WASTE MANAGEMENT PROGRAM

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1. INTRODUCTION

1.1 Context

The Tomago Aluminium Smelter is located at 638 Tomago Road, Tomago, approximately 13km northwest of Newcastle within the Port Stephens Local Government Area (LGA).

The waste management program provides a background to the aluminum smelting process and defines the wastes that can be generated. The program also identifies legal requirements, site responsibilities and defines the minimum requirements for ensuring that appropriate environmental management practices are in place for all waste streams generated, recycled and disposed by Tomago Aluminium Company (TAC). The objectives of the waste management program are to:

- Ensure legal compliance is maintained
- Promote a systematic approach in waste management through the effective use of management systems and through continual improvement in performance;
- Improve the efficiency in the management of waste; and
- Minimise the generation of waste.

1.2 Background: - The Aluminium Smelting Process and Key Waste Streams

Aluminium is made in a series of large electrolytic cells known as pots. Pots are large rectangular steel cells, lined with insulating bricks and carbon blocks.

Tomago Aluminium has three potlines, each containing 280 pots.

A potline is a series of pots connected electrically so that a direct current flows through one pot, then on to the next, and so on to the end of the line. Electricity is introduced to the pots via large carbon blocks known as anodes.

Aluminium production is a continuous process which extracts pure aluminum from alumina. Alumina is fed into the pots from a feed hopper above each pot. Pots remain closed during this process to minimise emissions.

Inside the pot, alumina is dissolved in a bath of molten cryolite (sodium aluminum fluoride).

As the electric current is passed through the bath it generates heat to keep the bath molten and causes the alumina to separate into aluminum and oxygen. As the oxygen is stripped from the alumina it combines with the carbon in the anodes, and they are consumed.

Molten aluminum formed in the pots is periodically syphoned off into a ladle using a vacuum system and taken to the Cast Products Unit by special transporters.

Once at the Cast Products Unit, the molten metal is placed in large holding furnaces where the composition of the metal is determined and adjusted where necessary by the addition of alloying elements such as silicon, manganese, magnesium, copper and zinc.

The molten metal is then cast in one of two casting processes. Small ingots are produced on the ingot chains, while billet and slab are produced in vertical casting pits.

Billets are also heat treated (homogenised) to ensure the internal metallurgical structure meets the requirements of the extrusion process.

The small ingot are sold and remelted by the customer while the semi-finished products (billet and slab) are sold and further processed. Billets are extruded; slabs are rolled into plate, sheet or foil.

The last of Tomago Aluminium's core production processes is the Rodded Anodes Unit, which manufactures carbon anodes, essential to the electrolysis process.

Anodes, which introduce electricity to the smelting process, are made from petroleum coke and liquid pitch. These materials are crushed and blended to produce a paste which is compacted and shaped. Each green anode weighs approximately 1.4 tonnes.

The Paste Plant manufactures around 185,000 "green" anodes per year. These anodes are baked in one of three Bake Ovens for several weeks in gas fired furnaces which reach temperatures of approximately 1200°C.

From the Bake Ovens the anodes are moved to the Rodding Shop where they are fitted to an aluminium rod before being transported to the Potlines.

The key solid wastes generated from the aluminium smelting process are:

- Spent Pot Lining (SPL). The SPL is generated when the electrolytic cell reaches end of life, after approximately 5 years of operation.
- Aluminum dross is generated as a result of the rapid oxidation of the molten aluminum when in contact with air.
- Used bake ovens refractory bricks that are generated as a result of the need to maintain the gas fired furnaces that bake the green anodes.
- Wastes contaminated with fluoride that cannot be recycled back into the aluminum smelting process due to contamination with elements that are detrimental to aluminum metal quality.

2. SCOPE

This program addresses the management of all types of waste streams (including solid, liquid and contained gaseous materials) at the Tomago Aluminium Site and includes the requirements of Condition 8 of Development Consent 4908-90 and Condition 14 of Development Consent 391-80.

This program applies to all classes of wastes generated at the Tomago Aluminium site including specific categories defined by waste management regulations, e.g. aluminium smelter waste, hazardous, restricted solid, solid, inert wastes and liquid waste.

This program covers the management of waste disposed at the Wallaroo Landfill Facility.

This program does not apply to wastes generated and owned by contractors provided the ownership and disposal responsibilities are clearly defined in the project contract documents.

This program is applicable to TAC personnel and contractors working on site.

3. LEGAL REQUIREMENTS

Tomago Aluminium has to meet legal requirements under the Protection of the Environment Operations Act and the Environmentally Hazardous Chemicals Act. The background to the development of these legislative controls is described below.

Environmentally Hazardous Chemicals Act

On the 21st of March 1986 the State Pollution Control Commission made a Chemical Control Order under section 22 of the Act in relation to aluminum smelter wastes containing fluoride and/or cyanide. As a result TAC operates under two licences issued under the Environmentally Hazardous Chemical Act 1985. One licence relates to waste activities on the TAC site (Licence number 03) and the other to waste activities at the Wallaroo landfill facility (Licence number 04).

The Chemical Control Order was gazetted as an instrument to control smelter wastes in NSW as at the time there was no other environment legislation in NSW that allowed regulatory authorities to control waste. To a certain extent the Chemical Control Order became redundant with the introduction of the Waste Minimization and Management Act 1995 and the subsequent transfer of these provisions into the Protection of the Environment Operations Act 1997.

An Environmental Legal and Other Requirements Register is maintained as part of the TAC Environmental Management System. It lists the requirements of the environmental licences and development approvals, and the relevant legislation and any other requirements. This register should be referred to for detailed legal requirements regarding management of waste at TAC.

Protection of the Environment Operations Act

TAC operates with two licences issued under the Protection of the Environment Operations Act 1997 that places responsibilities on TAC in regards to waste management. The licences are the TAC site licence (number 6163) and the Wallaroo Site licence (number 6048)

Hazardous Waste (Regulation of Exports & Imports) Act 1989

Permits under this Act are required for the export of untreated Spent Potlining.

4. DEFINITIONS

Waste – (a) any substance (whether solid, liquid or gaseous) that is discharged, emitted or deposited in the environment in such volume, constituency or manner as to cause an alteration in the environment, or
(b) any discarded, rejected, unwanted, surplus or abandoned substance, or
(c) any otherwise discarded, rejected, unwanted, surplus or abandoned substance intended for sale or for recycling, processing, recovery or purification by a separate operation from that which produced the substance, or
(d) any processed, recycled, re-used or recovered substance produced wholly or partly from waste that is applied to land, or used as fuel, but only in the circumstances prescribed by the regulations, or
(e) any substance prescribed by the regulations to be waste. (POEO Act 1997)

Aluminium Smelter Waste - means any chemical substance from an aluminium smelting process, which is or is likely to be stored in accumulating deposits or dumped or abandoned or otherwise dealt with as a chemical waste other than any emissions to the atmosphere or discharges to waters.

Leachable fluoride - in relation to aluminum smelter wastes means those wastes that when subjected to a test as specified by the authorities, being either the United States Environmental Protection Agency “Toxicity Characteristic Leaching Procedure: (TCLP Method 1311)” or other similar specified test, produce a leachate containing more than 150 mg/L fluoride.

Leachable Cyanide- in relation to aluminum smelter wastes means those wastes that when subjected to a test as specified by the authorities, being either the United States Environmental Protection Agency “Toxicity Characteristic Leaching Procedure: (TCLP Method 1311)” or other similar specified test, produce a leachate containing more than 10 mg/L cyanide.

5. ROLES & RESPONSIBILITIES

Key personnel and responsibilities for the execution of the Waste Management program are defined below:

Responsibilities	CEO	PSE Manager	Line Management (Managers, Superintendents, Supervisors	Employees and Contractors	Purchasing Manager	Environment personnel
Ensure that the waste management program is established and maintained to meets all applicable legal requirements	X					
Co-ordination of the waste management program including: implementation, maintenance, auditing and review		X				
Ensuring waste management procedures are implemented in their respective Department			X			
Ensure waste inventory is up to date						X
Ensure that employees & contractors under their control meet the waste management requirements			X			
Immediately report any conditions and practices that do not conform to the Waste Management requirements			X	X		
Investigate any non- conformances and implement corrective actions			X			
Co-operate with waste management program related investigations, audits and compliance reviews				X		
Ensure waste tracking and EPA reporting requirements are meet						X
Provision of technical assistance and identification of waste management issues that affect the implementation of the program						X
Ensuring the ownership and responsibilities for waste management are clearly defined in the contractor contract documents					X	
Maintenance and annual review of waste minimisation objectives with Departments						X
Hiring of waste contractors for the site					X	
Leading and co-ordinating emergency response activities related to a waste spill			X			X
Ensuring training systems are implanted and maintained to ensure employees are trained in waste management.		X				
Ensure the provision and maintenance of adequate waste storage facilities			X			

6. CLASSIFICATION OF TOMAGO ALUMINIUM WASTES

Wastes generated at the Tomago Aluminum site can be recycled within the smelter, reprocessed by third party suppliers or disposed to landfill following classification in accordance with the NSW waste classification guidelines.

Historical Waste Disposal

Tomago Aluminum disposed of Approved Smelter Waste to the Wallaroo Landfill facility from 1987 to 1999.

Prior to disposal of aluminium smelter wastes to the Wallaroo Landfill facility the waste must be classified as Approved Smelter Wastes (leachable fluoride concentrations less than 150mg/L and leachable cyanide concentrations less than 10 mg/L) and be certified by the EPA. For more detailed information on the Wallaroo Landfill Facility refer to the *Wallaroo Landfill Management Plan*, ES.EMS.0003.

Other wastes generated at TAC that are to be disposed of at third party waste disposal facilities are classified in accordance with EPA Waste Classification Guidelines which can be found at *www.epa.nsw.gov.au/your-environment/waste/classifying-waste/waste-classification-guidelines*.

TAC environment staff should be consulted on analysis and sampling required. Analysis must be performed by a NATA accredited laboratory. Common contaminants tested are Fluoride, Cyanide, Arsenic, Nickel, Chromium, Cadmium, Lead & Mercury. TCLP leachability tests can be requested to assist in waste classification if required.

Additionally, if materials have come from the Carbon area of the Plant they should be analysed for Total Polyaromatic Hydrocarbons (PAH) and Total Recoverable Hydrocarbons (TRH). Tomago Aluminium environment staff will then advise as the best method of disposal.

The detailed procedure for the sampling and classification of wastes generated is *Waste Disposal Procedure*, PW. EMS.007.

The regular waste streams specific to the Tomago Aluminium Smelter, waste classifications and waste receivers are detailed in **Table 1** below. More extensive details on TAC waste streams and classifications are detailed in ES. REG. 0007, *Waste Identification and Information Register*. This register provides details on the history of work completed to minimize the generation, treatment and disposal for each waste stream.

Table 1: Overview of major waste streams from the Tomago Aluminum Smelter

Waste	Typical annual tonnage	Waste classification	Analysis required for classification	Waste Code/UN number	Waste Receiver	Additional Information
Aluminium Dross	6kT	Hazardous	N/A	D300/3170	Weston Aluminium	Aluminium metal recovered
Spent Pot Lining	8kT	Hazardous	N/A	D110/3170	Regain Minerals	Reprocessed product beneficially reused in cement kilns
Bake Ovens Refractory Brick	3kT	Solid (non putrescible)	Total PAH, Benzo(a)pyrene,CN,F, As,Cd,Cr, Pb,Hg,Ni	N/A	Boral/SCE	Resource Recovery exemption that allows for the material to be utilized in road base following chemical verification
Stopped pot metal	500T	4.3	N/A	D300	Recycled within TAC casthouse or Weston Aluminium	Aluminium metal recovered from pot delining process
Carbon Butt Blast waste	900T	N/A	N/A	N/A	Regain Minerals	Iron and fluoride contaminated carbon dust from internal recycling of anodes
Used filter bags	15T	Based on analysis	CN,F,As,Cd,Cr, Pb,Hg,Ni, Additional if from Carbon area – PAH,TRH TCLP tests if required for classification	N/A	Weston Aluminium or Landfill	General or restricted solid waste based on chemical analysis characterisation
Used production material bags	10T	Based on analysis	CN,F,As,Cd, Cu,Pb,Hg,Ni Additional if from Carbon area – PAH,TRH TCLP tests if required for classification	N/A	Landfill	General or restricted solid waste based on chemical analysis characterisation
Waste oil	25T	Liquid	N/A	J120	Veolia Environmental Services	
Oily water /sump wastes	30T	Liquid	N/A	J120	Veolia Environmental Services	
Washbay solids	20T	Based on analysis	Total PAH, TRH,CN,F, As,Cd,Cr,Cu,Pb,Hg,Ni,Zn TCLP tests if required for classification	NA	Landfill or licensed waste receiver	Immobilisation approval / licensed waste receiver
Stormwater Sediment	variable	Based on analysis	Total PAH, TRH, ,F, As,Cd,Cr,Cu,Pb,Hg,Ni, TCLP tests if required for classification	NA	Landfill	Waste generated from dredging historical sediment build up. May require Immobilisation Approval

7. Options to Reduce and Reuse Waste

Opportunities to reduce and reuse waste are continually evaluated by TAC personnel as opportunities may develop and cease in relatively short periods of time. In order to maintain focus on emerging opportunities a waste element is included in TAC's annual HSE plan.

The HSE Objectives and Targets plan provides the targets for continual improvement in waste management. A strong focus of this strategy is waste minimisation or reuse improvement opportunities.

All departments are assigned environmental targets annually that are reviewed and approved by senior management and the TAC Board. Guidelines for setting annual improvement opportunities are found in HSE.MP.005 *Setting HSE Objectives & Targets*

The wastes generated at TAC are prioritized based on the following factors:

- The level of existing and potential environmental impact(s), including those occurring on-site and off-site (e.g. at waste disposal sites),
- Short- and long-term financial consequences and benefits of existing and potential optimisation initiatives;
- Stakeholder concerns (e.g. community health impacts);
- Impact on reputation;
- Risk of non-compliance with existing and upcoming (foreseeable) regulatory requirements;
- Potential for improvement of the efficiency in the use of resources and raw materials;
- Availability and feasibility of technical solutions that can be employed to minimise or eliminate waste or increase potential for reuse; and
- Business needs (i.e. financial constraints, business plan, etc).

8. WASTE MONITORING, REPORTING and TRANSPORT REQUIREMENTS

Individual product codes are assigned for each waste stream and all waste leaving the Tomago Aluminium site is weighed at the North Gate weighbridge with weights recorded in the TAC computer system. The waste data is collated at the end of each month and recorded in the TAC Environment Data Spreadsheet. This process allows waste quantities to be tracked, monitored and action initiated if waste quantities increase. Annual quantities of restricted waste and general solid waste landfilled or recycled, Spent Potlining generated, processed and Aluminium dross processed are included in the Annual Environment Report. A summary of the waste monitoring and reporting is included in **Table 2** below.

Table 2: Waste Monitoring and Reporting

Waste Monitoring or Reporting Element	Frequency	Responsible person	Summary of element
Establishment of product codes for each waste type	As Required	Tomago Aluminium Waste Co-ordinator	Establishes a product code for each waste type that leaves the Tomago Aluminium site. This allows for the quantity of waste to be tracked and reported.
Monthly collation and reporting of waste disposed	monthly	Tomago Aluminium Waste Co-ordinator	Update TAC Environment Data spreadsheet with waste quantities dispatched from site
EPA Waste Tracking	As Required	Tomago Aluminium Waste Co-ordinator	Completion of EPA waste tracking requirements.
Quantity Survey of Bulk waste stockpiles (ie Spent Potlining)	Annual	Third Party surveying company	Completion of laser surveys on bulk waste stockpiles
Annual Reporting of Waste	Annual	Tomago Aluminium Waste Co-ordinator	Waste Quantities disposed and recycled annually are reported in the Annual Environment Report

Where EPA waste tracking is required the online waste tracking system is used and hardcopy records of the completed tracking forms are maintained.

In order to ensure that waste management at TAC is effective the following procedures are also included in the Tomago Aluminum Environment Management System:

- *Waste Management Guidelines* (PW.EMS.0006): Identifies waste streams by Department and recommended storage and disposal options.
- *Waste Receival Procedure* (PW.EMS.0009): Provides detailed information on the receival of wastes to the TAC site for processing via REGAIN.

9. SPENT POTLINING MANAGEMENT

The management of Spent Potlining (SPL) Waste is a key requirement for TAC. TAC is committed to maintaining SPL storage levels to below 30,000 tonnes with storage maintained in undercover sheds. TAC's active management of SPL stockpiles has resulted in the operation having little historical stocks of SPL. Tomago Aluminium has contracts in place with third party companies to process SPL.

The SPL is crushed and heat treated by a third-party contractor who leases an area on-site at TAC. The resulting treated material is being benefically reused, predominantly in the cement industry. TAC can accurately predict the rate of pot

stoppages and therefore quantities of SPL that will be produced for the coming year so the third party can plan treatment and removal of processed material from site. The contract in place has the intention that total accruals of SPL will be treated that year but if operational difficulties prevent this, a minimum percentage must be treated or removed from site and the shortfall made up in the following year. This ensures that stock stored on-site by TAC will not exceed 30 000 tonnes. In the case of failure by the third party to meet contractual obligations, TAC has proven alternatives with another treatment company in Australia or export to overseas processors that have been used in the past.

Figure 1 below highlights the current accumulation and historical processing of SPL.

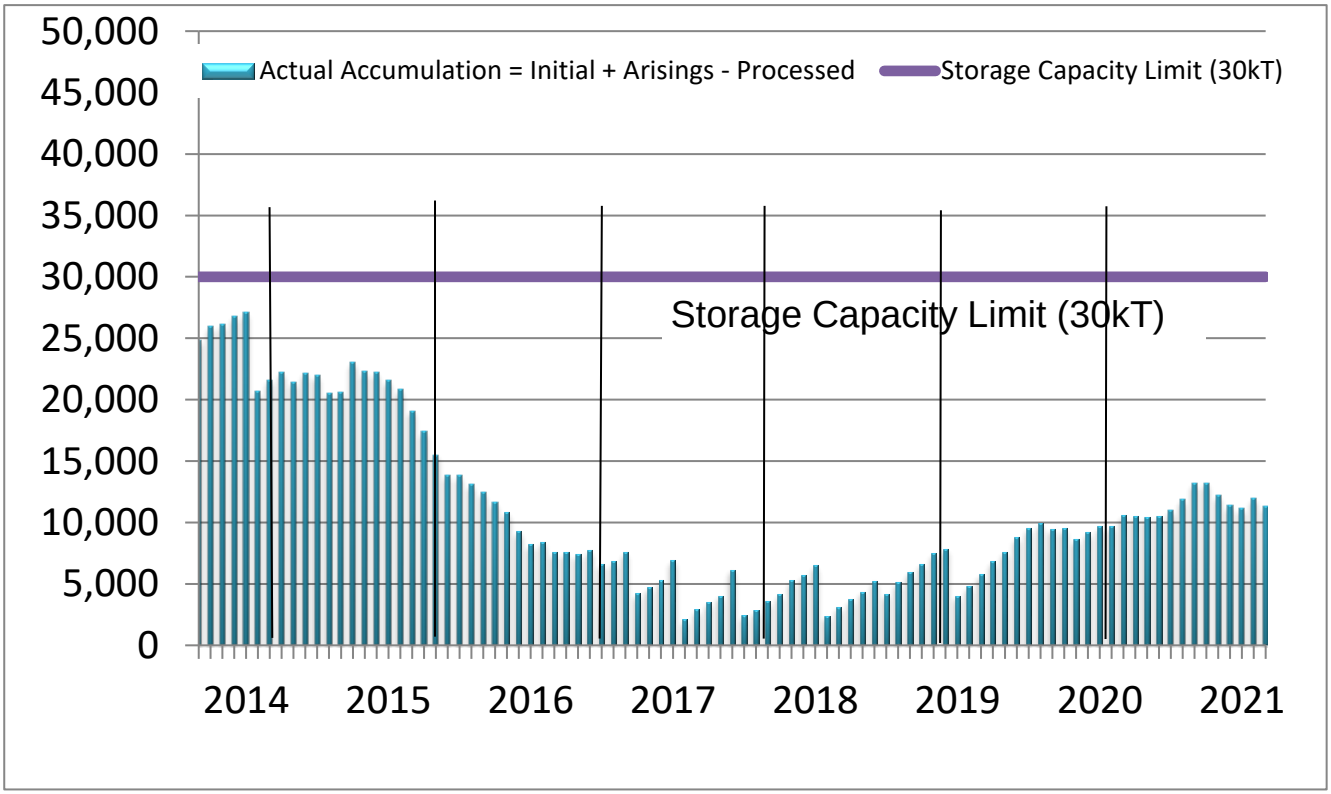

Figure 1: Current Accumulations and Historical Processing of SPL

10. TRAINING

All employees (including contractual employees) receive environmental awareness training such that they acquire the knowledge (including regulatory requirements) and skills necessary for the safe and comprehensive performance of waste management activities.

All training records are maintained in TAC's Human Resources Management System.

11. NOTIFICATION, REPORTING & DOCUMENTATION

TAC accurately reports all waste data required by government agencies. All waste-related regulatory reporting is managed by Environment personnel. Reports are submitted to the applicable government agency and records are maintained on file in accordance with the *Plantwide Records Management Procedure*, PW.MP.011.

Waste reporting requirements for TAC are available in the procedure *Environmental Reporting Program*, ES.EMS.0014.

12. CONTRACTORS & VISITORS

Any TAC employee responsible for bringing contractors or visitors on site must ensure that the individual(s) adheres to TAC's waste management requirements. TAC has implemented a Contractor and Visitor EHS Management Program that addresses this issue

13. COMMUNICATIONS

In accordance with Condition 8 of DA 4908-90 and Condition 14 of DA 391-80 this program was provided to the EPA for comment. The record of the communication is included in **Appendix A.**

The Waste Management Program is modified as required to reflect changes in regulatory requirements, or in response to recommended changes to facilitate continuous improvement. These changes are managed in conformance with the *Plantwide Document Control Procedure*, PW.DOC.0001.

Changes to the waste management procedures are communicated in conformance with *EHS Communications Procedure*, EHS.MP.006.

As this document is required to be approved by the Department of Planning, Infrastructure and Environment, subsequent revisions are required to be submitted for approval.

14. COMPLIANCE / AUDITING

Changes to relevant waste management regulations and other commitments are assessed, analysed and tracked in accordance with the *EHS Legal & Other Requirements Procedure*, EHS.MP.004

At TAC, various mechanisms are employed to ensure compliance, including

- TAC internal environment audits
- Line personnel conduct routine inspections to assess compliance; and
- Line personnel observe employees to assess compliance, and provide informal and formal feedback as necessary.
- External audits

15. PROGRAM EVALUATION & MANAGEMENT REVIEW

As part of the annual environment review process, TAC conducts a review of the program to:

- Ensure that it reflects the current site conditions
- Identify gaps in procedures or processes
- Serve as a planning tool for continual improvement.

The annual review addresses:

- Regulatory requirements;
- Roles and responsibilities;
- Management Procedures
- Training and communications

In addition the program is reviewed and modified whenever a change to process, procedures and/or site conditions warrant, and within three months of the site's Independent Environment Audit which is conducted every three years.

16. REFERENCES

Reference Document	Precis of Document
PW.EMS.0006 *Waste Management Guidelines*	The purpose of these guidelines is to provide all Tomago Aluminium Company (TAC) employees and contractors with a general introduction to waste management concepts (including the various waste type classifications), a summary of the wastes generated on the site and how these are to be segregated/stored, and the how they are either recycled, treated and/or disposed on or off the site.
PW.EMS.0007 Waste Disposal Procedure	This procedure summarises the required process for the disposal of wastes generated at the Tomago Aluminium Company (TAC) site**.** It describes the processes of new waste assessment and classification, storage and handling of waste products at the Tomago site, transport off-site & the recycling, treatment and/or disposal of wastes off-site.
PW.EMS.0009 Waste Receival Procedure	This **procedure** summarises the required process for the receival of Industrial and Hazardous wastes at the Tomago Aluminium Company (TAC) site. TAC is licenced to receive industrial and hazardous waste under the POEO licence. The receival of waste to the TAC site is associated with the SPL treatment operations.
ES.REG.0007 Waste Identification & Information register	This document summarises the common waste streams generated at TAC. It shows Dangerous Goods class, average annual tonnages, typical waste classification, information on waste tracking requirements and licenced transporters and receivers for disposal.
PW.MP.011 Plantwide Records Management	This procedure outlines the process for management of electronic and hardcopy records including identification, storage, retrieval, disposal and archiving to demonstrate conformance with the TAC Management Systems.
ES.EMS.0014 Environmental Reporting Program	This document summarises the environmental reporting requirements of Tomago Aluminium to ensure compliance with development consent conditions, Licence conditions under the Protection of the Environment Operations Act and reporting requirements under other relevant environmental based legislation. It also ensures environmental incidents on site are reported, investigated and corrective actions taken when required.
PW.DOC.0001 Plantwide Document Control Procedure	This procedure defines the system for document management at Tomago Aluminium Company (TAC) and applies to all documents required by the TAC Management System.
EHS.MP.006 EHS Communications Procedure	This document is a part of the Environment Management System and details the process for internal and external communication of EHS issues.

Reference Document	Precis of Document
HSE.MP.004 *HSE Legal & Other Requirements Procedure*	This procedure defines the methodology used to identify, access and update TAC's Environmental and WHS legal and other requirements and the communication of these requirements to the workforce. This procedure also addresses how TAC will assess compliance to identified legal and other requirements
ES.EMS.0003 Wallaroo Landfill Management Plan	This management plan details information on the operation of the Wallaroo Landfill Facility owned by Tomago Aluminium Company Pty Limited. This facility is no longer in use and there are no plans to use it to receive landfill. The site currently operates in accordance with the Protection of the Environment Operations Act (Licence number 6048).
HSE.MP.005 Setting HSE Objectives & targets	Provides guidelines for setting improvement opportunities in each department in areas of environmental performance and waste minimisation

APPENDIX A: Record of Consultation

NSW EPA

DOC17/441634, File No. EF13/3725

Tomago Aluminium Company Pty Limited
PO Box 405
RAYMOND TERRACE NSW 2324

Attention: Mr Neil Roser

Neil.Roser@tomago.com.au

Dear Mr Roser

ENVIRONMENT PROTECTION LICENCE 6163 – MANAGEMENT PLANS

Reference is made to your emails to the Environment Protection Authority (EPA) on 28 August 2017 providing updated management plans in respect of Tomago Aluminium. These plans included the:

- Air Emission Release Management Program;
- Water Management Program;
- Flora and Fauna Monitoring & Buffer Zone Management Plan; and
- Waste Management Program.

The EPA encourages the development of such plans to ensure that proponents and licensees have determined how they will meet their statutory obligations and designated environmental objectives.

Being a regulatory authority, the EPA's role is to administer and regulate statutes for environmental management and protection. As such the EPA does not directly get involved in the development of strategies to achieve those objectives and does not review or comment on such plans. Accordingly, the EPA has not reviewed and offers no comments on the above management plans and programs.

If you require any further information regarding this matter, please contact me on (02) 4908 6824.

Yours sincerely

28/8/2017

HAMISH RUTHERFORD
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