# APPENDIX D
# COMPARATIVE WORKER SAFETY ASSESSMENT

Intended for
**Hydro Aluminium Kurri Kurri Pty Ltd**

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RAMBOLL ENVIRON

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| Revision | **FINAL** |
| Date | **18//10/2017** |
| Made by | **S Taylor** |
| Checked by | **B Sinclair** |
| Approved by | **F Robinson** |
| Description | **Ramboll Environ Australia Pty Ltd has prepared this Comparative Worker Safety Assessment (CWSA) as supporting information for the Capped Waste Stockpile Waste Management Options Evaluation Study at the request of Hydro Aluminium Kurri Kurri.** |

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# 1. INTRODUCTION

This Comparative Worker Safety Assessment (CWSA) has been prepared by Ramboll Environ Australia Pty Ltd (Ramboll Environ) on behalf of Hydro Aluminium Kurri Kurri Pty Ltd (Hydro) to inform a Capped Waste Stockpile Waste Management Options Analysis (the Management Options Analysis) for submission to the Environmental Protection Authority (EPA). This CWSA was prepared to assess the implications to worker safety from the identified Management Options for the Capped Waste Stockpile (CWS) at the former Hydro Aluminium Kurri Kurri aluminium smelter at Hart Road Loxford (The Smelter).

## 1.1 Background

The objective of the Management Options Analysis relevant to this CWSA is to prepare a report for submission to the EPA that provides a detailed assessment of the options considered for the management of the wastes within the CWS (the Management Options).

The rational for, and background to, the identified Management Options is detailed in **Section 2** and **Section 3** of the Management Options Analysis. Six options (Management Options 2 to 7) have been identified for the management of the wastes within the CWS and for comparison against a do nothing scenario. These Management Options are the subject of the Management Options Analysis and this CWSA. A brief description of each of the CWS Management Options is provided in **Table D1-1**.

**Table D1-1: Capped Waste Stockpile Waste Management Options**

| Option | Description | Outline |
|---|---|---|
| Do Nothing | CWS remains *in situ* | The CWS would remain in its current location, with no improvement works. Ongoing groundwater, leachate and gas monitoring would occur at the CWS. Visual inspections would also be required to identify any faults in the capping layer. Long-term management and maintenance would comprise vegetation cover maintenance such as mowing, weed and tree/deep rooted plant removal and cap repairs as required. |
| 2 | Containment Cell | Removal of the CWS and onsite transport of materials for placement in an onsite Containment Cell. This would involve ongoing long term monitoring and maintenance of the Containment Cell for leachate, gas and any visual changes. |
| 3 | Sorting of Recyclables from the CWS and Treatment of Non-Recyclables Placed in Containment Cell | Removal of the CWS and onsite transport of materials for placement in an onsite Containment Cell. Potentially recyclable materials from the CWS (steel and carbon) would be sorted, cleaned, validated and make available for recycling. Non-recyclable materials from the CWS would be crushed prior to being treated to comply with the Chemical Control Order (CCO) and placement in the onsite Containment Cell. The ongoing maintenance and monitoring of the onsite Containment Cell would be as per Management Option 2. |
| 4 | Treatment of All Material within Containment Cell | Removal of the CWS and placement of all materials in the onsite Containment Cell with layers of lime interlayered with the placed CWS material. This option does not include any recycling or sorting of material. The ongoing maintenance and monitoring of the onsite Containment Cell would be as per Management Option 2. |
| 5 | Offsite Disposal of CWS to Licensed Waste Facility in NSW | Removal of the CWS, separation of the steel for cleaning and recycling and transport of the remaining waste offsite to a licensed waste management facility/facilities in NSW. Treatment to comply with the COO would occur at the receiving facility. There would be ongoing maintenance and monitoring at the receiving waste management facility/facilities. |
| 6 | Offsite Disposal of CWS to Salt Mine | Removal of the CWS material, separation of the steel for cleaning and recycling and heat treatment of the remaining material to 600 °C (in an onsite purpose built facility) prior to transportation offsite via road and rail to a salt mine in the Northern Territory. The receiving facility would dispose of the CWS material without further treatment. There would be ongoing maintenance and monitoring at the receiving waste management facility. |
| 7 | Onsite Destruction (Plasma Gasification) of CWS Material | Removal of the CWS material, separation of the steel for cleaning and recycling with the remaining waste material being subject to an onsite plasma gasification process to remove fluorides and cyanides. By-products of the plasma gasification process would include vitrified rock (slag) and elemental metal which would theoretically be suitable for a beneficial re-use. |

## 1.2 CWSA Objective

The purpose of this CWSA is to assist Hydro in comparatively assessing the worker safety risks arising from the seven potential management options identified for the CWS.

The objective of this CWSA is to assess the potential worker safety risks that may result from contact with or exposure to chemicals, interaction with vehicles and machinery, and other conditions, items and activities that pose a risk to workers as a result of implementing the Management Options.

In addition to considering the hazards associated with the tasks and activities that are required to be undertaken as part of the Option, the CWSA also assesses the worker safety risks associated with potential tasks or events associated with the Management Options which have a lower probability of occurring. For example, a truck turnover spilling contaminated load on public road or a minor or major cap repair. For the purpose of the Management Options Analysis these are known as 'alternative scenarios'.

The Worker Safety risks generated for each Management Option will be compared in conjunction with other risk factors: (Ecological, Health, Safety and Greenhouse Gas) when identifying the most appropriate Management Option for the CWS. This comparative assessment of the Management Options for the CWS will allow Hydro to determine the most viable Management Option.

## 1.3 CWSA Methodology

The CWSA has been prepared with consideration of the following:

- The procedure for a Preliminary Hazard Analysis (PHA) as described in the *Hazardous Industry Planning Advisory Paper No. 6 – Guidelines for Hazard Analysis* (Department of Planning, 2011). This will consider potential hazards associated chemicals and other materials.
- The Job Safety Analysis process as described in *How To Manage Work Health And Safety Risks Code of Practice* (WorkCover NSW, 2011).
- Australian Standard *AS4360:2004 Risk Management*.

This will consider the potential safety risks associated with specific tasks and activities identified for each option.

The key steps in the CWSA are the following:

- Identify the potential hazards to worker safety associated with a particular Key Action or alternative scenario.
- Nominate the proposed management approach to be applied to that hazard for each Key Action or alternative scenario.
- Determine the potential residual consequence of the hazard resulting from the Key Action or alternative scenario following implementation of the proposed management approach.
- Determine the likelihood of the hazard resulting from the Key Action or alternative scenario.
- For alternative scenarios, determine the probability of the task or event occurring.
- Using the Level Scores allocated for the Consequence Level, Likelihood Level and Probability Level, determine the Total Worker Safety Risk Score when considering the Key Actions and alternative scenarios.

It should be noted that potential chronic health risks to workers from chemicals (such as inhalation of asbestos) have been assessed in the Comparative Health Risk Assessment, which forms Appendix C of the Management Options Analysis.

## 1.4 CSWA Report Structure

This CSWA has the following structure:

- **Section 1** provides the background, objectives and a brief methodology for the CWSA.
- **Section 2** outlines the process of hazard identification and consequence analysis, likelihood of occurrence analysis and the risk level calculation methodology.
- **Section 3** presents the results of the risk level calculations and provides a discussion of the outcomes.
- **Section 4** provides concluding comments on the CSWA.

# 2. RISK LEVEL ASSESSMENT

## 2.1 Hazard Identification and Consequence Analysis

In order to identify the hazards and determine the consequence associated with the Management Options, including the additional events with varying probabilities of occurrence, **Appendix D1** outlines the following:

- The Key Actions required to be performed in order to complete the Management Option.
- The hazards associated with each of the Key Actions.
- The Consequence Level associated with the potential hazards.
- The proposed Worker Safety Controls to be implemented to address the potential consequence.
- The Residual Consequence of the main potential hazard following implementation of the proposed Worker Safety Controls.

The Consequence Level is determined based on the criteria described in **Table D2-1**. These Consequence Levels are provided a score used to calculate the Risk Score.

**Table D2-1: Consequence Level Definitions**

| Minor | Moderate | Serious | Major | Catastrophic |
|---|---|---|---|---|
| No injury associated with the activity. | First Aid injury. . | Lost time injury, medical treatment, restricted work injury. | Permanent disability.<br>Extensive injuries. | One or more fatalities. |

It should be noted that the analysis focuses on the major and specific safety issues associated with the task. There are a number potential safety risks that have not been included as they are common to all activities. For example this includes:

- The risks of accident during the transport of machinery (such as excavators and loaders) for delivery to and removal from the Smelter or other locations.
- Small vehicle accident (employees travelling to and from the Smelter or other location).
- Slips and trips.

Where tasks are common between options (appropriate to be included to inform the overall worker safety risk score), the same Consequence Level and Residual Consequence Level has been used for all options.

## 2.2 Likelihood of Occurrence Analysis

**Appendix D1** also identifies the Likelihood of the key hazards occurring.

The Likelihood Level is determined based on the criteria described in **Table D2-2**. These Likelihood Levels are provided a score used to calculate the Risk Score.

**Table D2-2: Likelihood Level Definitions**

| Rare | Unlikely | Possible | Likely | Almost Certain |
|---|---|---|---|---|
| May only occur in exceptional circumstances | Not likely to occur. Could occur once during the activity | Could occur once per year during the duration of the activity. | Will probably occur several times during the duration of the activity Known to have previously occurred. | Is expected to occur more than several times during the activity. |

Where tasks and hazards are common between options, the same Likelihood Level has been used for all those options.

In considering the likelihood of occurrence of a hazard a number of factors are considered, including:

- The duration of the action that presents the potential hazard.
- The number of times that a particular event presenting the potential hazard will occur.
- The distance or area covered by the activity presenting the potential hazard.

As such, the Likelihood Levels for some similar tasks are different. For example, it was determined that a truck transporting material to within a 200 km radius of the Smelter had a higher likelihood of an accident than a truck transporting material to within a 40 km radius.

## 2.3 Risk Level Calculation

The risk score is calculated by multiplying the Residual Consequence Level by the Likelihood Level. This score is then allocated a Risk Score as described in **Table D2-3**. This calculation was undertaken for each Key Action in each Management Option.

**Table D2-3: Risk Rating Matrix**

| **Likelihood Level** | **Consequence Level** | | | | |
|---|---|---|---|---|---|
| | Minor (1) | Moderate (10) | Serious (50) | Major (100) | Catastrophic (200) |
| Almost Certain (100) | 100 | 1000 | 5000 | 10000 | 20000 |
| Likely (80) | 80 | 800 | 4000 | 8000 | 16000 |
| Possible (50) | 50 | 500 | 2500 | 5000 | 10000 |
| Unlikely (30) | 30 | 300 | 1500 | 3000 | 6000 |
| Rare (10) | 10 | 100 | 500 | 1000 | 2000 |

### 2.3.1 Required Tasks

Once the calculations of multiplying the Residual Consequence Level by the Likelihood Level were completed the following calculations were undertaken for the Required Actions:

- The Required Risk Score for each Management Option (a total of the Risk Score for each Key Action) was tallied.
- An Average Risk Score was calculated, dividing the Required Risk Score by the number of Key Actions for the Management Option.

The results of these calculations are discussed in **Section 3**.

### 2.3.2 Alternative Scenarios

**Appendix D1** identifies the Consequence Level, Residual Consequence Level and Likelihood Level for the tasks required as part of each Management Option. As noted in **Section 1.2** the CWSA also assesses the worker safety risks associated with potential tasks or events associated with the Management Options which have a lower probability of occurring. For example, a truck turnover spilling contaminated load on public road or a minor or major cap repair. These alternative scenarios are given a Probability Level as described in **Table D2-4**.

**Table D2-4: Alternative Scenario Probability Level**

| Scenario Probability | Definition | Probability Level |
|---|---|---|
| Frequent | Can be expected to occur in most circumstances.<br>More than 80% chance of occurring.<br>This applies to the Required Tasks described in **Section 2.3.1.** | 1 |
| Probable | Will probably occur in most circumstances.<br>50-80% chance of occurring. | 0.5 |
| Occasional | Might occur at some time.<br>20 – 50% chance of occurring. | 0.1 |
| Remote | Could occur at some time.<br>Less than 20% chance of occurring | 0.01 |
| Improbable | May only occur in exceptional circumstances | 0.001 |

For example, the Risk Score tallied for all of the Occasional alternative scenarios in Option 2 (2300) is multiplied by 0.1 to give a score of 230. This score is then tallied with those for the Probable, Remote and Improbable events to derive the Alternative Scenario Risk Score.

### 2.3.3 Total Risk Rating

The Total Risk Rating for each Management Option is calculated by totalling the Required Risk Score with the Alternative Scenarios Risk Scores. The results of these calculations are discussed in **Section 3.2**.

# 3. RISK LEVEL CALCULATION

## 3.1 Required Actions Risk Score

**Appendix D2** provides the detailed Worker Safety Risk Scores for the Required Actions for each Management Option (Required Actions Risk Score). **Table D3-1** tabulates the following for the required actions for each of the Management Options:

- The number of Key Actions
- The Total Risk Score
- The Average Risk Score

**Table D3-1: Worker Safety Required Actions Risk Scores**

| | Management Option | | | | | | |
|---|---|---|---|---|---|---|---|
| | Do Nothing | 2 | 3 | 4 | 5 | 6 | 7 |
| Required Actions Risk Score | 1900 | 20030 | 36760 | 21830 | 26060 | 32060 | 24730 |
| Average Risk Score per Action | 380.0 | 1001.5 | 1050.3 | 992.3 | 1042.4 | 1457.3 | 1124.1 |
| Number of Actions | 5 | 20 | 35 | 22 | 25 | 22 | 22 |

Assessment of the worker safety hazards of the alternative scenarios (as defined in **Section 1.2**) (the Alternative Scenarios Risk Score) for each Management Option has also been completed and is detailed within **Appendix D3**. Assessment for each alternative scenario was conducted consistent with the methodology used for assessment of the Required Actions associated with the Management Options. A total for each of the probability categories (probable, occasional, remote and improbable) was generated. As the alternative scenarios have a lower probability of occurring, this total is then weighted related to the probability that it would occur. The Alternative Scenarios Risk Score for each Management Option is presented in **Table D3-2**.

**Table D3-2: Worker Safety Alternative Scenarios Risk Scores**

| | Management Option | | | | | | |
|---|---|---|---|---|---|---|---|
| | Do Nothing | 2 | 3 | 4 | 5 | 6 | 7 |
| Probable | 24300 | 800 | 1100 | 800 | 4100 | 800 | 800 |
| Occasional | 0 | 2300 | 4000 | 4800 | 4000 | 2500 | 300 |
| Remote | 5500 | 5000 | 5000 | 5000 | 5500 | 6000 | 0 |
| Improbable | 2500 | 2500 | 2500 | 2500 | 2500 | 2500 | 20000 |

## 3.2 Total Worker Safety Risk Score

The Required Actions Risk Score and the Alternative Scenarios Score were totalled to calculate a Total Worker Safety Risk Score. **Table D3-3** provides the results of the Total Worker Safety Risk Score.

**Table D3-3: Total Worker Safety Risk Scores**

| | | Management Option | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | Do Nothing | 2 | 3 | 4 | 5 | 6 | 7 |
| Frequent | 1 | 1900 | 20030 | 36760 | 21830 | 26060 | 32060 | 24730 |
| Probable | 0.5 | 12165 | 400 | 550 | 400 | 2050 | 400 | 400 |
| Occasional | 0.1 | 0 | 230 | 400 | 480 | 400 | 250 | 30 |
| Remote | 0.01 | 55 | 50 | 50 | 50 | 55 | 60 | 0 |
| Improbable | 0.001 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 20 |
| | **Total** | **14122.5** | **20712.5** | **37762.5** | **22762.5** | **28567.5** | **32772.5** | **25180** |

**Figure D3-1** graphically presents the result of **Table D3-3**.

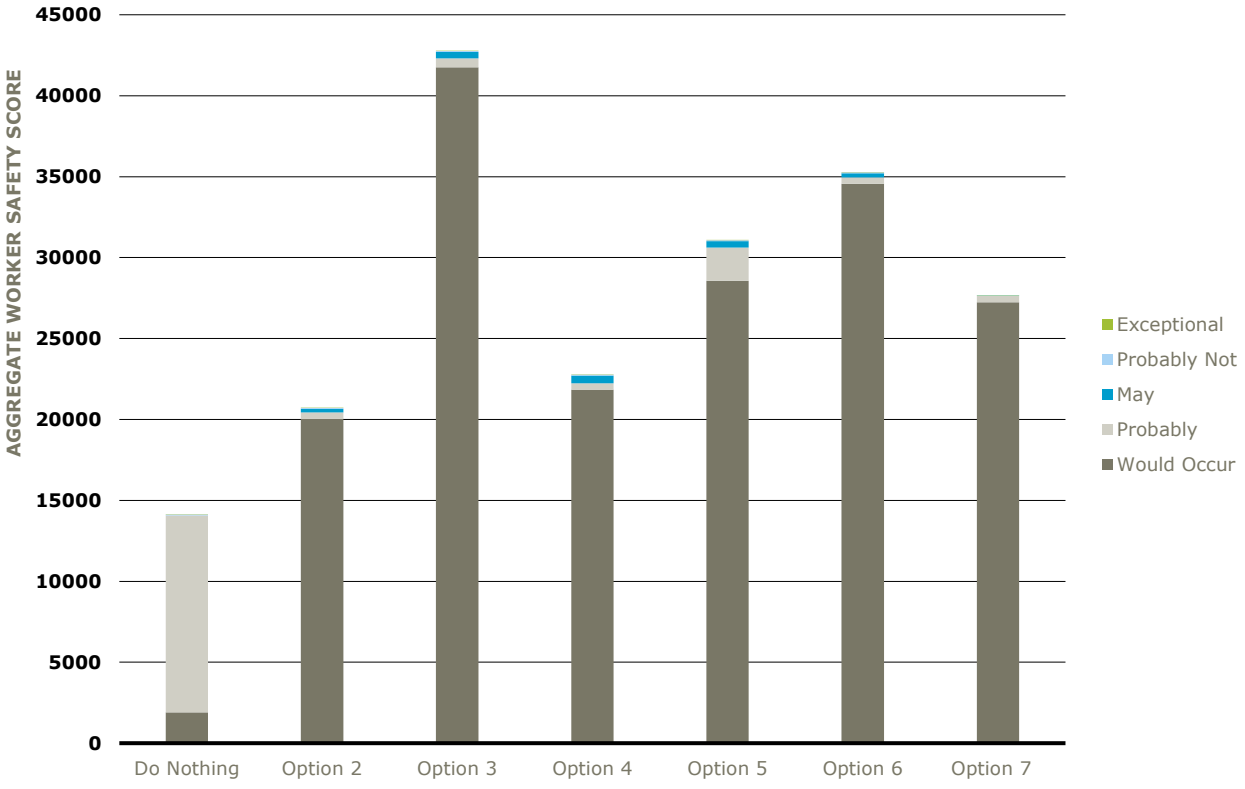


**Figure D3-1: Total Worker Safety Risk Scores for Management Options**

## 3.3 Results Discussion

The results of the Total Risk Score calculations indicate the following:

- Do Nothing has the lowest Total Worker Safety Risk Score and the median Average Risk Score. It also presents the highest Alternative Scenario Risk Score.
  Do Nothing has the lowest number of Key Actions (a quarter of the next lowest option) and these actions do not include the use of heavy machinery or result in heavy vehicle movements. Due to the number of alternative scenarios that could eventuate due to the failure of the Capped Waste Stockpile, and the consequences of many of these scenarios, it has the highest Alternative Scenario Risk Score.

- Option 2 (Containment Cell) has the second lowest Total Worker Safety Risk Score and the lowest Average Risk Score. It also has the second lowest number of Key Actions.
  Option 2 does not require the transportation of waste on public roads or the potential exposure to hazards associated with the sorting, crushing or cleaning of the waste material. Along with Option 4 it also has the shortest duration.
- Option 3 (Sorting of Recyclables from the Capped Waste Stockpile and Treatment of Non-Recyclables Placed in Containment Cell) has the highest Total Worker Safety Risk Score, and the highest Required Actions Risk Score.
  Option 3 has the highest number of Key Actions (10 greater than the next highest option). These additional tasks provide greater exposure of employees to potential hazards. In addition to the higher number of tasks, the nature of the tasks (sorting and cleaning of materials (particularly the use of water to clean the carbon material), and heavy vehicle movements on public roads) contributed to the higher risk.
  In addition to the hazards included in the assessment, there are hazards associated with some of the Worker Safety Controls that have not been included in the Risk Score for Option 3. This includes:
  - Installation and maintenance of the fume extraction system. This is likely to require working at height and other manual activities for the installation and maintenance of the system. This would have a risk of working at heights injuries and mechanical injuries.
  - The maintenance of the wash out stations. This is likely to require workers to clean the stations and machinery (used to place, turn and remove the cleaned material) of hazardous materials. This would have a risk of exposure to hazardous materials, chemicals and gases within a potentially confined space.
- Option 4 (Treatment of All Material within Containment Cell) has the third lowest Total Worker Safety Risk Score and the second lowest Average Risk Score.
  Option 4 has a higher Total Worker Safety Risk Score and Average Risk Score than Option 2 due to the transport and storage tasks associated with the lime treatment.
- Option 5 (Offsite Disposal of CWS to Licensed Waste Facility in NSW) has the third highest Total Worker Safety Risk Score and second highest Average Risk Score. It also has the second highest number of Key Actions and the highest Alternative Scenarios Risk Score.
  The Risk Score for Option 5 is largely influenced by the significant number of truck movements required to transport the CWS material a large distance (approximately 200km) on public roads.
- Option 6 (Offsite Disposal of CWS to salt mine) has the second highest Total Worker Safety Risk Score and the highest Average Risk Score.
  The Total Risk Score for Option 6 is largely influenced by the requirement for heat treatment, including its construction, operation and decommissioning As with Option 5 the Total Risk Score for Option 6 is also influenced by the significant number of truck and train movements required to transport the CWS material on public roads and rail networks.
- Option 7 (Onsite Destruction (Plasma Gasification) of CWS Material) has the median Total Risk Score and third highest Average Risk Score.
  Similarly to Option 6 the Total Risk Score for Option 7 is largely influenced by the plasma gasification plant, including its construction, operation and decommissioning.
- The Required Actions that posed the highest potential risk were:
  - The construction and decommission/ disassembly of the heat treatment facility and the plasma gasification plant. This is due to the machinery use requirements, the requirement to work from heights, the requirement to use cranes, the number of manual tasks, the need to connect to and disconnect from gas supplies or high voltage electricity supply, and the large number of vehicle movements required to transport components on public roads to and from the Smelter.

- The high pressure water cleaning of carbon and steel material. This is primarily due to the use of industrial grade high pressure water cleaners and the potential for serious injury. There is the potential for the use of water in cleaning of carbon material to generate toxic and flammable gases which could result in immediate health risks to workers (through inhalation) and the ignition of flammable gases.
- The transportation of waste materials on public roads. These additional heavy vehicle movements on public roads and freeways with high speed limits, and particularly those travelling longer distances (approximately 200km in each direction) posed a greater risk of accident and therefore injury to the truck drivers and other motorists.
- The heat treatment (both the low temperature method of Option 6 and plasma gasification of Option 7). This is due to the potential for generation of toxic and flammable gases, and the presence of heat. The gas generation has the potential for this to result in immediate health risks to workers (through inhalation) and the ignition of flammable gases, while significant heat (if the facility is incorrectly operated or malfunction occurs) could result in heat exposure and injury, and create an ignition source for the gases.

# 4. CONCLUSION

Do Nothing has the best Total Worker Safety Score. This would be expected as it is does not involve the removal of the Capped Waste Stockpile and the Required Actions are limited to monitoring and maintenance activities.

Of those Management Options that do include removal of the CWS, Management Option 2 has the lowest Total Risk Score as well as the lowest Average Risk Score and second lowest Alternative Scenario Risk Score.

The results of this Worker Safety Assessment will be considered with the other Management Options Assessments (Human Health, Ecological and Greenhouse Gas Emissions) to identify the best overall CWS Waste Management Option.

# 5. REFERENCES

Australian Standard *AS4360:2004 Risk Management*.

Department of Planning, 2011. *Industry Planning Advisory Paper No. 6 – Guidelines for Hazard Analysis*.

WorkCover NSW, 2011. *How to Manage Work Health and Safety Risks: Code of Practice*.

# 6. LIMITATIONS

Ramboll Environ Australia Pty Ltd prepared this report in accordance with the scope of work as outlined in our proposal to Hydro Aluminium Kurri Kurri Pty Ltd and in accordance with our understanding and interpretation of current regulatory standards.

The conclusions presented in this report represent Ramboll Environ's professional judgement based on information made available during the course of this assignment and are true and correct to the best of Ramboll Environ's knowledge as at the date of the assessment.

Ramboll Environ did not independently verify all of the written or oral information provided during the course of this investigation. While Ramboll Environ has no reason to doubt the accuracy of the information provided to it, the report is complete and accurate only to the extent that the information provided to Ramboll Environ was itself complete and accurate.

This report does not purport to give legal advice. This advice can only be given by qualified legal advisors.

## 6.1 User Reliance

This report has been prepared exclusively for Hydro Aluminium Kurri Kurri Pty Ltd and may not be relied upon by any other person or entity without Ramboll Environ's express written permission.

# APPENDIX D1
# CONSEQUENCE AND LIKELIHOOD ANALYSIS FOR REQUIRED ACTIONS

## ACRONYMS AND GLOSSARY

| | |
|---|---|
| Breathing apparatus | Personnel will be required to wear apparatus to provide a supply of breathable air. The form of the apparatus will be dependent on the task to be undertaken and the potential gases and chemicals that could be in the air of the work area. This could range from a dust mask appropriate for the material to full faced mask with an air supply. |
| Chemical Exposure PPE | In addition to the Level 1 PPE, personnel working with particular chemicals or contaminants will be required to wear equipment (as specific in a Safety Data Sheet or similar) to protect them from the risks associated with that chemical or contaminant. |
| Level 1 PPE | Minimum Personal Protective Equipment (PPE) for working on the Smelter/ in that task. Typically this will be:<br>• Hard hat<br>• Safety glasses<br>• Safety gloves<br>• Safety boots<br>• Long sleeve shirt<br>• Long drill pants<br>• Fluorescent vest/ strips on shirt |
| Plant and People separation | Where a person is required to observe the operation of machinery (such as to inspect the material removed by an excavator) that person remains at a safe distance when that machinery is in use, and only approaches the machinery when it is off or idling. |
| Preparatory Works | This involves the installation of environmental and safety controls, the construction of the Haul Road (for Management Options 2, 3 and 4), establishment of a small compound at the Containment Cell (for Management Options 2, 3 and 4) or the off-site facility (for Management Option 5). |
| Qualified personnel | Experienced personnel that that have the required permit, licence or approval, to operate a particular piece of machinery and/or undertake a task |
| Standard procedure | A procedure for undertaking a task that is either pre-existing from a government agency, a machinery manufacturer or a contractor; or a new procedure written by qualified personnel |
| Use of UHF Radios | UHF radios are used to allow operators of machinery to communicate with each other, and/ or on-ground personnel. |

**Do Nothing**

| Action No. | Key Action | Hazards | Consequence Level | Worker Safety Controls | Residual Consequence Level | Likelihood Level |
|---|---|---|---|---|---|---|
| **1.1** | **Monitoring** | | | | | |
| 1.1.1 | Groundwater monitoring at Capped Waste Stockpile location | Exposure to leachate and chemicals | Serious | Level 1 PPE<br>Chemical Exposure PPE<br>Use of equipment in accordance with manufacturer's requirements | Moderate | Possible |
| 1.1.2 | Visual capping monitoring | | Minor | Level 1 PPE | Minor | Unlikely |
| 1.1.3 | Leachate monitoring | Exposure to leachate and chemicals | Serious | Level 1 PPE<br>Use of equipment in accordance with manufacturer's requirements | Moderate | Possible |
| 1.1.4 | Gas monitoring | Exposure to gases | Major | Leve1 PPE<br>Breathing apparatus<br>Use of equipment in accordance with manufacturer's requirements | Moderate | Possible |
| **1.2** | **Long Term Management** | | | | | |
| 1.2.1 | Maintenance activities (as required) | Machinery injury | Serious | Level 1 PPE<br>Use of equipment in accordance with manufacturer's requirements | Moderate | Unlikely |

**Option 2**

| Action No. | Key Action | Hazards | Consequence Level | Worker Safety Controls | Residual Consequence Level | Likelihood Level |
|---|---|---|---|---|---|---|
| **2.1** | **Containment Cell Establishment and Construction** | | | | | |
| 2.1.1 | Vegetation clearance | Potential personnel contact with vehicles and machinery<br>Potential injury from falling trees<br>Collision between vehicles/ machinery<br>Machinery injury | Catastrophic | Level 1 PPE<br>Plant and People separation<br>Use of UHF Radios<br>Access Restrictions<br>Use of qualified personnel undertaking tasks in accordance with standard procedure. | Major | Unlikely |
| 2.1.2 | Preparatory works | Potential personnel contact with vehicles and machinery<br>Collision between vehicles/ machinery | Catastrophic | Level 1 PPE<br>Plant and People separation<br>Use of UHF Radios<br>Access Restrictions<br>Use of qualified personnel undertaking tasks in accordance with standard procedure. | Major | Unlikely |
| 2.1.3 | Cell Base liner Construction | Potential personnel contact with vehicles and machinery<br>Collision between vehicles/ machinery | Catastrophic | Level 1 PPE<br>Plant and People separation<br>Use of UHF Radios<br>Access Restrictions<br>Use of qualified personnel undertaking tasks in accordance with standard procedure. | Major | Unlikely |

| Action No. | Key Action | Hazards | Consequence Level | Worker Safety Controls | Residual Consequence Level | Likelihood Level |
|---|---|---|---|---|---|---|
| **2.2** | **Capped Waste Stockpile Removal** | | | | | |
| 2.2.1 | Site Establishment | Potential personnel contact with vehicles and machinery<br>Collision between vehicles/ machinery | Serious | Level 1 PPE<br>Plant and People separation<br>Use of UHF Radios<br>Access Restrictions<br>Use of qualified personnel undertaking tasks in accordance with standard procedure. | Moderate | Rare |
| 2.2.2 | Cap removal | Potential personnel contact with vehicles and machinery<br>Collision between vehicles/ machinery<br>Potential for vehicle rollover. | Major | Level 1 PPE<br>Breathing apparatus<br>Plant and People separation<br>Use of UHF Radios<br>Access Restrictions<br>Use of qualified personnel undertaking tasks in accordance with standard procedure.<br>Nominated parking and refuelling area. | Moderate | Unlikely |
| 2.2.3 | Material removal | Potential personnel contact with vehicles and machinery<br>Collision between vehicles/ machinery<br>Potential for vehicle rollover. | Major | Level 1 PPE<br>Breathing apparatus<br>Plant and People separation<br>Use of UHF Radios<br>Access Restrictions<br>Use of qualified personnel undertaking tasks in accordance with standard procedure.<br>Nominated parking and refuelling area.<br>Maintain safe vehicle access to the top of the | Serious | Unlikely |

| Action No. | Key Action | Hazards | Consequence Level | Worker Safety Controls | Residual Consequence Level | Likelihood Level |
|---|---|---|---|---|---|---|
| | | | | stockpile to prevent rollover.<br>Articulated haul trucks to be fitted with side swinging or self-actuated tail gates to prevent material being caught resulting in cab rollover. | | |
| 2.2.4 | Operate water treatment plant. | Machinery injury<br>Chemical exposure injury | Serious | Level 1 PPE<br>Use of qualified personnel undertaking tasks in accordance with standard procedure<br>Chemical Exposure PPE | Moderate | Rare |
| **2.3** | **Haul Road Maintenance** | | | | | |
| 2.3.1 | Maintain the Haul Road surface condition | Potential personnel contact with vehicles and machinery<br>Collision between vehicles/ machinery | Serious | Level 1 PPE<br>Plant and People separation<br>Access Restrictions<br>Haul Road Management Plan | Moderate | Rare |
| **2.4** | **Containment Cell Material Placement and Capping** | | | | | |
| 2.4.1 | Cell Material Acceptance and Placement | Potential personnel contact with vehicles and machinery<br>Collision between vehicles/ machinery<br>Potential for injury through contact with disposed material | Major | Level 1 PPE<br>Breathing apparatus<br>Chemicals Exposure PPE<br>Plant and People separation<br>Use of UHF Radios<br>Access Restrictions<br>Use of qualified personnel undertaking tasks in accordance with standard procedure.<br>Safe distance and location for spotters. | Serious | Unlikely |

| Action No. | Key Action | Hazards | Consequence Level | Worker Safety Controls | Residual Consequence Level | Likelihood Level |
|---|---|---|---|---|---|---|
| 2.4.2 | Leachate/ Rainwater Management (Material Placement Phase) | Machinery injury<br>Chemical exposure injury | Moderate | Level 1 PPE<br>Use of qualified personnel undertaking tasks in accordance with standard procedure<br>Chemical Exposure PPE | Moderate | Rare |
| 2.4.3 | Leachate pond removal | Potential personnel contact with vehicles and machinery<br>Chemical exposure injury | Major | Level 1 PPE<br>Plant and People separation<br>Use of qualified personnel undertaking tasks in accordance with standard procedure. | Serious | Unlikely |
| 2.4.4 | Haul road surface scrape | Collision between vehicles/ machinery | Serious | Level 1 PPE<br>Plant and People separation<br>Access Restrictions<br>Haul Road Management Plan | Moderate | Rare |
| 2.4.5 | Containment Cell Cap Construction | Potential personnel contact with vehicles and machinery<br>Collision between vehicles/ machinery | Major | Level 1 PPE<br>Breathing apparatus<br>Chemicals Exposure PPE<br>Plant and People separation<br>Use of UHF Radios<br>Access Restrictions<br>Use of qualified personnel undertaking tasks in accordance with standard procedure. | Serious | Unlikely |
| **2.5** | **Post Works Activities** | | | | | |
| 2.5.1 | Decommission water treatment infrastructure | Potential personnel contact with vehicles and machinery<br>Collision between vehicles/ machinery | Major | Level 1 PPE<br>Plant and People separation<br>Access Restrictions | Serious | Unlikely |

| Action No. | Key Action | Hazards | Consequence Level | Worker Safety Controls | Residual Consequence Level | Likelihood Level |
|---|---|---|---|---|---|---|
| **2.6** | **Operation/ Post-Completion Phase Activities** | | | | | |
| 2.6.1 | Groundwater monitoring at Capped Waste Stockpile location | Exposure to leachate and chemicals | Moderate | Level 1 PPE<br>Chemical Exposure PPE<br>Use of equipment in accordance with manufacturer's requirements | Moderate | Rare |
| 2.6.2 | Undertake monitoring of the Containment Cell | Exposure to gases<br>Exposure to leachate | Moderate | Leve1 PPE<br>Breathing apparatus<br>Chemical Exposure PPE<br>Use of equipment in accordance with manufacturer's requirements | Moderate | Unlikely |
| 2.6.3 | Maintenance activities (as required) | Machinery injury | Serious | Level 1 PPE<br>Use of equipment in accordance with manufacturer's requirements | Moderate | Rare |
| 2.6.4 | Leachate treatment | Machinery injury<br>Chemical exposure injury | Moderate | Level 1 PPE<br>Use of qualified personnel undertaking tasks in accordance with standard procedure<br>Chemical Exposure PPE | Moderate | Rare |

**Option 3**

| Action No. | Key Action | Hazards | Consequence Level | Worker Safety Controls | Residual Consequence Level | Likelihood Level |
|---|---|---|---|---|---|---|
| **3.1** | **Containment Cell Establishment and Construction** | | | | | |
| 3.1.1 | Vegetation clearance | Potential personnel contact with vehicles and machinery<br>Potential injury from falling trees<br>Collision between vehicles/ machinery<br>Machinery injury | Catastrophic | Level 1 PPE<br>Plant and People separation<br>Use of UHF Radios<br>Access Restrictions<br>Use of qualified personnel undertaking tasks in accordance with standard procedure. | Major | Unlikely |
| 3.1.2 | Preparatory works | Potential personnel contact with vehicles and machinery<br>Collision between vehicles/ machinery | Catastrophic | Level 1 PPE<br>Plant and People separation<br>Use of UHF Radios<br>Access Restrictions<br>Use of qualified personnel undertaking tasks in accordance with standard procedure. | Major | Unlikely |
| 3.1.3 | Cell Base liner Construction | Potential personnel contact with vehicles and machinery<br>Collision between vehicles/ machinery | Catastrophic | Level 1 PPE<br>Plant and People separation<br>Use of UHF Radios<br>Access Restrictions<br>Use of qualified personnel undertaking tasks in accordance with standard procedure. | Major | Unlikely |

| Action No. | Key Action | Hazards | Consequence Level | Worker Safety Controls | Residual Consequence Level | Likelihood Level |
|---|---|---|---|---|---|---|
| **3.2** | **Capped Waste Stockpile Removal** | | | | | |
| 3.2.1 | Site Establishment | Potential personnel contact with vehicles and machinery<br>Collision between vehicles/ machinery | Moderate | Level 1 PPE<br>Plant and People separation<br>Use of UHF Radios<br>Access Restrictions<br>Use of qualified personnel undertaking tasks in accordance with standard procedure. | Moderate | Rare |
| 3.2.2 | Cap removal | Potential personnel contact with vehicles and machinery<br>Collision between vehicles/ machinery<br>Potential for falls (personnel and/or vehicle) | Serious | Level 1 PPE<br>Plant and People separation<br>Use of UHF Radios<br>Access Restrictions<br>Use of qualified personnel undertaking tasks in accordance with standard procedure.<br>Nominated parking and refuelling area. | Moderate | Unlikely |
| 3.2.3 | Material removal and sorting | Potential personnel contact with vehicles and machinery<br>Collision between vehicles/ machinery<br>Potential for vehicle rollover. | Major | Level 1 PPE<br>Plant and People separation<br>Use of UHF Radios<br>Access Restrictions<br>Use of qualified personnel undertaking tasks in accordance with standard procedure.<br>Nominated parking and refuelling area.<br>Maintain safe vehicle access to the top of the stockpile to prevent rollover. | Major | Unlikely |

| Action No. | Key Action | Hazards | Consequence Level | Worker Safety Controls | Residual Consequence Level | Likelihood Level |
|---|---|---|---|---|---|---|
| | | | | Articulated haul trucks to be fitted with side swinging or self-actuated tail gates to prevent material being caught resulting in cab rollover. | | |
| 3.2.4 | Operate water treatment plant. | Machinery injury<br>Chemical exposure injury | Moderate | Level 1 PPE<br>Use of qualified personnel undertaking tasks in accordance with standard procedure<br>Chemical Exposure PPE | Moderate | Rare |
| **3.3** | **Recyclables Cleaning and Storage** | | | | | |
| 3.3.1 | Separation of carbon material and steel | Potential personnel contact with vehicles and machinery<br>Collision between vehicles/ machinery<br>Injury from contact with material | Serious | Level 1 PPE<br>Plant and People separation<br>Use of UHF Radios<br>Access Restrictions<br>Use of qualified personnel undertaking tasks in accordance with standard procedure.<br>Nominated parking and refuelling area. | Moderate | Rare |
| 3.3.2 | Carbon materials cleaning | Potential personnel contact with vehicles and machinery<br>Collision between vehicles/ machinery<br>Injury from moving of material during cleaning<br>Injury from incorrect/ accidental use of high pressure hose<br>Potential for generation of toxic and flammable gases | Major | Level 1 PPE<br>Breathing apparatus<br>Chemicals Exposure PPE<br>Plant and People separation<br>Use of UHF Radios<br>Access Restrictions<br>Use of qualified personnel undertaking tasks in accordance with standard procedure.<br>Nominated parking and refuelling area. | Serious | Possible |

| Action No. | Key Action | Hazards | Consequence Level | Worker Safety Controls | Residual Consequence Level | Likelihood Level |
|---|---|---|---|---|---|---|
| | | | | Use of hose system with emergency/ "dead man" switch<br>Ventilation | | |
| 3.3.3 | Carbon materials storage | Injury from contact with stockpiled material | Moderate | Access Restrictions | Moderate | Rare |
| 3.3.4 | Metals cleaning | Potential personnel contact with vehicles and machinery<br>Collision between vehicles/ machinery<br>Injury from moving of material during cleaning<br>Injury from incorrect/ accidental use of high pressure hose. | Major | Level 1 PPE<br>Breathing apparatus<br>Chemicals Exposure PPE<br>Plant and People separation<br>Use of UHF Radios<br>Access Restrictions<br>Use of qualified personnel undertaking tasks in accordance with standard procedure.<br>Nominated parking and refuelling area.<br>Use of hose system with emergency/ "dead man" switch<br>Ventilation | Serious | Possible |
| 3.3.5 | Metals storage | Injury from contact with stockpiled material | Moderate | Access Restrictions | Moderate | Rare |
| 3.3.6 | Separation of Carbon from embedded metals | Potential personnel contact with vehicles and machinery<br>Collision between vehicles/ machinery<br>Injury from falling overhead materials | Major | Level 1 PPE<br>Breathing apparatus<br>Chemical Exposure PPE<br>Plant and People separation<br>Use of UHF Radios<br>Access Restrictions<br>Use of qualified personnel undertaking tasks in accordance with standard procedure. | Serious | Possible |

| Action No. | Key Action | Hazards | Consequence Level | Worker Safety Controls | Residual Consequence Level | Likelihood Level |
|---|---|---|---|---|---|---|
| | | | | Nominated parking and refuelling area. | | |
| 3.3.7 | Final clean (second clean) and store | Potential personnel contact with vehicles and machinery<br>Collision between vehicles/ machinery<br>Injury from moving of material during cleaning<br>Injury from incorrect/ accidental use of high pressure hose.<br>Potential for generation of toxic and flammable gases | Major | Level 1 PPE<br>Breathing apparatus<br>Chemical Exposure PPE<br>Plant and People separation<br>Use of UHF Radios<br>Access Restrictions<br>Use of qualified personnel undertaking tasks in accordance with standard procedure.<br>Nominated parking and refuelling area.<br>Use of hose system with emergency/ "dead man" switch<br>Ventilation | Serious | Possible |
| **3.4** | **Non-Recyclable Material Treating** | | | | | |
| 3.4.1 | Transport untreated non-crushable/ non-recyclable material to the Containment Cell | Potential personnel contact with vehicles and machinery<br>Collision between vehicles/ machinery<br>Truck rollover | Minor | Level 1 PPE<br>Plant and People separation<br>Use of UHF Radios<br>Use of qualified personnel undertaking tasks in accordance with standard procedure.<br>Suitable haul road windrow height<br>Use of articulated haul trucks fitted with side swinging or self-actuated tail gates to prevent material being caught resulting in rollover. | Moderate | Possible |

| Action No. | Key Action | Hazards | Consequence Level | Worker Safety Controls | Residual Consequence Level | Likelihood Level |
|---|---|---|---|---|---|---|
| 3.4.2 | Crushing of fines and crushable materials | Potential personnel contact with vehicles and machinery<br>Injury from contact with material<br>Machinery injury<br>Chemical exposure injury | Major | Level 1 PPE<br>Plant and People separation<br>Access Restrictions<br>Nominated parking and refuelling area. | Moderate | Unlikely |
| 3.4.3 | Treatment Material Transportation and Stockpiling | Potential personnel contact with vehicles and machinery<br>Collision between vehicles/ machinery<br>Chemical exposure injury<br>Vehicle accident or roll over | Catastrophic | Level 1 PPE<br>Chemical Exposure PPE<br>Access Restrictions<br>Use of qualified personnel undertaking tasks in accordance with standard procedure. | Serious | Unlikely |
| 3.4.4 | Calcium treating of fines and crushables | Potential personnel contact with vehicles and machinery<br>Collision between vehicles/ machinery<br>Injury from contact with material<br>Machinery injury<br>Chemical exposure injury | Major | Level 1 PPE<br>Chemical Exposure PPE<br>Breathing apparatus<br>Plant and People separation<br>Use of UHF Radios<br>Access Restrictions<br>Use of qualified personnel undertaking tasks in accordance with standard procedure. | Moderate | Unlikely |
| 3.4.5 | Transport treated fines and crushables to the Containment Cell | Potential personnel contact with vehicles and machinery<br>Collision between vehicles/ machinery<br>Truck rollover | Major | Level 1 PPE<br>Plant and People separation<br>Use of UHF Radios<br>Use of qualified personnel undertaking tasks in accordance with standard procedure.<br>Suitable haul road windrow height<br>Use of articulated haul trucks fitted with side swinging or self-actuated | Serious | Unlikely |

| Action No. | Key Action | Hazards | Consequence Level | Worker Safety Controls | Residual Consequence Level | Likelihood Level |
|---|---|---|---|---|---|---|
| | | | | tail gates to prevent material being caught resulting in rollover. | | |
| **3.5** | **Haul Road Maintenance** | | | | | |
| 3.5.1 | Maintain the Haul Road surface condition | Potential personnel contact with vehicles and machinery<br>Collision between vehicles/ machinery | Serious | Level 1 PPE<br>Plant and People separation<br>Access Restrictions<br>Haul Road Management Plan | Moderate | Rare |
| **3.6** | **Containment Cell Material Placement and Capping** | | | | | |
| 3.6.1 | Cell Material Acceptance and Placement | Potential personnel contact with vehicles and machinery<br>Collision between vehicles/ machinery<br>Potential for injury through contact with disposed material | Major | Level 1 PPE<br>Breathing apparatus<br>Chemicals Exposure PPE<br>Plant and People separation<br>Use of UHF Radios<br>Access Restrictions<br>Use of qualified personnel undertaking tasks in accordance with standard procedure.<br>Safe distance and location for spotters. | Serious | Unlikely |
| 3.6.2 | Leachate/ Rainwater Management (Material Placement Phase) | Machinery injury<br>Chemical exposure injury | Serious | Level 1 PPE<br>Use of qualified personnel undertaking tasks in accordance with standard procedure<br>Chemical Exposure PPE | Moderate | Rare |
| 3.6.3 | Leachate pond removal | Potential personnel contact with vehicles and machinery<br>Chemical exposure injury | Major | Level 1 PPE<br>Plant and People separation<br>Use of qualified personnel undertaking tasks in | Serious | Unlikely |

| Action No. | Key Action | Hazards | Consequence Level | Worker Safety Controls | Residual Consequence Level | Likelihood Level |
|---|---|---|---|---|---|---|
| | | | | accordance with standard procedure. | | |
| 3.6.4 | Haul road surface scrape | Collision between vehicles/ machinery | Serious | Level 1 PPE<br>Breathing apparatus<br>Plant and People separation<br>Access Restrictions<br>Haul Road Management Plan | Moderate | Rare |
| 3.6.5 | Containment Cell Cap Construction | Potential personnel contact with vehicles and machinery<br>Collision between vehicles/ machinery | Major | Level 1 PPE<br>Breathing apparatus<br>Chemicals Exposure PPE<br>Plant and People separation<br>Use of UHF Radios<br>Access Restrictions<br>Use of qualified personnel undertaking tasks in accordance with standard procedure. | Serious | Unlikely |
| **3.7** | **Post Works Activities** | | | | | |
| 3.7.1 | Decommission water treatment infrastructure | Potential personnel contact with vehicles and machinery<br>Collision between vehicles/ machinery | Serious | Level 1 PPE<br>Plant and People separation<br>Access Restrictions | Moderate | Possible |
| **3.8** | **Operation/ Post-Completion Phase Activities** | | | | | |
| 3.8.1 | Groundwater monitoring at Capped Waste Stockpile location | Exposure to leachate and chemicals | Moderate | Level 1 PPE<br>Chemical Exposure PPE<br>Use of equipment in accordance with manufacturer's requirements | Moderate | Rare |

| Action No. | Key Action | Hazards | Consequence Level | Worker Safety Controls | Residual Consequence Level | Likelihood Level |
|---|---|---|---|---|---|---|
| 3.8.2 | Undertake monitoring of the Containment Cell | Exposure to gases<br>Exposure to leachate | Moderate | Leve1 PPE<br>Breathing apparatus<br>Chemical Exposure PPE<br>Use of equipment in accordance with manufacturer's requirements | Moderate | Unlikely |
| 3.8.3 | Maintenance activities (as required) | Machinery injury | Serious | Level 1 PPE<br>Use of equipment in accordance with manufacturer's requirements | Moderate | Rare |
| 3.8.4 | Leachate treatment | Machinery injury<br>Chemical exposure injury | Moderate | Level 1 PPE<br>Use of qualified personnel undertaking tasks in accordance with standard procedure<br>Chemical Exposure PPE | Moderate | Rare |
| **3.9** | **Recyclable Material Transport** | | | | | |
| 3.9.1 | Transport of 50,000 tonnes of cleaned and crushed carbon to carbon processing facility | Potential personnel contact with vehicles and machinery<br>Collision between vehicles/ machinery<br>Potential for injury through contact with loaded and unloaded material<br>Vehicle accident or roll over | Major | Level 1 PPE<br>Plant and People separation<br>Use of UHF Radios<br>Access Restrictions<br>Use of qualified personnel undertaking tasks in accordance with standard procedure.<br>Maximise travel on highways and freeways | Moderate | Possible |
| 3.9.2 | Transport of 10,000 tonnes of steel to steel recycling facility | Potential personnel contact with vehicles and machinery<br>Collision between vehicles/ machinery | Major | Level 1 PPE<br>Plant and People separation<br>Use of UHF Radios<br>Access Restrictions | Moderate | Possible |

| Action No. | Key Action | Hazards | Consequence Level | Worker Safety Controls | Residual Consequence Level | Likelihood Level |
|---|---|---|---|---|---|---|
| | | Potential for injury through contact with loaded and unloaded material<br>Vehicle accident or roll over | | Use of qualified personnel undertaking tasks in accordance with standard procedure.<br>Maximise travel on highways and freeways | | |
| **3.10** | **Recyclable Material Processing** | | | | | |
| 3.10.1 | Processing of 50,000 tonnes of cleaned and crushed carbon at carbon processing facility | Potential personnel contact with vehicles and machinery<br>Collision between vehicles/ machinery<br>Potential for injury through contact with loaded and unloaded material<br>Potential for generation of toxic and flammable gases through incorrect materials handling and processing | Major | PPE<br>Plant and People separation<br>Use of UHF Radios<br>Access Restrictions<br>Use of qualified personnel undertaking tasks in accordance with standard procedure. | Moderate | Unlikely |
| 3.10.2 | Processing of 10,000 tonnes of steel at steel recycling facility a | Potential personnel contact with vehicles and machinery<br>Collision between vehicles/ machinery<br>Potential for injury through contact with loaded and unloaded material | Moderate | PPE<br>Plant and People separation<br>Use of UHF Radios<br>Access Restrictions<br>Use of qualified personnel undertaking tasks in accordance with standard procedure. | Moderate | Unlikely |

**Option 4**

| Action No. | Key Action | Hazards | Consequence Level | Worker Safety Controls | Residual Consequence Level | Likelihood Level |
|---|---|---|---|---|---|---|
| **4.1** | **Containment Cell Establishment and Construction** | | | | | |
| 4.1.1 | Vegetation clearance | Potential personnel contact with vehicles and machinery<br>Potential injury from falling trees<br>Collision between vehicles/ machinery<br>Machinery injury | Catastrophic | Level 1 PPE<br>Plant and People separation<br>Use of UHF Radios<br>Access Restrictions<br>Use of qualified personnel undertaking tasks in accordance with standard procedure. | Major | Unlikely |
| 4.1.2 | Preparatory works | Potential personnel contact with vehicles and machinery<br>Collision between vehicles/ machinery | Catastrophic | Level 1 PPE<br>Plant and People separation<br>Use of UHF Radios<br>Access Restrictions<br>Use of qualified personnel undertaking tasks in accordance with standard procedure. | Major | Unlikely |
| 4.1.3 | Cell Base liner Construction | Potential personnel contact with vehicles and machinery<br>Collision between vehicles/ machinery | Catastrophic | Level 1 PPE<br>Plant and People separation<br>Use of UHF Radios<br>Access Restrictions<br>Use of qualified personnel undertaking tasks in accordance with standard procedure. | Major | Unlikely |

| Action No. | Key Action | Hazards | Consequence Level | Worker Safety Controls | Residual Consequence Level | Likelihood Level |
|---|---|---|---|---|---|---|
| **4.2** | **Capped Waste Stockpile Removal** | | | | | |
| 4.2.1 | Site Establishment | Potential personnel contact with vehicles and machinery<br>Collision between vehicles/ machinery | Major | Level 1 PPE<br>Plant and People separation<br>Use of UHF Radios<br>Access Restrictions<br>Use of qualified personnel undertaking tasks in accordance with standard procedure. | Serious | Rare |
| 4.2.2 | Cap removal | Potential personnel contact with vehicles and machinery<br>Collision between vehicles/ machinery<br>Potential for falls (personnel and/or vehicle) | Major | Level 1 PPE<br>Breathing apparatus<br>Plant and People separation<br>Use of UHF Radios<br>Access Restrictions<br>Use of qualified personnel undertaking tasks in accordance with standard procedure.<br>Nominated parking and refuelling area. | Moderate | Unlikely |
| 4.2.3 | Material removal | Potential personnel contact with vehicles and machinery<br>Collision between vehicles/ machinery<br>Potential for vehicle rollover. | Major | Level 1 PPE<br>Breathing apparatus<br>Chemicals Exposure PPE<br>Plant and People separation<br>Use of UHF Radios<br>Access Restrictions<br>Use of qualified personnel undertaking tasks in accordance with standard procedure.<br>Nominated parking and refuelling area.<br>Maintain safe vehicle access to the top of the | Serious | Unlikely |

| Action No. | Key Action | Hazards | Consequence Level | Worker Safety Controls | Residual Consequence Level | Likelihood Level |
|---|---|---|---|---|---|---|
| | | | | stockpile to prevent rollover.<br>Articulated haul trucks to be fitted with side swinging or self-actuated tail gates to prevent material being caught resulting in cab rollover. | | |
| 4.2.4 | Operate water treatment plant. | Machinery injury<br>Chemical exposure injury | Serious | Level 1 PPE<br>Use of qualified personnel undertaking tasks in accordance with standard procedure<br>Chemical Exposure PPE | Moderate | Rare |
| **4.3** | **Haul Road Maintenance** | | | | | |
| 4.3.1 | Maintain the Haul Road surface condition | Potential personnel contact with vehicles and machinery<br>Collision between vehicles/ machinery | Serious | Level 1 PPE<br>Plant and People separation<br>Access Restrictions<br>Haul Road Management Plan | Moderate | Unlikely |
| **4.4** | **Containment Cell Material Placement and Capping** | | | | | |
| 4.4.1 | Cell Material Acceptance and Placement | Potential personnel contact with vehicles and machinery<br>Collision between vehicles/ machinery<br>Potential for injury through contact with disposed material | Major | Level 1 PPE<br>Breathing apparatus<br>Chemicals Exposure PPE<br>Plant and People separation<br>Use of UHF Radios<br>Access Restrictions<br>Use of qualified personnel undertaking tasks in accordance with standard procedure.<br>Safe distance and location for spotters. | Serious | Unlikely |

| Action No. | Key Action | Hazards | Consequence Level | Worker Safety Controls | Residual Consequence Level | Likelihood Level |
|---|---|---|---|---|---|---|
| 4.4.2 | Treatment Material Transportation and Stockpiling | Potential personnel contact with vehicles and machinery<br>Collision between vehicles/ machinery<br>Chemical exposure injury<br>Vehicle accident or roll over | Moderate | Level 1 PPE<br>Breathing apparatus<br>Chemicals Exposure PPE<br>Access Restrictions<br>Use of qualified personnel undertaking tasks in accordance with standard procedure.<br>Maximise travel on highways and freeways | Moderate | Possible |
| 4.4.3 | Treatment Material Placement | Potential personnel contact with vehicles and machinery<br>Collision between vehicles/ machinery<br>Chemical exposure injury | Major | Level 1 PPE<br>Breathing apparatus<br>Chemicals Exposure PPE<br>Plant and People separation<br>Use of UHF Radios<br>Access Restrictions<br>Use of qualified personnel undertaking tasks in accordance with standard procedure. | Moderate | Unlikely |
| 4.4.4 | Leachate/ Rainwater Management (Material Placement Phase) | Machinery injury<br>Chemical exposure injury | Serious | Level 1 PPE<br>Use of qualified personnel undertaking tasks in accordance with standard procedure<br>Chemical Exposure PPE | Moderate | Rare |
| 4.4.5 | Leachate pond removal | Potential personnel contact with vehicles and machinery<br>Chemical exposure injury | Major | Level 1 PPE<br>Plant and People separation<br>Use of qualified personnel undertaking tasks in accordance with standard procedure. | Serious | Unlikely |

| Action No. | Key Action | Hazards | Consequence Level | Worker Safety Controls | Residual Consequence Level | Likelihood Level |
|---|---|---|---|---|---|---|
| 4.4.6 | Haul road surface scrape | Collision between vehicles/ machinery | Major | Level 1 PPE<br>Chemicals Exposure PPE<br>Plant and People separation<br>Access Restrictions<br>Haul Road Management Plan | Moderate | Rare |
| 4.4.7 | Containment Cell Cap Construction | Potential personnel contact with vehicles and machinery<br>Collision between vehicles/ machinery | Moderate | Level 1 PPE<br>Breathing apparatus<br>Chemicals Exposure PPE<br>Plant and People separation<br>Use of UHF Radios<br>Access Restrictions<br>Use of qualified personnel undertaking tasks in accordance with standard procedure. | Moderate | Rare |
| **4.5** | **Post Works Activities** | | | | | |
| 4.5.1 | Decommission water treatment infrastructure | Potential personnel contact with vehicles and machinery<br>Collision between vehicles/ machinery | Moderate | Level 1 PPE<br>Plant and People separation<br>Access Restrictions | Moderate | Rare |
| **4.6** | **Operation/ Post-Completion Phase Activities** | | | | | |
| 4.6.1 | Groundwater monitoring at Capped Waste Stockpile location | Exposure to leachate and chemicals | Moderate | Level 1 PPE<br>Chemical Exposure PPE<br>Use of equipment in accordance with manufacturer's requirements | Moderate | Rare |
| 4.6.2 | Undertake monitoring of the Containment Cell | Exposure to gases<br>Exposure to leachate | Moderate | Level 1 PPE<br>Breathing apparatus<br>Chemicals Exposure PPE<br>Use of equipment in accordance with | Moderate | Unlikely |

| Action No. | Key Action | Hazards | Consequence Level | Worker Safety Controls | Residual Consequence Level | Likelihood Level |
|---|---|---|---|---|---|---|
| | | | | manufacturer's requirements | | |
| 4.6.3 | Maintenance activities (as required) | Machinery injury | Serious | Level 1 PPE<br>Use of equipment in accordance with manufacturer's requirements | Minor | Unlikely |
| 4.6.4 | Leachate treatment | Machinery injury<br>Chemical exposure injury | Moderate | Level 1 PPE<br>Use of qualified personnel undertaking tasks in accordance with standard procedure<br>Chemical Exposure PPE | Minor | Rare |

**Option 5**

| Action No. | Key Action | Hazards | Consequence Level | Worker Safety Controls | Residual Consequence Level | Likelihood Level |
|---|---|---|---|---|---|---|
| **5.1** | **Capped Waste Stockpile Removal** | | | | | |
| 5.1.1 | Site Establishment | Potential personnel contact with vehicles and machinery<br>Collision between vehicles/ machinery | Major | Level 1 PPE<br>Plant and People separation<br>Use of UHF Radios<br>Access Restrictions<br>Use of qualified personnel undertaking tasks in accordance with standard procedure. | Serious | Rare |
| 5.1.2 | Cap removal | Potential personnel contact with vehicles and machinery<br>Collision between vehicles/ machinery<br>Potential for falls (personnel and/or vehicle) | Major | Level 1 PPE<br>Breathing apparatus<br>Chemicals Exposure PPE<br>Plant and People separation<br>Use of UHF Radios<br>Access Restrictions<br>Use of qualified personnel undertaking tasks in accordance with standard procedure.<br>Nominated parking and refuelling area. | Moderate | Unlikely |
| 5.1.3 | Material removal and sorting | Potential personnel contact with vehicles and machinery<br>Collision between vehicles/ machinery<br>Potential for vehicle rollover. | Major | Level 1 PPE<br>Breathing apparatus<br>Chemicals Exposure PPE<br>Plant and People separation<br>Use of UHF Radios<br>Access Restrictions<br>Use of qualified personnel undertaking tasks in accordance with standard procedure. | Major | Unlikely |

| Action No. | Key Action | Hazards | Consequence Level | Worker Safety Controls | Residual Consequence Level | Likelihood Level |
|---|---|---|---|---|---|---|
| | | | | Nominated parking and refuelling area.<br>Maintain safe vehicle access to the top of the stockpile to prevent rollover.<br>Articulated haul trucks to be fitted with side swinging or self-actuated tail gates to prevent material being caught resulting in cab rollover. | | |
| 5.1.4 | Operate water treatment plant. | Machinery injury<br>Chemical exposure injury | Serious | Level 1 PPE<br>Use of qualified personnel undertaking tasks in accordance with standard procedure<br>Chemical Exposure PPE | Moderate | Rare |
| **5.2** | **Capped Waste Stockpile Post Works Activities** | | | | | |
| 5.2.1 | Decommission water treatment infrastructure | Potential personnel contact with vehicles and machinery<br>Collision between vehicles/ machinery | Serious | Level 1 PPE<br>Plant and People separation<br>Access Restrictions | Moderate | Possible |
| **5.3** | **Capped Waste Stockpile Post-Completion Phase Activities** | | | | | |
| 5.3.1 | Groundwater monitoring at Capped Waste Stockpile location | Exposure to leachate and chemicals | Moderate | Level 1 PPE<br>Chemical Exposure PPE<br>Use of equipment in accordance with manufacturer's requirements | Moderate | Rare |
| **5.4** | **Waste Material Transportation** | | | | | |
| 5.4.1 | Waste transportation from Smelter to waste facility | Potential personnel contact with vehicles and machinery<br>Collision between vehicles/ machinery | Major | Level 1 PPE<br>Plant and People separation<br>Use of UHF Radios | Serious | Possible |

| Action No. | Key Action | Hazards | Consequence Level | Worker Safety Controls | Residual Consequence Level | Likelihood Level |
|---|---|---|---|---|---|---|
| | | Potential for injury through contact with loaded material<br>Vehicle accident or roll over | | Access Restrictions<br>Use of qualified personnel undertaking tasks in accordance with standard procedure.<br>Maximise travel on highways and freeway | | |
| 5.4.2 | Unload and stockpile material at receiving facility | Potential personnel contact with vehicles and machinery<br>Collision between vehicles/ machinery<br>Potential for injury through contact with unloaded material | Moderate | Level 1 PPE<br>Breathing apparatus<br>Chemicals Exposure PPE<br>Plant and People separation<br>Use of UHF Radios<br>Access Restrictions<br>Use of qualified personnel undertaking tasks in accordance with standard procedure. | Moderate | Unlikely |
| 5.4.3 | Treatment Material Transportation and Stockpiling | Potential personnel contact with vehicles and machinery<br>Collision between vehicles/ machinery<br>Chemical exposure injury<br>Vehicle accident or roll over | Catastrophic | Level 1 PPE<br>Breathing apparatus<br>Chemicals Exposure PPE<br>Access Restrictions<br>Maximise travel on highways and freeway | Moderate | Unlikely |
| 5.4.4 | Crushing of all material | Potential personnel contact with vehicles and machinery<br>Injury from contact with material<br>Machinery injury<br>Chemical exposure injury | Moderate | Level 1 PPE<br>Breathing apparatus<br>Chemicals Exposure PPE<br>Plant and People separation<br>Access Restrictions<br>Nominated parking and refuelling area. | Moderate | Unlikely |
| 5.4.5 | Transport crushed material to landfill | Potential personnel contact with vehicles and machinery<br>Collision between vehicles/ machinery | Moderate | Level 1 PPE<br>Plant and People separation<br>Use of UHF Radios | Serious | Unlikely |

| Action No. | Key Action | Hazards | Consequence Level | Worker Safety Controls | Residual Consequence Level | Likelihood Level |
|---|---|---|---|---|---|---|
| | | Potential for injury through contact with loaded material<br>Vehicle roll over | | Access Restrictions<br>Use of qualified personnel undertaking tasks in accordance with standard procedure. | | |
| 5.4.6 | Treatment Material Placement | Potential personnel contact with vehicles and machinery<br>Collision between vehicles/ machinery<br>Chemical exposure injury | Moderate | Level 1 PPE<br>Breathing apparatus<br>Chemicals Exposure PPE<br>Plant and People separation<br>Use of UHF Radios<br>Access Restrictions<br>Use of qualified personnel undertaking tasks in accordance with standard procedure. | Moderate | Unlikely |
| 5.4.7 | Leachate/ Rainwater Management (Material Placement Phase) | Machinery injury<br>Chemical exposure injury | Moderate | Level 1 PPE<br>Use of qualified personnel undertaking tasks in accordance with standard procedure<br>Chemical Exposure PPE | Moderate | Rare |

**Option 6**

| Action No. | Key Action | Hazards | Consequence Level | Worker Safety Controls | Residual Consequence Level | Likelihood Level |
|---|---|---|---|---|---|---|
| **6.1** | **Capped Waste Stockpile Removal** | | | | | |
| 6.1.1 | Site Establishment | Potential personnel contact with vehicles and machinery<br>Collision between vehicles/ machinery | Major | Level 1 PPE<br>Plant and People separation<br>Use of UHF Radios<br>Access Restrictions<br>Use of qualified personnel undertaking tasks in accordance with standard procedure. | Serious | Rare |
| 6.1.2 | Cap removal | Potential personnel contact with vehicles and machinery<br>Collision between vehicles/ machinery<br>Potential for falls (personnel and/or vehicle) | Major | Level 1 PPE<br>Plant and People separation<br>Use of UHF Radios<br>Access Restrictions<br>Use of qualified personnel undertaking tasks in accordance with standard procedure.<br>Nominated parking and refuelling area. | Moderate | Unlikely |
| 6.1.3 | Material removal and sorting | Potential personnel contact with vehicles and machinery<br>Collision between vehicles/ machinery<br>Potential for vehicle rollover. | Major | Level 1 PPE<br>Breathing apparatus<br>Chemicals Exposure PPE<br>Plant and People separation<br>Use of UHF Radios<br>Access Restrictions<br>Use of qualified personnel undertaking tasks in accordance with standard procedure.<br>Nominated parking and refuelling area. | Major | Unlikely |

| Action No. | Key Action | Hazards | Consequence Level | Worker Safety Controls | Residual Consequence Level | Likelihood Level |
|---|---|---|---|---|---|---|
| | | | | Maintain safe vehicle access to the top of the stockpile to prevent rollover.<br>Articulated haul trucks to be fitted with side swinging or self-actuated tail gates to prevent material being caught resulting in cab rollover. | | |
| 6.1.4 | Operate water treatment plant. | Machinery injury<br>Chemical exposure injury | Serious | Level 1 PPE<br>Use of qualified personnel undertaking tasks in accordance with standard procedure<br>Chemical Exposure PPE | Moderate | Rare |
| **6.2** | **Material Treatment** | | | | | |
| 6.2.1 | Transport and Construction/ installation of Heat Treatment Facility | Potential personnel contact with vehicles and machinery<br>Machinery injury<br>Fall from working at heights<br>Workers hit by materials from height<br>Exposure to fuel gas during connection | Catastrophic | Level 1 PPE<br>Use of qualified personnel undertaking tasks in accordance with standard procedure<br>Chemical Exposure PPE<br>Plant and People separation<br>Use of UHF Radios<br>Access Restrictions | Major | Possible |
| 6.2.2 | Crushing of all materials | Potential personnel contact with vehicles and machinery<br>Injury from contact with material<br>Machinery injury<br>Chemical exposure injury | Moderate | Level 1 PPE<br>Breathing apparatus<br>Chemicals Exposure PPE<br>Plant and People separation<br>Access Restrictions | Moderate | Unlikely |
| 6.2.3 | Treat at 600 degrees Celsius | Potential personnel contact with vehicles and machinery | Catastrophic | Level 1 PPE<br>Breathing apparatus | Major | Unlikely |

| Action No. | Key Action | Hazards | Consequence Level | Worker Safety Controls | Residual Consequence Level | Likelihood Level |
|---|---|---|---|---|---|---|
| | | Injury from contact with material<br>Machinery injury<br>Heat exposure<br>Potential for generation of toxic and flammable gases through incorrect materials handling and processing | | Chemicals Exposure PPE<br>Plant and People separation<br>Use of UHF Radios<br>Access Restrictions<br>Use of qualified personnel undertaking tasks in accordance with standard procedure. | | |
| 6.2.4 | Decommission/ Dismantle and Transport of Heat Treatment Facility | Potential personnel contact with vehicles and machinery<br>Machinery injury<br>Fall from working at heights<br>Workers hit by materials from height<br>Exposure to fuel gas during disconnection | Catastrophic | Level 1 PPE<br>Use of qualified personnel undertaking tasks in accordance with standard procedure<br>Chemical Exposure PPE<br>Plant and People separation<br>Use of UHF Radios<br>Access Restrictions | Major | Possible |
| **6.3** | **Material Transport** | | | | | |
| 6.3.1 | Deliver of containers and bagging for material transportation | Potential personnel contact with vehicles and machinery<br>Collision between vehicles/ machinery<br>Potential for injury through contact with loaded material<br>Vehicle accident or roll over | Catastrophic | Level 1 PPE<br>Plant and People separation<br>Use of UHF Radios<br>Access Restrictions<br>Use of qualified personnel undertaking tasks in accordance with standard procedure.<br>Maximise travel on highways and freeway | Serious | Possible |
| 6.3.2 | Transport from Smelter to rail terminal | Potential personnel contact with vehicles and machinery<br>Collision between vehicles/ machinery | Catastrophic | Level 1 PPE<br>Breathing apparatus<br>Chemicals Exposure PPE<br>Plant and People separation | Moderate | Possible |

| Action No. | Key Action | Hazards | Consequence Level | Worker Safety Controls | Residual Consequence Level | Likelihood Level |
|---|---|---|---|---|---|---|
| | | Potential for injury through contact with loaded material<br>Vehicle accident or roll over | | Use of UHF Radios<br>Access Restrictions<br>Use of qualified personnel undertaking tasks in accordance with standard procedure.<br>Maximise travel on highways and freeway | | |
| 6.3.3 | Transport from rail terminal to Tellus Rail Terminal | Train accident or rollover | Catastrophic | Use of qualified personnel undertaking tasks in accordance with standard procedure. | Major | Unlikely |
| **6.4** | **Receiving Facility Treated Material Disposal** | | | | | |
| 6.4.1 | Facility Material Acceptance and Placement | Potential personnel contact with vehicles and machinery<br>Collision between vehicles/ machinery<br>Potential for injury through contact with loaded material<br>Vehicle roll over | Moderate | Level 1 PPE<br>Breathing apparatus<br>Chemicals Exposure PPE<br>Plant and People separation<br>Use of UHF Radios<br>Access Restrictions<br>Use of qualified personnel undertaking tasks in accordance with standard procedure. | Minor | Rare |
| **6.5** | **Facility and Deposited Material Management and Monitoring** | | | | | |
| 6.5.1 | Post-Closure monitoring from Tellus EIS | Exposure to gases<br>Exposure to leachate | Major | Leve1 PPE<br>Breathing apparatus<br>Chemical Exposure PPE<br>Use of equipment in accordance with manufacturer's requirements | Minor | Rare |
| **6.6** | **Capped Waste Stockpile Post Works Activities** | | | | | |
| 6.6.1 | Decommission water treatment infrastructure | Potential personnel contact with vehicles and machinery | Serious | Level 1 PPE | Moderate | Possible |

| Action No. | Key Action | Hazards | Consequence Level | Worker Safety Controls | Residual Consequence Level | Likelihood Level |
|---|---|---|---|---|---|---|
| | | Collision between vehicles/ machinery | | Plant and People separation<br>Access Restrictions | | |
| **6.7** | **Capped Waste Stockpile Post-Completion Phase Activities** | | | | | |
| 6.7.1 | Groundwater monitoring at Capped Waste Stockpile location | Exposure to leachate and chemicals | Moderate | Level 1 PPE<br>Chemical Exposure PPE<br>Use of equipment in accordance with manufacturer's requirements | Moderate | Rare |

**Option 7**

| Action No. | Key Action | Hazards | Consequence Level | Worker Safety Controls | Residual Consequence Level | Likelihood Level |
|---|---|---|---|---|---|---|
| **7.1** | **Capped Waste Stockpile Removal** | | | | | |
| 7.1.1 | Site Establishment | Potential personnel contact with vehicles and machinery<br>Collision between vehicles/ machinery | Major | Level 1 PPE<br>Plant and People separation<br>Use of UHF Radios<br>Access Restrictions<br>Use of qualified personnel undertaking tasks in accordance with standard procedure. | Serious | Rare |
| 7.1.2 | Cap removal | Potential personnel contact with vehicles and machinery<br>Collision between vehicles/ machinery<br>Potential for falls (personnel and/or vehicle) | Major | Level 1 PPE<br>Breathing apparatus<br>Chemicals Exposure PPE<br>Plant and People separation<br>Use of UHF Radios<br>Access Restrictions<br>Use of qualified personnel undertaking tasks in accordance with standard procedure.<br>Nominated parking and refuelling area. | Moderate | Unlikely |
| 7.1.3 | Material removal and sorting | Potential personnel contact with vehicles and machinery<br>Collision between vehicles/ machinery<br>Potential for vehicle rollover. | Major | Level 1 PPE<br>Breathing apparatus<br>Chemicals Exposure PPE<br>Plant and People separation<br>Use of UHF Radios<br>Access Restrictions<br>Use of qualified personnel undertaking tasks in accordance with standard procedure. | Major | Unlikely |

| Action No. | Key Action | Hazards | Consequence Level | Worker Safety Controls | Residual Consequence Level | Likelihood Level |
|---|---|---|---|---|---|---|
| | | | | Nominated parking and refuelling area.<br>Maintain safe vehicle access to the top of the stockpile to prevent rollover.<br>Articulated haul trucks to be fitted with side swinging or self-actuated tail gates to prevent material being caught resulting in cab rollover. | | |
| 7.1.4 | Operate water treatment plant. | Machinery injury<br>Chemical exposure injury | Serious | Level 1 PPE<br>Use of qualified personnel undertaking tasks in accordance with standard procedure<br>Chemical Exposure PPE | Moderate | Rare |
| **7.2** | **Waste Material Sorting** | | | | | |
| 7.2.1 | Separation of Carbon from embedded metals | Potential personnel contact with vehicles and machinery<br>Collision between vehicles/ machinery<br>Injury from falling overhead materials | Moderate | Level 1 PPE<br>Breathing apparatus<br>Chemicals Exposure PPE<br>Plant and People separation<br>Use of UHF Radios<br>Access Restrictions<br>Use of qualified personnel undertaking tasks in accordance with standard procedure.<br>Nominated parking and refuelling area. | Moderate | Rare |
| **7.3** | **Metals Cleaning and Storage** | | | | | |
| 7.3.1 | Metals cleaning | Potential personnel contact with vehicles and machinery | Major | Level 1 PPE<br>Breathing apparatus<br>Chemicals Exposure PPE | Serious | Possible |

| Action No. | Key Action | Hazards | Consequence Level | Worker Safety Controls | Residual Consequence Level | Likelihood Level |
|---|---|---|---|---|---|---|
| | | Collision between vehicles/ machinery<br>Injury from moving of material during cleaning<br>Injury from incorrect/ accidental use of high pressure hose. | | Plant and People separation<br>Use of UHF Radios<br>Access Restrictions<br>Use of qualified personnel undertaking tasks in accordance with standard procedure.<br>Nominated parking and refuelling area.<br>Use of hose system with emergency/ "dead man" switch | | |
| 7.3.2 | Metals storage | Injury from contact with stockpiled material | Moderate | Access Restrictions | Moderate | Rare |
| 7.3.3 | Transport of 10,000 tonnes of steel to steel recycling facility | Potential personnel contact with vehicles and machinery<br>Collision between vehicles/ machinery<br>Potential for injury through contact with loaded and unloaded material<br>Vehicle accident or roll over | Catastrophic | Level 1 PPE<br>Plant and People separation<br>Use of UHF Radios<br>Access Restrictions<br>Use of qualified personnel undertaking tasks in accordance with standard procedure.<br>Maximise travel on highways and freeways | Serious | Unlikely |
| **7.4** | **Carbon and Non-Recyclable Material Crushing** | | | | | |
| 7.4.1 | Crushing of carbon materials | Potential personnel contact with vehicles and machinery<br>Injury from contact with material<br>Machinery injury<br>Chemical exposure injury | Major | Level 1 PPE<br>Breathing apparatus<br>Chemicals Exposure PPE<br>Plant and People separation<br>Access Restrictions | Moderate | Unlikely |
| 7.4.2 | Carbon materials storage | Injury from contact with stockpiled material | Moderate | Access Restrictions | Moderate | Rare |

| Action No. | Key Action | Hazards | Consequence Level | Worker Safety Controls | Residual Consequence Level | Likelihood Level |
|---|---|---|---|---|---|---|
| 7.4.3 | Transport treated fines and crushables to the plasma gasification plant | Potential personnel contact with vehicles and machinery<br>Collision between vehicles/ machinery<br>Truck rollover | Major | Level 1 PPE<br>Breathing apparatus<br>Chemicals Exposure PPE<br>Plant and People separation<br>Use of UHF Radios<br>Use of qualified personnel undertaking tasks in accordance with standard procedure.<br>Suitable haul road windrow height<br>Use of articulated haul trucks fitted with side swinging or self-actuated tail gates to prevent material being caught resulting in rollover. | Serious | Unlikely |
| **7.5** | **Plasma Gasification** | | | | | |
| 7.5.1 | Transport and Construction/ installation of Plasma Gasification Plant | Potential personnel contact with vehicles and machinery<br>Machinery injury<br>Fall from working at heights<br>Workers hit by materials from height<br>Exposure to high voltage electricity during connection | Catastrophic | Level 1 PPE<br>Use of qualified personnel undertaking tasks in accordance with standard procedure<br>Chemical Exposure PPE<br>Plant and People separation<br>Use of UHF Radios<br>Access Restrictions | Major | Possible |

| Action No. | Key Action | Hazards | Consequence Level | Worker Safety Controls | Residual Consequence Level | Likelihood Level |
|---|---|---|---|---|---|---|
| 7.5.2 | Treatment of crushed materials in the thermal desorption plant | Potential personnel contact with vehicles and machinery<br>Injury from contact with material<br>Machinery injury<br>Heat exposure<br>Potential for generation of toxic and flammable gases through incorrect materials handling and processing | Major | Level 1 PPE<br>Breathing apparatus<br>Chemicals Exposure PPE<br>Plant and People separation<br>Use of UHF Radios<br>Access Restrictions<br>Use of qualified personnel undertaking tasks in accordance with standard procedure. | Moderate | Unlikely |
| 7.5.3 | Decommission/ Dismantle and Transport of Plasma Gasification Plant | Potential personnel contact with vehicles and machinery<br>Machinery injury<br>Fall from working at heights<br>Workers hit by materials from height<br>Exposure to high voltage electricity during connection | Catastrophic | Level 1 PPE<br>Use of qualified personnel undertaking tasks in accordance with standard procedure<br>Chemical Exposure PPE<br>Plant and People separation<br>Use of UHF Radios<br>Access Restrictions | Major | Possible |
| **7.6** | **By-Product Stockpiling and Disposal** | | | | | |
| 7.6.1 | Removal and transfer of by-product to stockpile | Potential personnel contact with vehicles and machinery<br>Collision between vehicles/ machinery<br>Potential for injury through contact with loaded material<br>Vehicle roll over | Moderate | Level 1 PPE<br>Breathing apparatus<br>Chemicals Exposure PPE<br>Plant and People separation<br>Use of UHF Radios<br>Access Restrictions<br>Use of qualified personnel undertaking tasks in accordance with standard procedure. | Moderate | Rare |
| 7.6.2 | Transfer of by-product to Cessnock waste management facility. | Potential personnel contact with vehicles and machinery<br>Collision between vehicles/ machinery | Catastrophic | Level 1 PPE<br>Breathing apparatus<br>Chemicals Exposure PPE | Serious | Rare |

| Action No. | Key Action | Hazards | Consequence Level | Worker Safety Controls | Residual Consequence Level | Likelihood Level |
|---|---|---|---|---|---|---|
| | | Potential for injury through contact with loaded material<br>Vehicle accident or roll over | | Plant and People separation<br>Use of UHF Radios<br>Access Restrictions<br>Use of qualified personnel undertaking tasks in accordance with standard procedure.<br>Maximise travel on main roads, highways and freeway | | |
| **7.7** | **Capped Waste Stockpile Post Works Activities** | | | | | |
| 7.7.1 | Decommission water treatment infrastructure | Potential personnel contact with vehicles and machinery<br>Collision between vehicles/ machinery | Serious | Level 1 PPE<br>Plant and People separation<br>Access Restrictions | Moderate | Possible |
| **7.8** | **Capped Waste Stockpile Post-Completion Phase Activities** | | | | | |
| 7.8.1 | Groundwater monitoring at Capped Waste Stockpile location | Exposure to leachate and chemicals | Moderate | Level 1 PPE<br>Chemical Exposure PPE<br>Use of equipment in accordance with manufacturer's requirements | Moderate | Rare |

# APPENDIX D2
# WORKER SAFETY REQUIRED ACTIONS RISK LEVEL CALCULATION

| | | Minor | Moderate | Serious | Major | Catastrophic |
|---|---|---|---|---|---|---|
| | | 1 | 10 | 50 | 100 | 200 |
| Almost Certain | 100 | 100 | 1000 | 5000 | 10000 | 20000 |
| Likely | 80 | 80 | 800 | 4000 | 8000 | 16000 |
| Possible | 50 | 50 | 500 | 2500 | 5000 | 10000 |
| Unlikely | 30 | 30 | 300 | 1500 | 3000 | 6000 |
| Rare | 10 | 10 | 100 | 500 | 1000 | 2000 |

| Key Task | Option 1 | Option 2 | Option 3 | Option 4 | Option 5 | Option 6 | Option 7 |
|---|---|---|---|---|---|---|---|
| Groundwater monitoring at Capped Waste Stockpile location | 500 | | | | | | |
| CWS Visual capping monitoring | 100 | | | | | | |
| CWS Leachate monitoring | 500 | | | | | | |
| CWS Gas monitoring | 500 | | | | | | |
| CWS Maintenance activities (as required) | 300 | | | | | | |
| Vegetation clearance | | 3000 | 3000 | 3000 | | | |
| Preparatory works | | 3000 | 3000 | 3000 | 3000 | | |
| Cell Base liner Construction | | 3000 | 3000 | 3000 | 3000 | | |
| Capped Waste Stockpile Site Establishment | | 500 | 500 | 500 | 500 | 500 | 500 |
| Cap removal | | 300 | 300 | 300 | 300 | 300 | 300 |
| CWS Material removal | | 1500 | | 1500 | | | |
| CWS Material removal and sorting | | | 3000 | | 3000 | 3000 | 3000 |
| Material on site transportation to cell | | 300 | | 300 | | | |
| Operate water treatment plant at the CWS | | 100 | 100 | 100 | 100 | 100 | 100 |
| Maintain the Haul Road surface condition | | 30 | 30 | 30 | | | |
| Cell Material Acceptance and Placement | | 1500 | 1500 | 1500 | | | |
| Treatment Material Transportation and Stockpiling | | | 1500 | 1500 | 1500 | | |
| Treatment Material Placement | | | | 300 | 300 | | |
| Operate water treatment plant at the Containment Cell | | 100 | 100 | 100 | | | |
| Leachate ponds removal at CC and CWS | | 1500 | 1500 | 1500 | 1500 | 1500 | 1500 |
| Haul road surface scrape | | 100 | 100 | 100 | | | |
| Containment Cell Cap Construction | | 1500 | 1500 | 1500 | 1500 | | |
| Decommission water management infrastructure at the CWS | | 1500 | 1500 | 1500 | 1500 | 1500 | 1500 |
| Decommission water management infrastructure at the Containment Cell | | 1500 | 1500 | 1500 | | | |
| Groundwater monitoring at Capped Waste Stockpile location | | 100 | 100 | 100 | 100 | 100 | 100 |
| Undertake monitoring of the Containment Cell | | 300 | 300 | 300 | 300 | | |
| Maintenance activities (as required) | | 100 | 100 | 100 | 100 | | |
| Leachate treatment | | 100 | 100 | 100 | 100 | 100 | 100 |
| Separation of loose steel from carbon with embedded steel | | | 100 | | | | |
| Carbon materials cleaning | | | 5000 | | | | |
| Carbon materials storage | | | 30 | | | | 30 |
| Metals cleaning | | | 5000 | | 5000 | 5000 | 5000 |
| Metals storage | | | 100 | | 30 | 30 | 100 |
| Separation of Carbon from embedded metals | | | 100 | | 30 | 30 | 100 |
| Final clean (second clean) of carbon and store | | | 2500 | | | | |
| Transport untreated non-crushable/ non-recyclable material to the Containment Cell | | | 500 | | | | |
| Crushing of fines and crushable materials | | | 300 | | | | |
| Calcium treating of fines and crushables | | | 300 | | 300 | | |
| Transport treated fines and crushables to the Containment Cell | | | 1500 | | | | |
| Transport of 48,500 tonnes of cleaned and crushed carbon to Carbon Processing Facility | | | 1500 | | | | |
| Transport of 5,000 tonnes of steel to steel recycling facility | | | 1500 | | 1500 | 1500 | 1500 |
| Processing of 48,500 tonnes of cleaned and crushed carbon at carbon processing facility | | | 300 | | | | |
| Processing of 5,000 tonnes of steel at steel recycling facility | | | 300 | | 300 | 300 | 300 |
| Waste transportation from Smelter to waste facility | | | | | 2500 | | |
| Unload and stockpile material at receiving facility | | | | | 300 | | |
| Crushing of all crushable material | | | | | 300 | 300 | |
| Transport crushed material to landfill | | | | | 1500 | | |
| Construction of heat treatment facility | | | | | | 5000 | |
| Treat at 600 degrees Celsius | | | | | | 3000 | |
| Decommision and disassmbly of heat treatment facility | | | | | | 5000 | |
| Delivery of containers and bagging and containing material | | | | | | 2500 | |
| Transport from Smelter to rail terminal | | | | | | 1500 | |
| Transport from rail terminal to Tellus Rail Terminal | | | | | | 1500 | |
| Facility Material Acceptance and Placement | | | | | | 1500 | |
| Post-Closure monitoring from Tellus EIS | | | | | | 300 | |
| Establish plasma gasification facility | | | | | | | 5000 |
| Crushing of all crushable materials | | | | | | | 300 |
| Transport treated fines and crushables to the plasma gasification plant | | | | | | | 1500 |
| Transport non-recyclable and non-crushable material to offsite landfill | | | | | | | 1500 |
| Treatment of crushed materials in the plasma gasification plant | | | | | | | 3000 |
| Removal and transfer of by-product to stockpile | | | | | | | 300 |
| Transfer of by-product to Cessnock waste management facility. | | | | | | | 1500 |
| Decommision and disassemble plasma gasification facility | | | | | | | 5000 |
| REUIRED TASKS RISK SCORE | 1900 | 20030 | 41760 | 21830 | 28560 | 34560 | 27230 |
| NUMBER OF TASKS | 5 | 20 | 35 | 22 | 25 | 22 | 22 |
| AVERAGE RISK SCORE PER TASK | 380.0 | 1001.5 | 1193.1 | 992.3 | 1142.4 | 1570.9 | 1237.7 |

# APPENDIX D3
# WORKER SAFETY ALTERNATIVE SCENARIOS RISK LEVEL CALCULATION

| | | Minor | Moderate | Serious | Major | Catastrophic |
|---|---|---|---|---|---|---|
| | | 1 | 10 | 50 | 100 | 200 |
| Almost Certain | 100 | 100 | 1000 | 5000 | 10000 | 20000 |
| Likely | 80 | 80 | 800 | 4000 | 8000 | 16000 |
| Possible | 50 | 50 | 500 | 2500 | 5000 | 10000 |
| Unlikely | 30 | 30 | 300 | 1500 | 3000 | 6000 |
| Rare | 10 | 10 | 100 | 500 | 1000 | 2000 |

## PROBABLE EVENTS/TASKS

Risk Score

| Key Task | Probability of Activity | Option 1 | Option 2 | Option 3 | Option 4 | Option 5 | Option 6 | Option 7 |
|---|---|---|---|---|---|---|---|---|
| Complete remediation consistent with option 2 in response to cap failure; changing regulation; monitoring shows impacts of significance; development around cell required. | Occasional | 20030 | | | | | | |
| Leachate requires removal and treatment. Three years and involves groundwater/subsurface leachate extraction and treatment through a treatment plant (on or off site) | Probable | 300 | | | | | | |
| Moderate repairs to cap (2% - <10% cap surface) | Probable | 1500 | | | | | | |
| Community access capped waste stockpile | Probable | N/A | | | | | | |
| Future construction on surrounding properties encounters leachate and gas | Probable | 2500 | | | | | | |
| Heavy rainfall causes leachate discharge to onsite surface water | Probable | | 500 | | 500 | | | |
| Minor repairs to cap (<2% cap surface) | Probable | | 300 | 300 | 300 | 300 | | |
| Heavy rainfall causes erosion and sediment lost off site during works | Probable | | | 300 | | 300 | 300 | 300 |
| Heavy rainfall causes leachate discharge to offsite surface water | Probable | | | 500 | | 500 | 500 | 500 |
| Carbon material containing asbestos is pulverised | Probable | | | N/A | | | | |
| Heavy rainfall event causes erosion and sediment lost offsite at the receiving facility | Probable | | | | | 500 | | |
| Leachate reacts with other waste leachate within the larger cell | Probable | | | | | 2500 | | |
| Plant delays due to heterogenity of material feed | | | | | | | | N/A |
| PROBABLE SCORE | | 24330 | 800 | 1100 | 800 | 4100 | 800 | 800 |
| NUMBER of TASKS | | 4 | 2 | 3 | 2 | 5 | 2 | 2 |

## OCCASIONAL EVENTS/TASKS

Risk Score

| Key Task | Probability of Activity | Option 1 | Option 2 | Option 3 | Option 4 | Option 5 | Option 6 | Option 7 |
|---|---|---|---|---|---|---|---|---|
| Heavy rainfall causes leachate discharge to offsite surface water | Occasional | | 500 | | 500 | | | |
| Moderate repairs to cap (2-<10% cap surface) | Occasional | | 1500 | 1500 | 1500 | 1500 | | |
| Asbestos containing material is sent to recycler | Occasional | | | N/A | | N/A | N/A | N/A |
| Asbestos containing materials are distributed to consumer in recycled products | Occasional | | | N/A | | N/A | N/A | N/A |
| Recyclable carbon material has no end user | Occasional | | | N/A | | | | |
| Recyclable steel material has no end user due to asbestos risk | Occasional | | | N/A | | N/A | N/A | N/A |
| Leachate activates lime which crystallises and clogs leachate capture system resulting in increased gas emissions due to water content | Occasional | | | 2500 | 2500 | 2500 | | |
| Treatment with lime doesn't reduce leachable F concentration | Occasional | | | | N/A | | | |
| Community access containment cell location and exposed to gas | Occasional | | | | | N/A | | |
| Space for landfill insufficient | Occasional | | | | | N/A | | |
| Financial assurance for long term management insufficient or has lower regulatory requirement – government assistance required | Occasional | | | | | N/A | | |
| Heavy rainfall causes erosion and sediment lost off site during works | Occasional | | 300 | | 300 | | | |
| Gas build up in salt cavity of flamable/toxic gas (cavity not vented) | Occasional | | | | | | 2500 | |
| Slag end product requires landfilling | Occasional | | | | | | | 300 |
| OCCASIONAL SCORE | | 0 | 2300 | 4000 | 4800 | 4000 | 2500 | 300 |
| NUMBER of TASKS | | 0 | 3 | 2 | 4 | 2 | 1 | 1 |

## IMPROBABLE EVENTS/TASKS

Risk Score

| Key Task | Probability of Activity | Option 1 | Option 2 | Option 3 | Option 4 | Option 5 | Option 6 | Option 7 |
|---|---|---|---|---|---|---|---|---|
| Gas migration to surrounding buildings following future development of the site | Improbable | 5000 | | | | | | |
| Leachate reaches downstream receptors. Leachate requires removal and treatment. Three years and involves groundwater/subsurface leachate extraction and treatment through a treatment plant (on or off site) | Improbable | 500 | | | | | | |
| Truck turnover spilling contaminated load onsite | Improbable | | | Accounted for within the hazards associated with the Management Options | | | | |
| Leachate tanker spills/overtops | Improbable | | | Accounted for within the hazards associated with the Management Options | | | | |
| Containment Cell leaks causing leachate migration to groundwater | Improbable | | 2500 | 2500 | 2500 | 2500 | | |
| Major cap repair (10-<20%) | Improbable | | 2500 | 2500 | 2500 | 2500 | | |
| Treatment with lime doesn't reduce leachable F concentration | Improbable | | | N/A | | N/A | | |
| Truck spills contaminated load on public road | Improbable | | | | | 500 | 500 | |
| Train derailment causing spillage | Improbable | | | | | | 500 | |
| Groundwater seepage to salt cavity | Improbable | | | | | | 2500 | |
| Extreme weather event occurs during transport or transitory storage causing damage to containers and bags and uncontrolled release in air and water | Improbable | | | | | | 2500 | |
| Material interacts with co-disposed waste | | | | | | | N/A | |
| Plasma gasification plant gas leak occurs | Improbable | | | | | | | 300 |
| IMPROBABLE SCORE | | 5500 | 5000 | 5000 | 5000 | 5500 | 6000 | 0 |
| NUMBER of TASKS | | 2 | 2 | 2 | 2 | 3 | 4 | 1 |

## REMOTE EVENTS/TASKS

Risk Score

| Key Task | Probability of Activity | Option 1 | Option 2 | Option 3 | Option 4 | Option 5 | Option 6 | Option 7 |
|---|---|---|---|---|---|---|---|---|
| Major stockpile failure as a result of a seizmic event, major climatic event | Remote | 2500 | | | | | | |
| Major Containment Cell failure as a result of a seizmic event, major climatic event | | | 2500 | 2500 | 2500 | 2500 | | |
| Landfill leaks causing impact to groundwater or surface water | Remote | | | | | | 2500 | |
| Plasma gasification plant explodes | Remote | | | | | | | 20000 |
| REMOTE SCORE | | 2500 | 2500 | 2500 | 2500 | 2500 | 2500 | 20000 |
| NUMBER of TASKS | | 1 | 1 | 1 | 1 | 1 | 1 | 1 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| NUMBER OF ALTERNATIVE SCENARIO EVENTS | | 7 | 8 | 8 | 9 | 11 | 8 | 5 |