

# Spent Potlining Processing

## Preliminary Risk Screening Report



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## Executive Summary

Weston Aluminium (WA) currently has regulatory approval to process Second Cut Spent Potlining (SPL) on a commercial scale (up to 40,000 tonnes per annum in combination with aluminium dross inputs). In response to various research and development Trial activities, and changes in market demand, WA is now seeking to process all SPL arisings – i.e. First Cut SPL, Second Cut SPL and Mixed SPL (First Cut and Second Cut in combination) at this commercial scale.

This report discusses the potential change in the risk profile of the facility based on WA's Project to process all SPL waste inputs in addition to existing operations and to determine the extent to which the analysis in the existing Preliminary Hazard Analysis (PHA) prepared in 2012 (Ref. 1) remains valid.

The following elements were taken into account in the assessment:

- Differences in composition between First Cut SPL, Second Cut SPL and Mixed SPL, specifically in relation to materials that may be inherently hazardous or potentially hazardous when mixed with other materials;
- Differences in site location, processing or treatment techniques, transportation, storage arrangements, and other layout and design aspects; and
- Other differences that may have a material impact on the risk profile of the facility.

It was determined that in general, operations remain consistent with that defined in the 2012 Environmental Assessment (EA) (Ref. 8). The storage arrangements for SPL, including the construction of the buildings for areas where SPL will be stored, remains consistent with the current storage arrangements for Second Cut SPL. Therefore, any change to the risk profile of the facility will be due to changes in composition of the SPL.

The key difference between First Cut SPL and Second Cut SPL is the significantly higher in carbon content and marginally higher cyanide content. The gap analysis assessed the impact that the increase in carbon content and cyanide content has on the hazardous properties of the First Cut SPL as compared to Second Cut SPL.

Based on the analysis conducted in this study, the hazards associated with the proposed storage and treatment of SPL at the WA facility does not result in a change to the existing risk profile, hence, the risk criteria published by the NSW DPI in HIPAP No.4 (Ref. 5) are not exceeded and the facility remains classified as potentially hazardous and not hazardous.

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## 1.0 Introduction

### 1.1 Background

Weston Aluminium Pty Ltd (WA) operates an SPL and Dross processing and aluminium recycling facility at Kurri Kurri, NSW. The current WA facility recovers aluminium from dross, a by-product of the aluminium smelting process, reprocesses and value-adds to Second Cut SPL wastes, and remelts various grades of aluminium scrap and base metal for the production of deoxidant products for the steelmaking sector.

Second Cut Spent Potlining (SPL) is processed onsite to remove hazardous chemical compounds (e.g. cyanide) and alter its mineralogy such that the products generated can be used by customers as an input in various industrial processes. The facility is approved to process up to 40,000 tonnes of dross aluminium and Second Cut SPL per year in combined total, and up to 35,000 tonnes of scrap aluminium metal per year on site.

WA proposes to diversify its service provision to the aluminium smelters beyond the reprocessing of Second Cut SPL, aluminium drosses and other aluminium-bearing by-products to secure future sustainability and growth. WA proposes to process all SPL arisings (First Cut, Second Cut and Mixed SPL) on a commercial scale within existing tonnage limits (the Project).

The Project involves the use of existing technologies located at WA's Kurri Kurri premises, including the following processes:

- The transportation of material from primary aluminium smelters to WA's Kurri Kurri facility by a licensed Dangerous Goods Contractor (segregated First Cut SPL, Second Cut SPL, or unsegregated Mixed SPL);
- The storage of material within existing enclosed buildings and dedicated storage bays;
- The processing and treatment of material within existing crushing circuits and rotary furnaces, capable of attaining the required temperatures to thermally process contaminants and affect required mineralogical transformations;
- The continued use of existing best-practice emission controls systems, including extraction hoods, wet-dry lime scrubber, filter baghouse complexes, and real-time continuous fluoride and particulate monitoring systems; and
- The storage, handling and dispatch of finished product to customers under existing quality control procedures.

This report summarises the outcomes of the preliminary risk screening assessment in accordance with the provisions of State Environmental Planning Policy No.33 – Hazardous and Offensive Development (SEPP 33) to determine the potential for significant offsite impacts due to the processing of SPL within existing tonnage limits.

### 1.2 Objectives

The objective of the preliminary risk screening is to determine whether there is a change to the risk profile of the facility based on WA's Project to process SPL in addition to existing operations.

### 1.3 Scope of Work

The scope of work is for a preliminary risk screening of the facility based on the inclusion of the treatment and processing of SPL on a commercial scale, within the existing tonnage limits.

The scope does not include the assessment of any existing facilities that have already been reviewed as part of previous Preliminary Hazard Analysis (PHA) studies; however, the assessment of potential cumulative risks at the site is included within the scope.

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## 2.0 Methodology

A review and gap analysis of the PHA prepared in 2012 (Ref. 1) was conducted. The intent was to determine the extent to which each hazard scenario and corresponding consequence analysis for the processing of Second Cut SPL, remain applicable for the processing of all arising SPL (i.e. inclusive of First Cut and Mixed SPL).

The following elements were taken into account in the assessment:

- Differences in composition between First Cut SPL, Second Cut SPL and Mixed SPL, specifically in relation to materials that may be inherently hazardous or potentially hazardous when mixed with other materials;
- Differences in site location, processing or treatment techniques, transport, storage arrangements, and other layout and design aspects; and
- Other differences that may have a material impact on the risk profile of the facility.

Each identified key change was taken forward in the assessment to determine how the hazardous properties of the materials, hazardous incidents, and associated consequence analysis would be impacted based on the proposed changes at the site.

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## 3.0 Preliminary Risk Screening

### 3.1 Key Changes to Operating Profile

#### 3.1.1 Changes to Operating Profile

In addition to the approved commercial-scale processing of Second Cut SPL, Weston Aluminium proposes to treat and process mixed and First Cut SPL in its existing plant, within the existing tonnage limits.

In general, operations remain consistent with that defined in the 2012 Environment Authority (EA), with the following minor changes implemented since 2012:

- Minor upgrades to Program and Logic Controls (PLCs); and
- Minor changes to achieve gains in process efficiency.

The planned storage arrangements for First Cut and Mixed SPL are consistent with the current storage arrangements for Second Cut SPL. Generally speaking, subject to approval all SPL materials would be managed collectively as SPL.

The transport route for all truck movements transporting SPL is as per the existing transport route which is via Mitchell Ave, Government Rd, Hart Rd and the Hunter Expressway (i.e. this is the shortest route to the Hunter Expressway). There are no truck movements transporting SPL through Weston or Kurri Kurri.

The current site layout plan showing the location of the SPL storage and processing areas (including the Aldex building) is shown in the **Figure 1** below.

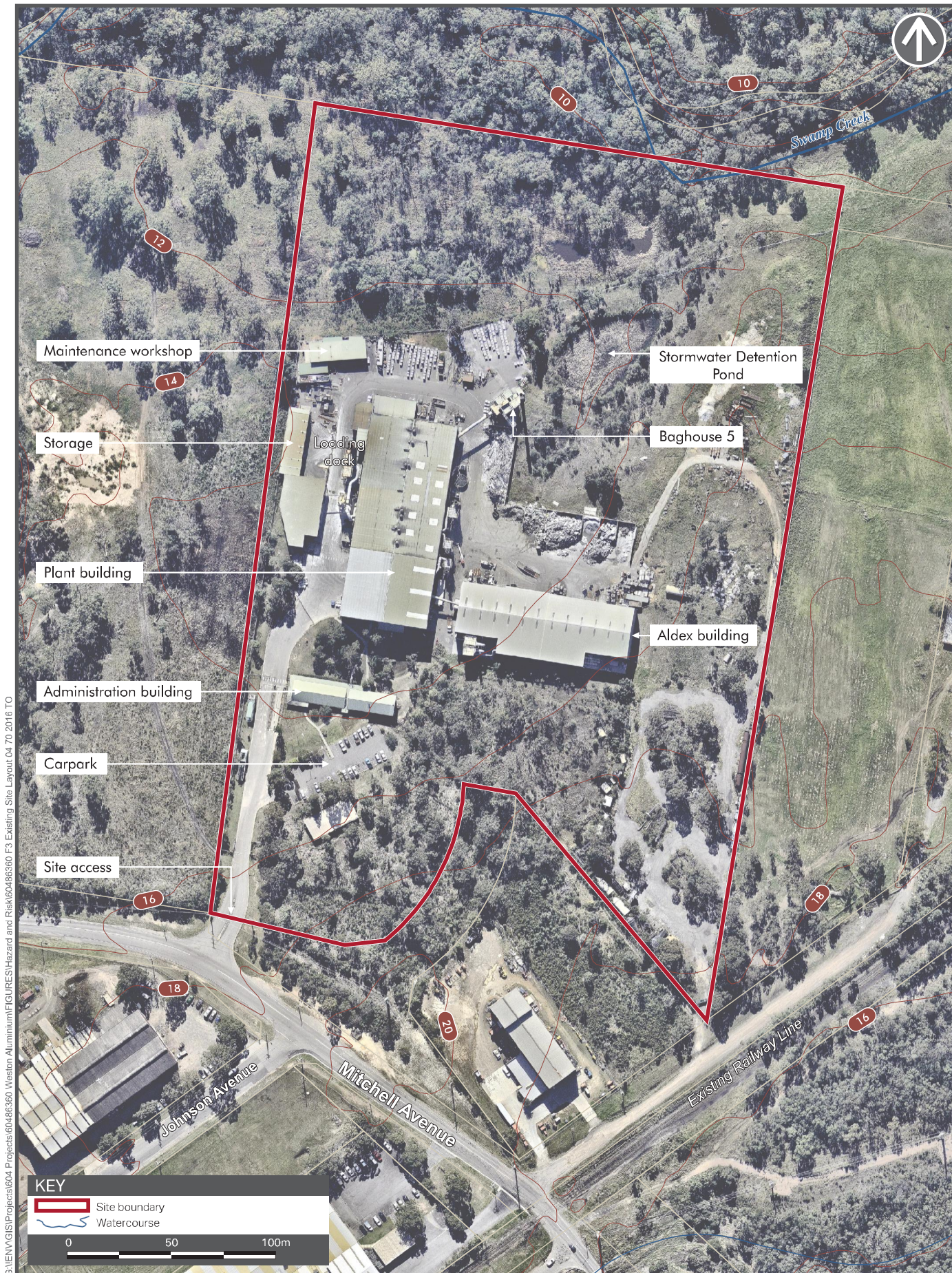
As no other significant changes are planned for the storage, processing and transportation of SPL, any change to the risk profile of the facility will be due to changes in composition of the SPL.

#### 3.1.2 Proposed Future Changes

There are currently proposed changes within the existing WA site boundary including the Thermal Waste Processing Facility Project (SSD 15\_7396). This Project represents a separate Project in a separate building on a separate portion of the WA site approximately 100m to the north of the SPL storage location.

Whilst the proposed thermal waste processing project may amend the entire risk profile of the WA site, potential impact to the existing SPL processing operation are expected to be negligible. Therefore potential changes to the risk profile of the locality as a result of the thermal waste processing project have not been assessed as a part of this study. It is noted that a separate Preliminary Hazard Assessment (PHA) is being prepared for the thermal waste processing project. That PHA would assess the potential hazard and risk impacts of that project including potential risk interactions with the existing WA operation including SPL handling and processing.





G:\ENV\GIS\Projects\604 Projects\60486360 Weston Aluminium\FIGURES\Hazard and Risk\60486360 F3 Existing Site Layout 04\_70 2016 TO



## 3.2 SPL Composition

SPL is a hazardous by-product of primary aluminium production, generated from the periodic de-lining of electrolytic cells. First Cut SPL (originating from the carbon cathode) and Second Cut SPL (refractory lining) contain varying proportions of aluminium, carbon, cyanide, fluorides, sodium and other trace contaminants which require management and disposal consideration.

The following SDSs were reviewed:

- Second Cut SPL: Refractory Byproduct (product use: Raw material feed to produce refractory feedstock) (Ref. 9); and
- First Cut SPL: Carbon Byproduct (product use: Raw material feed to produce kiln fuel) (Ref. 10).

**Table 1** lists the key composition differences between First Cut SPL and Second Cut SPL. Note that these compositions are general and representative of the type of First and Second Cut SPL that may be processed at the facility.

**Table 1** Compositions: First Cut SPL and Second Cut SPL

| Composition                                              | Refractory Byproduct – Second Cut SPL | Carbon Byproduct - First Cut SPL |
|----------------------------------------------------------|---------------------------------------|----------------------------------|
| Carbon, non-activated                                    | 2-5%                                  | 50-75%                           |
| Silica crystalline – quartz                              | 40-70%                                | 0-6%                             |
| Sodium hydroxide                                         | 1-2%                                  | 2-4%                             |
| Sodium fluoride                                          | 5-11%                                 | 9-11%                            |
| Sodium aluminium fluoride                                | 3-8%                                  | 0%                               |
| Aluminium                                                | 0-1%                                  | 0%                               |
| Iron                                                     | 0-1%                                  | 0%                               |
| Ferric oxide                                             | 2-4%                                  | 0%                               |
| Sulphur                                                  | 0-1%                                  | 0%                               |
| Fluorspar                                                | 0-1%                                  | 0-1%                             |
| Calcium oxide                                            | 1-5%                                  | 1-2%                             |
| Fresh alumina (aluminium oxide $\text{Al}_2\text{O}_3$ ) | 12-30%                                | 2-10%                            |
| Free cyanide                                             | 0-0.04%                               | 0-0.1%                           |

A preliminary assessment shows the key difference between First Cut SPL and Second Cut SPL is significantly higher in carbon content and marginally higher cyanide content. The higher carbon content classifies the First Cut SPL as a combustible material (Ref. 9) whereas the Second Cut SPL is considered a non-combustible material (Ref. 10).

Other composition differences between First and Second Cut SPL are not considered to result in additional hazards not already identified for Second Cut SPL.

The following product SDS information presented in **Table 2** is consistent for both the First Cut and Second Cut SPL product.

Table 2 Product Information for First Cut SPL and Second Cut SPL

| SPL Product Information*                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|----------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Proper shipping name:                              | Aluminium Smelting by-products                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Supplier:                                          | Tomago Aluminium Co. P/L                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| Hazard identification of the substance or mixture: | Hazardous Chemical according to WHS Regulations and Dangerous Good according to ADG Code.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| Class and Packing Group:                           | 4.3 III                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| UN number:                                         | 3170                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Incompatibilities:                                 | <ul style="list-style-type: none"> <li>- Contact with acids produces toxic fumes.</li> <li>- Contact with water liberates extremely flammable gases.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Safe handling:                                     | <ul style="list-style-type: none"> <li>- Keep dry</li> <li>- Store undercover</li> <li>- Store in well ventilated area</li> <li>- Store away from sources of heat/ ignition sources.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Hazards:                                           | <ul style="list-style-type: none"> <li>- Contact with water emits highly flammable gases.</li> <li>- Reacts with water or steam to produce toxic and corrosive fumes.</li> <li>- Avoid contamination with oxidising agents i.e. nitrates, oxidising acids, chlorine bleaches, pool chlorine etc. as ignition may result.</li> <li>- Heating may cause explosion or decomposition leading to violent rupture of containers.</li> <li>- Avoid creating dust – may present dust explosion hazard.</li> <li>- Dry dust can be electrostatically charged by turbulence, pneumatic transport, pouring, in exhaust ducts and during transport. Build-up of electrostatic charge may be prevented by grounding.</li> </ul> |

\* The SDSs from Tomago Aluminium are representative only. SPL would be sought from a variety of domestic source.

### 3.3 Key Changes to Control Measures

A review of each of the control measures and safeguards identified by the 2012 PHA has identified that they are in place at WA. At the time of the 2012 PHA, a control for steel casing for the SPL cooler was proposed and this has since been implemented.

WA has recently completed an Independent Hazard Audit of all operations, confirming suitability of plant, equipment and processes. A multi-gas meter has also been purchased under advice of the Independent Hazard Auditor to routinely verify low levels of ammonia.

There have been no other changes to the safeguards since 2012.

### 3.4 Gap Analysis

This task includes a preliminary risk screening assessment to determine the potential for significant offsite impacts due to the processing of SPL.

A gap analysis of the hazardous properties of materials, hazardous incidents, and consequence analysis completed in the previous PHA (Ref. 1) was undertaken to determine if changes to the composition of SPL would result in a change to the risk profile of the facility. The results of the gap analysis are presented in **Table 3**.

**Table 3** Gap Analysis

| Element / Consideration                                    | Gap Analysis                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Does the change impact on the risk profile? (Y/N) |
|------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------|
| <b>Hazardous Properties of Materials</b>                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                   |
| Spent Potline Materials                                    | A preliminary assessment shows that First Cut SPL has a significantly higher carbon content and slightly higher cyanide content than Second Cut SPL. The higher carbon content classifies the First Cut SPL as a combustible material (Ref. 9) whereas the second cut SPL is considered a non-combustible material (Ref. 10).<br>Although First Cut SPL is considered a combustible material, it is not classified as Dangerous Goods and no significant risks are identified as a result of this change.<br>Other composition differences between First and Second Cut SPL are not considered to result in additional hazards not already identified for Second Cut SPL. | No                                                |
| Treated Product Material                                   | The treated product materials of First Cut and Mixed SPL are similar to the treated product material derived from the processing of Second Cut SPL. Therefore, no significant change to the risk profile is expected to arise from the treated product material of First Cut and Mixed SPL.                                                                                                                                                                                                                                                                                                                                                                               | No                                                |
| <b>Hazardous Incident</b>                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                   |
| Water contamination with Cyanide                           | Water contamination with cyanide is covered under 'Consequence Analysis' below.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | [Refer Consequence Analysis below]                |
| Formation of Toxic Gases due to contact of SPL with acids. | ue <sup>⊥</sup> ¶ !! = "True" "ith acids may result in the formation of hydrogen sulphide or hydrogen cyanide. However, acids are not expected to be stored as part of the proposed changes*.                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | No                                                |
| Dust Generated during Delivery                             | The effectiveness of the existing dust control systems have been demonstrated during current plant operations. There is no change in the risk profile of dust generation during delivery.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | No                                                |
| Hole in the Equipment or Dust Extraction Ductwork          | As there will be no dust release from the building in the event of an equipment failure, there is no increase in the risk profile.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | No                                                |
| Bag-house Failure                                          | There are no proposed changes to how bag-house failure is monitored and controlled with the introduction of First Cut SPL and Mixed SPL to the site.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | No                                                |
| Minor Holes in the Aldex Building Roof                     | The current controls remain adequate for the new material. There is no increase in the risk profile.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | No                                                |
| Major Storm Damage to the Aldex Building                   | The mixing of water with SPL could result in the formation of hydrogen gas and minor quantities of                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | [Refer Consequence Analysis below]                |

| Element / Consideration                                                             | Gap Analysis                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Does the change impact on the risk profile? (Y/N) |
|-------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------|
|                                                                                     | ammonia/methane/acetylene due to trace concentrations of carbides and nitrides being present within the material.<br>This incident is covered under 'Consequence Analysis' below.                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                   |
| Furnace Firing Failure                                                              | In the event of a firing failure, there is a risk of cyanide remaining within the furnace charge mass during the treatment process.<br>Despite the concentration of cyanide being slightly higher in First Cut SPL, the quantities are still considered minor and no change to the risk profile is expected in this scenario.<br>Furthermore in the event of and firing failure the burners would be restarted and the process restarted and continued through to completion of the processing sequence.                                                                                                             | No                                                |
| <b>Consequence Analysis</b>                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                   |
| Water Ingress to the Building, Water/SPL Mix & Hydrogen Generation                  | Due to the storage arrangements being the same as currently applied to Second Cut SPL, no change to the risk profile is expected in this scenario.                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | No                                                |
| Water Ingress to the Building, Water/SPL Mix & Ammonia/Methane/Acetylene Generation | The mixing of water with SPL could result in the formation of hydrogen gas and minor quantities of ammonia/methane/acetylene due to trace concentrations of carbides and nitrides being present within the material.<br>Although there may be minor differences in the carbide and nitride concentrations of First Cut SPL compared with Second Cut SPL, the limiting factor in this scenario is the amount of water that may enter the storage building.<br>As the storage arrangements for First Cut SPL and Mixed SPL are the same as Second Cut SPL, no change to the risk profile is expected in this scenario. | No                                                |
| Water Ingress to the Building, Water/SPL Mix & Dissolving of Cyanide                | The previous PHA (Ref. 1) assessed the potential for leaching of cyanide due to water ingress.<br>Although First Cut SPL has a slightly higher concentration of cyanide to Second Cut SPL (0.1% compared with 0.04%), it is not expected that the slightly higher concentration would result in a significant risk of cyanide leaching to the environment.<br>Furthermore WA store and handle SPL materials within bunded and enclosed buildings eliminating potential contact with water Therefore, no change to the risk profile is expected in this scenario.                                                     | No                                                |



## 4.0 Conclusion

Based on the analysis conducted in this study, the hazards associated with the proposed storage and handling of First Cut and Mixed SPL (in conjunction with existing Second Cut SPL processing operations) at the Weston Aluminium facility does not result in a change to the existing risk profile, therefore, the risk criteria published by the NSW DPI in HIPAP No.4 (Ref. 5) are not exceeded. The facility would remain classified as potentially hazardous and not hazardous and would therefore be permitted to continue processing dross and SPL in a manner consistent with existing operational procedures.

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## 5.0 References

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8. AECOM Report No: 60250487-Environmental Assessment Spent Potlining Processing, Revision D – Final Revised, 10 May 2012.
9. First Cut SPL: Carbon Byproduct, Chemwatch SDS No: 4686-68, Version no: 6.1.1.1; Tomago Aluminium Co. P/L, Jan 01, 2013, (accessed March 18, 2016).
10. Second Cut SPL: Refractory Byproduct, Chemwatch SDS No: 4686-69, Version no: 6.1.1.1; Tomago Aluminium Co. P/L, Jan 01, 2013, (accessed March 18, 2016).

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