIS, BHP states that it will:

- set a goal of reducing greenhouse gas emissions (reportable under the *National Greenhouse and Energy Reporting (Measurement) Determination 2008*) to an amount equivalent to at least a 60% reduction of 1990 emissions, by 2050
- develop a Greenhouse Gas and Energy Management Plan, to be reviewed annually, which will:
    - set interim goals, targets and timelines for emissions reduction based projects
    - consider further renewable energy and greenhouse gas abatement opportunities, identified in the EIS
    - identify further greenhouse gas reduction strategies and projects

- establish modelling to forecast the likely emissions reduction pathway from commencement of operations to 2050.

Assessment

The SAAR recommends that the reduction and control of greenhouse gas emissions be managed through BHPB's proposed Greenhouse Gas and Energy Management Plan and that this plan be approved by the SA Government.

Greenhouse gas emissions associated with the proposal are significant in the regional context; however they are not significant in the global context where global annual emissions are in the order of 30 billion tonnes per year. Accordingly, it is not expected that greenhouse gas emissions associated with the proposed expansion will materially affect matters protected under national environmental law.

Recommendations

Greenhouse gas emissions from the expansion were raised in a large number of public submissions on the draft EIS. Despite the commitments made by BHPB, many submitters would like to see BHPB make greater use of renewable energy. The department notes that the Australian Government has announced a package of measures to reduce carbon pollution and secure a clean energy future including:

- putting a price on carbon pollution
- promoting innovation and investment in renewable energy
- improving energy efficiency
- creating opportunities in the land sector to cut pollution.

This package of measures is the Australian Government's policy response to addressing greenhouse gas emissions. The SAAR indicates that greenhouse gas emissions will also be subject to a plan to be approved by South Australia. Consequently, no EPBC conditions are recommended.

5.13 Nuclear Security/Safety

5.13.1 Introduction

The expanded Olympic Dam mine would produce and export approximately 19,000 tonnes of uranium oxide concentrate (UOC) and 1.6 million tonnes of copper concentrate (which contains 2,000 parts per million of uranium) each year. BHPB intends to export the copper concentrate directly to China for processing and the uranium oxide concentrate to one of several, Australian Government approved processing facilities. Nuclear safety, security and safeguards controls are discussed in detail in Appendix E3 of the DEIS. Around a quarter of the public submissions received on the DEIS raised concerns about the export of uranium from Olympic Dam and the associated nuclear security and safety risks. Key concerns related to:

- the potential use of uranium from Olympic Dam in nuclear weapons
- the adequacy of nuclear safeguards in ensuring that uranium from Australia is only used for peaceful purposes
- the effectiveness of nuclear safeguards associated with export of copper concentrate to China

- nuclear waste storage
- the safety of nuclear power plants.

5.13.2 Assessment

Security and safeguards

Nuclear security relates to the physical protection of nuclear material and installations so that there is no unauthorised use of this material. Nuclear safeguards are applied to ensure and confirm that exports of uranium are only used for peaceful purposes. Under the *Nuclear Non-Proliferation (Safeguards) Act 1987* all nuclear material exported from Australia (irrespective of source) is termed 'Australian Obligated Nuclear Material' (AONM), and strict limits are imposed on its use and sale globally. The Australian Government requires receiving countries to:

- be party to, and comply with, the Non Proliferation Treaty
- have a bilateral safeguards agreement with Australia
- have an Additional Protocol with the International Atomic Energy Agency (IAEA).

These requirements are verified through IAEA inspections. In addition to IAEA measures, Australia's bilateral safeguard agreements apply specific conditions to AONM, such that it:

- is to be exclusively used for peaceful non-military purposes
- is covered by IAEA safeguards for the full life of the material or until it is legitimately removed from safeguards
- is covered by fallback safeguards in the event that IAEA safeguards no longer apply for any reason
- cannot be transferred to a third party for enrichment beyond 20 per cent of U-235 and for reprocessing without prior Australian consent
- can only be received by countries that apply internationally accepted physical security standards.

There is not currently in place a bilateral safeguard agreement with China that covers the export of the uranium contained within the copper concentrate. Such an agreement would need to be finalised before any export of copper concentrate can take place. ASNO would determine the accounting arrangements and security measures required. An export permit would also be required from the Minister of Resources, Energy and Tourism under the *Customs (Prohibited Exports) Regulations 1958* to ensure that all handling, transport and non-proliferation requirements were met.

The transport and storage of uranium in Australia would also require a permit from ASNO.

Safety

Some public submissions questioned the safety of the nuclear power industry citing, as an example, the accident at the Chernobyl reactor in 1986. Internationally, there are a number of measures in place addressing nuclear safety, including the Convention on Nuclear Safety, Convention on Early Notification of a Nuclear Accident or Radiological Emergency, and the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management. The IAEA provides safety services and is actively involved in promoting high safety standards. There is an international

regime of inspections and peer reviews of nuclear facilities in IAEA member countries under the Convention on Nuclear Safety. The IAEA has also established an International Nuclear Safety Group to provide authoritative advice and guidance on nuclear safety approaches, policies and principles. The Group comprises experts in nuclear safety working in regulatory organisations, research and academic institutions and the nuclear industry.

Concerns about nuclear safety have been heightened by the nuclear accident following the Great East-Japan earthquake and tsunami. Consequently, and given the life of the mine is likely to extend beyond 40 years, it is reasonable to expect that international mechanisms and work to promote nuclear safety will continue to be further developed and strengthened over the life of the Olympic Dam project.

5.13.3 Recommendations

Export of uranium from Olympic Dam would be addressed by comprehensive international frameworks and legislative requirements covering nuclear safety and security. For this reason, the department does not recommend conditions under the EPBC Act to address these matters.

6. Other matters protected by the EPBC Act

This project is controlled under five provisions of the EPBC Act, of which section 21 and 22A (Protection of the environment from nuclear actions) required the assessment of impacts on the whole environment. Impacts on the other four provisions are discussed in this chapter, noting that the assessment of impacts in section 5 of this report has largely addressed these matters.

6.1 Wetlands of international importance

The proposal, as originally referred under the EPBC Act, canvassed a number of options for the increased water supply needed for the expansion. These included additional extraction of water from the Great Artesian Basin (GAB). When the delegate of the minister decided that the proposal was a controlled action, it was considered that sourcing such a large volume of water for the expansion from the GAB could have a significant impact on the Coongie Lakes Ramsar site, located approximately 50 kilometres from the wellfields that currently supply the mine.

Since then, BHPB has indicated in the EIS that it would not seek additional water from the GAB beyond its current licence. Instead, BHPB proposed the primary water supply for the expansion would come from a desalination plant at Point Lowly, as discussed above. This is reflected in the scope of the referred proposal as varied on 24 October 2008. Taking this into account, and the conclusion reached in section 5.1.3 (that there is a low probability that regional groundwater drawdown from the open pit will affect the GAB) the department considers it unlikely that the proposal will impact on the Coongie Lakes Ramsar site. The department's Environmental Reporting Tool (ERT) does not identify any other Ramsar wetlands that would potentially be impacted by the proposal.

6.2 EPBC listed threatened species and communities

As discussed in Section 5, the proposal may potentially impact on a number of threatened species.

There may be direct impacts on EPBC listed species on the Special Mining Lease (SML) through clearing of vegetation. Surveys conducted for the EIS did not identify any EPBC listed flora species. Excluding fauna species reintroduced to Arid Recovery, the survey identified three listed fauna species (Thick-billed Grasswren, Plains Wanderer and Plains Rat) as potentially occurring in the SML. The department's ERT also identified Slender-billed Thornbill as likely to occur in the area. Impacts on these species can be summarised as follows:

- The Thick-billed Grasswren (vulnerable) was not recorded in surveys of its preferred habitat to the east of the SML. It is widespread throughout the region and impacts are expected to be minor.
- The Plains Wanderer (vulnerable) was recorded as a vagrant on the SML. It is not identified by the ERT as likely to occur in the area. Consequently, any impacts on this species, if they did occur, would be minor.
- The Slender-billed Thornbill (vulnerable) was not recorded in surveys in the SML. It is a highly mobile and sparsely distributed species. Impacts are expected to be minor.
- The Plains Rat (vulnerable) is restricted to the gibber plains of Lake Eyre Basin in northern South Australia. It has been recorded on the SML. Impacts on the Plains Rat are likely but will be mitigated by the recent expansion to Arid Recovery. The EIS estimates that less than 2% of

suitable habitat within the EIS study area would be lost but a large area of similar habitat would be available for colonisation near the mine. The EIS concludes that the viability of local populations is unlikely to be affected. Overall, the department considers impacts will be minor.

No listed threatened ecological communities on or near the SML have been identified by BHPB, the South Australian Government or the department's ERT.

Most impacts would be restricted to vegetation which would be cleared for the proposal. There may be indirect impacts on EPBC listed species from dust, emissions, radiation, noise and light from mining and processing operations. Recommendations have been made in Section 5 of this report to address indirect impacts on listed species.

There may be impacts on groundwater dependent listed species and ecological communities as a result of regional groundwater drawdown from dewatering of the open pit. No species or communities have been identified that are dependent on groundwater in the Stuart Shelf. Mound springs in the Great Artesian Basin support the listed endangered ecological community: 'the community of native species dependent on natural discharge of groundwater from the Great Artesian Basin'. As discussed in section 5.1.3, regional drawdown of groundwater is unlikely to adversely affect the GAB mound springs. As a precautionary measure, recommendations have been made to address this risk.

The infrastructure corridors may potentially impact on listed threatened species and ecological communities. However, the department considers the proposed alignments in the EIS adequately minimise impacts on listed species and communities, although, the gas pipeline alignment requires further investigation. A recommendation has been made in section 5 to require approval of an infrastructure plan for the gas pipeline and if the other proposed alignments change.

Based on the assessment in section 5, the department considers it unlikely that any other component of the project would significantly affect listed terrestrial species or ecological communities.

The desalination plant, barge landing facility, sulphur handling facility and Port of Darwin concentrate loading facility all have the potential to impact on listed marine threatened species. Based on the assessment in section 5, the department considers the risks of impacts to be low. As a precautionary measure, recommendations have been made in section 5 to address residual risks.

6.3 EPBC listed migratory species

As with listed threatened species, there are a number of migratory species that could potentially be impacted by the proposal.

- The tailings retention system at the mine may adversely impact on migratory species. This is discussed in section 5.1.5 above. Recommendations have been made for an ongoing monitoring program and a requirement for use of best practicable technology to deter birds and minimise impacts.
- The desalination plant, barge landing facility, sulphur handling facility and Port of Darwin concentrate loading facility all have the potential to impact on listed migratory species. Based on the assessment in section 5, the risks of impacts are considered to be low. As a

precautionary measure, recommendations have been made in section 5 to address residual risks.

6.4 Actions involving Commonwealth land

The proposed infrastructure corridors pass through, or adjoin, the Cultana Training Area and the Woomera Air Weapons Range, both owned by the Department of Defence. Impacts on these areas, including on Defence operations, are discussed in sections 5.6 and 5.7 above.

The proposal also affects land owned by the Australian Rail Track Corporation (Pimba intermodal facility and rail corridor). The small disturbance footprint on this land (approximately 30 ha of partly degraded land) would result in minimal environmental impact. No other areas of Commonwealth land are likely to be impacted by the proposal.

7. Existing operation

Australian Government regulation of the existing Olympic Dam mine is through environmental requirements on BHPB's uranium export permit and is the responsibility of the Minister for Resources and Energy. As the existing operation was assessed under the *Environment Protection (Impact of Proposals) Act 1974*, it is outside the scope of the EPBC Act assessment of the expanded proposal. However, section 134(1) of the EPBC Act allows the minister to attach conditions to an approval of an action to protect the environment or repair or mitigate damage, even where this does not relate directly to the action. Consequently, it is recommended that conditions be applied to the existing operation so that the entire Olympic Dam operation (existing and expanded) is regulated by a single approval under the EPBC Act.

As the existing operation is not being assessed, the department recommends that the intent of the current environmental requirements governing the existing operation should not be changed. However, a number of these requirements are now redundant and others would require changes to make them consistent with the recommendations for the expansion in this report. The existing environmental requirements, and recommendations for each requirement, are as follows (Note the requirements refer to Western Mining Corporation, which is now owned by BHPB).

Current environmental requirement	**Department's recommendation**
That Western Mining Corporation (WMC) ensure that all existing and proposed arrangements for transport of uranium oxide from Olympic Dam mine to Adelaide comply with all relevant Commonwealth and South Australian legislation.	Delete as BHPB is already required to comply with all relevant state and Commonwealth law.
That WMC collect spring flow data and bore pressure data, and use these to refine aquifer parameters and re-estimate draw down effects at spring groups at regular intervals. These revised predictions must be presented to the Olympic Dam Environment Consultative Committee.	Retain requirement for collection of spring flow data and bore pressure data, and provision of details of how these will be used to refine aquifer parameters and re-estimate draw down effects at spring groups at regular intervals.

That WMC, consistent with clause 11.7 of the *SA Roxby Downs (indenture ratification) Act 1982* as amended and in consultation with the Olympic Dam Environment Consultative Committee, prepare detailed contingency measures and a response plan to address any significant deleterious variation in monitored and or predicted draw down or flow rates at mound springs occurring as a result of the projects operations.	Retain requirement for contingency measures and a response plan to address any significant deleterious variation in monitored and or predicted draw down or flow rates at mound springs.
Consistent with the 1996 Environmental Management and Monitoring Plan (EMMP) approved by the SA Government under the *SA Roxby Downs (indenture ratification) Act 1982 as amended,* that WMC continues, and expands when appropriate, the mound spring monitoring program to enable the collection of a long term data set to achieve a better understanding of biological fluctuations in these systems. The results of the monitoring program are to be presented to the Olympic Dam Environment Consultative Committee and Great Artesian Basin Consultative Council.	Retain requirement for collection of a long term data set to achieve a better understanding of biological fluctuations in these systems.
That WMC continues to reduce the demand on water resources to the maximum amount reasonably achievable both at the mine and at Roxby Downs Township, by the use of efficient water supply and usage practices, including the application of recycling systems and through the investigation and application of alternatives to the use of water where possible. This requirement is with clause 13 of the SA *Roxby Downs (indenture ratification) Act 1982* as amended.	Standard EPBC Act conditions would require BHPB to report annually on their compliance conditions of approval including monitoring requirements. This information would be made publicly available.
That WMC continues to monitor groundwater quality (hydrochemistry) to investigate the long term possibility of movement of more saline water in the main artesian aquifer (the Algebuckina Sandstone), due to interaction between aquifers. The findings of this monitoring are to be conveyed to the Olympic Dam Environment Consultative Committee.	Replace with the recommended new groundwater monitoring conditions for mining operations.
WMC continues research into the identification and assessment of alternative water supplies and review the viability of alternative options, taking into account changes in technology and economics. Progress is to be reported to the Olympic Dam Consultative Committee.	Delete. BHPB has identified an alternative supply (desalination plant).
That WMC continues to monitor groundwater in the region of the tailings retention system and mine waste water disposal pond and conduct further definitional analysis of the hydro-geological regimes consistent with recommendation 1h of the minister	Replace with the recommended new groundwater monitoring conditions for mining operations.
That WMC continues to make available to the scientific community, and to the Olympic Dam Environment consultative committee and Great Artesian Basin Consultative Council, information relating to monitoring of flora and fauna in and around its lease areas for mound springs monitored by WMC.	Delete. Recommend that BHPB's annual report on compliance with the EPBC conditions be made publicly available.
Should further expansion of operations be formally proposed for the Olympic Dam mine, then WMC is required to provide the Minister for Resources and Energy with relevant information on any proposed changes in technology or mining practice beyond that used for the expansion to 200,000 tpa copper and associated products. This information will allow the minister for resources and Energy to consider the need for designation under the EPIP Act.	Delete. The expansion has been assessed under the EPBC Act.

Should further expansion of operations be formally proposed at the Olympic Dam mine, then WMC is required to provide the Minister for Resources and Energy with relevant information on any proposed changes to the method of tailings management which differs from that used for the expansion of 200,000 tpa copper and associated products. This information will allow the Minister for Resources and Energy to consider the need for designation under the *Environment Protection (Impact of Proposals) Act 1974* (EPIP Act).	Delete. The expansion has been assessed under the EPBC Act.
Should further expansion of operations be formally proposed at the Olympic Dam mine, then WMC is required to provide relevant information to the Minister for Resources and Energy on groundwater use and management that exceeds the existing conditions approvals. This information will allow the Minister for Resources and Energy to consider the need for designation under the EPIP Act.	Delete. The expansion has been assessed under the EPBC Act.

8. Economic and social matters

Social matters

Information on social matters is provided in chapter 19 of the draft EIS and chapter 21 of the supplementary EIS. The EIS noted significant social benefits in terms of increased employment and business opportunities locally, regionally and state-wide. An expanded range of health, education and other services would also benefit residents of Roxby Downs. The EIS also notes potential negative social impacts such as increased crime and anti-social behaviour.

BHPB has proposed to minimise the social impacts of the proposal, in particular, by locating the camp for construction workers away from Roxby Downs and preparing a masterplan for Roxby Downs. In the EIS, BHPB has committed to developing a Social Management Plan to monitor the impacts of the proposal on Roxby Downs and regional communities and to identify areas for action, in conjunction with the South Australian Government.

Economic matters

Information on economic matters is in chapter 21 of the draft EIS and in chapter 24 of the supplementary EIS. The draft EIS estimates the Olympic Dam expansion would contribute $45.7 billion to South Australia's Gross State Product (GSP) over 30 years and the creation of 13,100 full-time equivalent jobs in South Australia.

The SAAR notes that the existing mine accounts for 2.4% of South Australian GSP, and the proposed expansion would increase average production more than three-fold. The SAAR concludes there would be very significant impacts on the region and the broader South Australian economy, should the project be approved.

The draft EIS also acknowledges the project may potentially cause some negative economic impacts through increased house prices and costs of goods and services, and crowding out of existing economic activity including competition for skilled labour. The increase in South Australia's revenue

raising capacity may also result in the state's share of GST revenue being decreased. Nevertheless, the project would result in a substantial net economic benefit to South Australia.

The Social Management Plan, referred to above, would assist in managing some of the negative economic impacts such as increased house prices. BHPB has also proposed a number of measures to maximise regional benefits including working with state and local government and regional economic development boards, and funding of the Olympic Dam Indigenous Participation Program.

On balance, the proposal would have substantial economic and social benefits. While benefits will mainly flow to South Australia, they will also be significant at a national level.

9. Conclusion

Risks relating to the proposal have been comprehensively addressed in the EIS and the South Australian Government's assessment report. Based on the assessment in this report, the department considers the potential impacts of the proposal on the environment, listed threatened species and ecological communities, migratory species, Ramsar wetlands of international importance and Commonwealth land will not be unacceptable subject to the recommendations in this report. Accordingly, the department recommends that the proposal be approved for each of the controlling provisions, and the recommended conditions attached to the approval.

Appendix 1: Project maps

1. Mining and processing
2. Southern infrastructure corridors, desalination plant and barge landing facility
3. Gas pipeline corridors
4. Port of Darwin copper concentrate handling facility
5. Sulphur handling facility

(All maps sourced from the Final EIS)

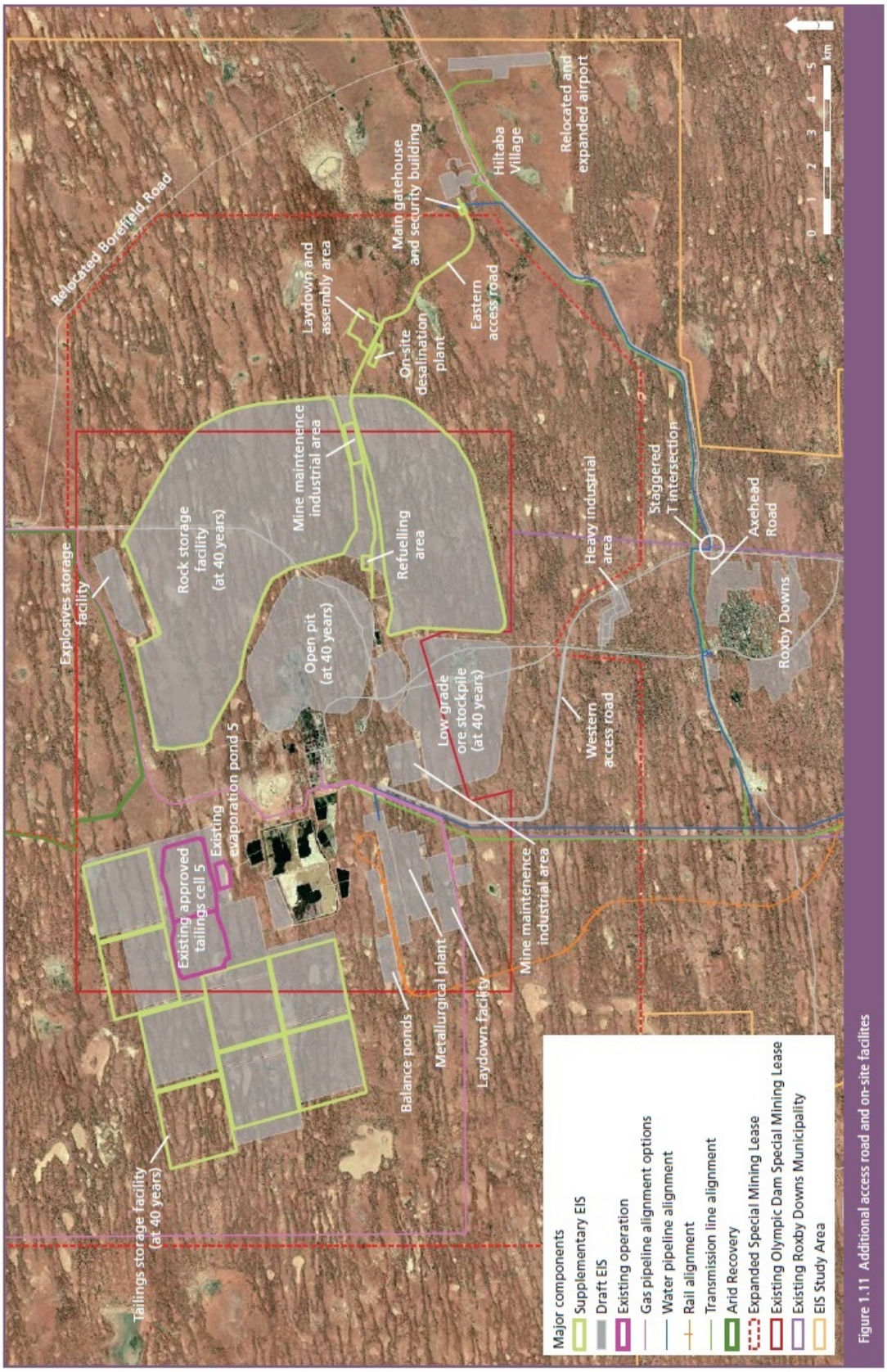

Figure 1.11 Additional access road and on-site facilities

Figure 5.4 Components of the proposed expansion in the southern corridor

Figure 5.3 Major infrastructure elements of the proposed expansion within the gas pipeline corridor options

Figure 5.50 Proposed location and indicative configuration of the Port of Darwin facilities

Figure 5.51 Indicative location and configuration of the Outer Harbor sulphur handling facility at Port Adelaide