

BACKGROUND

Spent Potlining (SPL) is a 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, and its management and disposal continues to represent a major issue faced by the industry on a worldwide scale.

Conventionally, primary aluminium smelters segregate the cathodic lining (1st Cut SPL) from the refractory lining (2nd Cut SPL) to assist with the fostering of end-use markets for the treated products. Prior to the mid-1990s, however, such segregation did not occur (or was otherwise limited), and legacy stockpiles of Mixed SPL have remained in storage on smelter sites without a viable treatment and reuse solution.

Weston Aluminium's present interest in Mixed SPL has emerged in response to the recent announcement by Hydro Aluminium of its Kurri Kurri smelter closure, and their forward strategy (and regulatory obligations) in relation to the management and treatment of their legacy Mixed SPL. Present aboveground Mixed SPL holdings are understood to be in the order of 30,000 tonnes (within sheds and curtailed pots), whilst holdings in the order of 100,000 – 150,000 tonnes exist within underground stores on the former smelter site.

Similarly, Weston Aluminium has been approached by other smelters, including Tomago Aluminium Company and Alcoa Australia Pty Limited, who also require an effective and sustainable solution for their legacy quantities of Mixed SPL stored onsite within their facilities.

Since 2005, Weston Aluminium has undertaken extensive research and development, both domestically and overseas, investigating available technologies for the treatment of SPL from primary aluminium smelters. Weston Aluminium's objective is to offer a sustainable solution to domestic smelters, enabling the cost-effective treatment of SPL and, in conjunction with other inputs, formulate the manufacture of a value-added product as direct substitutes for conventional industrial raw material feedstock.

This approach was conceived through our central foundation and ongoing involvement with the NSW Industrial Ecology Network, represented by like-minded industry, academics and Government regulators, eager to encourage the recovery of industrial by-products as valuable resources, and thereby achieve the diversion of large material volumes from landfill and/or overseas treatment. This research and development has culminated in the completion of numerous and successful small-scale trials (see below), and the recent attainment of Regulatory Approval for commercial-scale processing of domestic-sourced 2nd Cut SPL (September 2012). Second Cut SPL processing at our Kurri Kurri premises commenced during November 2012.

TRIAL PROJECT OVERVIEW

Due to the highly variable nature of the subject Mixed SPL (i.e. varied proportions of 1st and 2nd Cut SPL, and presence of other components known to be present, such as anodic material (carbon), aluminium dross and other aluminium-bearing wastes), Weston Aluminium is seeking a Trial scale appropriate to evaluate the performance of the treatment sequence, and to determine additional process requirements which may be required to achieve the manufacture of a consistent product specification suitable for end-use market consumption. Accordingly, Weston Aluminium is seeking approval to Trial the processing of up to 3,000 tonnes of Mixed SPL over an interval of up to 12 months from Approval.

Consistent with prior Trial activities, Weston Aluminium proposes a treatment process based on the following elements:

1. Input characterisation;
2. Raw material crushing;
3. Thermal treatment;
4. Crushing and blending; and
5. Dispatch to Customers.

It is proposed that existing plant and equipment, currently employed for the storage, handling and processing of aluminium dross and 2nd Cut SPL, will be utilized for the treatment of Mixed SPL. Existing infrastructure and associated controls will be employed for material containment and compliance with regulatory environmental requirements.

WESTON ALUMINIUM'S HISTORICAL SPL TRIAL ACTIVITIES

Laboratory-scale Trials - New Zealand, Feb – April 2010

Weston Aluminium undertook laboratory-scale trials in New Zealand during the period February - April 2010 to demonstrate the treatment concept and the emission control performance of a small-scale plant. This involved the processing of 1st and 2nd Cut SPL with proprietary additives in a 2.7m length diesel-fired kiln at temperatures of 650°C – 750°C in a batch-style process, and the recovery of the treated residue.

Independent emissions testing was performed during the trial process to assess control performance. The emission control system comprised a wet lime scrubber and fabric filter baghouse constructed for the removal of fluoride and particulate emissions. This pollution control system was designed and operated to emulate that operating at our Kurri Kurri facility, and from which a full-scaled operation could be modeled.

Trial data demonstrated the complete destruction of cyanide, the immobilisation of fluoride and heavy metal contaminants, and verified emission control performance (i.e. control and removal of fluoride, particulates and cyanide by the small-scaled lime scrubber and fabric filter baghouse; see below).

Onsite Rotary Furnace Trial – August 2010

Following the completion and success of NZ-based trials, Weston Aluminium sought Development Consent Modification and Environment Protection Licence variation to validate the treatment process and emission control systems on a larger scale before considering further Research and Development activities and the development of a commercial operation.

Our Kurri Kurri processing facility was considered ideal for the validation trial due to the compatibility of existing unit processes and practices including:

- A rotary furnace, capable of attaining elevated temperatures required to thermally oxidise cyanide (typically >650°C);
- Casting facilities for the recovery of treated SPL; and
- Best-practice emission controls systems, including extraction hoods, wet-dry lime scrubber, baghouse complex, and real-time continuous fluoride and particulate monitoring system controlled by a Citect-based PLC.

On 14 August, approximately 8 tonnes of 2nd Cut SPL was sourced from Tomago Aluminium and processed using an existing rotary furnace. A Monitoring and Verification Report detailing laboratory analysis and monitoring data collected throughout the trial including feed, product and stack emission testing was subsequently issued to various Regulatory Authorities.

The trials were undertaken to establish:

- Optimal furnace operating conditions, including identifying suitable batch/residence time, required operating temperature and rotation protocol for the complete destruction of cyanide contained within the untreated SPL;
- Verify the performance of the existing pollution control system;
- Verify the performance of feedstock formulations implemented in NZ and of SPL-only feeds; and
- Energy demand requirements.

SPL was processed independently of normal aluminium dross processing activities to allow the assessment of emissions performance directly attributed to SPL processing. Rotary furnace off-gases were directed through the existing wet-dry fluoride scrubber and baghouse pollution control systems with emission control emission performance monitored continuously throughout the Trial via real-time stack emissions monitoring and independent NATA accredited stack emission testing.

Samples from both feed and processed SPL were submitted to a NATA accredited laboratory for material characterisation. Cyanide contaminant concentrations contained within the products were dramatically reduced and considered to be negligible.

Real-time, continuous emission monitoring data confirmed that gaseous fluoride and particulate emission concentrations were below the regulatory compliance limits throughout the entire Trial interval. Treatment temperatures during the trial were increased to over 1000°C to demonstrate worst-case fluoride dissociation, with the pollution control system demonstrating appropriate fluoride scrubbing capability. Real-time fluoride data logged during the Trial period is detailed in **Figure 1**.

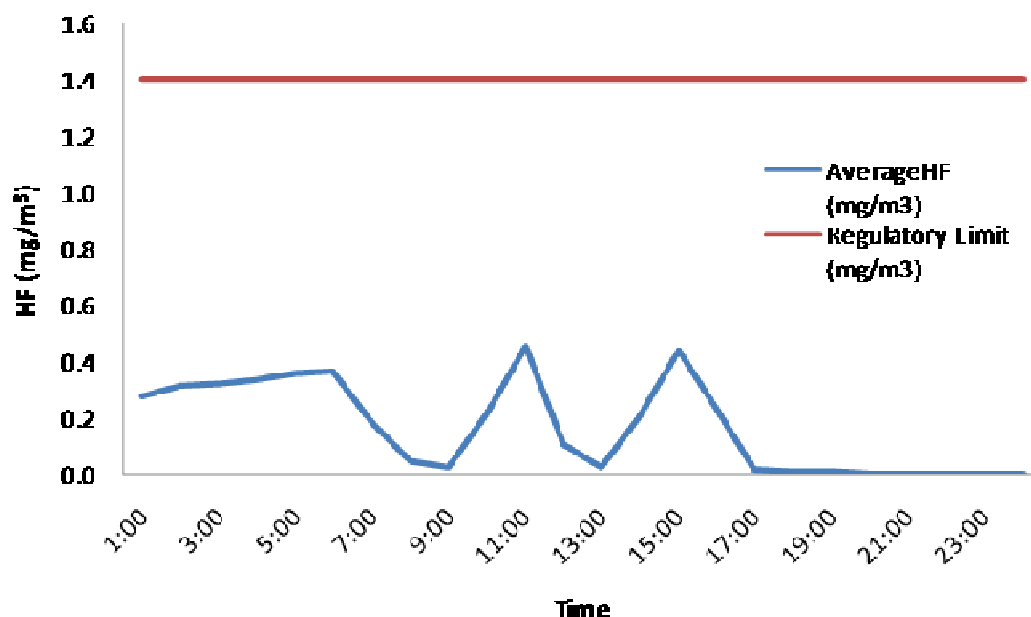


Figure 1 – Real-time fluoride monitoring concentration data obtained during SPL Trial.

NATA-accredited emission testing was undertaken in conjunction with Trial activities, revealing low pollutant discharge concentrations, and confirming the suitability of the existing lime-scrubber and fabric filter baghouse pollutant control systems. All air emission concentrations were well below regulatory compliance limits demonstrating the suitability of the existing pollution control system for future processing of SPL. A summary of stack emission testing data collected during the Trial is provided in **Table 1**.

Table 1: Emission Assessment - Kurri Kurri Trial SPL Processing (2010)

Emission Monitoring Parameter	Trial Emission Monitoring (2010)	Regulatory Compliance Limits
Total Particulate Matter	8.9	25
Fine Particulate Matter	0.24	NL
Hydrogen Chloride	0.95	400
Chlorine	0.42	NL
Particulate Fluoride	0.027	NL
Gaseous Fluoride	0.38	2
Sulfuric Acid Mist	<1.6	100
Sulfur Dioxide	<7.8	NL
Total Hazardous Substances (metals)	0.017	10
Total Polycyclic Aromatic Hydrocarbons	0.74	NL
Volatile Organic Compounds	<0.17	NL
Total Oxides of Nitrogen (as equiv. NO ₂)	4	2500
Carbon Monoxide	5	100
Cyanide	<0.061	NL
Notes: All values are expressed in mg/m ³ (0°C, 1 atm, dry gas) unless otherwise defined NL – Not Listed ND – Not Determined		

Rotary Furnace Optimisation Laboratory Trials – February 2011

A process optimisation study was conducted during February 2011 using a laboratory scale rotary infra-red rotary furnace located at the University of Newcastle Newbolds laboratories. Samples of 2nd Cut SPL was heated to various treatment temperatures (450°C – 750°C) for a period of 45min. Treated SPL samples were collected for each temperature point and submitted to a NATA accredited laboratory for analysis to determine residual cyanide contaminations contained within the treated samples. Data obtained from the study were used to refine future process conditions required to meet SPL processing objectives in future trials. Cyanide concentrations data collected during the experiments are detailed in **Table 2**.

Table 2: Treated product cyanide concentrations determined at various treatment temperatures.

Treatment temperature (°C)	Cyanide Concentration (mg/kg)
Untreated	97
450	3
550	1
650	<1
750	<1

A treatment temperature of greater than 650°C was determined to be sufficient for the complete destruction of cyanide contained within 2nd Cut SPL material, which is consistent with previously published literature for SPL treatment.

Onsite Rotary Furnace Trial – December 2011 – March 2012

In response to the success of earlier Trials, Weston Aluminium sought Development Modification Approval and a variation to our Environmental Protection Licence for a larger-scale (200Mt) Trial exercise. The objectives of this larger Trial were to treat sufficient quantities of 2nd Cut SPL to provide prospective Customers the opportunity to evaluate the suitability of the material as an input within their processes, and to capture process, occupational hygiene and environmental compliance data to support subsequent approvals for commercial scale operation. These Trials were again performed at our Kurri Kurri facility.

Approximately 180 tonnes of 2nd Cut SPL was sourced from Tomago Aluminium and handled, stored and processed using existing infrastructure, and via an adaptation to conventional dross-processing protocols. A Monitoring and Verification Report detailing laboratory analysis and monitoring data collected throughout the Trial including feed, product and stack emission testing, was subsequently issued to various Regulatory Authorities.

The trials were undertaken for the:

- Verification of technology & infrastructure compatibility and performance on a relatively large-scale (storage & containment, treatment, and environmental control systems);
- Assessment and confirmation of process controls relating to occupational exposures and safety performance; and
- Generation of treatment product quantities for reuse assessment & evaluation.

As for prior Trials, SPL was processed independently of normal aluminium dross processing activities to allow for the assessment of emissions performance directly attributed to SPL processing. Process emissions were monitored continuously throughout the Trial by real-time stack emissions monitoring (refer **Figures 2 and 3**), and via independent NATA accredited stack emission testing (refer **Table 3**).

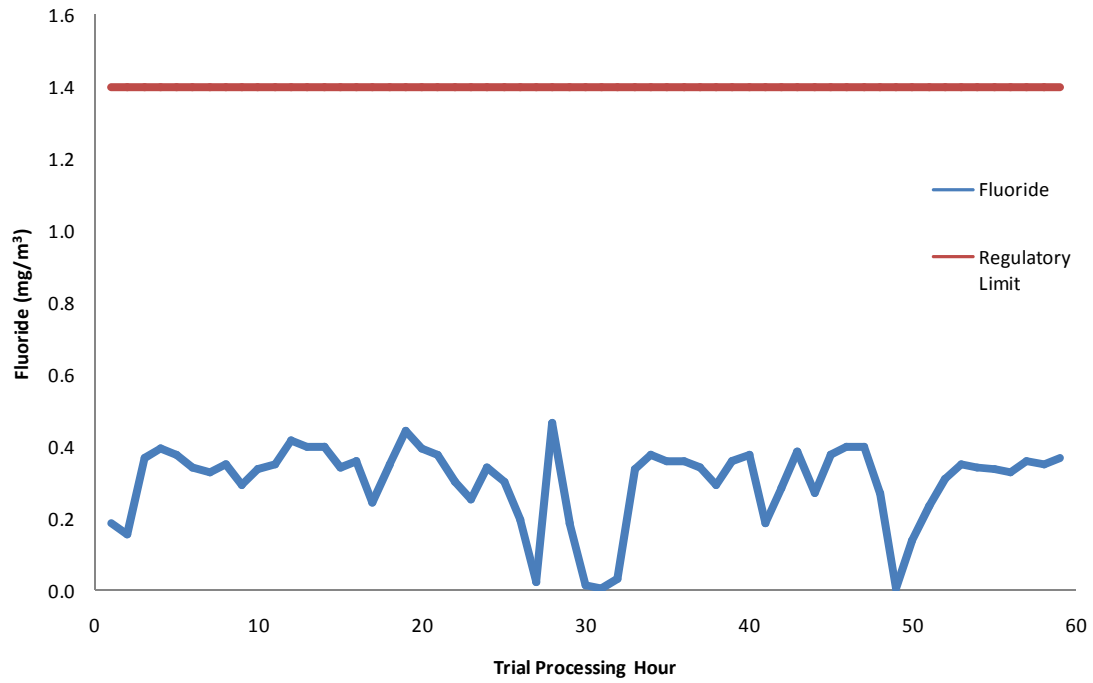


Figure 2: Real-time Gaseous Fluoride Emissions Monitoring Data

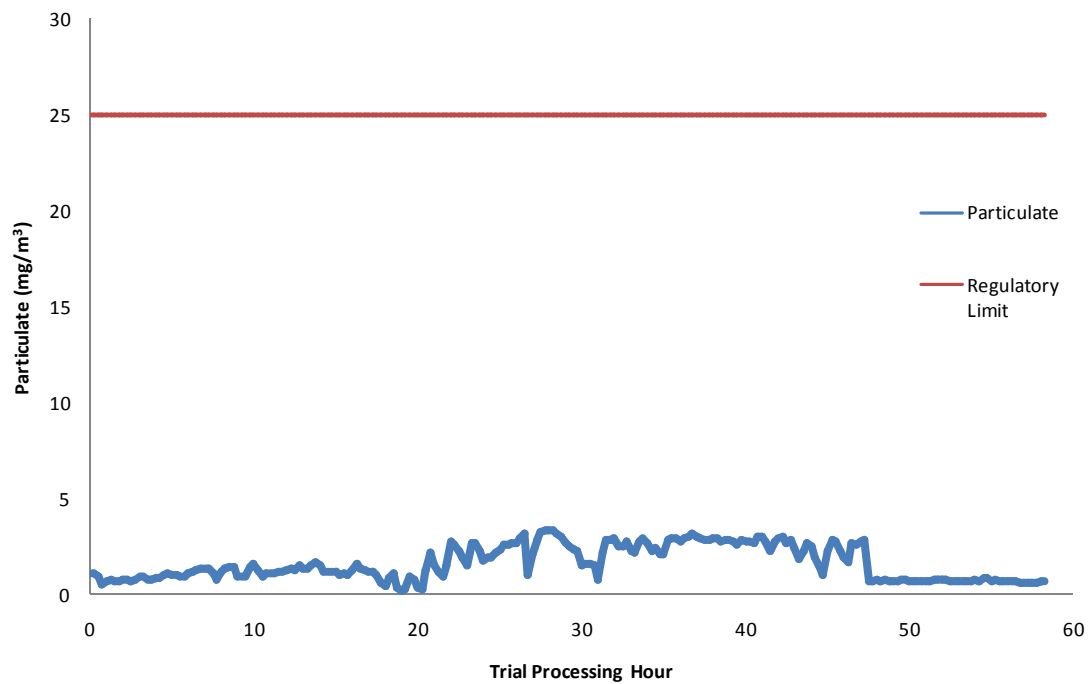


Figure 2: Real-time Particulate Emissions Monitoring Data

Table 3: Emission Assessment - Kurri Kurri Trial SPL Processing (2012)

Emission Monitoring Parameter	Trial Emission Monitoring (2012)	Regulatory Compliance Limits
Total Particulate Matter	0.23	25
Fine Particulate Matter	0.76	NL
Hydrogen Chloride	1.1	400
Chlorine	1	NL
Particulate Fluoride	0.013	NL
Gaseous Fluoride	0.16	2
Oxides of Sulfur	0.9	100
Total Hazardous Substances (metals)	0.025	10
Total Polycyclic Aromatic Hydrocarbons	0.005	NL
Volatile Organic Compounds	<0.00019	NL
Total Oxides of Nitrogen (as equiv. NO ₂)	0.7	2500
Carbon Monoxide	19	100
Cyanide	<0.0082	NL
Notes: All values are expressed in mg/m ³ (0°C, 1 atm, dry gas) unless otherwise defined NL – Not Listed ND – Not Determined		

Trial findings reveal the following:

- Existing material storage, handling and treatment protocols, adapted from those conventionally employed for the processing of aluminium dross, were suitable for SPL storage and handling;
- Cyanide was confirmed to be thermally-destroyed at process temperatures achieved, as confirmed by the negligible cyanide residuals;
- Emissions monitoring data verify the control of air emissions throughout the Trial process. Pollutant discharge concentrations were exceptionally low, and well below regulatory compliance limits;
- The leachability of trace elements was dramatically reduced in the treatment process. The particle size distribution, fluoride content and composition profile of treated residues (proprietary information withheld) is of great interest to prospective Customers, and will enable the substitution of virgin raw materials in various industrial processes (proprietary information withheld); and
- Research and development activities have successfully demonstrated the compatibility of facility infrastructure, processes and control measures available for the effective treatment of 2nd Cut SPL, have confirmed environmental and safety performance and compliance of such processes, and have verified sustainable market interest.

TRIAL PROPOSAL

Weston Aluminium's approach for the proposed Mixed SPL processing Trials will be principally the same as that outlined for the recent 200Mt 2nd Cut SPL Trial.

The following activities are proposed:

1. Weston Aluminium will facilitate Community and Stakeholder Information Sessions prior to Trial commencement to outline details of the proposal to interested parties. Invitations to the Information Sessions will be sent to previously active participants, including primary smelters and representatives of local environmental and interest groups. These sessions will occur approximately 2 weeks prior to the Trial period commencing;
2. The transportation of material from primary aluminium smelters to Weston Aluminium's Kurri Kurri facility by a licensed Dangerous Goods Contractor. Note: Mixed SPL has the same DG 4.3 PGIII classification as those Aluminium Smelter By-products for which processing approval has been granted (Aluminium dross and 2nd Cut SPL), and hence Weston Aluminium has extensive experience with, and maintains facilities and procedures for the correct storage, handling and processing of such materials;
3. Up to 3,000 Mt of Mixed SPL will be sourced from domestic smelters;
4. Trial processing of the Mixed SPL will occur at our Kurri Kurri facility over a period up to 12 months from Approval;
5. The processing sequence proposed is as follows:
 - The delivery of Mixed SPL from domestic smelters will be undertaken by a licensed Dangerous Goods transport Contractor. Transport routes, material handling and documentation protocols established and implemented for current aluminium dross and 2nd Cut SPL movements will be adopted for the transport and handling of Mixed SPL;
 - Mixed SPL feedstock bulk deliveries will be stored in existing, purpose-built and enclosed bays until processing. Mixed SPL received from each smelter will be stored separately for quality control purposes. Other inputs will similarly be stored undercover;
 - The processing and treatment of material will occur within crushing circuits and rotary furnaces, capable of attaining the required temperatures to thermally oxidise contaminants and affect required mineralogical transformations;
 - Design formulations of Mixed SPL-only and proprietary Mixed SPL blends will be processed through existing natural gas-fired rotary furnace in a batch process;
 - Mixed SPL processing Trials will be undertaken during normal Plant operating hours (10pm Sunday to 10pm Friday);
 - 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;
 - Processed material will be tapped from the furnace into existing sow molds or bins. Once sufficiently cooled, the product will be stored undercover awaiting laboratory assessment and future integration into Trial end-use products; and
 - The storage, handling and dispatch of finished product to Customers under existing quality control procedures.

ENVIRONMENTAL IMPACT ASSESSMENT

In response to preliminary meetings and discussions with representatives of the NSW DPI and the NSW EPA, and for consistency with prior trials and approvals, Weston Aluminium has prepared Applications to modify Development Consent and an environmental impact assessment of the proposed trials. This assessment describes proposed operations, safeguards and emission control technologies designed to ensure compliance with existing regulatory standards.

Regulatory Approvals

Approval is sought from the NSW DPI to modify our existing Development Consents (DA-86-04-01-MOD 7 and 10397 of 1995-Mod 5), authorizing the carrying out of necessary trial activities to assess treatment and beneficial end use opportunities for processed Mixed SPL product. Our Applications to Modify a Development Consent are enclosed as **Attachment 1**.

Concurrently, Weston Aluminium is also seeking a Variation of our Environmental Protection Licence (EPL 6423).

It is noted that Weston Aluminium's application relates only to the trial processing of Mixed SPL at our Kurri Kurri facility. **Consistent with prior Modifications, Application is not sought to vary existing environmental performance requirements established for the premises.** Weston Aluminium is committed to maintaining its high standard of emissions compliance, and is confident that existing emission control technologies and practices will be sufficient to maintain this high performance standard.

Potential Key Environmental Issues and Proposed Management and Mitigation Measures

A review of potential environmental issues associated with the proposed Mixed SPL processing Trials is provided in **Table 4**. Proposed management and mitigation measures designed to address these potential issues are also tabulated.

Table 4: Potential Key Environmental Issues and Proposed Management and Mitigation Measures

Environmental Aspect	Potential Environmental Issue	Management and Mitigation Measure	Potential Environmental Impact
Air Quality	• Generation of fugitive dust emissions • Non-compliance with existing regulatory compliance stack air emission limits (including particulates and fluoride)	• Historical Trials performed at our Kurri Kurri premises verify the performance of existing pollution control systems, operating to effectively control emissions to within acceptable levels. Further, prior trials also confirmed that the raw materials and process do not generate nuisance odour. • All trial operations will be performed within enclosed buildings. • Deliveries of raw materials will occur by truck. All delivery loads will be covered by tarpaulin, as per current dross and 2nd Cut SPL deliveries. • All relevant facilities/unit operations (storage bays, furnace melting and casting) are serviced by existing pollution control systems (also see below). • Weston Aluminium will operate existing fabric filter baghouses for the control and removal of particulate matter. The existing PCME particulate emission monitoring system will be operated to provide continuous, real-time assessment of particulate emissions. • Typical fluoride loads within SPL are in the same order or lower than that of aluminium dross processed onsite. Fluoride evolution may be expected to occur within furnace gases at the proposed trial temperatures (650–850°C). Weston Aluminium will operate existing wet-dry lime scrubber systems for the control and removal of fluoride within furnace exhaust. The existing Citect monitoring system will be operated to provide continuous, real-time assessment of gaseous fluoride emissions. • Furnace burners are routinely tuned on an annual basis to ensure optimal operating efficiencies. This minimises emissions of carbon monoxide, volatile organic compounds and oxides of nitrogen. • In conjunction with the NSW EPA, Weston Aluminium has recently updated and implemented our Air Quality Monitoring Program, which defines operational, maintenance and validation protocols to ensure compliance with regulatory requirements.	• Emission performance is expected to be similar to that of normal site operations, and remain within existing compliance limits. The potential impact on local air emissions is therefore considered to be low.

Environmental Aspect	Potential Environmental Issue	Management and Mitigation Measure	Potential Environmental Impact
Water Quality	Spills of raw materials to site catchment and pollution of local water ways	- All raw material truck delivery loads will be covered by tarpaulin to prevent spillages, as per current dross and 2nd Cut SPL deliveries. - No deliveries will occur during wet weather. - All trial operations will be performed within enclosed buildings to mitigate against external spills. - Should a spill occur, site personnel will recover materials in accordance with established spill response procedures. Spilt material will be returned to storage for processing (i.e. not disposed of). - The onsite Stormwater management system (drainage network, pond and wetland) captures and contains all runoff from potentially dirty areas, including hardstand and traffic ways, for subsequent onsite irrigation reuse. Only waters impinging on the catchment after this first flush is contained are directed to the adjacent Swamp Creek (north-west corner of site). The pond and wetland will similarly contain any spills, should they occur. It is expected, however, that this system will not be relied upon due to other controls proposed for the Trial. Nevertheless, routine monitoring of water quality will be maintained to assess the presence of any associated contaminants, including cyanide.	The potential impact on local water ways is considered to be low.
Noise	Exceedance of regulatory compliance noise limits	- Weston Aluminium has Regulatory approvals for plant operation 24-hours a day, 7-days per week. Specific receptor noise limits are prescribed for daytime, evening and night time periods. Weston Aluminium continues to comply with these limits. Trial operations will be restricted to normal operating hours (10pm Sunday to 10pm Friday). - As defined above, all operations will occur within the enclosed Plant Building.	The potential impact on noise amenity is expected to be negligible.
Waste Management	Generation of hazardous waste requiring disposal	- Mixed SPL raw materials will be delivered in bulk. Some proprietary additives are delivered in polypropylene bulka bags. These bags will be disposed of following Trial completion. Approximately 500 kg of bulka bag waste may be generated. All raw materials will be delivered in a dry state. These bags will be disposed of to an approved landfill facility in conjunction with routine site disposal protocols. - No other waste will be generated during the trial process.	No hazardous waste will be generated by the proposed Trial process.

Environmental Aspect	Potential Environmental Issue	Management and Mitigation Measure	Potential Environmental Impact
Hazards	- Potential contact with water and resultant generation of flammable gases - Furnace explosion and expulsion of raw/product materials	- Weston Aluminium will adopt existing hazard management strategies, and operate and maintain associated infrastructure. - Contact of raw materials with water (and potential flammable gas generation) will be prevented by coordinating deliveries during dry weather conditions only and by conducting all trial operations within purpose-built and enclosed buildings. - The risk of furnace explosion and resultant expulsion of material is considered to be negligible. Nevertheless, furnace charging, melt, mixing and casting techniques established for dross and 2nd Cut SPL processing will also be adopted. This includes loading the furnace with burners off, lowering furnace doors during the processing phase, and idling burners during mixing and casting. - Weston Aluminium has implemented recommendations made in the Preliminary Hazard Analysis, prepared in support of our recent Development Consent Modification for the commercial-scale processing of 2nd Cut SPL. - In accordance with the current Development Consent Modification (inclusion of 2nd Cut SPL processing), Weston Aluminium is currently updating its Fire Safety Study, Safety Management System and Emergency Response Plan. These document updates are due for submission to the NSW DPI by 7 December 2012. These documents define appropriate operational and management strategies designed for hazard assessment, mitigation and management and safe operation of the processing operation.	The potential for flammable gas generation, fires and furnace explosion is considered to be negligible.
Greenhouse Gases	Excessive generation of greenhouse gases (GHG), including carbon dioxide, methane and oxides of nitrogen	- As described above, furnace burners are routinely tuned to optimise burner efficiencies, and minimise GHG emissions. - Emission of unburnt methane and other natural gas constituents is not likely to occur due to burner tuner and set-up, and furnace temperatures proposed for the Trial.	Emission of GHGs is expected to be typical of normal furnace operation. The potential for excessive GHG emissions is considered to be negligible.

Other Environmental Aspects

The proposed SPL processing Trials are not expected to have any impact on transportation, biological values, visual amenity nor community effects (socio-economic, heritage and cultural values and land use).

Conclusion

Weston Aluminium has established, through undertaking previous trials, that suitable existing technologies, facilities, operating protocols and emission control systems are in place to process SPL material at our Kurri Kurri premises. We are confident that the Trial activities proposed will allow the development of sustainable end-use markets for the treated material, thereby providing a viable value-added re-use pathway for idle legacy stockpiles of Mixed SPL.