APPENDIX 3
EXISTING PRACTICES FOR LEGACY ALUMINIUM SMELTER LANDFILLS

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Waste management options that may be applicable to the capped waste stockpile materials were identified through a comprehensive search of available technologies and experiences. Data sources reviewed were:

- Experiences of smelter personnel and the Norsk Hydro team in Norway
- Ramboll Environ global experiences
- Knowledge of two Australian based smelters
- Literature search of practices implemented at legacy landfills and aluminium smelters locally and globally

A3.1 Existing Management Practices

The review found that globally, many older aluminium smelters, similar to Kurri Kurri, have legacy waste landfills. The research has not identified any other legacy waste management solutions other than capping and containment. In most cases, legacy wastes were left *in situ* and capped. In some cases, waste has been consolidated and groundwater remediation measures also implemented. Australian and global examples of the management of aluminium smelter legacy wastes is described in this section.

A3.1.1 Australia

Two smelters that were constructed and commenced operations in Australia prior to the mid 1980's have smelter waste landfills of similar nature to that within the CWS at Kurri Kurri. These are Pacific Aluminium Bell Bay (Tasmania) and Alcoa Point Henry (Victoria).

3.1.1.1 Pacific Aluminium Bell Bay

Pacific Aluminium Bell Bay had a number of smelter waste stockpiles (including spent pot lining) and landfills that were consolidated in the mid 1990's within three purpose built containment cells (see **Photo A3.1**). In October, 1994 the Director of Environmental Management of the (now) Tasmania Environment Protection Authority (Tasmania EPA) provided a Letter of Approval (in principle) for the relocation of SPL to multiple sealed stockpiles. This 'in principle' approval was given in lieu of the Final Environmental Project Evaluation Spent Pot Lining Encapsulation Report, which was to clarify engineering details, hydrology and geology of wetlands, water balance of the system, and review of groundwater boreholes.

Although Ramboll Environ was unable to obtain a copy of the Final Environmental Project Evaluation Spent Pot Lining Encapsulation Report or the final approval from the Director of Environmental Management of the (now) EPA, documentation which has been obtained indicate that 250,000 tonnes of spent cell lining was transferred to the purpose built containment cells.

3.1.1.2 Alcoa Point Henry

From information available on the Alcoa Point Henry website Point Henry has a number of capped waste stockpiles and landfills, some that included mixed smelter wastes. This available information indicates that Alcoa intends to retain these capped stockpiles and landfills *in situ* as part of the site closure plans and future redevelopment and reuse (see **Photo A3.2**).

Alcoa continues to work with the Victoria EPA to comply with an Amended Clean Up Notice associated with hydrocarbon contamination of groundwater.

A3.1.2 United States of America

Uncontrolled landfilling of spent pot lining (similar to the CWS prior to its capping) historically occurred at aluminium smelters in the USA. An example is at the Alcoa Massena aluminium smelter at Massena, New York. The smelter commenced operations in 1903, and several aluminium smelter waste landfills were established on site. One area was a spent pot lining stockpile site, with materials stockpiled at the location between 1951 and 1976. Remediation of the location began in 1992 with the construction of a soil-bentonite slurry wall around the perimeter of the stockpile location, which was keyed into an underground clay stratum which

established an inward hydraulic gradient. A leachate collection system was established within the slurry wall.

At the former Martin Marietta Aluminum Reduction Facility at The Dalles, Oregon, spent pot lining and other smelter wastes were consolidated into a capped landfill and a leachate treatment facility (for fluoride and cyanide) established. A groundwater monitoring program was also implemented (US EPA 1994).

Photo A3.1: Bell Bay Smelter Waste Stockpiles and Landfills (Source: Google Earth, 2017)

Photo A3.2: Alcoa Point Henry Capped Mixed Smelter Waste Stockpiles and Envisioned Concept Master Plan Components (Source: Alcoa, 2016)

In response to issues at historical aluminium smelter landfills, the US EPA initially prohibited land disposal of spent pot lining. However in 1998 it issued *Land Disposal Restrictions; Treatment Standards for Spent Potliners From Primary Aluminum Reduction (K088); Final Rule*. This stated "spent pot liners will be prohibited from land disposal unless the wastes have been treated in compliance with the numerical standards contained in this rule. These treatment standards are necessary to minimise threats to human health and the environment from exposure to hazardous constituents which may potentially leach from landfills to groundwater." These treatment standards included treatment standard of 26.1 mg/kg total arsenic and 30 mg/L leachable cyanide for non-wastewater, but did not include a standard for fluoride.

A3.1.3 United Kingdom

The Rio Tinto Alcan (formerly Alcan) Lynemouth smelter disposed of spent pot lining in a landfill cell known as the Woodhorn Landfill. The cell was closed in 2007 using a capping layer, gas collection and fly ash. Future spent pot linings were stockpiled onsite. Closure of the smelter was announced in 2012 and it is understood that spent pot linings have been capped in-situ.

A3.1.4 Norway

Spent pot lining has been placed into a number of landfills in Norway. An example is a landfill at the Hydro Husnes (formerly Søral) aluminium smelter. The smelter and landfill are located on the shore of a fjord in the west of Norway. The landfill contained spent pot lining, dross, asbestos wastes and municipal waste and was used from 1995 to 2006. This included an area that received 75,000m^3 of spent pot lining between 1996 and 2006. At this time the landfill was capped and rehabilitated under approval of the Norwegian Environment Agency.

A golf course and marina were constructed on the former landfill (as shown in **Photo A3.3**). Due to the positive results of monitoring in the fjord adjacent to the landfill and the surrounding area there are no fishing or farming restrictions.

Photo A3.3: The rehabilitated Hydro Husnes mixed aluminium smelter waste location

A second Norwegian example is the Langøya Hazardous Waste Facility. This is located on a narrow island in a fjord south of Oslo. Prior to the 1980's the island was a limestone quarry, but is now the largest hazardous waste facility in Norway. The Hydro Holmestrand aluminium rolling mill is located approximately 2 km southwest of the island. Spent pot lining was one of the wastes placed in the landfill. The operator of the facility, NOAH, has developed plans for the completion of landfilling, closure and capping of the landfill.