TOMAGO ALUMINIUM COMPANY PTY LTD.

PRODUCTION CAPACITY INCREASE

585,000 TO 600,000 TONNES SALEABLE PRODUCTION

PROJECT DESCRIPTION AND STATEMENT OF ENVIRONMENT EFFECTS

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EXECUTIVE SUMMARY

Following the approval in 2015, metal production has increased to be close to 585,000 tonne. With the current performance of the upgraded cell technology, and improved efficiencies, the amperage through the three potlines has the potential to increase 259 kA. A proposed production increase of 2.5 % is considered possible between 2016 and 2021. Apart from the increase in potline amperage the operation will remain materially the same as to the consent approval granted in 2009 and 2015.

- No upgrade in plant or equipment required.
- Air emissions of key pollutants of Fluoride and Sulphur Dioxide will remain within existing load limits stipulated in EPL 6163.
- Environmental monitoring conducted under EPL 6163 and DA consent conditions 392/80 and 4908/90 demonstrate no increased environment impact as production has increased by 54kT over the last 8 years.
- Changes in traffic are minimal.
- Improvements will be realised in electricity consumption on a MW/tonne basis.

1 INTRODUCTION

Tomago Aluminium Company Pty Limited was founded in 1980 to build and manage, as agent for the participants, the Tomago Aluminium Smelter located 13 km North West of Newcastle. The joint venture participants sell aluminium produced at Tomago throughout the world.

The participants are:
Pacific Aluminium, Gove Aluminium Finance Ltd (CSR and AMP) and Hydro Aluminium.

Production of aluminium began in September 1983, and the smelter reached full operating capacity in 1984 producing 220, 000 t/yr of aluminium, DA no 392/80.

In 1991 development consent was granted to expand the existing plant capacity by building a new Potline No. 3, in conjunction with extending the existing Potlines No. 1 and No. 2, DA No 4908/90.

In 1993, Potline No. 3 was commissioned and the smelter's operating capacity increased to 380, 000 t/yr. Following a delay due to low market prices for aluminium in the mid 1990s, the planned Potline No. 1 and No. 2 extension took place in 1998 which resulted in the operating capacity increasing to 440, 000 t/yr.
In early 2002, Tomago Aluminium's participants decided to proceed with another major project, upgrading the smelter with a new pot design unknown as AP22 that allowed additional amperage to be applied to the aluminium reduction cells to produce additional liquid metal. This project saw production capacity increase from 440,000 to 525,000 tonnes per annum and the operating amperage increase from 180kA to 225kA.
In 2009 approval was granted to increase metal production to 575,000 tonnes per year. This expansion is known as the AP2X project. The expansion was similar to the AP22 Project and involved increasing the potline operating amperage to 245kA.
In 2015 approval was received to increase the smelter capacity to 585,000 tonne of saleable metal through increasing amperage and improvements in pot technology.
The performance of the pot technology is exceeding expectations and Tomago Aluminium Company seek approval to increase capacity to 600,000 tonne of saleable metal, an increase of 2.5%.

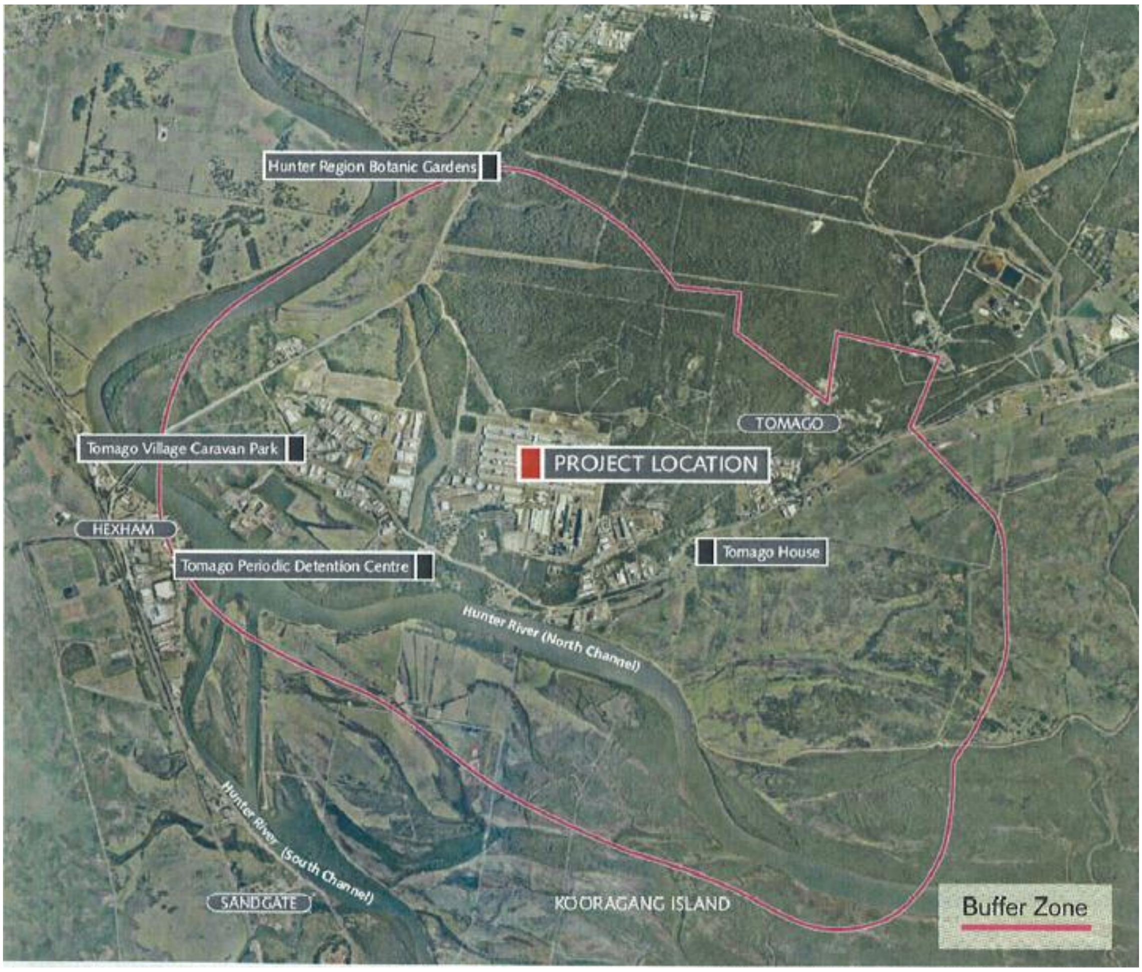
2 SITE DESCRIPTION

The existing TAC smelter is located at 638 Tomago Road, on land described as Lots 12,13,14 15 and 16 of Deposited Plan(DP) 258020, Part of portion 6 Parish of Stockton and being the remainder of land in certificate of title Volume 6352 Folio 184, Lot 100 of DP 604166, Lot 70 of DP 634535, Lot 3232 of DP 618103, Lot 301 of DP 634536 and Lot 3 of DP 38904.

The site is in the industrial suburb of Tomago, which is part of the Port Stephens local government area (LGA). A regional context map is shown in **Figure 1** and a site location map is shown in **Figure 2.**

Figure 1: Regional Context

Figure 2: Site Location



A number of small to medium industrial facilities are located adjacent to the plant. The nearest residential areas are located to the southwest Hexham (3km) and to the northwest: Tarro (4.6km); Woodbury, Beresfield (5.7km).

Neighbouring non industrial/manufacturing facilities include; a caravan park (approximately 1.5 km west), Hunter Region Botanic Gardens (approximately 2 km north) and Tomago House (approximately 1 km south east).

3 EXISTING DEVELOPMENT AND OPERATIONS

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 aluminium 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 aluminium fluoride).

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

Molten aluminium 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 four 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.

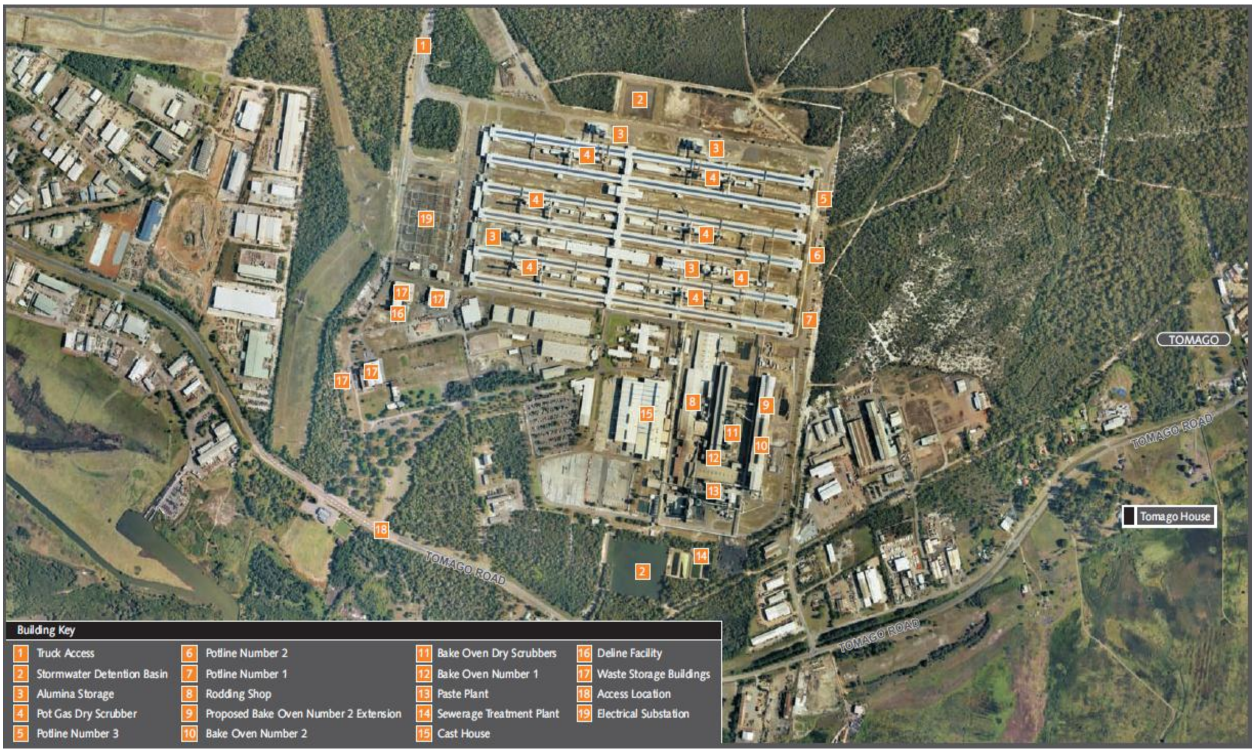
The last of Tomago Aluminium's core production processes is the Rodded Anodes Unit, which manufactures carbon anodes, essential to the electrolysis process.

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 tonne.

The Paste Plant manufactures around 185,000 green anodes per year. These anodes are baked in one of two 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 (shaped like a stem) before being transported to the Potlines. A site layout map is provided in **Figure 3**.

Figure 3: Site Layout



4 PROJECT DESCRIPTION

Following the AP2X project approval in 2009, the three potlines at Tomago Aluminium had the capacity to operate at a amperage of 245 kA. With the inception of the next generation of upgraded cell technology that reduces the cell resistance and improves the heat dissipation, the amperage through the three potlines can be incrementally increased, resulting in the overall operating capacity increasing from 585,000 tonne/year to 600,000 tonne/year by December 2021, a production increase of 2.5%. The existing plant infrastructure has the capability for the increased production with no capital work required. Details of specific production areas are detailed below.

Potlines

Potline operations have the potential to operate at additional amperage. The next generation of the pot cell is designed to be a lower resistance pot cell. This allows the pot cell to operate at higher amperage and as a result produces more metal per day.

Substation

The current onsite electrical substation has design capability to rectify to an amperage of 260kA. No capital investment is required.

Carbon

The gross carbon requirement for the plant has reduced from 551 kg/tonne of Aluminium in 2014 to 528kg/tonne YTD (Jan-Jul 2016) .These improvements in anode quality ensures the existing plant has the capability of supplying the required anodes without any capital modifications.

Cast Products

Casting of the additional liquid aluminium is envisaged to be managed by the existing ingot chains and current billet processes. No capital modifications are required.

Alumina Handling and Emission Control

Pot cell emissions are collected and transported to a number of Gas Treatment Centres (GTCs) before release into the environment. At each GTC, fresh alumina is injected into the stream of potline gases, which reacts with the fluoride. Once reacted, the fluoride and alumina mix is collected with other particulate emissions in the baghouses and recycled back into the potrooms. The fluoride scrubbing efficiency of the GTCs is greater than 99%.

The existing pneumatic alumina conveying systems, which transport alumina from the holding silos to the GTCs will not need to be upgraded as the design capacity has the scope to handle the increased tonnage.

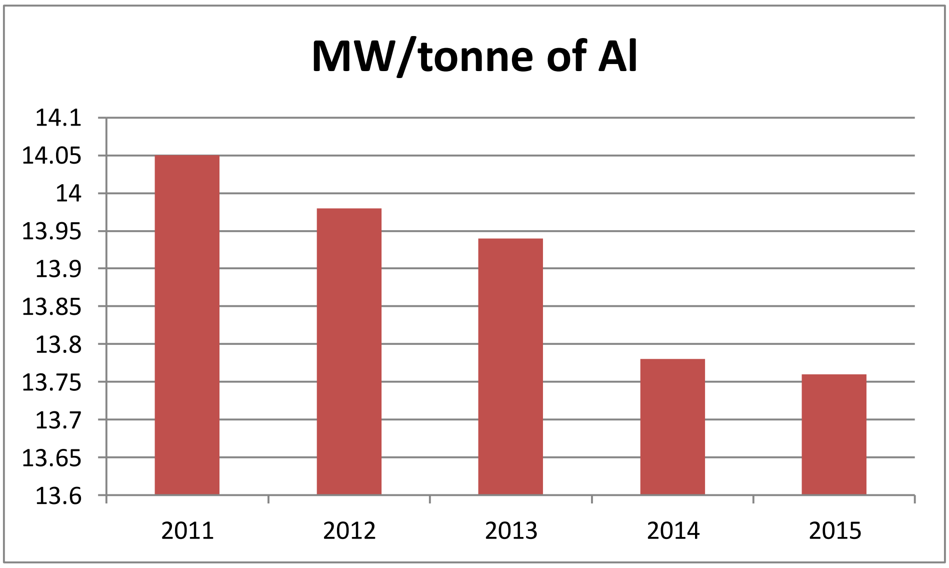
Bake Oven No. 1 & 2 Fume Treatment Centres will not require any upgrade to accommodate the additional production.

5 RESOURCES AND RAW MATERIALS

Energy Requirements

Electricity consumption is expected to continue to decrease per tonne of aluminium produced as a result of plant efficiency improvements which results from the cell design and improvements associated with the operation of the potlines. The improvements achieved over the last five years are highlighted in **Figure 4** below.

Figure 4: Smelting Electrical Energy Performance



Traffic and Transport Movements

The increase in production will result in the requirement of an additional 30,000 tonne of alumina and 7,000 tonne of petroleum coke being received at the Port of Newcastle and transported to the smelter site. This equates to three additional raw material trucks per day. In regards to shipping the additional tonnage equates to 1 additional alumina ship and 1 additional coke ship during a two year period. **Table 1** below details truck movements to the Smelter in July 2016 and the anticipated trucking movements at 600,000 tonne/annum based on the current trucking arrangement of deliveries of alumina on the weekend and petroleum coke on weekdays only.
The 2009 approval was based on anticipated trucking movements of 454 trucks per day.

Table 1 Anticipated Increase in truck movements

	Current truck movements	Anticipated increase
Alumina truck movements/ day	78	2
Coke/ Pitch truck movements/day	17	1
Finished product Truck movements /day	34	1
Other Heavy vehicle movements/day	5	1
Total	134	5

Staff

No additional staff are planned to be employed as a result of the proposed modifications. However, incremental growth opportunities will assist in maintaining the internationally competitive position of the aluminium smelter and underpin employment security of existing staff, contractors and service providers.

6 ENVIRONMENT IMPACT ASSESSMENT

Air quality

From an air quality perspective, the production increase is not expected to result in any additional impact. In the case of the key emissions of fluorides and sulphur dioxide existing load limits of 298 tonne for fluoride and 11,900 tonne for sulphur dioxide established during the 2009 approval process will be respected and no increase in the load limit will be required.

Fluoride Source Emissions

Improved emission performance has been achieved by improvements such as upgrading pot fume extraction systems and focusing on work practices. Fluoride emission performance is a key performance indicator for the site, **Figure 5** displays the improvement in fluoride emission performance over the last 8 years against an increase in production of 54kT.

Figure 5: Total fluoride load and metal production over the last 8 years

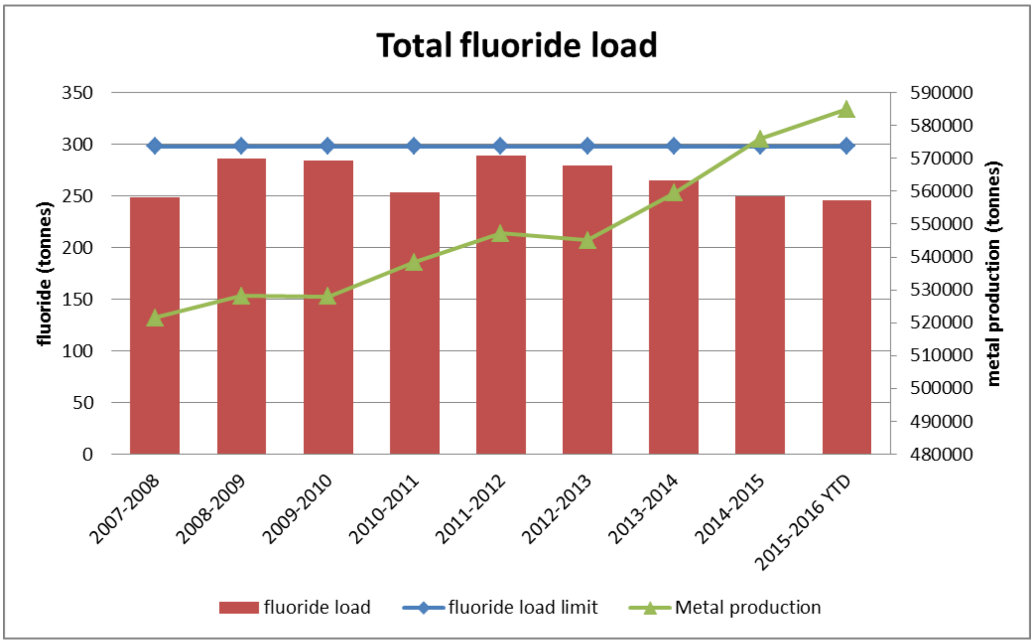
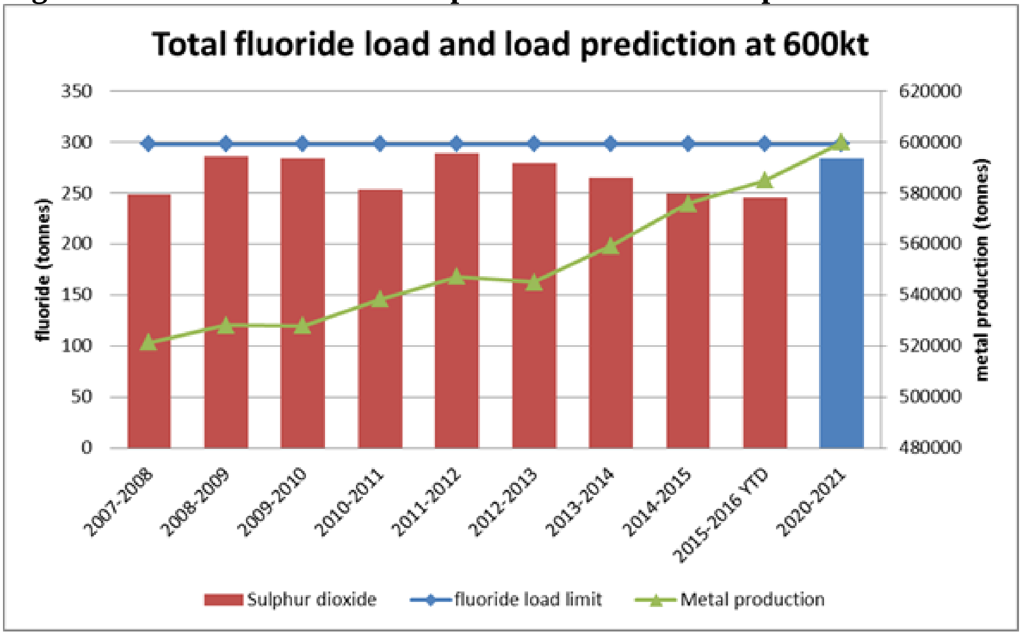


Figure 6 displays the fluoride emission performance (kilograms fluoride) since 2007-2008 EPL licence year and production volume. Performance from 2012-13 to 2014-2015 was used to predict the annual load when production volume reaches 600kT.

Note: The 2015 -2016 data is based on the current performance year to date (November 2015- July 2016).

Figure 6: Fluoride emission rate performance and load prediction



Sulphur Dioxide Source Emissions

Existing controls for sulphur dioxide currently rely on limiting the sulphur levels in petroleum coke and pitch used in the manufacture of the carbon anode .Sulphur dioxide is emitted during the baking and consumption of the anode. The annual sulphur dioxide limit of 11,900 tonnes is maintained through the purchase of petroleum coke that meets a targeted sulphur specification determined for the smelter to meet the annual sulphur dioxide target.

Figure 7 displays sulphur dioxide loads against the increase in production over the last 8 years.

Figure 8 displays the sulphur dioxide emission rate performance (kilograms sulphur dioxide/tonne of aluminium) since the 2010/2011 EPL licence year. The 2020-2021 emission rate prediction is based on the average annual performance over the last 3 years.

Figure 7: Total sulphur dioxide load and metal production over the last 5 years

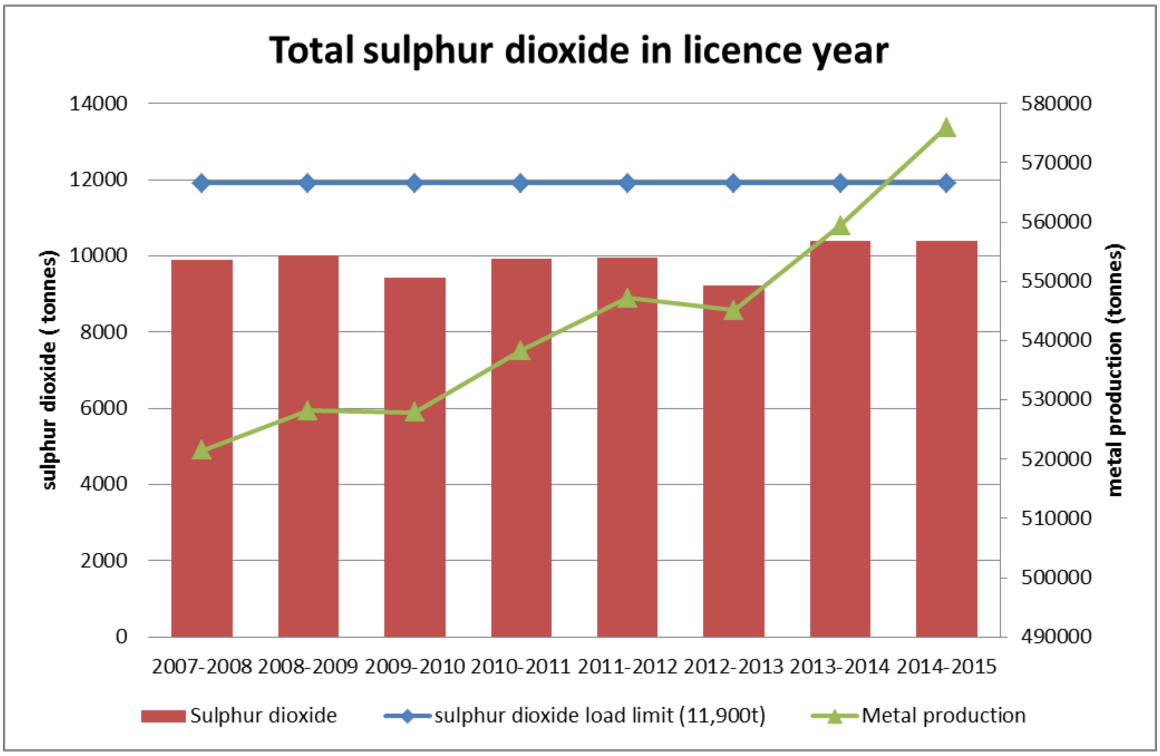
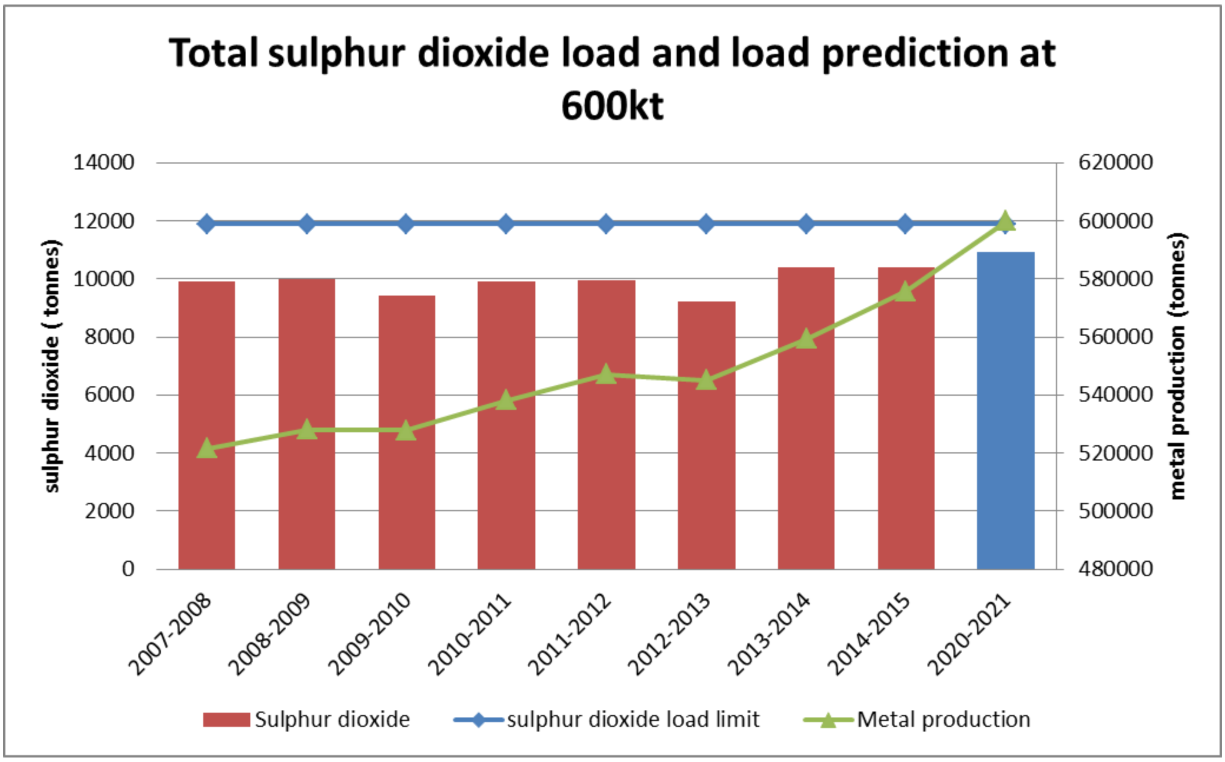


Figure 8: Sulphur Dioxide emission rate performance and forecast sulphur dioxide emission rate at 600,000 tonne production



Ambient Air monitoring data

Sulphur Dioxide

As part of the negotiations for the development application for the production increase from 530,000tpa to 575,000tpa, the EPA negotiated the installation of three further ambient sulphur dioxide monitors to better understand sulphur dioxide emissions from the premises. After the installation of the new monitoring sites Tomago Aluminium reported that the EPA 24 hour impact assessment criteria for sulphur dioxide was exceeded on some days during strong westerly winds at one of the newly established sites. As a result the EPA placed a Pollution Reduction Program on EPL 6163 to review air emission modelling and investigate feasible and reasonable technologies that can be implemented to reduce sulphur dioxide emissions from key areas of the smelter.

Following extensive dispersion and wind tunnel modelling it was concluded that under specific defined meteorological conditions of persistent strong wind from the northwest sector the newly established monitoring site would receive sulphur dioxide emissions from both the bake ovens and potline processes due to the orientation of the plant emission sources. Subsequent monitoring has confirmed a defined area of impact that will exceed the EPA 24 hour impact assessment criteria under persistent strong winds from the northwest sector when the wind persists for the 24 hour period. To address this issue Tomago Aluminium purchased the remaining residential property in the area of impact and demolished the existing Tomago Aluminium owned rental properties in the area. The EPA has removed the Pollution Reduction Plan from the current EPL. In 2015 no exceedances of sulphur dioxide were recorded at the 5 company operated sulphur dioxide monitoring sites. In 2016 YTD one exceedance of the 24 hour sulphur dioxide standard was recorded at the monitoring site situated to the south east of the smelter site, at the site referred to as the “farm monitor”, which is in the company’s buffer zone.

The NEPM air quality concentration levels and standard are:

Averaging Period	NEPM standard
1 hour	20pphm
1 day	8.0pphm
1 year	2.0pphm

The NEPM goal allows for 1 hour and 1 day standard levels to be exceeded for one day per year. The five ambient sulphur dioxide monitoring sites operated by Tomago Aluminium Company are all located within the designated buffer zone.

Table 2 and **Table 3** displays a summary of maximum concentrations of the ambient sulphur dioxide levels conducted in the vicinity of the smelter during 2015 and 2016 year to date.

Table 2: Ambient sulphur dioxide monitoring data for 2015

SITE		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Meteorological Station	Max 24 hour Value (pphm)	3.2	0.3	1.2	2	4.4	1.4	2.3	1	3.8	1.2	0.4	0.3
Grid Ref (812 681)	Max 1 hour value (pphm)	9.9	2.5	6.4	7.5	8	7.8	8.8	4	7.3	5.2	3.9	1.7
Tomago Farm Monitor	Max 24 hour Value (pphm)	2.2	0.5	1.2	6	7.5	5.2	7.4	5.3	2.4	3.6	3.1	1.2
Grid Ref (813 665)	Max 1 hour value (pphm)	11.8	2.8	7.4	12.5	14	16.8	14.4	13.1	9.5	12	10.5	10.5
Highway Monitor	Max 24 hour Value (pphm)	1.3	1.6	4	0.8	0.5	0.7	0.5	0.7	1.2	1.7	1.3	1.7
Grid Ref (793 688)	Max 1 hour value (pphm)	4.3	6	8.5	2.9	2.3	3.5	1.3	2.3	10.5	6	5.2	6.9
Laverick Ave Monitor	Max 24 hour Value (pphm)	1.8	2.5	0.7	0.4	0.8	0.9	0.3	0.4	0.7	1.1	2.8	2.0
Grid Ref (784 667)	Max 1 hour value (pphm)	8.1	7.8	4.2	1.1	3.7	6.4	1	2.1	3.9	6.5	7.5	6.6
Site 179 Monitor	Max 24 hour Value (pphm)	0.6	0.3	0.9	2.7	4.7	1.6	2.6	2.5	1.9	0.6	1.1	0.8
Grid Ref (817 671)	Max 1 hour value (pphm)	3.0	4.0	6.0	11.5	10.2	6.6	9.5	12.2	8.6	5.2	7.6	5.2

Table 3: Ambient sulphur dioxide monitoring data for 2016 YTD

SITE		Jan	Feb	Mar	Apr	May	Jun	Jul
Meteorological Station	Max 24 hour Value (pphm)	1.0	0.3	2.7	2.5	0.9	2.3	2.1
Grid Ref (812 681)	Max 1 hour value (pphm)	3.4	1.3	7.9	5.7	8.4	7.0	5.0
Tomago Farm Monitor	Max 24 hour Value (pphm)	1.8	0.6	1.2	1.5	8.1	7.6	7.7
Grid Ref (813 665)	Max 1 hour value (pphm)	7.3	2.7	5.8	6.8	14.2	11.7	12.7
Highway Monitor	Max 24 hour Value (pphm)	1.3	1.1	1.5	2.9	0.4	0.5	0.6
Grid Ref (793 688)	Max 1 hour value (pphm)	5.5	4.8	5.6	6.5	2.2	2.0	2.6
Laverick Ave Monitor	Max 24 hour Value (pphm)	1.5	1.1	1.9	1.5	0.6	1.2	0.7
Grid Ref (784 667)	Max 1 hour value (pphm)	5.8	5.3	6.2	4.9	2.2	3.0	2.8
Site 179 Monitor	Max 24 hour Value (pphm)	0.5	0.3	0.8	0.3	3	3.2	4.5
Grid Ref (817 671)	Max 1 hour value (pphm)	3.6	1.8	4.4	2.0	9.6	11.2	9.3

Ambient Sulphur dioxide concentrations are predicted to remain the same as production increases to 600kt.

Fluoride

Unlike most ambient objectives, guidelines or standards for common air pollutants, goals for ambient air fluoride are designed to protect against injury to plants and grazing animals rather than to protect human health.

The National Goals for fluoride in ambient air as established by the Australian and New Zealand Environment Council and subsequently adopted by the NSW EPA as assessment criteria set hydrogen fluoride concentrations at:

- 0.5ug/m^3 as a maximum 90 day average;
- 0.84ug/m^3 as a maximum 30 day average;
- 1.7 ug/m^3 as maximum 7 day average; and
- 2.9ug/m^3 as a maximum 24 hour average.

The ANZEC goals are designed to protect most of the sensitive species in the natural environment.

A buffer zone was designated during the approval process for the third potline in 1991 to accommodate an annual emission load equivalent of 298 tonnes of total fluoride per year. The establishment of the buffer zone was to assist in the management of land use around the smelter. Tomago Aluminium purchased land that was zoned as either rural or residential under the Development Consent condition.

Fluoride monitoring around the TAC smelter occurs at a variety of locations **(refer to figure 9)**. Monitoring consists of the collection of 7 day average samples. A summary of the results for the various locations is shown below in **Table 4.**

Table 4: Fluoride Monitoring Results: 2015

Location	Max 7 Day (ug/m^3)	Max 30 Day (ug/m^3)	Max 90 Day (ug/m^3)	Site within established buffer zone
Corner of Martin Dr and Old Punt Rd (TAC #84)	1.2	**0.87**	**0.6**	Yes
Detention Centre Tomago Rd (TAC #83)	0.97	0.5	0.4	Yes
Western End Enterprise Dr (TAC #179)	**1.9**	**1.0**	**0.8**	Yes
Corner of Pacific Highway and old Punt Rd (TAC #85)	1.4	0.6	0.5	Yes
Botanic Gardens Pacific Highway (TAC # 122)	0.74	0.3	0.2	Yes
HWA Offices off Tomago Rd (TAC #80)	0.4	0.2	0.2	No
"The Farm" Tomago Road (TAC #181)	**6.1**	**4.5**	**3.5**	Yes
Redbill Drive Woodberry (TAC #188)	0.2	0.2	*	
Criteria	1.7	0.84	0.5	

*Site relocated during 2015. No 90 day averages are available due to the relocation

The ambient air sites where exceedances were recorded are highlighted in the table in bold. These sites are situated within the Tomago industrial estate and due to the highly disturbed state of the natural environment no environmental impact will result. The ANZEC goals are met at all sensitive receptors within the buffer zone and at monitoring locations outside the buffer zone. Ambient fluoride concentrations are expected to remain constant as production increases to 600kt.

Figure 9: Ambient Air Monitoring Sites

The historical and recent monitoring highlights that the small proposed increase in production and respecting the existing load limits for fluoride and sulphur dioxide, no additional environmental impacts from air emissions can be expected.

Fluoride in Vegetation

Gaseous fluoride concentrations in the air can affect the condition of vegetation. Gaseous fluoride is absorbed by plants via the leaf stomata during normal respiration processes. The gaseous fluoride is preferentially absorbed instead of carbon dioxide and can reduce the capacity of the plant to photosynthesise. The extent to which fluoride accumulates in vegetation depends upon a number of variables including exposure regimes, meteorological conditions and plant species characteristics. Specific plant characteristics are an important variable as species can vary in their sensitivity to fluoride. Sensitive species often display foliar damage at tissue concentrations of 50 μg/g. Intermediate species may be damaged at 200 μg/g and resistant species can tolerate tissue concentrations above 500 μg/g before exhibiting symptoms. Background concentrations are typically around 20 μg/g.

Foliar Fluoride Concentrations

In accordance with EPL 6163 Tomago Aluminium undertake an extensive fluoride vegetation monitoring program, with sites that are situated at varying distances from the smelter sampled on a monthly or quarterly basis. To complement this program an annual visual inspection of the condition of vegetation is also conducted.

Overstorey sites at varying distances from the smelter (refer Appendix 1, map 2) are sampled on a monthly or quarterly basis and the fluoride concentration in leaf tissue is determined. The average results for 2015 and the four years prior are displayed in **Table 5**. The sample sites are displayed in **figure 10**.

Fluoride concentrations in vegetation remain stable and no increase is expected as a result of the increase in production.

Figure 10: Fluoride in Vegetation monitoring sites

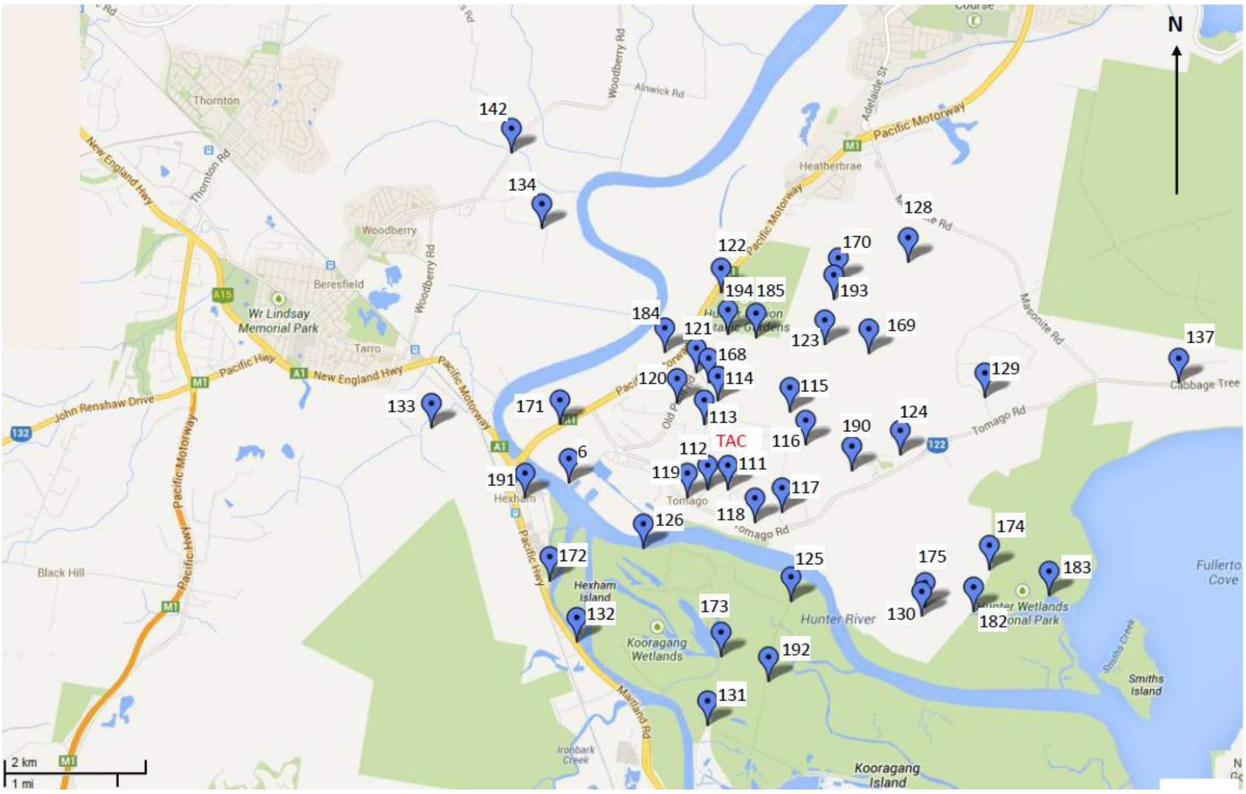


Table 5 AVERAGE FLUORIDE CONCENTRATIONS IN OVERSTORY AROUND THE TOMAGO ALUMINIUM SMELTER 2011 – 2015

SITE	2011	2012	2013	2014	2015
6	10	11	11	12	7
111	1003	555	557	876	744
112	253	184	177	233	266
113	283	223	270	311	253
114	547	238	407	616	593
115	71	140	122	108	73
116	71	109	78	54	103
117	511	386	250	386	460
118	140	130	182	308	468
119	200	131	119	127	120
120	25	24	30	32	20
121	31	29	19	19	17
122	16	19	23	18	18
123	19	25	15	23	21
124	15	25	13	13	18
125	nra	6	7	8	7
126	53	36	52	43	38
128	15	15	9	15	21
129	11	14	8	11	11
130	10	11	12	9	8
131	7	6	7	5	5
132	9	11	8	8	6
133	10	14	9	8	10
134	14	13	8	9	10
136	9	6	6	5	6
137	9	13	9	8	11
138	10	15	8	6	5
139	5	8	5	10	5
141	5	11	8	11	5
142	13	11	8	9	8
144	8	9	5	6	5
147	9	6	5	5	6
149	9	6	5	5	5
151	11	16	10	10	9
168	160	130	92	129	79
169	15	22	17	15	17
170	25	30	39	18	28
171	23	18	16	19	15
172	12	15	13	13	10
173	10	8	10	8	7
174	38	31	32	23	30
175	25	38	29	28	32
182	25	33	27	31	24
183	26	39	32	25	22
184	54	47	28	27	30
185	24	26	19	25	30
190	16	23	37	30	20
191	16	18	17	18	15
192	nra	11	9	8	6
193	15	18	9	10	14
194	48	33	21	25	38

Visual Assessment

A total of 587 sites were assessed in November 2015. Visible injury symptoms attributable to gaseous emissions from the smelter, particularly hydrogen fluoride and sulphur dioxide, were identified and graded. The grading was used to provide a semi-quantitative indication of the occurrence of injury. Visible injury was determined by assigning foliage of selected perennial plant species to categories of injury due to chlorosis, necrosis, cupping or undulation of foliage, anthocyanin accumulation and insect attack. The sites assessed were mapped and the injury category interpolated to produce a model of vegetation injury around the smelter. The symptom code used for visible injury assessment to vegetation is

Injury Category	Symptom expression	
	Visual extent	Percent of leaf
0	Nil	0
1	Very slight	<2%
2	Slight	<5%
3	Distinct	<10%
4	Marked	<25%
5	Severe	<50%
6	Very severe	<75%
7	Extreme	>75%

Figure 11 shows a model of visible injury in vegetation attributed to smelter operations. **Table 6** compares the area of each Injury Category within the Modelling Domain since 2013.

The smelter emissions have an impact on vegetation that is limited to an area of about 450 ha around the smelter perimeter. This area varies from 700 to about 1,300 m wide (widest in the north and east, narrowest in the southwest). Within this area the vegetation showing marked or more severe injury (category 4 or greater) covers about 3.9 ha mostly opposite the potrooms in the east.
The area of impact has decreased from 2014 as has the area showing marked or more severe injury.

There were no symptoms that could be attributed to fluoride in the Hunter Region Botanic Gardens; either within the introduced collections or the naturally occurring forest.

Figure 11:**Model of visible injury in vegetation attributable to smelter operations as assessed by Ecoplan Australia in November 2015.**

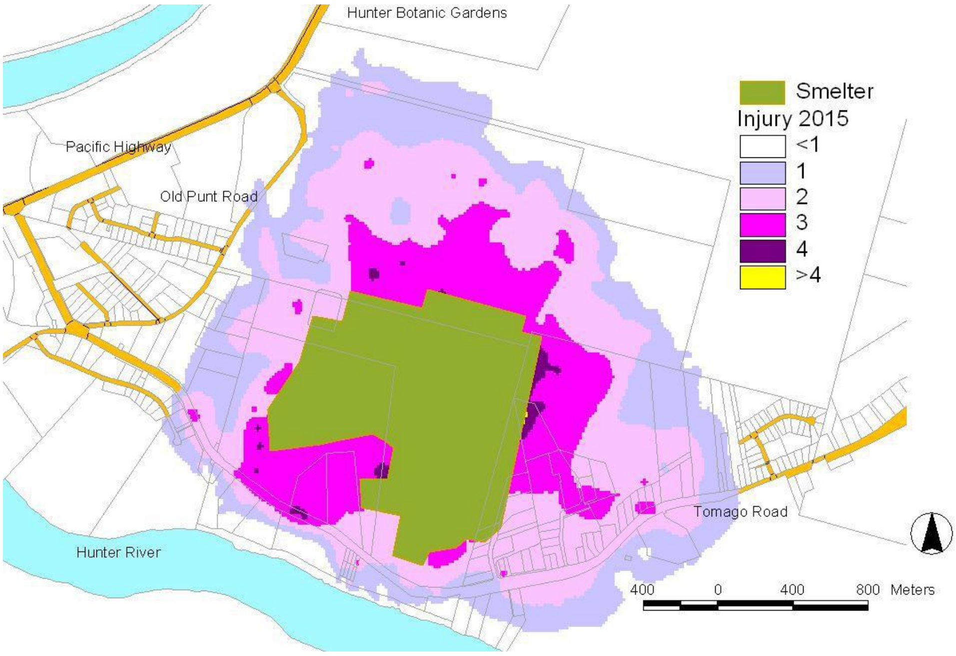


Table 6 Area of each vegetation injury category within the modelling domain

	2015		2014		2013	
Category	Area (ha)	Area %	Area (ha)	Area %	Area (ha)	Area %
0	1776.7	79.8	1754.3	78.8	1756.1	78.9
1	149.7	6.7	167.3	7.5	169.7	7.6
2	197.8	8.9	235.7	10.6	180.3	8.1
3	98.7	4.4	64.7	2.9	106.0	4.8
4	3.8	0.2	4.5	0.2	14.3	0.6
>4	0.1	0.0	0.3	0.0	0.5	0.0
Total	2226.8	100.0	2226.8	100.0	2226.8	100.0

Noise

The existing acoustic environment around the site consists mainly of industrial noise which include warehousing facilities, various metal fabrication works, a gas storage facility and an aluminium cable manufacturing facility.

Previous noise modelling conducted for the AP22 Project SEE (April 2001) indicated that noise levels would be similar to those in the previous Potline No 3 EIS study (1990). As part of the AP2X (2009) approval, regular noise monitoring was conducted at the TAC electrical substation to assess if the amperage increase impacted on the noise generated from the substation. A summary of the noise monitoring results as the amperage increased from 225 kA to 245 kA is presented in **Table 7** and **Table 8** below. No increase in noise levels was detected**. Figure 12** details the substation noise monitoring sites.

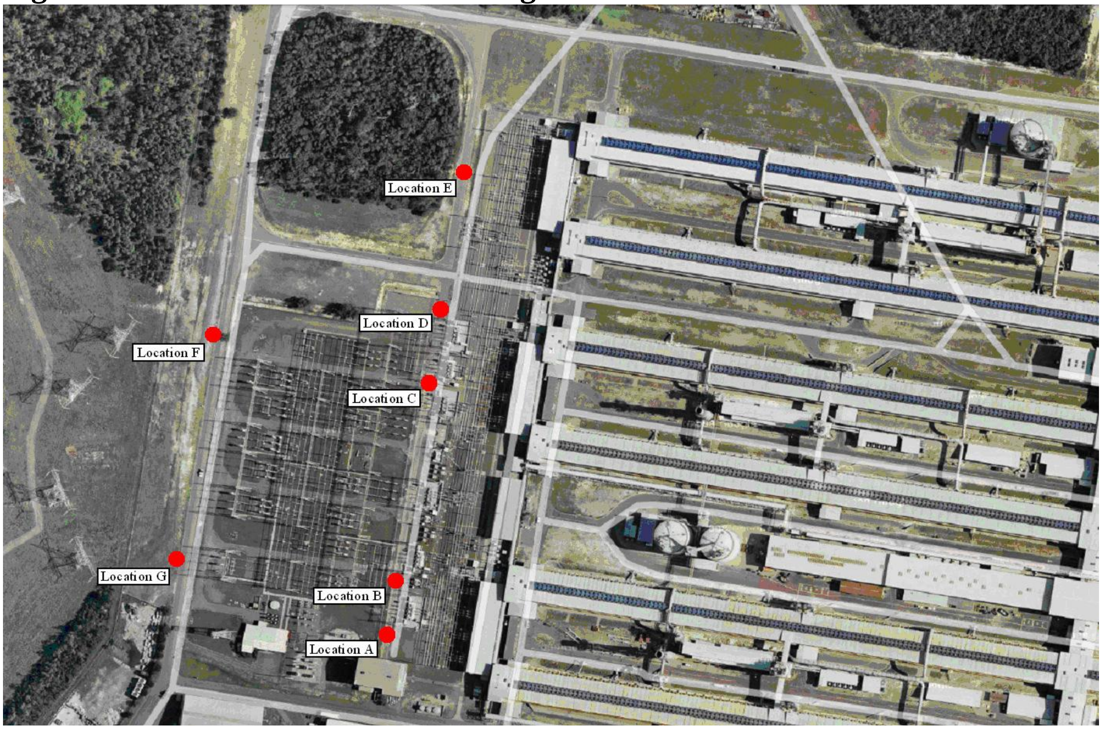
Table 7 Sound Pressure Levels (L_{A90} dB)

Location	06/04/10	19/07/10	28/03/11	09/03/12	16/10/12	02/12/13	26/9/14	Overall Change
A	76	78	78	76	76	74	77	1
B	76	75	75	75	75	75	72	-4
C	75	76	75	73	75	76	75	Nil
D	70	70	69	69	69	71	66	-4
E	67	68	67	66	65	68	66	-1
F	60	61	63	56	56	60	59	-1
G	58	59	63	58	56	60	59	1

Table 8 Sound intensity Levels (L_{Aeq} dB)

Location	06/04/10	19/07/10	28/03/11	09/03/12	16/10/12	02/12/13	26/9/14	Overall Change
A	81	80	80	79	80	76	79	-2
B	78	78	76	77	75	77	75	-3
C	78	79	75	74	77	77	76	-2
D	72	71	70	70	71	72	67	-5
E	69	70	70	69	67	71	68	-1
F	64	64	65	60	60	62	61	-3
G	62	63	66	61	60	62	61	-1

Figure 12: Substation noise monitoring locations



TAC currently undertakes attended Noise Monitoring at three locations surrounding the site, Old Punt Road (rear of Tomago Caravan Park), Tomago Detention Centre and 47 School Drive on a six monthly basis. The monitoring locations are detailed in **Figure 13.** The 2013-15 monitoring data is presented in **Table 9** below.

Figure 13: Environment Noise Monitoring Sites

Table 9: Environment Noise Monitoring Data

		Old Punt Road (L1)				Detention Centre (L2)				School Drive (L3)			
	Noise Goal (night)	1997 - 1999	2013	2014	2015	1997 - 1999	2013	2014	2015	1997 - 1999	2013	2014	2015
L_{A90} (dB)		48	46	50	46	51	49	52	50	44	40	38	39
L_{A10} (dB)		60	51	52	52	61	51	52	52	51	44	46	55
L_{Aeq} (dB)	50	58	50	51	48	63	50	52	50	56	42	42	52
L_{Aeq} (dB) TAC attrib.				46	48			52	50			33	37

Note : IA = Inaudible

The land use criteria around the Tomago Aluminium Smelter has changed significantly over the last 15years to be now largely dominated by industrial facilities, noise levels measured at the monitoring sites are conservatively compared to night time urban / industrial interface amenity criteria of 50 L_{Aeq} dB(a) detailed in Table 2.1 of the NSW Industrial Noise Policy.

Whilst some measured levels are above the recommended amenity levels, the L_{Aeq} levels are generally trending down when compared to the 1997-1999 levels. No noise complaints have been received by the Tomago Aluminium smelter in the last ten years.

No increase in noise is expected to occur as a result of the increase in production to 600,000 tonnes.

Water Quality

Stormwater

The management of stormwater at the TAC smelter is not expected to be modified from the current arrangements as a result of the proposed production capacity increase. The surface water management arrangements as described in the SEE (April 2001) for AP22 project are still applicable. These are summarised below.

Stormwater runoff is directed to a separate collection pond, which accepts the first flush of a one in 10 year storm event. Subsequent stormwater runoff that contains lower fluoride concentrations is discharged directly to the Hunter River. The first flush collection is later discharged at a controlled rate after the quality of the water has been verified. This ensures that fluoride levels entering the river are within approved limits.

The process of stormwater discharge is controlled by the conditions of the EPL 6163 for the smelter. Under the licence TAC monitors conductivity, fluoride, total suspended solids and pH during discharge.

Surface Water

The current EPL 6163 requires TAC to monitor the fluoride, pH and conductivity levels of surface waters within 16.6 km of the smelter. The Potline No. 3 EIS (July 1990), AP22 project SEE (April 2001) and the AP2X project May 2009) reviewed the monitoring data. Both the EIS and SEE reviews concluded that the only surface water monitoring location that showed an increased fluoride level was a temporal pond approximately 0.5km North of the smelter (site 1). This site is subject to regular drying out, influencing the results and monitoring data from 2011 display that fluoride concentrations have remained stable. The capacity increase will have no impact on surface water quality in the environs of the smelter. Surface water monitoring data from 2011-2015 is presented in **Table 10**. The location of the monitoring sites is detailed in **Figure 14**.

TABLE 10 **SURFACE WATER MONITORING IN THE VICINITY OF TOMAGO ALUMINIUM SMELTER FOR 2011 – 2015**

(all results expressed as milligrams of fluoride per litre of water)

SITE	Average 2005-2009	2011	2012	2013	2014	2015
1	3.5	3.4	2.3	3.9	4.0	3.8
2	0.71	0.57	0.54	0.61	0.53	0.77
3	1.5	2.3	2.4	1.5	2.6	1.7
4	1.0	1.1	0.97	1.4	1.3	1.8
5	0.91	0.68	0.76	1.0	1.2	0.9
6	0.70	0.42	0.58	0.71	1.0	0.7
7	0.56	0.74	0.68	0.91	3.6	0.8
9	0.17	0.20	0.24	0.58	0.34	0.28
11	0.29	0.24	0.32	0.76	0.35	0.42
17	0.17	0.19	0.19	0.23	0.20	0.22
34	0.11	0.11	0.13	0.14	0.15	0.14
178	0.95	0.89	1.1	0.87	0.82	0.19

Figure 14: Surface water monitoring sites

Surface Water Monitoring Points

Groundwater

The current EPL 6163 requires TAC to monitor the fluoride, pH and conductivity levels of groundwater within 16.5km of the smelter. The groundwater monitoring result summary for 2011-2015 are provided in **Table 11.**

TABLE 11 GROUNDWATER MONITORING IN THE VICINITY OF TOMAGO ALUMINIUM SMELTER FOR 2011-2015

(all results expressed as milligrams of fluoride per litre of water)

Bore Group	2011	2012	2013	2014	2015
Hunter Water Bores	<0.1	0.3	0.2	0.1	0.1
Northern Boundary Bores	1.4	1.6	2.1	1.7	2.1
Eastern Boundary Bores	5.2	5.9	5.7	6.7	6.6
Southern Boundary Bores	12	11	10	10	10
Southern Off-Site Bores	0.3	0.3	0.3	0.3	0.3
South-Western Boundary Bores	2.5	2.2	2.0	2.2	2.2
Western Boundary Bores	5.5	9.6	9.7	9.4	11

The Hunter Water bores are generally situated in the Tomago Sandbeds Area as displayed in **Figure 15**, The concentrations levels of fluoride presented in **Table 11** highlight that fluoride concentrations are at background levels and indicate there has been no impact on the regional Tomago Sandbeds groundwater reserve as a result of the operation of the smelter.

The groundwater sites sampled by Tomago Aluminium are largely located within the smelter site and to the south of the smelter, the sampling locations are displayed in **Figure 16**. The groundwater flow direction on the smelter site is to the south east towards the Hunter River. An increase in the western boundary bores has been observed since 2011 but concentrations remain relatively stable. During 2011-2015 groundwater monitoring sites on the southern boundary (close to the first flush stormwater basin) have displayed elevated but stable fluoride concentrations. Tomago Aluminium commissioned Coffey Environments Australia in 2012 to undertake an assessment of the significance of fluoride recorded in groundwater within the vicinity of the southern stormwater pond. The contaminant fate and transport modelling concluded:

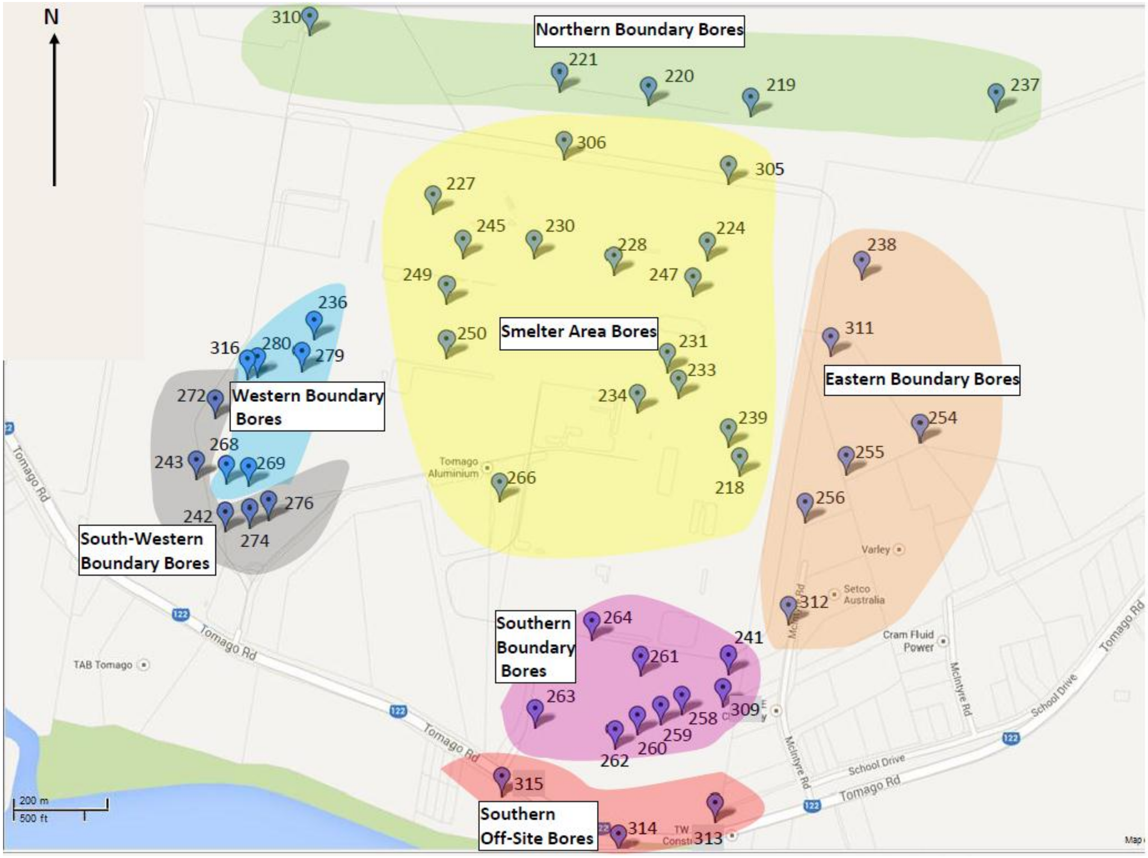
- The migration of fluoride contaminated groundwater will result in only marginal increases in fluoride levels at the groundwater/river interface. When the effects of adsorption are considered within the modelling based on reference and field data derived from pond sediment, the modelling predicts that the fluoride plume would not break through at the groundwater/river interface within the next 100 years.

- An appraisal of the net flow of the Hunter River indicates the river would provide significant dilution potential. In the context of the marginal increase in fluoride concentrations predicted to discharge into the river, it is assessed that the increase in fluoride levels within the river would not be detectable.

Fluoride concentration in groundwater is not expected to increase as a result of the marginal production increase.

Figure 15: Hunter Water groundwater monitoring sites

Figure 16: Tomago Aluminium groundwater monitoring sites



Waste

Wastes generated at the TAC smelter as a result of the aluminium smelting process are classified in accordance with the Protection of Operations (Waste) Regulations.

The categorisation of aluminium smelter solid wastes and the manner in which they are either stored or disposed in NSW is also regulated by a Chemical Control Order (CCO) issued under the *Environmentally Hazardous Chemicals* (*EHC) act 1985.* The CCO was enacted in the 1980's when there were limited controls on waste movement and disposal in NSW.

The key smelter solid wastes include:

- Spent Pot lining (SPL)
- Dross
- Used refractory bricks
- Fluoridated waste.

The waste products are not expected to increase as a result of the production increasing to 600,000 tonnes. Existing contracts are in place to manage Spent Pot Lining and Dross.
Currently the smelter has 7,500t of SPL stored undercover onsite. With the existing contracts in place and the continued consolidation of markets for treated products this stockpile will continue to reduce towards zero in the coming months.
100 percent of the used refractory bricks are recycled with a current exemption under Part 6 of the Protection of the Environment Operations (Waste) Regulation.

7 CONCLUSIONS

Presented in this document is a description of the proposed production capacity increase at Tomago Aluminium Company. This project is envisaged to result in an incremental increase of total operating capacity from the existing 585, 000 t/year saleable production to 600,000 t/year saleable an increase of 2.5 %.

The project is based on an incremental increase of the total amperage through each of the three potlines based on the strong performance of the current cell technology.

The main air pollutants associated with aluminium smelting, namely fluoride and sulphur dioxide will remain below the existing load limits.
Based on the small material increase in proposed tonnage, the verification and ongoing monitoring conducted as part of the Environment Protection Licence 6163 and the development consent conditions defined in DA No 392/80 and 4908/90, no additional environmental impact is expected.