31 HAZARD AND RISK

31.1 CLARIFICATION OF THE DRAFT EIS RISK ASSESSMENT PROCESS

31.1.1 DESCRIPTION OF PROCESS

Issue:

BHP Billiton was asked whether it would involve appropriate government agencies in more detailed risk assessments of the project in the future. In particular, the involvement of emergency services organisations was requested.

Submission: 2

Response:

BHP Billiton would consult with appropriate emergency services organisations about a range of issues as the project progressed, including the potential risks.

The risk assessment process undertaken for the purpose of the Draft EIS was outlined in Chapter 26, and the details were provided in Appendix C. The primary aims of the risk assessment completed for the Draft EIS were to:

- identify possible risk events or risk situations that were considered to be 'extreme' (and therefore intolerable and requiring modification)
- develop a list of project risks
- identify key project risks that require additional controls, in the form of management plans.

As the project progressed, BHP Billiton would undertake further risk assessments, building on the work presented in the Draft EIS. In particular, BHP Billiton is committed to working with the relevant national, state and territory emergency services organisations throughout the project development and implementation stages, to ensure proper training, planning and coordination of emergency response services.

Issue:

Further clarification on the Draft EIS risk assessment process was requested.

Submissions: 139 and 301

Response:

Impact assessment and risk assessment are quite different processes and are addressed differently in the Draft EIS. Some submissions confused the two processes, asking why certain issues had not been risk-assessed.

Section 1.6.2 of the Draft EIS discussed the difference between impact and risk assessment and explained the methods used for the Draft EIS, and included a graphic representation in Figure 1.11 and more detailed information in Tables 1.3, 1.4, 1.5 and 1.6. This approach is consistently used in other EIS assessments.

The impact assessment process and the risk assessment are fundamentally different. An impact assessment is an assessment of the predicted impacts of a given situation or event, whereas a risk assessment is an investigation of what could go wrong in that particular situation or event. For example, the dust modelling predicts the concentration of dust at certain locations would reach particular levels (i.e. the impact). The risk assessment is an informed assessment of what might go wrong that would result in higher-than-expected dust levels.

Chapter 26 and Appendix C of the Draft EIS then described the risk management methodology used in more detail. The risk assessment process was developed specifically for the Draft EIS and used a combination of the BHP Billiton proprietary risk management system and other recognised risk systems, including the Australian Standards system. The entire risk assessment process was reviewed independently and found to be appropriate and fit for purpose.

The risk assessment process was applied over a period of almost two years and identified approximately 5,000 individual project risks, including a number that were defined as intolerable risks. As a consequence, some aspects of the project were redesigned or modified and were subjected to further investigation. The process considered all parts of the proposed expansion, including those options that were investigated by the BHP Billiton project development team but were not included in the final design. As well as providing information for the Draft EIS, the risk assessment produced a project risk register that became the foundation for the broader BHP Billiton project risk system.

Classifying a level of risk is based on assessing the probability or likelihood of an event, and the consequences if that event were to occur. The 'risk' is then obtained by cross-referencing the likelihood with the consequence on a risk matrix reference table. The risk matrix is used to delineate what is considered to be acceptable from what is not acceptable (refer Chapter 26 and Appendix C of the Draft EIS for details).

Issue:

The risk assessment process used in the Draft EIS was quite complex and a number of submissions sought further information or clarification. In particular, more information was requested on:

- why 'likelihood' was not used in the impact assessment
- the application of the EIS risk assessment process to the current operation
- the method for determining the final risk results
- the terminology used in the risk assessments
- provision of more details on policies and controls
- the inconsistent link between risk assessment outcomes and assessment criteria
- BHP Billiton policies and control measures.

Submissions: 2, 27, 139, 288 and 301

Response:

Before addressing the specific issues raised, it is useful to reiterate the purpose and the processes behind the Draft EIS risk assessment methodology.

The risk assessment process was a comprehensive process conducted over almost two years, which identified and quantified some 5,000 individual project risks. The process considered all parts of the expanded project, including options that may have been investigated by the BHP Billiton project development team but were not included in the final project scope. As well as providing information for the Draft EIS process, the risk assessment produced a project risk register, which became the foundation for the broader and ongoing project risk system.

As described in Chapter 26 of the Draft EIS, an aim of the risk assessment process was to identify those risks that could be classified as 'intolerable'. These risks were deemed to be too high for the project to proceed if the risk remained unmitigated. When the risk assessment process identified any intolerable risks, BHP Billiton committed to either changing the situation that produced the risk or to implementing measures to lower the risk to a 'tolerable' level.

'Tolerable' risks were defined as those that were classified as either 'high', 'medium' or 'low'. 'High' risks were summarised and, together with mitigation measures, were addressed in specific environmental management plans (as discussed in Chapter 24 of the Draft EIS). 'Medium' or 'low' risks required no additional mitigation measures and could be managed by existing management systems.

Workshops involving appropriate experts and engineering and design personnel were used to assess each risk event or situation. No risk was reassessed without either BHP Billiton's commitment to an agreed mitigation measure or more information from other experts (i.e. involvement of experts not involved in the original assessment process).

The results of the process, including the risk registers, were documented in Chapter 26 and Appendix C of the Draft EIS. The complete list of risk events was provided in the reference document, Arup 2008 Technical Supplement to the Olympic Dam Development Study – Risk Assessment (Arup 2008).

Answers to the specific issues raised in the submissions are addressed below.

Why 'likelihood' isn't used in the impact assessment

An impact assessment is an assessment of a known event; for example, the impact of clearing vegetation to accommodate the proposed project infrastructure. In this case, the 'likelihood' of the impact occurring is certain because if the expansion is implemented as planned, the event will occur. The key requirement is therefore to determine the magnitude of the impact as a result of the event and to then decide whether the impact is 'acceptable'. This is usually done by a comparison to standards or limits (refer Section 1.6.2 of the Draft EIS for details). In the absence of legislated criteria, the magnitude of the impact was assessed against known values and the period of time over which an impact may persist. In summary, an impact assessment is an assessment of something that is expected to happen, and there is no need to consider the probability or likelihood of the event occurring.

A risk assessment looks at what could go wrong, and events that were not predicted or which may or may not occur (i.e. there is a chance the event may occur, but it isn't certain to occur). Therefore, it is possible to assign a 'likelihood' (or probability) of an unplanned event occurring, and then determine the consequence should that unplanned event actually occur. For example, clearing more vegetation than is required to accommodate the proposed project infrastructure is not planned, but it may occur, and so this event is addressed as a risk. The risk assessment establishes the likelihood that additional clearing may occur considering the strict protocols BHP Billiton places on construction contractors, and then determines the consequence should that event occur. A risk rating is derived by combining the likelihood and consequence of the event (as per Tables 1.4 to 1.6 of the Draft EIS).

This distinction is critically important: an impact assessment is not a risk assessment.

Applying the EIS risk assessment process to the current operation

The risk assessment undertaken for the Draft EIS specifically looked at the components of the proposed expansion, not the existing operation. For example, the control measures in the case of the tailings storage facility (TSF) are specific to the design and operation of the newly proposed TSF. The operation of the existing TSF is subject to regular safety reviews by the Olympic Dam management and relevant authorities. A risk assessment of existing facilities is beyond the scope of the expansion project EIS.

Method for determining the final risk results

The risk assessment method and the risk tables themselves were outlined in Section 1.6.2, Section 26.2 and detailed in Appendix C of the Draft EIS.

In summary, risk results were determined by assessing the likelihood and consequence of identified risk events through risk workshops attended by appropriately qualified and experienced professionals. Look-up tables were used to standardise the likelihood and consequence of an event. The standardised likelihood and consequence of the risk event were cross-referenced, on a risk table, resulting in a risk level.

A unique risk table was developed for the Draft EIS to take into account the possible additive effects of a particular risk having consequences in more than one receptor domain; for example, a risk event might have consequences for both air and water receptors. In addition, the risk table incorporates a level of conservatism, which means that the risks were more likely to be rated higher than they might otherwise have been using other risk assessment systems (refer Section 5.10 of Appendix C of the Draft EIS).

Terminology used in the risk assessments

Clarification was sought regarding the use of the term 'receptor' in the risk assessment work and the term 'environmental value' used elsewhere in the Draft EIS.

In general, these terms were used interchangeably. The risk assessment tended to prefer 'receptor', while the impact assessment tended to prefer 'environmental value'.

Inconsistent linkage between risk assessment outcomes and assessment criteria

The full issue outlined in the submission is as follows.

> 'Additional information is to be provided in relation to the indicated framework process (Figure 24.2) where linkages do not appear to be consistent and not linked to a process where outcomes have been defined from a risk assessment process leading on to defining assessment criteria and monitoring programs.'

This submission has been interpreted as questioning the link between the outcomes of the risk assessment and the monitoring and contingency measures outlined in Environmental Management Plans (EMPs) described in Chapter 24 (Environmental Management Framework) of the Draft EIS.

Figure 24.2 of the Draft EIS is, with minor changes, the impact and risk framework provided as Figure 1.11 in the introductory chapter of the Draft EIS. Figure 24.2 differs only in that it also shows the Draft EIS requirements (or inputs) and the Environmental

Management System documentation that results from these inputs. Figure 24.2, as in Figure 1.11, shows:

- every extreme risk rating resulted in design modifications or management measures to reduce the level of risk
- risks rated as 'high' and 'moderate' were required to have monitoring and contingency measures developed and outlined in the respective environmental management plans
- standard monitoring measures could be applied for risks that were rated as 'low'.

Each of the EMPs outlined in Appendix U of the Draft EIS addressed the relevant 'high' and 'moderate' risks from the risk assessment workshops.

Additional information on BHP Billiton policies and control measures

The BHP Billiton environmental management framework was described in Chapter 24 of the Draft EIS. In addition, reference documents cited in the Draft EIS (e.g. the BHP Billiton 2008c – Annual Environmental Management and Monitoring Report) provided further details.

A significant amount of information regarding control measures was provided in the Draft EMPs provided in Appendix U, and this information has been further updated in the Supplementary EIS (see Chapter 29 for details). This process of updating the Draft EMPs would continue throughout the ongoing development and execution of the expansion project.

It is noted that all extreme risks were mitigated with commitments identified in Chapter 26 and Appendix C of the Draft EIS. High risks have been addressed in the EMPs and contingency measures are continuing to be developed and included in the progressively developing EMPs. The control measures for low and medium risks are part of the existing Olympic Dam Environmental Management System, and where relevant have also been transferred to the Draft EMPs.

31.1.2 APPLYING THE RISK ASSESSMENT PROCESS IN THE EIS CONTEXT

Issue:

It was suggested that the application of the Draft EIS risk assessment process to a number of situations results in unacceptable outcomes.

Submission: 318

Response:

In this submission, the author has identified a number of situations and then undertaken a risk assessment (as described in Chapter 26 of the Draft EIS). However, the particular situations are more appropriately addressed through the impact assessment method, rather than the risk assessment method, and can be seen in the Supplementary EIS in the following sections: 25.2.1, 26.1.2, 26.2.1, 26.2.4, 26.3.1, 26.3.2 and 31.2.

Section 31.1.1 of the Supplementary EIS has provided additional discussion on the application of the impact and risk assessment process used in the Olympic Dam Draft EIS (and is outlined in Section 1.6.2 of the Draft EIS). The differences between a risk assessment and an impact assessment are described, including when each of these methods should be used.

Issue:

Clarification was requested on the risk assessment process for:

- groundwater
- the desalination plant and marine ecology
- post-closure
- the Northern Territory transport option
- uranium shipping

Submissions: 1, 93, 139 and 211

Response:

The risk assessment process undertaken for the Draft EIS was outlined in Sections 1.6.2 and 26.2 of the Draft EIS, and further details were provided in Appendix C and in the references to Appendix C. Appendix C detailed the methodology used and the assumptions made for each project component assessed, and summarised the findings of the risk assessment. The raw data collected during the risk assessment workshops were collated in the referenced document *Arup 2008 Technical Supplement to the Olympic Dam Development Study Risk Assessment (Amended)* (ARUP 2008). ARUP (2008) was provided to the South Australian Government to assist its review of the Draft EIS. The detailed risk registers have been used to address each of the specific issues raised here.

Groundwater

One submission questioned whether the impacts of possible risk events on groundwater-related values had been considered. The water supply risk assessment in ARUP (2008) specifically considered:

- the consequences of drawdown on mound springs (note that this risk assessment was conducted in relation to a borefield extension option which is not part of the final proposal)
- the risks of incorrectly modelling drawdown on Yarrawurta springs
- a complete subsection on secondary supply – local saline aquifers.

The mining risk assessment considered the risk of the open pit cutting the local aquifer and impacting on the springs.

The construction and gas pipeline risk assessments considered direct impacts on the mound springs.

Various other EIS risk-related assessments considered situations or events in relation to groundwater.

In addition to the risk assessment of groundwater issues, the Draft EIS conducted impact assessment of the proposed expansion on groundwater. The results of the impact assessment were provided in Chapter 12 and Appendix K of the Draft EIS.

Desalination plant and marine ecology

A complete risk assessment was conducted for the desalination plant, the outcomes of which were provided in Section 7.2 of Appendix C of the Draft EIS (with the full risk register provided in ARUP 2008).

As noted elsewhere in this chapter, impact assessment and risk assessment are two different processes that were both conducted for the Draft EIS. Impact assessment of the desalination plant was addressed in various chapters of the Draft EIS, with marine impacts described in detail in Chapter 16.

Post-closure

The submission claims that a post-closure risk assessment was not conducted. This is incorrect and the details and findings of the assessment were provided in Section 7.5 of Appendix C of the Draft EIS (with the associated risk registers provided in ARUP 2008).

No risk assessment for the Northern Territory transport option

Section 7.18 of Appendix C of the Draft EIS noted that there was no specific workshop convened for the Northern Territory transport option (NTTO). As noted in Section E4.11 of Appendix E of the Draft EIS, this does not mean no risk assessment was performed. Workshops are one means of collecting raw data and information for a risk assessment. All of the components for the NTTO had been adequately covered in other workshops, namely the concentrate transport workshop, the transport workshop (specifically the uranium oxide transport section), the construction workshop and the closure workshop.

The specific relevant risk items from each of these workshops were collated and checked by the risk facilitator, a transport adviser and the occupational health, radiation and environmental specialist. A gap analysis was also undertaken to identify whether any specific risks had been missed by the work in these other workshops.

Uranium shipping

A submission asserts that there was no risk assessment undertaken on uranium shipping. This is incorrect. Section 7.1 of Appendix C of the Draft EIS described the risks associated with uranium shipping. In addition, the raw data from the risks registers are provided in ARUP (2008).

Issue:

It was noted that some statements in the risk assessment could not be audited and some were contradictory in relation to the evaporation ponds, as follows:

- criteria for 'intolerable' risks in relation to impacts of fauna provides no quantitative data
- Appendix C states evaporation ponds are unacceptable, yet concludes that there were no unacceptable risks for the proposed expansion

Submission: 301

Response:

Before addressing the specific issues in this submission, it is noted that the risk assessment for evaporation ponds for the proposed expansion provides an excellent example of how the iterative assessment and design refinement process was undertaken for the Draft EIS (this iterative process was described in Section 1.6.2 of the Draft EIS). In summary, the risk assessment established that providing additional evaporation ponds would entail an 'intolerable' risk. As a result, the proposed tailings storage design was modified to avoid the need to construct new evaporation ponds. This was achieved in several ways, including increasing the density of deposited tailings, recycling additional liquor back to the metallurgical plant, using larger tailings cells to increase evaporation, and using small, covered balance ponds to accommodate excess liquor generated from large rainfall events.

The first issue raised in this submission refers to the criteria for assessing the risk level for additional evaporation ponds in relation to the possible number of bird deaths that might occur due to the installation and operation of evaporation ponds. The submission expressed concern that the criteria cannot be audited because data on the current level of bird deaths were not provided. The submission also noted that the tally of bird deaths recorded for the existing evaporation ponds may underestimate the actual number of deaths.

While these observations may be correct (and indeed data on current bird deaths, and the likely underestimation of these figures, were noted in Section 15.5.7 of the Draft EIS), it is important to note that risk assessments are inherently qualitative in their nature. It is not important to know the exact number of bird deaths and therefore set this exact number as the criterion for assessing the consequence in risk assessment; a broader, qualitative approach is more useful. In developing the risk assessment criteria, a consequence value for bird deaths above the current rates was established, together with an assessed likelihood of this happening, which resulted in an 'intolerable' rating for this particular risk event. As there is no higher risk rating than 'intolerable', no amount of additional data would have changed this outcome.

Underpinning this is the fact that the Draft EIS risk assessment process was conservative, which means that risks are assessed to be higher than they actually might be.

With regard to the second issue raised in the submission, Chapter 26 and Appendix C of the Draft EIS noted that a primary aim of the risk assessment was to identify project components or events that were deemed to be 'intolerable' if the risk remained unmitigated. Project personnel then developed mitigation and control measures to reduce the risk to a tolerable level. In some cases, such as the option of building additional evaporation ponds, the risk could not be mitigated and the project component (or event) was deemed to be unacceptable and removed from the project design.

The evaporation ponds for the expanded TSF were a case in point. There were no mitigation measures identified to address the 'extreme' risk rating assigned to the installation of new evaporation ponds, and as a consequence they were removed from the proposed expansion project.

31.2 NEW RISK ASSESSMENTS

As discussed in Section 1.4 of the Supplementary EIS, there have been a few changes to the project scope since the publication of the Draft EIS in January 2009. This section discusses the outcomes of new risk assessments for some project changes and then responds to requests for additional risk assessments from some submissions.

Additional risk assessment work was conducted to address two of the five changes to the Draft EIS scope (i.e. a realignment of the access corridor, and tunnelling for the desalination plant outlet pipeline). A report of this work is provided in Appendix O to the Supplementary EIS, with a summary provided below.

As existing risk assessment work adequately covers possible risk events for the remaining three project configuration refinements described in Section 1.4, no additional risk assessment work was conducted. The three refinements being the:

- minor relocation of the TSF cells
- new eastern access road and on-site facilities
- trucking of ammonium nitrate (dangerous substances).

All additional risk assessment work was conducted as per the methods undertaken in the Draft EIS, which was described in Chapter 26 of the Draft EIS. That is, workshops were convened with appropriate design and environmental personnel and were conducted by an experienced risk facilitator.

As with the original risk assessment work, any 'extreme' risks were deemed 'intolerable' and therefore required changes to the project or commitment to management measures. The risks were then reassessed incorporating these changes. Risks that were categorised as 'high' or 'moderate' were transferred to the project EMPs as per Chapter 29 of the Supplementary EIS.

Access corridor realignment risk assessment

The original access corridor alignment and the proposed realignment are illustrated in Figure 5.18 of the Supplementary EIS. The main change from a risk perspective is that the road runs past the Port Augusta airport and runs parallel to the main Port Augusta to Whyalla road. The risk register developed for the Draft EIS was revisited with these changes in mind and changes are provided in Appendix O of the Supplementary EIS. Briefly, the additional risks were:

- 2 high
- 0 medium
- 2 low.

The two risks rated as 'high' are as follows:

- public traffic incidents during construction, potentially leading to injuries due to drivers being distracted by movement of the large equipment
- public traffic incidents during operations, potentially leading to injuries due to drivers being distracted by movement of the large equipment.

Tunnelling risk assessment workshop

BHP Billiton is intending to install the outfall pipeline for the desalination plant by means of subterranean tunnelling. For completeness, the risk assessment workshop on this project change also investigated risks associated with a change in the installation method for the intake pipe even though this pipe would continue to be installed by the trenching method assessed in the Draft EIS.

The results of the additional risk workshop on this aspect, and the associated risk register, are presented in Appendix O of the Supplementary EIS.

In all, 107 risks were identified, as follows:

- 0 extreme
- 24 high
- 32 medium
- 51 low.

Eighteen of the 24 high risks were related to occupational health and safety during the tunnel construction and are summarised as follows:

- failures with lifting equipment
- failure to maintain security measures during construction, leading to unauthorised access
- confined spaces in tunnels, leading to fatality
- failure of ventilation fans
- water inflow into tunnel, resulting in flooding
- helicopter accident
- accident during diving.

Occupational health and safety-related risks would be managed in the manner described in Section 26.3.3 of the Draft EIS, that is, under the existing BHP Billiton Fatal Risk Control procedures (refer Chapter 22 of the Draft EIS for details).

The environmental and social 'high' risks are provided in Table 31.1, together with reference to the relevant EMP (refer Section U1.2 of Appendix U of the Draft EIS).

Table 31.1 High risks (non-OHS) for tunnelling

Receptor	Event	Where addressed (EMP)
Groundwater	Failure of base of spoil treatment ponds, leading to seepage to groundwater	ID 4.3
Social	Transport of soil from site causes greater public concern than expected	ID 5.1
Social	Failure of spoil pipeline, leading to surface impacts	ID 5.1
Flora	Failure of spoil pipeline, leading to surface impacts	ID 4.5
Physical	Failure of spoil pipeline, leading to surface impacts	ID 1.1
Social	Failure of materials transfer at sea, leading to oil release to sea	ID 5.1
Social	Social effects of blasting underestimated, leading to public concern	ID 5.1

Issue:
Additional risk assessments were requested for specific situations or events identified by some submissions.

Submissions: 1, 2 and 6

Response:

As noted above, a detailed report of the methods applied and findings from the additional risk workshops undertaken to address these issues is provided in Appendix O to the Supplementary EIS, with a summary provided below.

All additional risk assessment work was conducted using the methods undertaken in the Draft EIS, which was described in Chapter 26 of the Draft EIS. That is, workshops were convened with appropriate design and environmental personnel and were conducted by an experienced risk facilitator.

As with the original risk assessment work, any 'extreme' risks were deemed 'intolerable' and therefore required changes to the project or commitment to management measures. The risks were then reassessed, incorporating these changes. Risks that were categorised as 'high' were transferred to the project EMPs, as per Chapter 29 of the Supplementary EIS.

Some submissions requested that specific items (including particular project components and events) be risk-assessed and that some risk levels be risk-assessed. A summary of these with the relevant outcomes is provided in Table 31.2.

In total, 55 risks were reviewed and 56 new risks were identified and assessed.

Note that the ID numbers in Table 31.2 refer to line items in the respective risk registers (ARUP 2008; ARUP 2010) and the following abbreviations have been used:

- L – low
- M – medium
- H – high
- E – extreme

Table 31.2 Specific additional risk work from public submissions

Risk register	Submission comment	Outcomes of additional work	Intolerable risk identified
Water	The likelihood that the risk profile is different than was initially indicated for the desalination plant, given that the workshops assessed intake and outfalls located further out into Spencer Gulf than was indicated in the Draft EIS.	36 existing risks reviewed taking into account inlet and outfall pipes being further out in Spencer Gulf. One change to assessment – risk to fishermen and aquaculture increased from L to M due to pipes being closer to fishermen	No
	Comment included with ID 24 indicates that groundwater is not used for human consumption. However, groundwater contaminated by leakage from the sludge/evaporations basins could have an impact on the marine environment through migration off-site. This would also need to be considered.	4 risks added in relation to seepage from sludge and evaporation ponds – all M or L risk ratings	No
	It does not appear that potential impacts of chlorinated water on vegetation and the environment due to pipeline burst have been considered.	3 risks added in relation to pipeline failure – all L	No
Construction	ID 24 and ID 25 do not include issue related to infiltration to soil and contamination of groundwater as a potential risk.	5 risks added in relation to fuel contamination – all L	No
	ID 42 refers to sediment discharge due to excavation/ dredging activities being a similar event to sediment from a storm. However, the risks due to sediment from earthworks activities are additional to normal events and may result in an increased impact.	13 risks added in relation to discharge during excavation and dredging – all M or L	No
	ID 228, an additional item should be included to reflect the interim measures for wastewater treatment and associated risks.	7 risks added in relation to liquid effluent control. 2 H risks for OHS and physical receptors for failure of waste management processes.	No
Township	ID 10–ID 13 do not appear to consider the potential impacts of dust on vegetation.	2 risks added in relation to inaccurate modelling leading to increase in dust impacts – all L.	No
	ID 74 does not appear to have considered the potential for groundwater contamination as a result of spills to soil and migration to groundwater.	1 risk added in relation to accidental release of fuel – M.	No
	ID 87–ID 92, no consideration of seepage from wastewater lagoons and impact on groundwater.	5 risks added in relation to spillage and seepage – 2 H risks and others M and L.	No
Process – tailings	ID 25, risk event refers to acid contamination and has not included contamination by heavy metals and radionuclides.	3 new risks added – all M or L.	No
	ID 26, an increase in water levels would also increase the driving head and could have an impact on assumed groundwater migration and potential impact timeframes.	3 existing risks reviewed in relation to changes in groundwater aquifer – 1 risk (H) added to water receptor. 2 new risks added in relation to changes in groundwater quality in water receptor – one M and one L.	No
	ID 60, failure of the base liner would result in increased seepage and impact on groundwater, which has not been considered a credible risk.	1 new risk added in relation to changes in groundwater aquifer in water receptor – H.	No

Table 31.2 Specific additional risk work from public submissions

Risk register	Submission comment	Outcomes of additional work	Intolerable risk identified
Process – balancing ponds	ID62, failure of the baseliner would result in increased seepage and impact on groundwater, which has not been considered a credible risk.	2 existing risks reviewed in relation to changes in groundwater aquifer – 1 risk (H) added to water receptor. 2 new risks added in relation to changes in groundwater quality in water receptor – one M and one L.	No
Mining	There is no consideration of seismic risks from de-stressing of rock during mining.	4 new risks added related to de-stressing of rock while mining – all M or L. In-pit slope stability reassessed – OHS risk increased from M to H.	No
	ID 83–85. There appears to be no consideration of the risks of acid drainage in the low-grade stockpile.	7 existing risks reviewed – risk modified to include low-grade material stockpile. No changes made.	No
	ID 117, the fact that storage facilities are bunded does not necessarily mean that there would be low impacts. Long-term leakage from storage tanks at low rates if not detected early can contaminate soil and groundwater. This could be an issue where limestone is near the surface, providing a preferential flow path to groundwater.	1 new risk added related to leak or failure of fuel containment system – H in the water receptor.	No
Landing facility	ID 14 refers to turbidity impacts on vegetation. In addition, there could be impacts on marine fauna due to smothering as the sediment settles on the seafloor.	No new risks added in relation to silt plume smothering invertebrates on the seafloor (not a credible risk)	No
	ID 50 and 51 refer to noise levels exceeding pollution levels and medium risk levels. The EIS modelling indicates that noise levels exceed EPA levels, so risk levels perhaps should be high.	2 new social risks added in relation to noise from operation of the landing facility. One risk rated as E (residual risk H) and one as H.	Yes

One 'extreme' (E) risk was identified during the additional risk assessment work. The addition of the following commitment reduces this potential risk from extreme to high, and therefore with appropriate controls it is considered to be tolerable; BHP Billiton would ensure that necessary measures were implemented to maintain operating noise levels for the proposed landing facility within applicable limits.

Issue:

It was suggested that a high-level risk assessment is required to compare the risks of tailings disposal in a surface tailings facility and in the newly created open pit.

Submission: 10

Response:

Section 4.1 of the Supplementary EIS addresses the options of partial or complete backfilling of the open pit with tailings and demonstrates the impracticality of this option for Olympic Dam. As such, a new risk assessment for this rejected project alternative is not provided.

The Draft EIS provided a comprehensive impact and risk assessment of the preferred tailings disposal method and demonstrated that the environmental, health and social impacts are acceptable. The TSF has been designed to contain all tailings in perpetuity.

Issue:

It was suggested that the risk and impacts of a flood sweeping across the region of Olympic Dam and overflowing the tailings should have been considered.

Submission: 27

Response:

To overtop the existing tailings cells and proposed tailings cells at design height, it would require a rainfall event 1,470 and 3,190 times greater than a 1:100-year rainfall event, for either of the existing cells or proposed cells.

The walls of the existing tailings storage facility are about 22 m high and have a current design height of 30 m. The proposed tailings cells have a design height of 65 m, and they would be established initially at a height of 10 m and each subsequent rise would be in increments of 10 m. Olympic Dam is about 100 m above sea level and almost 300 km inland.

Section 8.4.2 of the Draft EIS described the potential for flooding and storm events in the Olympic Dam region and Section 11.3.3 of the Draft EIS described the effects of flooding in the region's recorded history. A rainfall event in the Olympic Dam region that is predicted to occur once in 100 years (1:100) has an intensity of 204 mm over a five-minute period, 5.7 mm over a 24-hour period or 2.2 mm over a 72-hour period (refer Table 8.2 of the Draft EIS).

Issue:

It was suggested that the risk of another fire in the solvent extraction plant should be considered.

Submission: 318

Response:

The risk of fires in the copper and uranium solvent extraction plants were considered as part of the Draft EIS risk assessment. The results were included in the risk assessment summaries provided in Appendix C and ARUP (2008). The health and safety risk was rated as 'high' and therefore required specific management control measures.

The assessment noted that any new design would be required to be equivalent to or better than the recently rebuilt solvent extraction plant at Olympic Dam.

More details on the new extraction plant are discussed in Section 25.2.1 of the Supplementary EIS.

Issue:

It was asked whether the risks associated with voids under the proposed tailings storage facility (TSF) were considered. In particular, the submission noted that doline structures beneath the proposed TSF could present a construction hazard. The submission noted that voids have been detected in the Andamooka Limestone during previous drilling and are likely to exist across the new TSF area. It was also suggested that sub-surface structures are to be identified using survey techniques such as ground-penetrating radar to reduce the risk of structure collapse.

The submission also requested clarity on whether the possibility of new cavities being formed as a result of downwards percolation of acidic water through smaller preferential pathways had been considered in the Draft EIS risk assessment.

Submission: 1

Response:

The response below has been divided into five sections to address each separate aspect raised in the submission. In addition, Chapter 12 and Section 26.2.3 of the Supplementary EIS provide further information.

Identification of doline structures

The operation of the existing mine and processing facilities over the past 20 years has confirmed the presence of doline and karst structures in the Olympic Dam area. The operation is experienced in the potential risks from these features and they are managed by detailed site investigation during project planning, appropriate design to address potential risks, site investigations and proof rolling during construction.

Use of GPR to reduce the risk of structural collapse

Ground-penetrating radar (GPR) and other geophysical techniques have been trialled at Olympic Dam and elsewhere in attempts to identify karst features and dolines. These techniques have been unsuccessful at Olympic Dam as the dolines are filled by fine soils, resulting in a lack of contrast between the filled doline and surrounding ground. While various geophysical techniques have been useful at some sites, they have been unsuccessful at others where there is inadequate contrast between filled dolines and the surrounding ground.

Proof rolling is the most effective means of identifying near-surface dolines for Olympic Dam and has been used successfully elsewhere (Kranjc 1989).

Management and sealing of identified dolines

Any dolines identified during site investigation or proof rolling would be excavated and filled with clay to minimise the risk of dolines providing a preferred flow path. The techniques developed at Olympic Dam for addressing the risk of dolines have been effective at preventing significant leakage via doline features at tailings and water storage facilities over the past 20 years.

The design of water and tailings liquor storage facilities include the use of a lining system and *in situ* calcareous clays to provide a barrier to reduce seepage rates and minimise the risk of preferential flow from the ponded water via dolines.

The design and operation of the TSF includes:

- minimising liquor ponding on the floor of the facility during initial beach development
- deposition of tailings in thin layers to allow drying and consolidation of tailings, which results in a low-permeability material increasing in thickness over time
- collecting and removing supernatant tailings liquor.

The design and operation of the TSF therefore minimises the availability of liquor for seepage and reduces the risk of preferred flow paths developing along dolines. Tailings would only flow into a doline in the event that a preferred flow path was developed, but the tailings themselves would plug the doline and close the preferred flow path, resulting in no material environmental impact.

Possibility of new cavities forming

There is a low risk that new cavities would form or that existing cavities would expand at any detectable rate. There is a possibility that dolines filled with fine material could develop into a preferential flow path given a prolonged exposure to a source of ponded water. However, management practices during operation minimise this risk and if a preferred flow path via a doline did develop it would be plugged by tailings, as noted above. After closure there would be a significant thickness of tailings restricting seepage from any ephemeral ponded water and minimising the risk of a preferred flow path developing.

Role of risk assessment

The risk assessment identified doline and seepage risk items and these were documented in Chapter 26 and Appendix C of the Draft EIS.

Issue:

The risk of Australia becoming a target for coups or wars in order for foreign countries to get access to uranium was raised.

Submission: 318

Response:

Australia's national security is the responsibility of the Australian Government.

BHP Billiton is able to mine and export uranium only with the approval of the Australian Government.

Issue:

It was questioned whether the risk of containers of uranium oxide concentrate becoming targets for attacks in order to be 'dirty bombs' was considered.

Submission: 318

Response:

The risk of malicious intent was considered in the risk assessment presented in Chapter 26 and Appendix C of the Draft EIS, with the raw data from the risk assessment provided in ARUP (2008). ARUP (2008) identified a number of potential risk events, as follows:

- malicious intent including theft of commodity leading to a potential security threat
- perceptions of terrorist threats during various handling stages
- malicious action or sabotage leading to derailment
- malicious release of uranium oxide in urban, rural and sensitive areas.

The specific risk events were classified as either low or medium risk, given that the transport of the material complies with all national and international standards for its safe transport.