



# Decision Document

## *Environmental Protection Act 1986, Part V*

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**Licensee: Global Advanced Metals Greenbushes Pty Ltd**

**Licence: L8501/2010/2**

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**Registered office:** Level 3, Centrepoint Tower  
123B Colin Street  
WEST PERTH WA 6005

**ACN:** 125 585 284

**Premises address:** Global Advanced Metals Greenbushes  
Maranup Ford Road  
GREENBUSHES WA 6000  
Being Sub-leases of Mining Tenements M01/06 and M01/3 as shown in  
Schedule 1

**Issue date:** Thursday, 12 December 2013

**Commencement date:** Saturday, 14 December 2013

**Expiry date:** Sunday, 13 December 2026

### **Decision**

Based on the assessment detailed in this document the Department of Water and Environmental Regulation (DWER), has decided to issue an amended licence. DWER considers that in reaching this decision, it has taken into account all relevant considerations and legal requirements.

Decision Document prepared by: Louise Lavery  
Licensing Officer

Decision Document authorised by: Tim Gentle  
Delegated Officer



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## 1 Purpose of this Document

This decision document explains how DWER has assessed and determined the application and provides a record of DWER's decision-making process and how relevant factors have been taken into account. Stakeholders should note that this document is limited to DWER's assessment and decision making under Part V of the *Environmental Protection Act 1986*. Other approvals may be required for the proposal, and it is the proponent's responsibility to ensure they have all relevant approvals for their Premises.

## 2 Administrative summary

Administrative details		
Application type	Works Approval <input type="checkbox"/> New Licence <input type="checkbox"/> Licence amendment <input checked="" type="checkbox"/> Works Approval amendment <input type="checkbox"/>	
Activities that cause the premises to become prescribed premises	<b>Category number(s)</b>	<b>Assessed design capacity</b>
	44	7 000 tonnes per annum product roasted
Application verified	Date: 16/08/2016	
Application fee paid	Date: 19/08/2016	
Works Approval has been complied with	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input checked="" type="checkbox"/>	
Compliance Certificate received	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input checked="" type="checkbox"/>	
Commercial-in-confidence claim	Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>	
Commercial-in-confidence claim outcome		
Is the proposal a Major Resource Project?	Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>	
Was the proposal referred to the Environmental Protection Authority (EPA) under Part IV of the <i>Environmental Protection Act 1986</i> ?	Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>	Referral decision No: Managed under Part V <input type="checkbox"/> Assessed under Part IV <input type="checkbox"/>



Is the proposal subject to Ministerial Conditions?	Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>	Ministerial statement No: EPA Report No:
Does the proposal involve a discharge of waste into a designated area (as defined in section 57 of the <i>Environmental Protection Act 1986</i> )?	Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Department of Water consulted Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>	
Is the Premises within an Environmental Protection Policy (EPP) Area Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> If Yes include details of which EPP(s) here.		
Is the Premises subject to any EPP requirements? Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> If Yes, include details here, eg Site is subject to SO <sub>2</sub> requirements of Kwinana EPP.		

### 3 Executive summary of proposal and assessment

Global Advanced Metals Greenbushes Pty Ltd (GAMG) owns an underground mine, a crushing plant and two mineral processing plants at Greenbushes. Tantalum concentrate products are produced. Tin ingots are also produced from the tantalum process using an electric arc furnace.

GAMG's operations are located within the mining tenements granted to Talison Lithium Australia Pty Ltd (Talison). Sub-leases have been granted to GAMG by Talison for a primary production plant and a secondary production plant, via a contractual arrangement between the two companies.

GAMG is not currently conducting any mining activities. The underground mine is in a period of care and maintenance and sealed to prevent access. The primary tantalum processing facility has also been placed into care and maintenance, however some equipment is maintained to facilitate the drying of concentrate. The crushing plant and associated ROM (run of mine) pad and fine ore stockpile are licensed to Talison. The secondary tantalum plant is operated to process mineral concentrates that are either (i) produced by Talison for GAMG; or (ii) obtained by GAMG from other sources.

#### Primary Processing Plant Environmental Impacts

Currently no tailings are generated from the primary processing plant.

Noise emissions from the Primary Processing Plant (and Secondary Processing Plant) are managed in conjunction with Talison to meet the requirements of the Regulation 17 Approval (Environment Protection (Global Advanced Metals Greenbushes operation Noise Emissions) Approval 2015) gazetted on 27 February 2015, under the *Environmental Protection (Noise) Regulations 1997*. As this approval specifies requires monitoring and management of the activities via a management plan to be submitted according to the conditions of the Approval, requirements to manage and monitor noise will not be duplicated in this Licence.

Stormwater from the primary sub-lease site has the potential to pick up metals/metalloids (in particular lithium) from ROM (run of mine) pad, crusher circuit, concentrate stockpiles and building surroundings. Noting that the crusher and stockpiles are currently leased to Talison and under Talison's management, drainage from the rest of the site is directed to one of two drains from the



northeast and east of the site to exit at the south east of the lease to the Talison's concrete silt recovery sump. Conditions have been placed on Talison's Licence L4247/1991/13 in relation to management and monitoring of stormwater overflows from this silt recovery sump.

Fugitive dust emissions arising from the operation of the crusher are under the responsibility of Talison. Talison has a condition on their Licence to continuously monitor ambient air quality at the Talison Prescribed Premises boundary, adjacent from the town of Greenbushes.

### **Secondary Processing Plant**

The Secondary Processing Plant upgrades primary tantalum concentrate using gravity separation, magnetic separation, roasting and smelting. Tin contained within the primary tantalum concentrate is recovered as metal from the smelting process.

The plant can process up to 20 000 tonnes of tantalum concentrate per annum and roast/smelt 10 000 tonnes per annum.

Potential environmental impacts relate to dust, noise, point source emissions to air and releases to surface water and groundwater.

Dust emissions from dry processing activities are controlled using dust collection equipment, with dust collected returned to the process for upgrading as tantalum concentrates.

Noise is managed according to the Regulation 17 Approval as discussed above, with Talison operating the ambient noise monitoring equipment and completing the reporting requirements on behalf of GAMG.

Roaster and smelter air emissions are treated in a cooler/baghouse system prior to discharge via a stack. The baghouses collect particulates as solid fume. Roaster and smelter stacks are 36m and 18m in height, respectively.



## 4 Decision table

All applications are assessed in line with the *Environmental Protection Act 1986*, the *Environmental Protection Regulations 1987* and DWER's *Guidance Statement: Risk Assessments (February 2017)*. Where other references have been used in making the decision they are detailed in the decision document.

<b>DECISION TABLE</b>			
<b>Works Approval / Licence section</b>	<b>Condition number W = Works Approval L = Licence</b>	<b>Justification (including risk description &amp; decision methodology where relevant)</b>	<b>Reference documents</b>
<b>General conditions</b>	L1.2.1	L1.2.1 specifies that all spills of saline wastewater and process liquors outside of containment shall be immediately cleaned up and where possible, returned to the process.	
<b>Premises operation</b>	L1.3.1 – L1.3.3	Condition L1.3.1 authorises the use of Tin Shed Dam to store process water and contaminated stormwater. L1.3.2 prescribes a freeboard limit to be maintained. L1.3.1 and L1.3.3 require the operation of the arsenic remediation unit. Refer to Appendix B for DWER's risk assessment of fugitive emissions to surface water and/or groundwater from the Tin Shed Dam.	Appendix B
	L1.3.4	Requirements for inspections of the containment infrastructure and baghouses operation is detailed in L1.3.4. This condition replaces conditions A6(b), A6(c) in part.	
<b>Point source emissions to air including monitoring</b>	L2.2.1 - L2.2.2 L3.2.1, L3.2.2 L3.2.3, L4.1.1	Refer to Appendix A for DWER's risk assessment and decision making.	Appendix A
<b>Point source emissions to surface water including monitoring</b>	L – no conditions	No point source emissions to surface water are located within the Premises and hence no conditions are specified in this section.	N/A
<b>Point source emissions to groundwater</b>	L – no conditions	No point source emissions to groundwater are located within the Premises and hence no conditions are specified in this section.	N/A



DECISION TABLE			
Works Approval / Licence section	Condition number W = Works Approval L = Licence	Justification (including risk description & decision methodology where relevant)	Reference documents
including monitoring			
Emissions to land including monitoring	L – no conditions	No point source emissions to land are located within the Premises and hence no conditions are specified in this section.	N/A
Fugitive emissions	Previous conditions A2(a), A2(b), A3 and A4	<p>Conditions relating to the ambient air quality monitoring requirements, including an emission limit of 50 µg/m<sup>3</sup> for PM<sub>10</sub> over a 24 hour period, are included in conditions on the Talison Lithium Mine’s licence L4247/1991/13. The monitoring equipment and the program are maintained and completed by the Licensee for L4247 and as such these conditions have been removed from this Licence L8501/2010/1.</p> <p>As the crusher and related stockpiles located in the Primary Plant are currently leased to Talison impacts to ambient air quality from that activity is also addressed in the Talison Licence.</p> <p><b>Normal Operation – Secondary Plant</b>  <u>Emission Description</u>  <i>Emission:</i> Dust emissions from the secondary plant.  <i>Impact:</i> Poor local ambient air quality resulting in health impacts (respiratory impairment) to local sensitive receptors (neighbouring residents in town of Greenbushes) and adjacent rural residents.  <i>Controls:</i> Dust from dry processing activities (gravity separation, magnetic separation) is collected through ducting and vents to be recovered as tantalum concentrate product. The roaster and smelter is enclosed within a covered building. Arsenic fume treatment repacking shed is covered.</p> <p><u>Risk Assessment</u>  <i>Consequence:</i> Minor, controls in place.  <i>Likelihood:</i> Unlikely, to be a significant source for poor ambient air quality particularly in the town of Greenbushes</p>	



<b>DECISION TABLE</b>			
<b>Works Approval / Licence section</b>	<b>Condition number W = Works Approval L= Licence</b>	<b>Justification (including risk description &amp; decision methodology where relevant)</b>	<b>Reference documents</b>
		<p><i>Risk Rating:</i> Medium</p> <p><u>Regulatory Controls</u> Monitoring of ambient air quality is undertaken by Talison according to the Licence L4247/1991/13 and a limit imposed for particulate matter concentration. No further regulatory controls have been specified for Licence L8501/2010/2.</p>	
<b>Odour</b>	L – no conditions	No significant odour emissions occur from the Premises and hence no conditions are specified in this section.	N/A
<b>Noise</b>	L – no conditions  Previous conditions N1(a) and N1(b)	Noise from the Licensee’s Premises is regulated by an approval under Regulation 17 of the <i>Environmental Protection (Noise) Regulations 1997</i> . The approval prescribes conditions for noise minimisation, management, monitoring and annual reporting to the CEO. Previous noise conditions N1 (a) and N1(b) have been removed from the Licence as the gazetted approval applies.	<i>Environmental Protection (Global Advanced Metals Greenbushes Operations Noise Emissions) Approval 2015</i>
<b>Monitoring general</b>	L3.1.1 – L3.1.4	Standard conditions prescribing the monitoring standards to be adopted, the frequency of monitoring and calibration requirements.	
<b>Monitoring of inputs and outputs</b>	L – no conditions	No conditions are specified in this section.	N/A
<b>Process monitoring</b>	L3.3.1	Monitoring of water quality in Tin Shed Dam and flow discharged to Tin Shed Dam is required by condition L3.3.1. For further detail on the risk assessment, refer to Appendix B.	Appendix B
<b>Ambient quality monitoring</b>	Previous condition W5(a)	The ambient groundwater monitoring program included on the previous licence has been removed as all ambient groundwater monitoring within the vicinity of the Talison Lithium Australia’s Tailings Storage Facilities (TSFs) and water storages is included on Licence L4247/1991/13. Previous condition W5(a) was previously duplicated on both Licence L8501/2010/2 and Licence L4247/1991/13 but following a major amendment to Licence L4247, the responsibility for the ambient groundwater program associated with Talison’s TSFs has been clearly defined to lie with Talison.	L4247/1991/13 (Talison Lithium Australia Pty Ltd Part V Licence)



<b>DECISION TABLE</b>			
<b>Works Approval / Licence section</b>	<b>Condition number W = Works Approval L= Licence</b>	<b>Justification (including risk description &amp; decision methodology where relevant)</b>	<b>Reference documents</b>
	L4.1.1	An improvement condition (L4.1.1) has been added to this Licence L8501 to require the Licensee to install a groundwater monitoring bore within the secondary sub-lease area, in order to monitor potential impacts to groundwater from seepage from the Tin Shed Dam. A water balance submitted as part of the Talison Licence amendment estimated that of a total annual inflow of 398 ML to Tin Shed Dam, 52 ML per annum was lost as seepage to Talison's Secondary Recovery Seepage Sump, from where it would flow to Cowan Brook Dam. Refer to Appendix B for the supporting risk assessment.	Appendix B
<b>Meteorological monitoring</b>	L – no conditions	No meteorological monitoring conditions have been imposed on the Licence.	N/A
<b>Improvements</b>	L4.1.1	As a result of uncertainty of the potential risk to receptors from the arsenic emissions from the roaster and smelter stacks at the secondary plant, an improvement requirement has been specified for a screening level assessment of nearby sensitive receptors. Refer to Appendix A for the supporting risk assessment. An improvement condition has been placed on the Licence to install a groundwater monitoring bore (s) (slotted at shallow, intermediate and deep intervals) in an area to the north or north-west of the Tin Shed Dam within the Premises sub-lease area. A requirement to reduce the lithium concentration in the Dam and/or reduce the rate of seepage from the dam has also been imposed. Refer to Appendix B for the supporting risk assessment.	Appendix A Appendix B
<b>Information</b>	L5.1.1 – L5.1.4 L5.2.1 -	Requirements for Annual Audit Compliance Report and the Annual Environmental Report are specified in this section. These conditions replace previous conditions G1, G2(a) – G2(c) and G3	N/A
<b>Licence Duration</b>	-	The Licence duration was extended by an Amendment Notice on 23 June 2016. The expiry date is now 13 December 2026.	Sections 59(1)(k) and s59B(9) of the <i>Environmental Protection Act 1986</i>





## 5 Advertisement and consultation table

Date	Event	Comments received/Notes	How comments were taken into consideration
13/09/2018	Applicant sent a copy of draft instrument	Comments received 6/3/2019: Correct registered address	Corrected
		Amend secondary processing plant capacity from 7000 tpa to 10000 tpa	Updated
		Correct reference from tenement M01/2 to M01/03	Corrected
		Amend annual period, quarterly, six monthly periods	Updated
		Insert new definitions for Talison and tenements	Inserted
		Condition 2.3.1: Delete the visible fugitive dust condition as difficult to establish compliance	Deleted as other measures are in place for monitoring ambient air quality (high volume air sampler via Talison)
		Condition 3.1.3: Typo identified	Typo corrected
		Table 3.3.1: Correct 'flows (from Tin Shed Dam) discharged to Talison TSFs' as these are routed to the S3 sump or other components of the Talison water circuit'	Amended
		Table 4.1.1 IR1: Correct groundwater bores to groundwater bore	Corrected
		Table 4.1.1 IR3: Recommend improvement requirement to require a reduction in lithium concentration in Tin Shed Dam or improvement in seepage capture at the same Dam be removed as the water goes to Talison's water circuit from where the water will be treated to remove lithium	DWER queried whether the stormwater capture in the secondary plant would significantly contribute to the lithium loading in Tin Shed Dam. Advice from Talison was that they did not consider it a significant source. DWER then agreed to remove this improvement requirement from the draft licence.



Date	Event	Comments received/Notes	How comments were taken into consideration
		Updated figures supplied for Licence	Inserted into Licence once the coordinates had been included on the figures.
11/4/2019	Applicant sent a revised draft	Two comments received: <ul style="list-style-type: none"><li>• Typo in text on page 3 referring to wrong tenement M01/02 instead of M01/03</li></ul>	Corrected
		<ul style="list-style-type: none"><li>• Alternative definitions for 'Tenements' proposed</li></ul>	Definition updated.
12/4/2019	DWER queried whether category 5 needed to remain on the Licence. The capacity on the current Licence of 4 000 000 tpa was related to Talison's previous operations. Their Licence has been substantially amended to detail the processing capacity and tailings deposition permitted.	Applicant noted that the current capacity for category 5 (primary plant) is 20 000 tpa. As this is below the 50 000 tpa threshold for category 5, DWER advised this category could be removed from the Licence.	Category 5 removed.



## 6 Risk Assessment

A risk rating will be determined for risk events in accordance with the risk rating matrix set out in Table below.

**Table 1: Risk rating matrix**

Likelihood	Consequence				
	Slight	Minor	Moderate	Major	Severe
Almost certain	Medium	High	High	Extreme	Extreme
Likely	Medium	Medium	High	High	Extreme
Possible	Low	Medium	Medium	High	Extreme
Unlikely	Low	Medium	Medium	Medium	High
Rare	Low	Low	Medium	Medium	High

DWER will undertake an assessment of the consequence and likelihood of the Risk Event in accordance with Table 15 below.

**Table 2: Risk criteria table**

Likelihood		Consequence	
The following criteria has been used to determine the likelihood of the Risk Event occurring.		The following criteria has been used to determine the consequences of a Risk Event occurring:	
		Environment	Public health* and amenity (such as air and water quality, noise, and odour)
Almost Certain	The risk event is expected to occur in most circumstances	<b>Severe</b> <ul style="list-style-type: none"> <li>onsite impacts: catastrophic</li> <li>offsite impacts local scale: high level or above</li> <li>offsite impacts wider scale: mid-level or above</li> <li>Mid to long-term or permanent impact to an area of high conservation value or special significance<sup>^</sup></li> <li>Specific Consequence Criteria (for environment) are significantly exceeded</li> </ul>	<ul style="list-style-type: none"> <li>Loss of life</li> <li>Adverse health effects: high level or ongoing medical treatment</li> <li>Specific Consequence Criteria (for public health) are significantly exceeded</li> <li>Local scale impacts: permanent loss of amenity</li> </ul>
Likely	The risk event will probably occur in most circumstances	<b>Major</b> <ul style="list-style-type: none"> <li>onsite impacts: high level</li> <li>offsite impacts local scale: mid-level</li> <li>offsite impacts wider scale: low level</li> <li>Short-term impact to an area of high conservation value or special significance<sup>^</sup></li> <li>Specific Consequence Criteria (for environment) are exceeded</li> </ul>	<ul style="list-style-type: none"> <li>Adverse health effects: mid-level or frequent medical treatment</li> <li>Specific Consequence Criteria (for public health) are exceeded</li> <li>Local scale impacts: high level impact to amenity</li> </ul>



<b>Possible</b>	The risk event could occur at some time	<b>Moderate</b>	<ul style="list-style-type: none"> <li>• <b>onsite impacts:</b> mid-level</li> <li>• <b>offsite impacts local scale:</b> low level</li> <li>• <b>offsite impacts wider scale:</b> minimal</li> <li>• Specific Consequence Criteria (for environment) are at risk of not being met</li> </ul>	<ul style="list-style-type: none"> <li>• <b>Adverse health effects:</b> low level or occasional medical treatment</li> <li>• Specific Consequence Criteria (for public health) are at risk of not being met</li> <li>• <b>Local scale impacts:</b> mid-level impact to amenity</li> </ul>
<b>Unlikely</b>	The risk event will probably not occur in most circumstances	<b>Minor</b>	<ul style="list-style-type: none"> <li>• <b>onsite impacts:</b> low level</li> <li>• <b>offsite impacts local scale:</b> minimal</li> <li>• <b>offsite impacts wider scale:</b> not detectable</li> <li>• Specific Consequence Criteria (for environment) likely to be met</li> </ul>	<ul style="list-style-type: none"> <li>• Specific Consequence Criteria (for public health) are likely to be met</li> <li>• <b>Local scale impacts:</b> low level impact to amenity</li> </ul>
<b>Rare</b>	The risk event may only occur in exceptional circumstances	<b>Slight</b>	<ul style="list-style-type: none"> <li>• <b>onsite impact:</b> minimal</li> <li>• Specific Consequence Criteria (for environment) met</li> </ul>	<ul style="list-style-type: none"> <li>• <b>Local scale:</b> minimal to amenity</li> <li>• Specific Consequence Criteria (for public health) met</li> </ul>

^ Determination of areas of high conservation value or special significance should be informed by the *Guidance Statement: Environmental Siting*.

\* In applying public health criteria, DWER may have regard to the Department of Health's *Health Risk Assessment (Scoping) Guidelines*.

"onsite" means within the Prescribed Premises boundary.

## Acceptability and treatment of Risk Event

DWER will determine the acceptability and treatment of Risk Events in accordance with the Risk treatment table below:

**Table 3: Risk treatment table**

Rating of Risk Event	Acceptability	Treatment
<b>Extreme</b>	Unacceptable.	Risk Event will not be tolerated. DWER may refuse application.
<b>High</b>	May be acceptable. Subject to multiple regulatory controls.	Risk Event may be tolerated and may be subject to multiple regulatory controls. This may include both outcome-based and management conditions.
<b>Medium</b>	Acceptable, generally subject to regulatory controls.	Risk Event is tolerable and is likely to be subject to some regulatory controls. A preference for outcome-based conditions where practical and appropriate will be applied.
<b>Low</b>	Acceptable, generally not controlled.	Risk Event is acceptable and will generally not be subject to regulatory controls.



## Appendix A

### Point source emissions to air including monitoring

#### Operation of the Roaster

##### Emission Description

*Emission:* Particulates and metals/metalloids (arsenic) in vapour from the roaster and emitted via the roaster stack.

*Impact:* Reduced local air quality due to particulate emissions, metal and metalloids in particulates and vapour, notably arsenic. Potential impact to third party receptors. Arsenic is a class 1 carcinogen.

*Controls:* A baghouse is installed to collect particulate emissions. Arsenic particulate fume is collected as arsenic trioxide.

##### Risk Assessment

*Consequence:* Moderate. April 2016 monitoring indicated concentrations of arsenic (volatilised) at 0.79 - 0.87 mg/m<sup>3</sup> from the roaster stack (Ektimo 2016a). November 2015 recorded concentrations of between 0.86 – 3.7 mg/m<sup>3</sup> volatile arsenic in emissions from the roaster stack (Ektimo 2015).

Particulate emissions in April 2016 were below < 1mg/m<sup>3</sup>, and 1.4 – 1.5 mg/m<sup>3</sup> for November 2015.

In the absence of Western Australian guidance, New South Wales (NSW) and Victorian guidance has been adopted as a screening tool. Schedule 3 of the 2010 NSW Clean Air Regulation states that for smelting/refining processes used in non ferrous metals primary production for new plant there is no emission limit for type 1 substances (antimony, arsenic, cadmium, lead or mercury) in aggregate. For plant that commenced operation between 1986 – 1997 the limit is 10mg/m<sup>3</sup> and for older plant 20 mg/m<sup>3</sup>.

According to Schedule D of the *Victorian State Environmental Protection Policy (Air Quality Management)*, 10 mg/m<sup>3</sup> is the stack emission limit for the combination of antimony, arsenic, cadmium, lead and mercury from all stationary sources; 10mg/m<sup>3</sup> is also the limit for stack emissions solely composed of arsenic and its compounds.

*Likelihood:* Unlikely, arsenic stack concentrations are below the corresponding NSW guidance for similarly aged plant and below the Victorian emission limit. Current operating hours are reduced due to limited processing.

*Risk Rating:* Preliminary risk rating of Medium, given the reduced operating hours. In the event that operating hours were increased, this risk will be reevaluated. Refer also to the improvement condition requirement below.

##### Regulatory Controls

A limit has been imposed on the particulate discharge for both the roaster and smelter stacks by condition 2.2.2. This replaces previous condition A6(a).

Condition 3.2.1 requires quarterly emissions monitoring by stack testing to validate emissions and effective functioning of baghouses. Condition 3.2.1 replaces previous condition A7(a).

An improvement condition has been added to the Licence to identify receptors in the vicinity of the roaster and smelter stacks. In the event that these receptors are located within a 5km radius of the roaster stack, GAMG must complete an ambient air quality model to estimate the arsenic and particulate ground level concentrations at each receptor from the combined point sources (i.e. from both the roaster and smelter stacks) for normal operations and a worst case scenario operation.

#### Operation of the Smelter

##### Emission Description

*Emission:* Particulates and metals/metalloids (arsenic) in vapour from the smelter and emitted via the smelter stack.



**Impact:** Reduced local air quality due to particulate emissions, metal and metalloids in particulates and vapour, notably arsenic. Potential impact to third party receptors. Arsenic is a class 1 carcinogen.  
**Controls:** A baghouse is installed to collect particulate emissions. Arsenic fume is collected as arsenic trioxide.

#### Risk Assessment

**Consequence:** Moderate. July 2016 monitoring indicated concentrations of arsenic (volatilised) at 0.22 - 0.32 mg/m<sup>3</sup> from the roaster stack (Ektimo 2016b).

Particulate emissions in July 2016 were below < 1mg/m<sup>3</sup>.

In the absence of Western Australian guidance, New South Wales (NSW) and Victorian guidance has been adopted as a screening tool. Schedule 3 of the 2010 NSW Clean Air Regulation states that for smelting/refining processes used in non ferrous metals primary production for new plant there is no emission limit for type 1 substances (antimony, arsenic, cadmium, lead or mercury) in aggregate. For plant that commenced operation between 1986 – 1997 the limit is 10mg/m<sup>3</sup> and for older plant 20 mg/m<sup>3</sup>.

According to Schedule D of the *Victorian State Environmental Protection Policy (Air Quality Management)*, 10 mg/m<sup>3</sup> is the stack emission limit for the combination of antimony, arsenic, cadmium, lead and mercury from all stationary sources; 10mg/m<sup>3</sup> is also the limit for stack emissions solely composed of arsenic and its compounds.

**Likelihood:** Unlikely, arsenic stack concentrations are below the corresponding NSW guidance for similarly aged plant and below the Victorian emission limit. Current operating hours are reduced due to limited processing.

**Risk Rating:** Preliminary risk rating of Medium, given the reduced operating hours. In the event that operating hours were increased, this risk will be reevaluated. Refer also to the improvement condition requirement below.

#### Regulatory Controls

A limit has been imposed on the particulate discharge for both the roaster and smelter stacks by condition 2.2.2. This replaces previous condition A6(a).

Condition 3.2.1 requires quarterly emissions monitoring by stack testing to validate emissions and effective functioning of baghouses. Condition 3.2.1 replaces previous condition A7(a).

An improvement condition has been added to the Licence to identify receptors in the vicinity of the roaster and smelter stacks. In the event that these receptors are located within a 5km radius of the roaster stack, GAMG must complete an ambient air quality model to estimate the arsenic ground level concentrations at each receptor from the combined point sources (i.e. from both the roaster and smelter stacks) for normal operations and a worst case scenario operation.

#### **References**

Ektimo (2015) *Emission Test Report – Tantalum Roaster for Global Advanced Metals Greenbushes*, Report Number R001897, 23 November 2015

Ektimo (2016a) *Emission Test Report for the Tantalum Roaster for Global Advanced Metals Greenbushes*, Report Number R002689, 10 May 2016

Ektimo (2016b) *Emission Test Report Furnace Global Advanced Metals Greenbushes*, Report Number R002997, 14 July 2016

*Protection Of The Environment Operations (Clean Air) Regulation 2010 NSW*

*Victorian State Environmental Protection Policy (Air Quality Management) No.240, 2001*



## Appendix B

### Fugitive source emissions to surface water/groundwater including monitoring

#### Normal Operation of the Stormwater/ Process Water Storage System (Tin Shed Dam)

##### Emission Description

*Emission:* Seepage elevated in lithium, manganese, arsenic released from Tin Shed Dam. Lithium concentrations in Tin Shed Dam in the period January 2015 – July 2016 ranged from 6.2 mg/L to 11.8 mg/L. Arsenic concentrations dropped in the same period from a maximum of 1.1 mg/L in March 2015 to 0.089 mg/L.

In 2013 a water balance over the combined Talison and GAM premises estimated a seepage loss from Tin Shed Dam of approximately 52 ML per annum, from a total storage capacity of 182 000 m<sup>3</sup>, equivalent to 182 ML (GAMG 2016). For that 2013 year, the seepage rate was approximately 11% of the total inflows of 434ML to the Dam.

*Impact:* Seepage from the Tin Shed Dam with elevated lithium and arsenic concentrations (and other soluble metals/metalloids) is released to the surficial groundwater aquifer from where it travels to the neighbouring Talison Premises, via the Secondary Recovery Seepage Sump to Cowan Brook Dam. Lithium is potentially toxic to the freshwater aquatic species found in creeks downstream of Talison's and GAM's prescribed premises.

A literature review of available scientific literature on lithium toxicity in aquatic ecosystems has indicated that:

- A 2016 review of lithium toxicity noted that concentrations of lithium from 13 to >100mg/L recorded LC50s (lethal concentrations for 50% of the population) for different fish species (Shahzad B., *et al.*, 2016). Similarly Emery (1981) (quoted in Shahzad B., *et al.*, 2016) noted that a lithium concentration of 0.6 mg/L was the lowest no effect concentration for rainbow trout. Another study quoted also noted that the exposure duration of aquatic species to lithium dosages also influenced the magnitude of lithium toxicity. Lennetch (2007), (quoted in Shahzad B., *et al.*, 2016), noted that *Pimephales promelas* (fathead minnow) showed a LC50 of 1.2 – 8.7 mg/L when exposed for 26 days to lithium stress while *Tanichthys albonubes* exhibited 9.2 - 62 mg/L LC50 after 48 hours of exposure to lithium.
- An algae study of exposure to lithium in high concentrations resulted in increased domoic acid (a neurotoxin) in algae and suggested that lithium may contribute to different toxicity levels in the marine environment by stimulating the growth of naturally inhabiting toxic organisms (Rao *et al.*, 1998 in Shahzad B., *et al.*, 2016)
- Lithium has been found to retard the embryonic development stage and induces microcephaly in amphibians (Shahzad B., *et al.*, 2016)
- Other studies indicated that lithium had observable effects on aquatic snails at concentrations as low as 200 µg/L (Sawasdee, B., *et al.*, 2011) and that lithium can disrupt biological function in rainbow trout (Tkatcheva, *et al.*, 2015).

Talison has completed two studies of the impact of discharge from Cowan Brook Dam in the receiving environment; one on aquatic fauna present in Norilup Brook, where a direct toxicity assessment of the effluent on three local aquatic species was completed to determine an EC50 for each. EC50 represents the effective concentration at which a particular effect (immobility in this case) is observed in 50% of the organisms tested. The lowest 96 hour EC50 of the three species sampled was recorded for Pygmy Perch at a lithium concentration of 42 mg/L. As the EC50 value does not account for long-term or non-lethal effects of lithium, an attenuation factor was applied in order to derive a recommended trigger value of 0.42 mg/L (CENRM 2013). This value was determined using an Assessment Factor method, as described in section 3.2.3 of Schedule B5b of the National Environment Protection (Assessment of Site Contamination) Measure 1999 (the NEPM). The trigger value is conservative, given the lack of data on chronic effects.



The second study, analysed water quality, sediments and macrofaunal species diversity, abundance and bioaccumulation at sites upstream and downstream of the discharge point. Metals in sediments at the near downstream location were elevated as discussed above, and some evidence of bioaccumulation of arsenic and lithium in the flesh of fish and crayfish sampled at the location downstream of Cowan Brook Dam was recorded. The majority of other ecological indicators were not significantly different from upstream to downstream (CENRM 2014).

**Controls:** An arsenic remediation unit is installed on the inflow to the Tin Shed Dam to remove arsenic from the major inflow (stormwater discharge from the Secondary Processing Plant site) into Tin Shed Dam. Arsenic concentrations have progressively reduced in Tin Shed Dam as a result.

#### Risk Assessment

**Consequence:** Major. Potential for moderate off-site impacts as a result of the seepage.

**Likelihood:** Possible. In the period up to 2016 contaminated surface water was released during winter from Cowan Brook Dam downstream to Cowan Brook and Norilup Dam by Talison. For the calendar year 2017 to date no releases have occurred from Cowan Brook Dam. Condition 2.2.2 of Talison's Licence L4247/1991/13 does not currently permit discharges (overflows) from Cowan Brook Dam off the Premises. This is an interim measure to limit further offsite contamination of surface water, pending installation of a water treatment system. Talison is currently installing a reverse osmosis treatment plant to remove lithium from their process circuit, by treating their decant (process water) at the new Clear Water Dam. Treated water will then be returned to Austins Dam and reduce the build up of lithium in the Talison water circuit. Part of the water used to fill the Tin Shed Dam will be sourced from this circuit.

The majority of the surficial aquifer seepage flow from Tin Shed Dam to Cowan Brook Dam will however bypass the new treatment circuit, and remain a potential contributor to elevated lithium concentrations downstream of Cowan Brook Dam.

**Risk Rating:** High

#### Regulatory Controls

Given the high risk associated with the concentration of lithium (and to a lesser extent arsenic) in the seepage from Tin Shed Dam an improvement condition has been added to the Licence L8501 under condition 4.1.1. IR1 requires a plan to be submitted to install a groundwater bore at one site within the secondary plant sub-lease, in order to determine the contaminant concentrations in the surficial aquifer (representative of seepage concentrations downstream to Talison's Premises) and also bores to be slotted at an intermediate depth and a deep bore to determine whether the underlying bedrock aquifer is being impacted by seepage discharge from Tin Shed Dam. Following plan submission, the plan must be implemented within one month or such other time as agreed by the CEO.

Monitoring of water quality within Tin Shed Dam is required by condition 3.3.1. A record of flows discharged to the Talison Tailings Storage Facility must also be kept and reported according to condition 3.3.1.

A freeboard limit of 0.8m for Tin Shed Dam is imposed on the Licence to ensure that no overflows of the facility occur (condition 1.3.2). Condition 1.3.3 requires the arsenic remediation unit to be operating with at least one unit for 95% of the time during the year.

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