



Decision Document

Environmental Protection Act 1986, Part V

Proponent: South32 Worsley Alumina Pty Ltd

Licence: L4504/1981/17

Registered office: Gastaldo Road
ALLANSON WA 6225

ACN: 008 905 155

Premises address: Worsley Alumina Refinery
Lease No 3116/7574 Gastaldo Road
WORSLEY WA 6225
Being Wellington Locations 5314-5317 on Deposited Plan 220209

Issue date: 24 September 2015

Commencement date: 1 October 2015

Expiry date: 30 September 2024

Decision

Based on the assessment detailed in this document the Department of Environment Regulation (DER) has decided to issue an amended licence. DER considers that in reaching this decision it has taken into account all relevant considerations.

Decision Document prepared by: Cristina Angel
Senior Licensing Officer

Decision Document authorised by: Jonathan Bailes
Delegated Officer



Contents

1	Purpose of this Document	2
2	Administrative summary	3
3	Executive summary of proposal and assessment	4
4	Decision table	6
5	Advertisement and consultation table	9
6.	Risk Assessment	10
	Appendix 1 – Point Source Emissions to Air (MFC Power Plant	11

1 Purpose of this Document

This decision document explains how DER has assessed and determined the application and provides a record of DER's decision-making process and how relevant factors have been taken into account. Stakeholders should note that this document is limited to DER'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	Category number(s)	Assessed design capacity
	46	4.7 million tonnes per year
	52	260 Mega Watts per year
	53	65000 tonnes per year
	61	100 tonnes per year
	63	15000 tonnes per year
	54	270 cubic metres per day
	89	500 tonnes per year
Application verified	Date: 5 August 2016	
Application fee paid	Date: 26 August 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 checked="" type="checkbox"/> No <input 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 checked="" type="checkbox"/> No <input type="checkbox"/>	Referral decision No: 1526 Managed under Part V <input type="checkbox"/> Assessed under Part IV <input checked="" type="checkbox"/>
Is the proposal subject to Ministerial Conditions?	Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>	Ministerial statement No: 423, 719 and 751 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"/>		
Is the Premises subject to any EPP requirements? Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>		



3 Executive summary of proposal and assessment

South32 Worsley Alumina Pty Ltd (the Licence Holder) operates the Worsley Alumina Refinery located approximately 15 kilometers (km) northwest of Collie on the Darling Plateau within the Augustus (minor) and Brunswick (major) river water catchments and the Collie (minor) and Bunbury (major) airsheds. The refinery is principally surrounded by State forest with some broad scale farming properties, including isolated farmhouses. The nearest residence is approximately 7km from the refinery boundary, and the nearest urban location is Allanson approximately 11km south of the refinery. Construction of the refinery commenced in 1980, and the first alumina was produced in April 1984. The key legislative framework over the premises is the *Alumina Refinery (Worsley) Agreement Act 1973* (as amended) (the Agreement Act) and Ministerial Statement 719 (as amended) issued under Part IV of the *Environmental Protection Act 1986* (EP Act).

The refinery turns crushed bauxite into calcined alumina via the Bayer process. The extended Bayer process used at Worsley has the following key elements;

- Grinding – Bauxite is delivered to the refinery via overland conveyor from the Boddington Bauxite operations. It then passes through a crushing/grinding circuit;
- Digestion – Crushed/ground bauxite is mixed with caustic at high temperature and pressure liberating odorous volatile organic compounds;
- Clarification – Washing, settlement, and filtration of digested liquor (and diversion of “red mud” to Bauxite Residue Disposal Areas (BRDAs));
- Precipitation/Seed Preparation – The clarified liquor is cooled and seeded with precipitation of hydrated alumina crystals;
- Liquor Burning – Liquor and oxalate streams are passed through a high-temperature furnace to remove dissolved organic material and destroy oxalate;
- Calcination – Dehydration of hydrated alumina in high-temperature furnace to produce calcined alumina (a fine white powder); and
- Bauxite Residue Drying Area – Residual sand and mud (bauxite residue) from the process is pumped as an alkaline slurry to the residue drying area where excess caustic and liquor is collected and recycled through the process. Sodium oxalate which cannot be treated by the Liquor Burner is also stored in the bauxite residue drying areas.

The final calcined alumina product is stored on site before transport via rail to the Port of Bunbury for export.

The alumina refining process produces point source and broad scale gaseous and particulate emissions. Point source air emissions occur from digestion, calcination, liquor burning and power generating activities through 12 key stacks. Emissions of significance from the point sources include carbon monoxide, nitrogen oxides, sulfur dioxide, particulates, Volatile Organic Compounds (VOCs), mercury and greenhouse gases. Pollution control equipment has been installed at the majority of the point sources. Equipment installed includes Electrostatic Precipitators (ESP), Regenerative Thermal Oxidiser (RTO's), wet scrubber, baghouses and low NOx burners. The Licence Holder maintains an air emissions inventory and commissioned a “Health Risk & Toxicological Assessment – Worsley Expansion Emissions” (Toxikos, April 2005) to predict the air emission impact as a result of increasing production to 4.7 million tonnes per year.

Fugitive particulate emissions and contaminated water and slurry are other emissions of significance for the premises. Fugitive particulate sources include bauxite grinding, bauxite and coal handling and stockpiles, hydrate stockpiles, rail loading and BRDAs. The BRDAs are the most significant of these sources as they cover the majority of the cleared area of the premises. The Licence Holder operates two high-volume dust samplers near the premises boundary to monitor particulate emissions in accordance with requirements of Ministerial Statement 719.

Storage of contaminated waste slurry in BRDAs and contaminated surface runoff present a ground and surface water contamination risk. This risk is managed through operating a closed water circuit with all contaminated water directed to a central storage area (Refinery Catchment Lake, RCL) and uncontaminated water directed to a separate temporary storage area (Fresh Water Lake, FWL) away from production areas. The BRDAs have low permeability clay liners with two under drainage systems which separate uncontaminated groundwater beneath the BRDA



from potentially contaminated seepage via a network of underflow collection pipes. The under drainage systems are separated by a clay drainage blanket. Seepage is directed to downstream pipehead dams where it is collected and returned to the process via the RCL. The uncontaminated groundwater is collected, monitored and if contamination is not detected it is directed into the FWL. Regular groundwater monitoring is undertaken across the premises, including below the BRDAs, to detect contamination, seepage and changes in water quality in accordance with a Water Resources Management Plan required by Ministerial Statement 719.

In addition to alumina refining and power generation, other activities occurring on the premises include flyash disposal, the operation of a landfill, liquid waste disposal and sewage treatment. Flyash is generated from coal-fired power generation with captured flyash being disposed within specified areas of the BRDA's. The site landfill has also been established on a decommissioned BRDA. The landfill accepts inert and putrescible wastes generated on the site for disposal. The landfill also has a wet dump area which can accept wastewater generated off-site from pressure testing of refurbished tube heaters from the digestion part of the process. The landfill is equipped with an extensive leachate recovery system. Domestic grey water and sewage generated on the premises is directed to a Sequential Batch Reactor (SBR) waste water treatment plant with treatment via an extended aeration, activated sludge process. Treated water is discharged to the RCL for reuse in the Refinery.

This licence is the result of an amendment sought by the Licence Holder to:

- Include Boiler 5 and Boiler 6 from the new Multi-Fuel Cogeneration (MFC) power plant onto the licence.
- Extend the RCL and to accept water from the nearby Harris and Wellington dams into the RCL for use in bauxite refining.
- Remove ambient air monitoring stations Willis and 303.
- Remove annual stack testing for fluoride in the powerhouse, stack testing for PM where particulate CEMS are in place, and quarterly testing for mercury in the digestion RTO.
- Remove testing and targets for benzene, acetaldehyde, and formaldehyde in calcination, the liquor burner, and digestion RTO.
- Increase the sulfur dioxide target for Boiler 5 and Boiler 6.
- Consolidate monitoring and reporting requirements for point source emissions to air.



4 Decision table

All applications are assessed in line with the *Environmental Protection Act 1986*, the *Environmental Protection Regulations 1987* and DER's Operational Procedure on Assessing Emissions and Discharges from Prescribed Premises. Where other references have been used in making the decision, they are detailed in the decision document.

DECISION TABLE			
Works Approval / Licence section	Condition number W = Works Approval L = Licence	Justification (including risk description & decision methodology where relevant)	Reference documents
Definitions and Interpretation	L1.1.2 L1.1.5	Condition 1.1.2 has been updated to remove definitions no longer used in the licence and to add new definitions in accordance with changes made the licence. Condition 1.1.5 has been removed as it contained explanatory text only.	
General conditions	L1.2.1- L1.2.3	These conditions have been removed in accordance with administrative changes implemented within DER: <ul style="list-style-type: none">• Condition 1.2.1 has been removed as the outcome that must be achieved or the measures required to achieve compliance are unclear.• Condition 1.2.2 has been removed as it is the Licence Holder's responsibility to ensure that they comply with the legislative requirements for secondary activities such as the handling and storage of environmentally hazardous materials. Unauthorised discharges of environmentally hazardous materials are subject to the provisions of the <i>Environmental Protection (Unauthorised Discharges) Regulations 2004</i>.• Condition 1.2.3 has been removed as it is not sufficiently clear or certain. The condition does not specify what stormwater infrastructure is required to be constructed and maintained, or what specific management actions are required. Contaminated stormwater has previously been assessed as posing a moderate risk. The Delegated Officer has considered whether the risk profile of the premises has significantly changed since the previous licence was granted, and no changes have been identified. Uncontaminated stormwater is currently diverted to the fresh water lake, and all potentially contaminated stormwater is diverted to the Refinery Catchment Lake (RCL) where it is recirculated through the refinery process. On this basis, this condition has been removed. The	DER public website at: www.der.wa.gov.au <i>Environmental Protection Act 1986</i> <i>Environmental Protection (Unauthorised Discharge) Regulations 2004</i>



DECISION TABLE			
Works Approval / Licence section	Condition number W = Works Approval L= Licence	Justification (including risk description & decision methodology where relevant)	Reference documents
		substantive offences of the EP Act provide enforceable prohibitions for discharges of contaminated stormwater that result in pollution or environmental harm.	
Point source emissions to air including monitoring	L2.2.1 - L2.2.3 L3.2.1	The assessment of point source emissions to air from Boiler 5 and Boiler 6 of the MFC power plant has been included in the licence as part of this amendment. Details of DER's decision making are included in Appendix A.	
Ambient environmental monitoring	L3.4.1 L3.4.4 L3.4.5	<p>The Licence Holder has requested that ambient monitoring stations Willis ("W") and "303" are removed from the licence. Ambient monitoring station 303 is within the refinery boundary and data obtained from it is not suitable to measure exceedances of the ambient NEPM standard for SO₂. The siting for this monitor does not meet the siting requirements specified under AS/NZS 3580.1.1:2016 <i>Methods for sampling and analysis of ambient air-Guide to siting air monitoring equipment</i>, and the validity of readings from the monitor may be further limited by this factor. Based on the fact that the monitor is within the premises boundary and does not comply with the relevant standard, the Delegated Officer has determined that it can be removed from the licence.</p> <p>The Willis station which is situated 15km west of the premises. A review of the data provided since 2001 when monitoring commenced has shown that SO₂ levels at this location are consistently below the NEPM standard. The property where this monitor is located has recently been sold by the Licence Holder. From a human health and environmental risk perspective, the Delegated Officer considers that the requirement to continue monitoring at this location is not justified. Whilst the Delegated Officer has determined to remove the monitoring stations; it is noted that the premises are part of the industry-led Collie Air Shed Study and that data from both these stations formed part of the study scope and may provide useful data for the study. Therefore, the Licence Holder should consult with the study Scientific Director before removing these stations. DER will notify the study Scientific Director of the intention to remove these stations from the licence.</p>	AS/NZS 3580.1.1:2016 Methods for sampling and analysis of ambient air-Guide to siting air monitoring equipment
Monitoring of	L3.3.1	Condition 3.6.1 is included in the current licence to replace conditions 3.1.3 and 5.2.2(a)	



DECISION TABLE			
Works Approval / Licence section	Condition number W = Works Approval L= Licence	Justification (including risk description & decision methodology where relevant)	Reference documents
inputs and outputs	L3.6.1 L5.2.2(a)	from the previous licence version, which were not specific as to the information that was required to be monitored. Information on specific production, process, and operational parameters is necessary for the assessment of emissions monitoring data and environmental performance data provided through existing licence conditions.	
Improvements	L4.1.2	Condition 4.1.2 has been amended to include improvement requirement IR3 specifying the submission of information for the incorporation of an existing pond (Water Body 1 in the map in Schedule 1) into the Catchment Refinery Lake system for the storage of contaminated process water. Although groundwater is managed in accordance with the Water Resources Management Plan developed under Ministerial Statement 719, there is the potential for seepage of water from the pond to contaminate groundwater. The Delegated Officer has determined that further information is required for an environmental risk assessment to be carried out for this aspect.	
Information	L5.1.2 L5.13	<p>Reporting condition 5.1.2 has been removed to reflect changes implemented through Departmental reform. The condition is not enforceable, and the requirements for compliance are not clear. It is not a defence to offences under the EP Act for the Licence Holder to claim they were unaware of licence conditions.</p> <p>Condition 5.1.3 and Table 5.2.1 have been amended to separate the AACR from the AER in accordance with DER Guidance Statement on Publication of Annual Audit and Compliance Reports. Table 5.2.1 has also been updated to include the reporting of process monitoring specified in new condition 3.6.1.</p>	DER Guidance Statement: Publication of Annual Audit and Compliance Reports
Notification	L5.3.1	Condition 5.3.1 has been simplified to provide consolidation of reporting requirements as they apply to numerical or descriptive target exceedances. Monthly reporting allows for the Licence Holder to determine the validity of the exceedances and provide meaningful information about the causes, validity, management actions taken, and impacts / outcomes. The Licence Holder is still obliged under Section 72 of the <i>Environmental Protection Act 1986</i> to report all exceedances which have the ability to cause environmental harm or pollution, For further information on reporting on pollution can be found at www.der.wa.gov.au/your-environment/reporting-pollution .	Section 72 of <i>Environmental Protection Act 1986</i> .



5 Advertisement and consultation table

Date	Event	Comments received/Notes	How comments were taken into consideration
20 October 2016	Proponent sent a copy of draft instrument	<p>The Licensee identified typographical errors in Table 2.2.2 (NO_x, CO and CEMS averaging period for Boiler 5 and Boiler 6 emission targets).</p> <p>The Licensee advised they would have difficulty providing accurate coal sulfur feed rates during stack testing events as there is a delay between coal testing and firing of the coal in the boilers of up to five days.</p>	<p>The Boiler 5 and Boiler 6 NO_x and CO emission targets were changed to reflect the works approval and commissioning data sets.</p> <p>The draft condition was amended to require the test data for sulfur in coal to be provided for up to five days prior to a stack testing event.</p>



6. Risk Assessment

Note: This matrix is taken from the DER Corporate Policy Statement No. 07 - Operational Risk Management

Table 1: Emissions Risk Matrix

Likelihood	Consequence				
	Insignificant	Minor	Moderate	Major	Severe
Almost Certain	Moderate	High	High	Extreme	Extreme
Likely	Moderate	Moderate	High	High	Extreme
Possible	Low	Moderate	Moderate	High	Extreme
Unlikely	Low	Moderate	Moderate	Moderate	High
Rare	Low	Low	Moderate	Moderate	High



Appendix 1 – Point Source Emissions to Air (MFC Power Plant)

Environmental approval under Part IV of the *Environmental Protection Act 1986* was granted by the EPA in September 2007 to increase production to 4.4Mtpa of alumina under (Ministerial Statement No. 751). This expansion required the construction of a new Multi-Fuel Cogeneration (MFC) power plant to cater for the increased electrical power and steam requirements of the expansion.

The use of coal in the MFC power plant (Boilers 5 and 6) was assessed under Works Approvals W4430/2008/1 and W4432/2008/1 granted by DER in August 2008. In April 2011, the Licence Holder submitted a revised works approval application, requesting to use a coal and biomass mixture (70:30 ratios) as a fuel source in each of the MFC boilers. The works approval amendment assessments considered the specifications (physical and chemical) required for biomass to be used as a suitable fuel source, the supply sources, transportation and delivery methods, and mixed fuel ratios and predicted emissions when co-firing.

Boilers 5 and 6 have been commissioned using a 100% coal feed, and Boiler 5 has been commissioned using a coal and biomass mix (commissioning was undertaken with only 20% biomass rather than the proposed 30% biomass).

Emission: The main emissions of concern from the two multi-fuel boilers are sulfur dioxide (SO₂), nitrogen dioxide (NO₂), and particulate emissions (PM). Other emissions include fluoride (F), volatile organic compounds (VOC), and metals such as cadmium and mercury. Carbon monoxide (CO) is also an emission of significant and can be used as a de-facto measure of combustion efficiency within the boilers.

As assessed in the works approval applications there will be no net increase in SO₂, NO₂ or PM point source emissions from the operation of the new MFC power plant as efficiencies will be gained through the production expansion project (*Strategen, 2008*). A slight decrease was expected in combustion gases; however, CO and VOC emissions were expected to increase marginally (30-40tpa). Table 1 below shows the expected point source emission targets proposed and those realised during commissioning for both Boiler 5 and Boiler 6.

Table 1: Average point source emissions from Boiler 5 and Boiler 6 (results presented in mg/m³)

Source	Particulates (PM10)	NOx as NO ₂	CO	SO ₂	VOC as n-hexane	Mercury	Fluoride
Targets proposed in Works Approval application ¹	20	500	100	400-600	NA	NA	5
Boiler 5- 100% Coal feed ²	2	280	16	440	<1	0.0016	0.28
Boiler 6- 100% Coal feed ³	2	290	19	460	<1	0.0008	0.13
Boiler 5- coal/biomass mixture feed ⁴	2	190	67	230	2.9	0.0025	0.18
Boiler 6- coal/biomass mixture feed	NA	NA	NA	NA	NA	NA	NA

Note 1: source: p 22, *Worsley Alumina Bauxite Alumina Project- production rate Increase to 4.7MTpa, Strategen, 2008*

Note 2: source: Boiler 5- Commissioning on 100% Coal, South32 Worsley Alumina Pty Ltd, Collie September 2015

Note 3: source: Boiler 6- MFC Boiler 6 Commissioning 100% Coal, South32 Worsley Alumina Pty Ltd, Collie July 2016

Note 4: source: Boiler 5- Commissioning on Biomass, South32 Worsley Alumina Pty Ltd, Collie January 2016

Impact: reduced air quality from emissions from the operation of MFC power plant. A review of the likely air quality impact was performed as part of the approval for the increase in production to 4.7Mtpa and included the operation of Boilers 5 and Boiler 6. This review, summarised in Table 2 below shows that while emissions are significant, maximum ground level concentrations (GLCs)



of combined sources are not predicted to exceed the 1-hour NEPM guideline; the 24-hour NEPM guideline, or of the Annual NEPM guideline for the main air pollutants.

Table 2: Predicted maximum ground level concentrations of key contaminants at sensitive receptors within 15 km of Worsley Alumina Refinery¹

Contaminant	Average Time	NEPM Guideline (µg/m ³)	Maximum ground level concentration (µg/m ³) at 4.7Mtpa		
			Worsley Refinery	Alumina	Combined Worsley Refinery and Collie Sources
SO ₂	1 hour	570	114		149
	24 hour	230	18		25
	Annual	57	1.2		1.9
NO ₂	1 hour	250	49		49.3
	Annual	62	0.7		0.6
PM ₁₀	24 hour	50	4.8 (includes fugitives)		11.8 (includes fugitives)

Note 1: source: Environmental Assessment Report Version 5

Licence Holder controls:

- Boilers 5 and 6 are fitted with baghouses to reduce particulate emissions and emissions are monitored using continuous emission monitors (CEMS);
- Planned baghouse and boiler maintenance are carried out;
- SO₂ emissions are influenced by the sulfur content of coal. Blending of coal or control of feed rates can be employed to reduce sulfur emissions;
- The Licence Holder has developed and implemented an Air Quality Management Plan.

Risk Assessment

Consequence: Moderate

Likelihood: Possible

Risk Rating: Moderate

Regulatory Controls:

- Boilers 5 and 6 have added as point source emission sources A13 and A14 in condition 2.2.1 (Table 2.2.1). The boilers have been specified as using a maximum 30% (thermal substitution) of biomass fuel. This is consistent with the amended works approvals. Although Boiler 5 was commissioned on biomass at 20% substitution, the emissions testing has demonstrated that key emissions are lower when using a biomass/coal mix. Given the identical design of the two boilers the Delegated Officer has determined that Boiler 6 can also be fired on biomass. Condition 3.6.1 has been included to require the Licence Holder to monitor the thermal substitution of biomass fuel used in the MFC boilers.
- Condition 2.2.2 has been amended to include emission targets for emission points A13 and A14 as specified by the Licence Holder in the works approval assessments. The Licence Holder has requested to have the proposed target at Boiler 5 and Boiler 6 for SO₂ emissions increased from 600mg/m³ as specified in the works approval to 800mg/m³. The 600mg/m³ target was derived from a high sulfur coal content of 0.6%. The Licence Holder has reported that current coal sulfur levels vary between 0.3% to a maximum of 0.9%. The Delegated Officer has determined to keep the target at 600mg/m³. Management actions in response to target exceedances (Table 2.2.3) have been amended to reduce the reporting burden. The Delegated Officer notes that the emissions targets will be reviewed on completion of version 3 of the Air Emissions Inventory condition 4.1.2 IR1) and the industry-funded study into SO₂ emissions in the Collie airshed. Condition 3.6.1 has been included in the licence to require the Licence Holder to monitor the coal sulfur content as part of the monitoring of SO₂ emissions.
- Condition 3.2.1 has been updated to include emission points A13 and A14 in the premises monitoring program.
- Conditions 3.4.1 to 3.4.3 specify ambient air quality monitoring and conditions 3.4.4 and 3.4.5 specify ambient SO₂ targets and management actions. Condition 3.5.1 requires the Licence Holder to undertake meteorological monitoring to help interpret ambient monitoring data.



Residual Risk

Consequence: Moderate

Likelihood: Possible

Risk Rating: Moderate

References:

- Annual Environmental Report FY201 Worsley Alumina, South32 Worsley Alumina September 2015
- Environmental Assessment Report Version 5, Department of Environment and Conservation, Sept 2005;
- Ministerial Statement 719;
- Scope of Works for the Development of “Versions 3” Air Emissions Inventory BHP Billiton Worsley Alumina Refinery Draft (ENVALL, March 2015)
- Worsley Alumina Pty Ltd – Air Emissions Impact Assessment Project, Air Emissions Inventory Version 2, ChemSearch, September 2007;
- Worsley Alumina Pty Ltd, Air Quality Management Plan, 2011; and
- Worsley Alumina Bauxite Alumina Project- production rate Increase to 4.7MTpa, Strategen, 2008