

Appendix 4

Best practicable technology assessment



BPT RANKING DESCRIPTORS

Version: Version 12
Date: December 2013

		Ranking				
		Inadequate Does not meet current standards & modifications unlikely to affect this result	Poor Does not meet current standards but modifications might reverse this conclusion	Acceptable Meets Current standards	Good Option exceeds current standards	Excellent Option is Best Practice
BPT Aspect		1	2	3	4	5
Traditional Owner Culture & Heritage						
Living culture (Operations)	Cultural practices, traditions and customs are an important part of life for Aboriginal people and communities; this is the living culture. This aspect considers the Traditional owners cultural practices and how these might be impacted by the option being considered. Included is access to country and the ongoing care of country including considerations such as bush tucker, bush medicine, flora and fauna, habitation sites, traditional ceremonies, dreaming sites. Note: health aspects of all members of the public including Aboriginal people is assessed under <i>Community Health & Safety</i> .	The option would impair traditional beliefs or traditional practices and ceremonies.	The option would impair traditional beliefs or traditional practices and ceremonies. However, opportunities for ameliorating this assessment have been identified and could be explored further.	The option would not change or impair current traditional beliefs or traditional practices and ceremonies, or impairment is temporary and acceptable to the Traditional owners with appropriate ceremony.		The option would assist Aboriginal communities in maintaining cultural activities, practices and ceremonies
Cultural heritage	Ranger Project Area contains sacred and archaeological places, sites and objects of significance. These form an important part of Aboriginal culture that has been practised for over 50,000 years. This aspect concerns the impact on such important cultural items.	The option disturbs or is perceived to disturb sacred and archaeological places, sites, and sites of significance. The option interferes with access to these sites. Adoption of the option would be considered unacceptable to Traditional Owners and could result in legal challenge under heritage legislation.	Adoption of the option could be perceived to disturb sacred and archaeological places, sites, and sites of significance and/or result in interference with access to these sites. Options have been identified that could ameliorate this assessment and are being investigated with Traditional Owners.	The option does not disturb sacred or archaeological places, sites or objects of significance. Such disturbance could occur close to such sites but Traditional Owners assess the proximity as acceptable. However normal routes to some sites may be subject to limited access restrictions resulting in discouragement of Traditional Owner cultural sites of significance.	The option does not disturb sacred and archaeological places, sites and objects of significance and any disturbance associated with the option is remote from such sites. However normal routes to some sites may be subject to limited access restrictions resulting in discouragement of Traditional Owner cultural sites of significance.	The option does not disturb sacred and archaeological places, sites and objects of significance and any disturbance associated with the option is remote from such sites. The option provides for ongoing access to cultural sites by Traditional Owners.
Protection of People and the Environment during the Operational Phase						
Community Health & Safety	This aspects assess potential impacts on the health and safety of Aboriginal and non-Aboriginal members of the local community. Such impacts could arise through radiation exposure or chemical exposure as a result of dispersion of contaminants through the atmosphere, surface water or ground water. All such exposures must comply with national and internationally accepted standards.	Estimates of the likely impacts on the health and/or safety of members of the local community show that internationally accepted standards will probably not be met. No options have been identified for appropriate modification of option design to ensure standards are met.	Estimates of the likely impacts on the health and/or safety of members of the local community show that internationally accepted standards will probably be met but the margin for error is small. Options have been identified for appropriate modification of option design that could ensure standards are met.	Estimates of the likely impacts on the health and/or safety of members of the local community show that internationally accepted standards will be met and options for additional control are available if needed in practice. The option will satisfy health and safety standards for members of the public.	Estimates of the likely impacts on the health and/or safety of members of the local community show that internationally accepted standards will be met comfortably and no additional controls need be considered.	The option poses no significant risk for the health and safety of members of the public and is established as best practice (from a health and safety perspective) in mines or other industries around the world.
Socio-economic Impact on Local Communities	This aspect considers the socio-economic impacts of the option in relation to: • social impacts on the region and Jabiru (including lifestyle, alcohol and drug, health and educational, regional demographics). • economic impacts (including employment, business opportunities and taxes)	The option would probably result in unacceptable negative social or economic impact on Jabiru and the regional community. Options for amending this assessment have not been identified.	The option could result in unacceptable negative social and economic impact on Jabiru and the regional community. Options for amending this assessment have been identified and would probably be successful.	The option has a neutral socio-economic impact on Jabiru and the surrounding region relative to the current situation	No negative socio-economic impacts on Jabiru and the regional community have been identified for this option and there are some probable positive outcomes that would be welcomed by the community.	Adoption of the option would have a clear positive impact on Jabiru and the surrounding region
Ecosystems & Natural world heritage values of Kakadu National Park	This aspect assesses potential impacts during the operational period on: • scale and integrity of landscapes and ecosystems • rare and endangered species • flora and fauna species diversity. The very highest environmental protection standards apply to Kakadu National Park to reflect its World Heritage and Ramsar status. Minimal impact ranks highest.	Assessment of the potential environmental impact arising from the adoption of the option demonstrates significant risk to some of the world heritage values of Kakadu National Park or its Ramsar status. There appear to be no viable options for reducing this risk adequately.	Assessment of the potential environmental impact arising from the adoption of the option demonstrates that some of the world heritage values of Kakadu National Park or its Ramsar status could be at risk. Viable options for modifying the option to reduce the risk to an acceptable low level have been identified.	Assessment of the potential environmental impact arising from the adoption of the option demonstrates a low risk to the World Heritage or Ramsar values of Kakadu National Park. In addition, management options are available to ensure low impact should unexpected events occur.	Assessment of the potential environmental impact arising from the adoption of the option demonstrates a very low risk to the World Heritage or Ramsar values of Kakadu National Park. While contingency action should not be necessary, management options for additional control have been identified.	Assessment of the potential environmental impact arising from the adoption of the option demonstrates that the risk to the World Heritage or Ramsar values of Kakadu National Park is negligible.
Ecosystems of the Project Area	This aspect considers the impact of the environment of the Project Area. While it is clear that environmental impact is inevitable on the Project Area during the operational period, such impact should be minimised. Minimal impact rank highest.	The option results in significant environmental disturbance on the Project Area that could be avoided by the adoption of alternative options. There appear to be no viable options for reducing this impact significantly.	The option results in significant environmental disturbance on the Project Area that could be avoided by the adoption of alternative options. However, viable options for reducing this impact have been identified.	The option results in environmental disturbance on the Project Area comparable with that caused by the adoption of alternative options.	The option results in a lower level of environmental disturbance on the Project Area than that caused by the adoption of most alternative options.	The option results in a low level of environmental disturbance on the Project Area and the impact would be less significant than that caused by the adoption of all alternative options.
Long term protection of the environment (Operations only)	This aspect considers the impact of the option on the protection of people and ecosystems of Kakadu National Park following rehabilitation. Minimal impact rank highest.	The option results in unacceptable long-term health or ecological impacts.		The option offers long-term protection of the health of members of the public to currently accepted standards and of local ecosystems to the standards required for Kakadu National Park.		The option offers long-term protection of the health of members of the public to currently accepted standards and of local ecosystems to the standards required for Kakadu National Park and is best practice compared to other mines.
Fit for Purpose						
Proven technology	This aspect considers the technical certainty of the option. Proven and demonstrated performance ranks higher than unproven.	Unproven, theoretical support only, evaluation or historical performance proven inadequate. Further testing unlikely to improve confidence.	Unproven but further practicable testing could improve confidence and, if successful, could yield significant benefits.	Proven operation at a small number of sites and history of successful application of the technology.	Proven operating performance at multiple sites with demonstrated results being achieved.	Proven operating performance at multiple sites with results demonstrating high performance and reliability.
Technical performance	This aspect, for individual discipline assessments, considers the effectiveness of the option in achieving its technical objective and its robustness to variations in feed and consumables. For the overall project assessment, consider the effectiveness of the option in maximising the uranium processed at Ranger in the remaining years before closure while still meeting all closure requirements.	For individual discipline assessments, the option considered is assessed as a standard of performance that is inadequate compared with the other options and is considered inappropriate in achieving a sound business case. For the overall project assessment, adoption of the option is likely to result in either cessation of mining before the extraction of the full resource is achieved or milling before processing of all ore is complete. Modifications of option design are not expected to achieve a significantly better outcome.	For individual discipline assessments, the option considered is assessed as a standard of performance that is inferior to that of most other options and is considered poor in achieving a sound business case. For the overall project assessment, adoption of the option is likely to result in either cessation of mining before the extraction of the full resource is achieved or milling before processing of all ore is complete. However, viable modifications of option design have been identified that should reverse this assessment.	For individual discipline assessments, the option considered is assessed as a standard of performance that is comparable with other options and is considered appropriate in achieving a sound business case. For the overall project assessment, adoption of the option is likely to achieve extraction and processing of the full uranium resource before cessation of activities is required to complete closure in the time legally required.	For individual discipline assessments, the option considered is assessed as a standard of performance that is better than most other options considered and is considered appropriate in achieving a good business case. For the overall project assessment, there is a high probability that adoption of the option would achieve extraction and processing of the full uranium resource before cessation of activities is required to complete closure in the time legally required.	For individual discipline assessments, the option considered is assessed as a standard of performance that is the best of all options considered and is considered appropriate in achieving an excellent business case. For the overall project assessment, adoption of the option would almost guarantee extraction and processing of the full uranium resource before cessation of activities is required to complete closure in the time legally required.
Environmental Protection	This aspect considers the standard of environmental protection achieved relative to current best practice in other uranium mines, taking into account the age of the practice. While the ERs specify uranium mining, comparison with best performing technologies in any industry will usually be considered appropriate. The importance of performance and protection of the environment is paramount. Even old technology may rank highly if it is the best currently available from an environmental perspective.	The option achieves a very poor standard of environmental protection compared to other options adopted in uranium mining elsewhere in the world.	The option achieves a standard of environmental protection comparable with that achieved in uranium mining elsewhere in the world with minor exceptions for which viable management options have been identified.	The option achieves a standard of environmental protection comparable with that achieved in uranium mining elsewhere in the world.	The option achieves a standard of environmental protection that is on a par with the best performance achieved in uranium mining elsewhere in the world.	The option achieves a standard of environmental protection that is significantly higher than that achieved in any other uranium mining operation elsewhere in the world.

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BPT Aspect	BPT Aspect Description					
CAPEX	The capital requirements have a bearing on overall project viability. The option with lower capital cost will rank higher.	The option has associated capital costs that would make the project economically prohibitive.	The option has higher capital costs than alternative viable options.	The option has expected capital requirements that are comparable with other viable alternatives.	The option has expected capital requirements that are lower than those of other viable alternatives.	The option has very low capital cost requirements and contributes significantly to the overall project value
Operational Adequacy						
Occupational Health & Safety	This aspect contrasts how inherently safe the option is. Occupational health and safety (including radiation safety) of the workforce is of paramount importance. Options requiring least controls or controls higher in the control hierarchy to ensure safety rank high.	Safety: The option is inherently unsafe and safe operation is very dependent on non-engineered controls. Health: The option results in unacceptable health impacts on the workforce.	The option is safe when control actions are implemented but controls are from lower in the control hierarchy. The option will satisfy Rio Tinto occupational health requirements.	The option is safe when normal levels of control actions are implemented. The option will satisfy Rio Tinto occupational health requirements.	The option is safe when control actions are implemented and the controls are from higher in the control hierarchy. The option will satisfy Rio Tinto occupational health requirements.	Safety: The option is inherently safe and only minor aspects require safety controls. Health: The option will satisfy Rio Tinto occupational health requirements and is best practice relative to other mines.
Operability	This aspect considers how much effort is required to operate the equipment or process. Lower effort and simpler operations rank high.	The option is difficult to operate requiring extensive control and support effort to achieve results.	Some operational aspects of the option have been identified that could require limited control and support effort to achieve desired results.	The option is controllable to normal levels.	The option has been assessed as being readily controlled and stable.	Extensive evidence is available demonstrating that this option is easily controlled and is inherently stable.
Inherent availability and reliability	This aspect considers the inherent availability associated with the option. Some options are simple by design or have features that make them highly reliable resulting in high availability. Such options rank high. Longevity of an option should be considered under this criterion.	The option is very sensitive to a single plant item failure and major disruptions could result from such failures.	The option is intolerant of single plant item failures but major disruptions are unlikely.	The option can tolerate single plant item failures with minor disruptions experienced.	The option is robust and performance is not unduly impacted with single plant item failures	The option is highly robust and the effect on performance arising from single plant item failures would be minimal.
Maintainability	This aspect considers the effort required for maintenance of the plant and equipment. Some options will require less effort and cost to maintain as the access is adequate, parts are readily available and skill and repair equipment levels match those readily available. If maintenance costs are high as a result of the plant being old or because the arrangement of plant makes maintenance costly then this aspect would rank low.	The option is difficult to maintain and/or requires high levels of maintenance given the equipment age and/or load placed on equipment (duty levels). Aspects include plant age, duty levels, difficult access, inadequate level of spares, high levels of skills and equipment required for maintenance.	The option is likely to require a moderate level of maintenance and commensurate costs to ensure an adequate level of operability.	The option is maintainable with normal levels of maintenance input. The age of plant and duty placed on equipment results in normal levels of maintenance effort.	The option is readily maintained and maintenance effort is low. Aspects include equipment age and/or duty placed on equipment, easy access, available spares, normal skill levels and maintenance equipment.	The option is very easily maintained and maintenance effort will be extremely low compared to alternatives. Aspects include equipment age and/or duty placed on equipment, easy access, available spares, normal skill levels and maintenance equipment.
OPEX	Operating costs have a large impact on project value. Options with low operating costs rank high.	Adoption of the option would result in very high operating costs (consumables, people, maintenance, power) compared to alternative options and would have a very significant impact on overall project costs.	The option has higher operating costs than some of the alternatives in terms of consumables, people, maintenance, power.	The option has normal levels of operating costs	The option has lower operating costs than most alternatives in terms of consumables, people, maintenance, power.	The option has very low operating costs compared to alternatives in terms of consumables, people, maintenance and power; and would make a significant reduction in overall project costs.
Rehabilitation & Closure						
Environmental Acceptability (Operations only)	This aspect considers the need to rehabilitate the site to the standards required to enable its incorporation into Kakadu National Park following closure. Options that avoid the need for significant rehabilitation measures would rank highly.	Adoption of this option would result in significant difficulty in meeting closure criteria and no viable options to redress the issue have been identified.	Adoption of this option would result in difficulty in meeting closure criteria but viable options to redress the issue have been identified	Rehabilitation measures to meet closure criteria are as expected for equivalent mine and processing operations	Rehabilitation measures to meet closure criteria are expected to be less demanding than for equivalent mine and processing operations elsewhere	Minimal rehabilitation measures required to meet closure criteria.
Cost (Operations only)	This aspect considers the cost associated with closure and whether or not the option would significantly detract from overall project value.	Adoption of the option would result in very high closure costs compared to alternative options and would have a very significant impact on overall project value	The option has higher closure costs than some of the alternatives and would have a significant impact on project value	Closure costs are comparable to those for other options	Closure costs would be relatively low and would improve project value	Closure costs are expected to be very low and would result in a significant increase in project value
Schedule	This aspect addresses the need to achieve closure within a period that meets stakeholder expectations and any legal requirements. The principal legal requirements are (a) cessation of milling by January 2021 and (b) completion of all rehabilitation works and relinquishment of the site by January 2026. However, there are operational deadlines that must be met to achieve these legal deadlines. These operational deadlines need to be carefully specified and options need to be assessed against their suitability for meeting the required schedule.	The detailed schedule for implementation of the option predicts that the operational deadlines will not be met. Hence there is very low confidence that adoption of the option would ensure that legal requirements on cessation of activities on the Ranger Project Area will be met. Modifications of option design are not expected to achieve a significantly better outcome.	The detailed schedule for implementation of the option predicts that there will be difficulties in meeting the operational deadlines. Hence confidence is poor that adoption of the option would ensure that legal requirements on cessation of activities on the Ranger Project Area will be met. However, viable modifications of option design have been identified that could achieve a significantly better outcome.	The detailed schedule for implementation of the option predicts that the operational deadlines will be comfortably met with relative ease and the schedule has been assessed as robust. Hence there is reasonable confidence that adoption of the option would ensure that legal requirements on cessation of activities on the Ranger Project Area will be met. An action plan is in place to monitor activities on the critical path and introduce active additional management if required.	The detailed schedule for implementation of the option predicts that the operational deadlines will be comfortably met with relative ease and the schedule has been assessed as robust. Hence there is a high level of confidence that adoption of the option would ensure that legal requirements on cessation of activities on the Ranger Project Area will be met. An action plan is in place to monitor activities on the critical path and introduce active additional management if required but it is not expected to be required.	The detailed schedule for implementation of the option predicts that the operational deadlines will be met with considerable ease and the schedule has been assessed as robust. Hence there is a very high level of confidence that adoption of the option would ensure that legal requirements on cessation of activities on the Ranger Project Area will be met. An action plan is in place to monitor activities on the critical path and introduce active additional management if required but is very unlikely to be required.
Constructability						
Construction Occupational Health & Safety	This aspect contrasts how inherently safe any option with a major construction component is to construct. Occupational health and safety (including radiation safety) of the workforce is of paramount importance. Options requiring least controls to ensure safety rank high.	Safety: Construction aspects of the option are inherently unsafe and safe operation is very dependant on non-engineered controls. Health: Construction aspects of the option result in unacceptable health impacts on the workforce.	Construction aspects of the option are safe when control actions are implemented but controls are from lower in the control hierarchy. The option will satisfy Rio Tinto occupational health requirements.	Construction aspects of the option are safe when normal levels of control actions are implemented. The option will satisfy Rio Tinto occupational health requirements.	Construction aspects of the option are safe when control actions are implemented and the controls are from higher in the control hierarchy. The option will satisfy Rio Tinto occupational health requirements.	Safety: Construction aspects of the option are inherently safe and only minor aspects require safety controls. Health: Construction aspects of the option will satisfy Rio Tinto occupational health requirements and are best practice relative to other mines.
Construction Environmental and Cultural risks	This aspect addresses the likely environmental and cultural risks arising from the option during project construction. On-site disturbance needs to be minimised, Kakadu National Park must be protected and construction work needs to avoid sites of cultural significance. Risks associated with logistics such as the number and frequency of truck movements through Kakadu National Park must be considered as does work force numbers and the social impacts from transient construction workforce numbers.	The option would give rise to significant on-site disturbance or would threaten the ecosystems of Kakadu National Park or would require construction activity near culturally significant sites. Or the option would result in high numbers or high frequency of truck movements through Kakadu National Park. Or the option has negative social impacts associated with the construction workforce. Modifications of option design are not expected to achieve a significantly better outcome.	The option would give rise to significant on-site disturbance or would threaten the ecosystems of Kakadu National Park or would require construction activity near culturally significant sites. Or the option would result in high numbers or high frequency of truck movements through Kakadu National Park. Or the option has negative social impacts associated with the construction workforce. However, viable modifications of option design have been identified that should reverse this assessment.	Environmental and cultural risks associated with construction aspects of the project are relatively low and transient. Truck movements through Kakadu National Park are limited and the social impact arising from a relatively small transient construction work force are not expected to be of significant concern to the local community.	Environmental and cultural risks associated with construction aspects of the project are low and quite short-lived. Truck movements through Kakadu National Park are low and the social impact arising from a small transient construction work force are not expected to be of concern to the local community.	The option has low environmental and cultural risks during the project construction phase and has features that could significantly reduce such risks even further. The construction workforce numbers are very low as are the social impacts from the construction work force.
Construction complexity	This aspect addresses the project cost risks arising from uncertainty in schedule due to complexity, construction complexity and/or manpower effort required during project construction. Note construction CAPEX is included in CAPEX aspect.	The option has high or less certain construction costs, high work effort and/or construction complexity. Costs are relatively high and there is a high chance of cost over runs and delayed completion of the project. Modifications of option design are not expected to result in a significantly better assessment.	The option has higher or less certain construction costs than other options, higher work effort and/or construction complexity. Costs are relatively high and there is a chance of cost over runs and delayed completion of the project. However, viable options for modifications of option design have been identified that should result in a significantly better assessment.	The option has normal levels of construction costs, complexity and/or work effort resulting in normal levels of cost and schedule uncertainty. Cost over runs are less likely and would be less than that allowed for in normal contingency allowances. It is likely that the project would be completed as originally scheduled.	The option has relatively low construction costs, low complexity and/or the costs are reasonably predictable with relatively low chance of cost over runs. The work effort is medium for the option under consideration and the project will most likely be completed ahead of original schedule.	The option has very low construction costs and very low complexity and the costs are very predictable with low chance of cost over runs. The work effort is low for the option under consideration and the project will most likely be completed ahead of original schedule.