Government of Western Australia
Department of Environment Regulation

Licence

Environmental Protection Act 1986, Part V

Licensee: 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 COLLIE WA 6225
Being Wellington Locations 5314-5317 on Deposited Plan 220209 as depicted in Schedule 1

Issue date: 24 September 2015

Commencement date: 1 October 2015

Expiry date: 30 September 2024

Prescribed premises category
Schedule 1 of the Environmental Protection Regulations 1987

Category number	Category description	Category production or design capacity	Approved Premises production or design capacity
46	Bauxite refining	NA	4.7 million tonnes per annual period
52	Electric power generation (using fuel other than natural gas)	10 MW or more in aggregate	260 Mega Watts per annual period
53	Flyash disposal	1 000 tonnes or more per year	65 000 tonnes per annual period
54	Sewage facility	100 cubic metres or more per day	270 cubic metres per day
61	Liquid waste facility	100 tonnes or more per year	100 tonnes per annual period
63	Class I inert landfill site	500 tonnes or more per year	15 000 tonnes per annual period
89	Putrescible landfill site	More than 20 but less than 5 000 tonnes per year	500 tonnes per annual period

Conditions
Subject to this Licence and the conditions set out in the attached pages.

Date signed: 11 November 2016
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Jonathan Bailes
Manager Licensing (Process Industries)
Officer delegated under section 20
of the Environmental Protection Act 1986

Contents

Introduction

This Introduction is not part of the Licence conditions.

DER's industry licensing role
The Department of Environment Regulation (DER) is a government department for the state of Western Australia in the portfolio of the Minister for Environment. DER's purpose is to advise on and implement strategies for a healthy environment for the benefit of all current and future Western Australians.

DER has responsibilities under Part V of the *Environmental Protection Act 1986* (the Act) for the licensing of prescribed premises. Through this process DER regulates to prevent, control and abate pollution and environmental harm to conserve and protect the environment. DER also monitors and audits compliance with works approvals and licence conditions, takes enforcement action as appropriate and develops and implements licensing and industry regulation policy.

Licence requirements
This Licence is issued under Part V of the Act. Conditions contained within the Licence relate to the prevention, reduction or control of emissions and discharges to the environment and to the monitoring and reporting of them.

Where other statutory instruments impose obligations on the Premises/Licensee the intention is not to replicate them in the licence conditions. You should therefore ensure that you are aware of all your statutory obligations under the Act and any other statutory instrument. Legislation can be accessed through the State Law Publisher website using the following link:
http://www.slp.wa.gov.au/legislation/statutes.nsf/default.html

For your Premises relevant statutory instruments include but are not limited to obligations under the:

- *Environmental Protection (Unauthorised Discharges) Regulations 2004* – these Regulations make it an offence to discharge certain materials such as contaminated stormwater into the environment other than in the circumstances set out in the Regulations.

- *Environmental Protection (Controlled Waste) Regulations 2004* - these Regulations place obligations on you if you produce, accept, transport or dispose of controlled waste.

- *Environmental Protection (Noise) Regulations 1997* – these Regulations require noise emissions from the Premises to comply with the assigned noise levels set out in the Regulations.

You must comply with your licence. Non-compliance with your licence is an offence and strict penalties exist for those who do not comply.

Licence holders are also reminded of the requirements of section 53 of the Act which places restrictions on making certain changes to prescribed premises unless the changes are in accordance with a works approval, licence, closure notice or environmental protection notice.

Licence fees
If you have a licence that is issued for more than one year, you are required to pay an annual licence fee prior to the anniversary date of issue of your licence. Non-payment of annual licence fees will result in your licence ceasing to have effect meaning that it will no longer be valid and you will need to apply for a new licence for your Premises.

Ministerial conditions
If your Premises has been assessed under Part IV of the Act, you may have had conditions imposed by the Minister for Environment. You are required to comply with any conditions imposed by the Minister.

Premises description and Licence summary
South32 Worsley Alumina Pty Ltd (the Licence Holder) operates the Worsley Alumina Refinery located approximately 15 kilometres (km) north-west 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 broadscale 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 Licensee 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.

The licences and works approvals issued for the Premises since 28/09/2006 are:

Instrument log		
Instrument	**Issued**	**Description**
L4504/10	28/09/2006	Licence re-issue
L4504/1981/11	27/09/2007	Licence re-issue. Throughput increased to 3.7 million tonnes per annum.
W4430/2008/1	14/08/2008	Works approval to allow construction of MCF Boiler 5
W4432/2008/1	14/08/2008	Works approval to allow construction of MCF Boiler 6, Calciner 6 and increase capacity to 4.7 million tonnes per year.
L4504/1981/12	25/09/2008	Licence re-issue
L4504/1981/13	24/09/2009	Licence re-issue
L4504/1981/14	24/09/2010	Licence re-issue
L4504/1981/15	29/09/2011	Licence re-issue
L4504/1981/15	24/08/2012	Proponent amendment to increase production to 4.7 million tonnes per annum and allow operation of Boiler Unit 5 and Calciner 6.
L4504/1981/16	20/09/2012	Licence re-issue
L4504/1981/16	27/11/2014	Amendment to include improvement conditions.
L4504/1981/16	15/01/2015	Amendment to change Calciner 6 targets, remove Boiler 5 and convert to REFIRE format including a review of existing conditions.
L4504/1981/16	16/04/2015	Amendment to remove the requirement to monitor CO using CEMS on emission point A4 and replace with monitoring of RTO bed temperature as an indicator of VOC destruction.
L4504/1981/17	24/09/2015	Licence reissue and amendment to change the occupier name to South32 Worsley Alumina Pty Ltd, extend reporting due date, add category 61 liquid waste facility and administrative changes.
L4504/1981/17	29/04/2016	Licence amended to extend duration in accordance with DER's *Guidance Statement on Licence Duration (November 2014)*.
L4504/1981/17	22/07/2016	Amended to extend the expiry date of the Licence until 30 September 2024.
L4504/1981/17	04/08/2016	Amendment Notice 1 Licence amended to include Minister's Appeal Determination and extend the compliance date of Condition 4.1.1, table 4.1.1 (IR2) until the 30 November 2016.
L4504/1981/17	11/11/2016	Licence amended to include Boiler 5 and Boiler 6 and remove ambient SO_2 monitoring stations Willis and 303.

Severance

It is the intent of these Licence conditions that they shall operate so that, if a condition or a part of a condition is beyond the power of this Licence to impose, or is otherwise *ultra vires* or invalid, that condition or part of a condition shall be severed, and the remainder of these conditions shall nevertheless be valid to the extent that they are within the power of this Licence to impose and are not otherwise *ultra vires* or invalid.

END OF INTRODUCTION

Licence conditions

1 General

1.1 Interpretation

1.1.1 In the Licence, definitions from the *Environmental Protection Act 1986* apply unless the contrary intention appears.

1.1.2 For the purposes of this Licence, unless the contrary intention appears:

'Act' means the *Environmental Protection Act 1986;*

'Annual Audit Compliance Report' means a report in a format approved by the CEO as presented by the Licensee or as specified by the CEO from time to time and published on the Department's website;

'annual period' means the inclusive period from 1 July until 30 June in the following year;

'asbestos' means the asbestiform variety of mineral silicates belonging to the serpentine or amphibole groups of rock-forming minerals and includes actinolite, amosite, anthophyllite, chrysolite, crocidolite, tremolite and any mixture containing 2 or more of those;

'AS 3580.1.1' means the Australian Standard AS 3580.1.1 *Methods for sampling and analysis of ambient air – Guide to siting air monitoring equipment;*

'AS 3580.4.1' means the Australian Standard AS 3580.4.1 *Methods for sampling and analysis of ambient air - Determination of sulfur dioxide - Direct reading instrumental method;*

'AS 3580.14' means the Australian Standard AS *3580.14* Methods for sampling and analysis of ambient air - Meteorological monitoring for ambient air quality monitoring applications;

'AS 4323.1' means the Australian Standard AS4323.1 *Stationary Source Emissions Method 1: Selection of sampling positions;*

'averaging period' means the time over which a limit or target is measured or a monitoring result is obtained;

'Biomass fuel' means fuel derived from untreated wood waste sourced from pine plantations or native forest

'BRDA' means Bauxite Residue Disposal Area

'CEMS' means continuous emissions monitoring system;

'CEMS Code' means the current version of the Continuous Emission Monitoring System (CEMS) Code for Stationary Source Air Emissions, Department of Environment & Conservation, Government of Western Australia;

'CEO' means Chief Executive Officer of the Department of Environment Regulation;

'CEO' for the purpose of correspondence means:

Chief Executive Officer
Department Div. 3 Pt V EP Act
Locked Bag 33
CLOISTERS SQUARE WA 6850
Email: info@der.wa.gov.au

'Clean Fill' has the meaning defined in *Landfill Waste Classification and Waste Definitions 1996* published by DEC and as amended from time to time;

'Collie airshed power generators' means the occupiers of the following part V licences in force during the term of this Licence:

1. Bluewaters I & II Power Station; Bluewaters Power 1 Pty Ltd & Bluewaters Power 2 Pty Ltd, L8326/2008;
2. Collie A Power Station, Transfield Worley Power Services Pty Limited, L6637/1995;
3. Muja Power Station, Electricity Generation Corporation T/A Verve Energy, L4076/1972; and
4. Worsley Alumina Refinery, South32 Worsley Alumina Pty Ltd, L4504/1981;

'controlled waste' has the definition in *Environmental Protection (Controlled Waste) Regulations 2004*;

'Department' means the department established under s.35 of the Public Sector Management Act 1984 and designated as responsible for the administration of Division 3 Part V of the *Environmental Protection Act 1986*;

'Inert Waste Type 1' has the meaning defined in Landfill Waste Classification and Waste Definitions 1996 published by the CEO and as amended from time to time;

'Inert Waste Type 2' has the meaning defined in Landfill Waste Classification and Waste Definitions 1996 published by the CEO and as amended from time to time;

'Licence' means this Licence numbered L4504/1981/16 and issued under the Act;

'Licensee' means the person or organisation named as Licensee on page 1 of the Licence;

'NATA' means the National Association of Testing Authorities, Australia;

'NATA accredited' means in relation to the analysis of a sample that the laboratory is NATA accredited for the specified analysis at the time of the analysis;

'normal operating conditions' means any operation of a particular process (including abatement equipment) excluding start-up, shut-down and upset conditions, in relation to stack sampling or monitoring;

'oxalate' means sodium oxalate cake, a mix of caustic liquor and sodium oxalate derived from the refinery process;

'PM' means total particulate matter including both solid fragments of material and minuscule droplets of liquid;
'PM_{10}' means particles with an aerodynamic diameter of less or equal to 10 μm;

'Premises' means the area defined in the Premises Map in Schedule 1 and listed as the Premises address on page 1 of the Licence;

'Putrescible Waste' means the organic component of the waste stream which can be decomposed by microbial action and become putrid and likely to cause obnoxious odours and attract (scavenging) birds or animals; putrescible waste includes food wastes or wastes of animal or vegetable origin;

'quarterly' means the 4 inclusive periods from 1 April to 30 June, 1 July to 30 September, 1 October to 31 December and in the following year, 1 January to 31 March;

'Schedule 1' means Schedule 1 of this Licence unless otherwise stated;

'Schedule 2' means Schedule 2 of this Licence unless otherwise stated;

'shut-down' means the period when plant or equipment is brought from normal operating conditions to inactivity;

'stack test' means a discrete set of samples taken over a representative period at normal operating conditions;

'start-up' means the period when plant or equipment is brought from inactivity to normal operating conditions;

'STP dry' means standard temperature and pressure (0^{o}Celsius and 101.325 kilopascals respectively), dry;

'SW-846 Method 0011' means the promulgated Test Method SW-846/ 0011 – Sampling for Selected Aldehyde and Ketone Emissions from Stationary Sources;

'USEPA' means United States (of America) Environmental Protection Agency;

'USEPA Method 5' means the promulgated Test Method 5 - Determination of Particulate Matter Emissions from Stationary Sources;

'USEPA Method 6C' means the promulgated Test Method 6C – Determination of Sulfur Dioxide Emissions from Stationary Sources (Instrumental Analyzer Procedure);

'USEPA Method 7E' means the promulgated Test Method 7E – Determination of Nitrogen Oxides Emissions from Stationary Sources (Instrumental Analyzer Procedure);

'USEPA Method 10' means the promulgated Test Method 10 – Determination of Carbon Monoxide Emissions from Stationary Sources;

'USEPA Method 17' means the promulgated Test Method 17- Determination of Particulate Matter Emissions from Stationary Sources;

'USEPA Method 18' means the promulgated Test Method 18 – Measurement of Gaseous Organic Compound Emissions by Gas Chromatography;

'USEPA Method 26' means the promulgated Test Method 26 – Determination of Hydrogen Halide and Halogen Emissions from Stationary Sources, Non-Isokinetic Method;

'USEPA Method 26A' means the promulgated Test Method 26A – Determination of Hydrogen Halide and Halogen Emissions from Stationary Sources, Isokinetic Method

'USEPA Method 29' means the promulgated Test Method 29 – Determination of Metals Emissions from Stationary Sources;

'USEPA Method 201A' means the promulgated Test Method 201A – Determination of PM10 Emissions (Constant Sampling Rate Procedure);

'usual working day' means 0800 – 1700 hours, Monday to Friday excluding public holidays in Western Australia; and

'waste' has the meaning defined in the *Environmental Protection Act 1986*;

1.1.3 Any reference to an Australian or other standard in the Licence means the relevant parts of the standard in force from time to time during the term of this Licence.

1.1.4 Any reference to a guideline or code of practice in the Licence means the version of that guideline or code of practice in force from time to time and shall include any amendments or replacements to that guideline or code of practice made during the term of this Licence.

1.2 General conditions

1.2.1 The Licensee shall only accept waste onto the Premises if:
(a) it is of a type listed in Table 1.2.1;
(b) the quantity accepted is below any quantity limit listed in Table 1.2.1;
(c) it meets any specification listed in Table 1.2.1;

Table 1.2.1: Waste acceptance

Waste	Waste Code	Specification[1]	Quantity Limit
Industrial Wash Water		Liquid waste received from pressure testing of Worsley Alumina Refinery digestion heaters and associated vehicle wash down only	100 tonnes per year in total
Car and truck wash waters	L100		
Industrial wash waters contaminated with controlled waste	L150		

Note 1: Additional requirements for the acceptance of controlled waste are set out in the *Environmental Protection (Controlled Waste) Regulations 2004*.

1.2.2 The Licensee shall ensure that where waste does not meet the waste acceptance criteria set out in conditions 1.2.1 it is removed from the Premises by the delivery vehicle or, where that is not possible, the Licensee shall contact the CEO to agree on a course of action in relation to the waste.

1.2.3 The Licensee shall ensure that wastes accepted into the landfill and wastewater treatment plant are only subjected to the processes set out in Table 1.2.2 and in accordance with any process limits described in that Table.

Table 1.2.2: Waste processing

Waste type	Process	Process limits[1,2]
Bauxite Residue and oxalate	Disposal in BRDA's. Oxalate to be covered with bauxite residue immediately following disposal.	N/A
Inert Waste Type 1	Handling and disposal of waste by landfilling Disposal of waste by landfilling shall only take place within the landfill cells within BRDA 3.	15 000 tonnes per year
Inert Waste Type 2		
Clean Fill		
Wastes generated from alumina production and associated activities. Excludes: i) Elemental mercury ii) Asbestos materials iii) Packaged laboratory chemical wastes; and iv) Clinical wastes		
Putrescible Waste		500 tonnes per year
Sewage	Sequence Batch Reactor (SBR) Treated wastewater to be disposed to the Refinery Catchment Lake only.	270 cubic metres per day
Controlled liquid wastes as specified in Table 1.2.1	Receipt, handling and landfilling. Liquid waste is discharged to a "wet dump area" within BRDA 3.	100 tonnes per annum

Note 1: Requirements for landfilling tyres are set out in Part 6 of the *Environmental Protection Regulations1987*.
Note 2: Additional requirements for the acceptance and landfilling of controlled waste (including asbestos and tyres) are set out in the Environmental Protection (Controlled Waste) Regulations 2004.

1.2.4 The Licensee shall ensure that waste material is only stored and/or treated within vessels or compounds provided with the infrastructure detailed in Table 1.2.3 and as identified on the Map of premises and containment infrastructure in Schedule 1.

Table 1.2.3: Containment infrastructure

Reference and location on Map of premises and containment infrastructure	Material	Requirements
BRDA 1, 2, 3, 4, 4X and 5	Bauxite residue, oxalate and controlled liquid waste	Low permeability clay lined with liquor collection system installed (pipework and decant) to transport liquor to PHDs. Groundwater underflow collection pipes to collect groundwater and relieve pressure on liners and allow detection of any residue liquor. Groundwater is transported to the PHDs.
Fresh Water Lake (FWL)	Uncontaminated surface water and groundwater from within the refinery lease.	None.
Pipehead Dams (PHDs)	NVPHD – residue liquor from BRDAs 1,2,3,4 & 4X	Low permeability clay lined with a chemical grout curtain installed below the earth embankment to prevent downstream migration of high pH residue liquor. Depressurisation bores located upstream to ensure groundwater is directed to bores and not lower parts of the catchment.
	SVPHD – residue liquor from BRDA 5	
Refinery Catchment Lake (RCL)	Recirculated process cooling water from Refinery, residue liquor from PHD's and outflow from Sequence Batch Reactor	Low permeability clay lined.
Sewage sludge vessels	Sewage sludge	Enclosed tanks which return sludge leachate to the start of the Sequence Batch Reactor process.
Solar Evaporation Ponds (SEP) 1 and 2a	Spent sulphuric and hydrochloric acid	HDPE lined with a permeability of 10^{-9} and slotted underflow pipes to collect groundwater which may impact on the base of the liners.
SEP 3	Oxalate	HDPE lined with a permeability of 10^{-9} and slotted underflow pipes to collect groundwater which may impact on the base of the liners.

1.2.5 The Licensee shall manage the landfilling activities to ensure:
(a) Waste is placed in a defined trench within the defined landfill cell within BRDA 3;
(b) Waste is covered with clean fill, bauxite residue, sand or other similar material on a minimum weekly basis; and
(c) A register of waste disposed of to landfill cells is maintained.

1.2.6 The Licensee shall store oxalate in a manner which ensures it remains moist or maintained underwater or beneath a full surface cover that ensures dust is not generated. from oxalate storage.

1.2.7 The Licensee shall ensure that the total quantity of alumina produced does not exceed 4,700,000 tonnes per annual period.

2 Emissions

2.1 General

2.1.1 The Licensee shall record and investigate the exceedance of any descriptive or numerical limit or target specified in any part of section 2 of this Licence.

2.2 Point source emissions to air

2.2.1 The Licensee shall ensure that where waste is emitted to air from the emission points in Table 2.2.1 and identified on the map of emission points in Schedule 1 it is done so in accordance with the conditions of this Licence.

Table 2.2.1: Emission points to air

Emission point reference and location on Map of emission points	Emission Point	Emission point height (m)	Source, including any abatement
A1	Boiler Flue 1	76	Coal Fired Power Station Boiler Unit 1 via Electrostatic Precipitator
A2	Boiler Flue 2		Coal Fired Power Station Boiler Unit 2 via Electrostatic Precipitator
A3	Boiler Flue 3		Coal Fired Power Station Boiler Unit 3 via Electrostatic Precipitator
A4	Digestion (RTO) Stack	40	Digestion Unit 1 and 2 via RTO
A5	Calciner Stack 1	40	Calciner 1 via Electrostatic Precipitator
A6	Calciner Stack 2	40	Calciner 2 via Electrostatic Precipitator
A7	Calciner Stack 3	40	Calciner 3 via Electrostatic Precipitator
A8	Calciner Stack 4	40	Calciner 4 via Electrostatic Precipitator
A9	Calciner Stack 5	40	Calciner 5 via Electrostatic Precipitator
A10	Calciner Stack 6	60	Calciner 6 via Baghouse
A11	Liquor Burner (RTO) Stack	105	Liquor Burner Facility via Baghouse, wet scrubber and RTO
A12	Cogeneration Plant Stack	55	Gas-Fired Cogeneration Plant with Low NOx Burners
A13	Boiler Flue 5	90	Multi Fuel Cogeneration Power Plant Boiler Unit 5, via baghouse. Maximum biomass fuel use of 30% (thermal substitution)
A14	Boiler Flue 6		Multi Fuel Cogeneration Power Plant Boiler Unit 6, via baghouse. Maximum biomass fuel use of 30% (thermal substitution)

2.2.2 The Licensee shall target point source emissions to air at or below the levels specified in Table 2.2.2.

Table 2.2.2: Point source emission targets to air

Emission point Reference	Parameter	Target (including units)[1,2,3]	Averaging period
A1 – A3	Carbon Monoxide	88 mg/m^3	Stack test (30 minute average)
	Nitrogen Oxides	990 mg/m^3	
	Sulphur Dioxide	2200 mg/m^3	
	Fluoride	4.8 mg/m^3	Stack test (60 minute average)
	PM	150 mg/m^3	Stack test and CEMS (60 minute average)
A4	Carbon Monoxide	100 mg/m^3	Stack test (30 minute average)
	Benzene	3.5 mg/m^3	Stack test (30 minute average)
	Mercury	67.2 mg/m^3	Stack test (60 minute average)
	Acetaldehyde	7.0 mg/m^3	
	Formaldehyde	6.3 mg/m^3	
A5-A8	Carbon Monoxide	330 mg/m^3	Stack test (30 minute average)
	Nitrogen Oxides	220 mg/m^3	
	Benzene	2 mg/m^3	
	Acetaldehyde	14.4 mg/m^3	Stack test (60 minute average)
	Formaldehyde	11.5 mg/m^3	
	PM	250 mg/m^3	Stack test and CEMS (60 minute average)
A9	Carbon Monoxide	330 mg/m^3	Stack test (30 minute average)
	Nitrogen Oxides	220 mg/m^3	
	Benzene	2 mg/m^3	
	Acetaldehyde	14.4 mg/m^3	Stack test (60 minute average)
	Formaldehyde	11.5 mg/m^3	
	PM	150 mg/m^3	Stack test and CEMS (60 minute average)
A10	Carbon Monoxide	120 mg/m^3	Stack test (30 minute average)
	Nitrogen Oxides	220 mg/m^3	
	Benzene	2 mg/m^3	
	Acetaldehyde	14.4 mg/m^3	Stack test (60 minute average)
	Formaldehyde	11.5 mg/m^3	
	PM	80 mg/m^3	Stack test and CEMS (60 minute average)
A11	Carbon Monoxide	100 mg/m^3	Stack test (30 minute average) and CEMS (60 minute average)
	Nitrogen Oxides	245 mg/m^3	Stack test (30 minute average)
	Benzene	3.5 mg/m^3	
	Acetaldehyde	7 mg/m^3	Stack test (60 minute average)
	Formaldehyde	6.3 mg/m^3	
A12	Nitrogen Oxides	70mg/m^3	Stack test (30 minute average)
A13-A14	Carbon Monoxide	100 mg/m^3	Stack test and CEMS (60 minute average)
	Nitrogen Oxides	500 mg/m^3	
	Sulphur Dioxide	600 mg/m^3	
	Fluoride	2.0 mg/m^3	Stack test (60 minute average)
	PM	80 mg/m^3	Stack test and CEMS (60 minute average)

Note 1: All units are referenced to STP dry

Note 2: Concentration units for A1-A3; A13-A14 are referenced to 7% O_2. Concentration units for A5-A9 are referenced to 6% O_2. Concentration unit for A10 is referenced to 9% O_2. Concentration unit for A12 is referenced to 15% O_2. When continuous oxygen correction is not available and for parameters requiring CEMS, targets shall not be achieved by the addition of dilution gases

Note 3: All targets apply during normal operating conditions

2.2.3 The Licensee shall take the specified management action in the case of an event in Table 2.2.3.

Table 2.2.3: Management actions			
Emission point reference	**Event/ action reference**	**Event**	**Management action**
A1-A3 A5- A11 A13- A14	EA1a	Parameters monitored by CEMS exceed the target specified in Table 2.2.2	The Licensee shall submit a monthly summary of environmental controls for an emission point that triggers EA1a or EA1b and include: (a) An analysis of the root cause(s) and contributing factors of the target exceedances; and (b) Short and long term corrective actions taken or planned to prevent reoccurrence of the exceedances, including timelines for implementation;
A1-A14	EA1b	Parameters monitored by stack tests exceed the target specified in Table 2.2.2	
A1-A3 A5-A10 A13- A14	EA2	USEPA Performance Specification 11 CEMS correlation via manual stack sampling causes an exceedance of particulates target.	The Licensee shall notify the CEO in writing 7 days prior to the commencement of the annual CEMS calibration curve correlation.
A4	EA4	Digestion Unit 1 (RTO60) or 2 (RTO70) average RTO bed temperature falls below target temperature in Table 2.2.4.	The Licensee shall initiate shut down of the digestor RTO unit.
A11	EA3	Online instrumentation identifies the failure of 3 or more baghouse cells.	The Licensee shall immediately initiate shut down of the Liquor Burner.

2.2.4 The Licensee shall take all practical measures to ensure that the process control parameters in Table 2.2.4 comply with the requirements specified in that table**.**

Table 2.2.4.: Process controls for emissions to air		
Parameter	**Target**	**Averaging period**
Digestion Unit 1 (RTO60) and 2 (RTO70) average RTO bed temperature	700 ^{o}C or greater	Continuous

3 Monitoring

3.1 General monitoring

3.1.1 The Licensee shall ensure that all laboratory samples are submitted to and tested by a laboratory with current NATA accreditation for the parameters being measured.

3.1.2 The Licensee shall ensure that:
(a) quarterly monitoring is undertaken at least 45 days apart;
(b) biannual monitoring is undertaken at least 5 months apart; and
(c) annual monitoring is undertaken at least 9 months apart.

3.1.3 The Licensee shall ensure that all monitoring equipment used on the Premises to comply with the conditions of this Licence is calibrated in accordance with the manufacturer's specifications and the requirements of the Licence and any relevant Australian standard.

3.1.4 The Licensee shall, where the requirements for calibration cannot be practicably met, or a discrepancy exists in the interpretation of the requirements, bring these issues to the attention of the CEO accompanied with a report comprising details of any modifications to the methods.

3.2 Monitoring of point source emissions to air

3.2.1 The Licensee shall undertake the monitoring in Table 3.2.1 according to the specifications in that table.

Table 3.2.1: Monitoring of point source emissions to air

Emission point reference	Parameter	Units[1, 3]	Averaging period	Frequency[2]	Method
A1 – A11	Carbon Monoxide	mg/m^3 g/s	Stack Test (minimum 30 minute average)	Quarterly	USEPA Method 10
A11 A13-A14			CEMS (60 minute average)	Continuous	CEMS
A1 – A3 A5 – A11	Nitrogen Oxides		Stack Test (minimum 30 minute average)	Quarterly	USEPA Method 7E
A12				Biannual	
A13-A14			CEMS (60 minute average)	Continuous	CEMS
A1 – A3	Sulfur Dioxide		Stack Test (minimum 30 minute average)	Quarterly	USEPA Method 6C
A13-A14			CEMS (60 minute average)	Continuous	CEMS
A1 – A3 A5 – A10	PM10		Stack Test (minimum 60 minute average)	Annual	USEPA Method 201A
A1 – A3 A5 – A10 A13-A14	PM		Stack Test (minimum 60 minute average)	Annual	USEPA Method 5, 17 or 201A
			CEMS (60 minute average	Continuous[4]	CEMS via suitable annual correlation of referenced particulates
A1 – A3 A13-A14	Fluoride		Stack Test (minimum 60 minute average)	Annual	USEPA Method 26 or 26A
A4 – A11	Benzene		Stack Test (minimum 30 minute average)	Quarterly	USEPA Method 18
A4	Mercury		Stack Test (minimum 60 minute average)	Quarterly	USEPA Method 29
A1 – A3 A5 – A10 A13-A14	Metals – AS, Be, Cd, Co, Cr, Cu, Hg, Mn, Ni, Pb, Zn			Annual	
A4 – A11	Acetaldehyde & Formaldehyde		Stack Test (minimum 60 minute average)	Quarterly	USEPA SW846 Method 0011
A1 – A11 A13-A14	Total Volatile Organic Compounds		Stack Test (minimum 30 minute average)	Annual	USEPA Method 18

Note 1: All units are referenced to STP dry

Note 2: Monitoring shall be undertaken to reflect normal operating conditions and any limits or conditions on inputs or production.

Note 3: Concentration units for A1-A3 and A13-A14 are referenced to 7% O_2. Concentration units for A5-A9 are referenced to 6% O_2. Concentration unit for A10 is referenced to 9% O_2. Concentration unit for A12 is referenced to 15% O_2. When continuous oxygen correction is not available and for parameters requiring CEMS, targets shall not be achieved by the addition of dilution gases

Note 4: Continuous monitoring is required once CEMS are installed and operational in accordance with the CEMS Code.

3.2.2 The Licensee shall ensure that sampling required under Condition 3.2.1 of the Licence is undertaken at sampling locations in accordance with the AS 4323.1 or relevant part of the CEMS Code.

3.2.3 The Licensee shall ensure that all non-continuous sampling and analysis undertaken pursuant to condition 3.2.1 is undertaken by a holder of NATA accreditation for the relevant methods of sampling and analysis.

3.2.4 For any parameter in Table 3.2.1 requiring continuous monitoring, the Licensee shall ensure that the CEMS is regularly maintained and calibrated in accordance with the CEMS Code.

3.3 Process monitoring

3.3.1 The Licensee shall undertake the monitoring in Table 3.3.1 according to the specifications in that table.

Table 3.3.1: Process monitoring

Monitoring point reference	Process description	Parameter	Units	Frequency	Method
Digestion RTO60: Bed Htr A Bed Htr B Centre	VOC destruction	Temperature	^{o}C	Continuous	None Specified
Digestion RTO70: Bed Htr A Bed Htr B Centre	VOC destruction	Temperature	^{o}C	Continuous	None Specified

3.4 Ambient environmental quality

3.4.1 The Licensee shall undertake the monitoring in Table 3.4.1 according to the specifications in that table.

Table 3.4.1: Monitoring of ambient air quality

Monitoring point reference and location on Map of ambient air emission monitoring sites	Parameter	Units [1]	Frequency [2]	Method
J	Sulfur dioxide	ppb	Continuous (minimum 6 minute intervals)	AS 3580.4.1

Note 1: All units are referenced to ambient conditions
Note 2: Intervals must be referenced by the end time of the interval with the first interval of a calendar day ending at 00:06 and the last interval ending at 24:00.

3.4.2 The Licensee shall ensure that the siting of ambient air monitoring equipment is in accordance with AS 3580.1.1.

3.4.3 The Licensee shall ensure that the monitoring equipment specified in condition 3.4.1 is operated and calibrated in accordance with the required methodology and is maintained so as to provide valid data for greater than 90% of the measurement intervals in every calendar month, and greater than 95% of the measurement intervals over any 12 consecutive calendar months.

3.4.4 The Licensee shall target ambient concentrations in air at or below the levels specified in Table 3.4.2.

Table 3.4.2: Ambient Air Quality Targets			
Monitoring point reference and location on Map of ambient monitoring locations	**Parameter**	**Target (including units)[1]**	**Averaging period[2]**
J	Sulfur dioxide	200ppb	Continuous (1 hour average)

Note 1: All units are referenced to ambient conditions.
Note 2: Clock hour average. Averaging periods must be referenced by the end time of the averaging period with the first averaging period of a calendar day ending at 01:00am.

3.4.5 The Licensee shall take the specified management action in the case of an event in Table 3.4.3.

Table 3.4.3: Management actions			
Monitoring point reference	**Event/ action reference**	**Event**	**Management action**
J	EA1	The ambient monitoring data indicates an exceedance of ambient sulfur dioxide target specified in Table 3.4.2.	The Licensee shall investigate the cause of the exceedance within 2 usual working days of the event and provide a report to the CEO within 5 usual working days of the exceedance. The report shall contain a summary of: i. The date, time, location and length of the exceedance; ii. Operating conditions of the site for the 48hrs preceding the exceedance, including fuel consumption, load and coal sulphur content; iii. Any ambient monitoring data conducted by the Licensee for the 48hrs preceding the exceedance; iv. Any meteorological data conducted by the Licensee for the 48hrs preceding the exceedance; v. Any actions that the licensee has taken towards preventing, controlling or abating pollution or environmental harm; and vi. Any other factors relevant to the exceedance of the target.

3.4.6 The Licensee shall review their operations upon notification from DER of any ambient target exceedance within the Collie area, as represented in the Map of ambient air emission monitoring sites operated and maintained by Collie airshed power generators in Schedule 1. The Licensee shall provide a report within 2 usual working days containing a summary of:

(a) Operating conditions of the site for the 48hrs preceding and following the exceedance, including fuel consumption, load and coal sulphur content;
(b) Any ambient monitoring data conducted by the Licensee for the 48hrs preceding and following the exceedance;
(c) Any meteorological data conducted by the Licensee for the 48hrs preceding and following the exceedance;
(d) Any actions that the licensee has taken towards preventing, controlling or abating pollution or environmental harm since receiving the report; and
(e) Any other factors relevant to the exceedance of the target.

3.5 Meteorological monitoring

3.5.1 The Licensee shall undertake the meteorological monitoring in Table 3.5.1 according to the specifications in that table.

Table 3.5.1: Meteorological monitoring

Monitoring point reference and location on Map of ambient air emission monitoring sites	Parameter	Units	Height	Method
RMS	Wind speed	m/s	10 m	AS 3580.14
	Wind direction	Degrees	10 m	
	Wind direction standard deviation	Degrees	10 m	
	Air temperature	°C	2m	
	Relative humidity	%	2m	
	Solar radiation	W/m^2	Not specified	

3.5.2 The Licensee shall ensure that the monitoring equipment is operated and calibrated in accordance with the required methodology and is maintained so as to provide valid data for greater than 90% of the measurement intervals in every calendar month, and greater than 95% of the measurement intervals over any 12 consecutive calendar months.

3.6 Monitoring of inputs and outputs

3.6.1 The Licensee shall undertake the monitoring in Table 3.6.1 according to the specifications in that table.

Table 3.6.1: Monitoring of inputs and outputs

Input/ Output	Parameter	Units	Frequency
Coal	Sulfur content	% by weight	Every train wagon on delivery
Alumina	Production rates	tonnes	Annually
Alumina	Production rates	tonnes	Daily during stack test monitoring carried out in accordance with Table 3.2.1
Biomass	Thermal substitution of biomass (emission points A13 and A14)	%	Monthly

Note 1: Composite samples shall be collected.

4 Improvements

4.1 Improvement program

4.1.1 The Licensee shall complete the improvements in Table 4.1.1 by the date of completion in Table 4.1.1.

4.1.2 The Licensee, for improvements not specifically requiring a written submission, shall write to the CEO stating whether and how the Licensee is compliant with the improvement within one week of the completion date specified in Table 4.1.1.

Table 4.1.1: Improvement program

Improvement reference	Improvement	Date of completion
IR1	The Licensee shall submit a final report for Version 3 of the Air Emissions Inventory as described in the *Scope of Works for Development of "Versions 3" Air Emissions Inventory BHP Billiton Worsley Alumina Refinery Draft* (ENVALL, March 2015)	30/03/2018
IR2	The Licensee shall submit to the CEO, a Continuous Emissions Monitoring System (CEMS) Implementation Plan for monitoring temperature, flow rate, oxygen, particulates, SO_2 and opacity from emission points A1 to A3 where currently not available. The Plan shall include but not be limited to the following: (i) Identification of the CEMS technology of choice in accordance with the CEMS code; (ii) Timeframe for installation, calibration and operation of the CEMS on boilers 1-3; and (iii) Proposed action plan, which addresses any constraints identified, with the objective of having the CEMS technology identified above operational as early as possible.	30/11/2016
IR3	The Licensee shall submit a report containing design specifications and criteria for the RLC expansion project at least 3 months prior to commencement of the project . This report shall include and not be limited to: (i) size and extent of the proposed extension; (ii) updated maps; (iii) an updated water balance for the site; (iv) liner specifications and construction methods including third party construction quality assurance testing; (v) a description of localised hydrogeology and separation distances to surface and groundwater resources; and (vi) water resource protection measures employed during and post construction, including seepage management practices.	31/01/2017

5 Information

5.1 Records

5.1.1 All information and records required by the Licence shall:
- (a) be legible;
- (b) if amended, be amended in such a way that the original and subsequent amendments remain legible or are capable of retrieval;
- (c) except for records listed in 5.1.1(d) be retained for at least 6 years from the date the records were made or until the expiry of the Licence or any subsequent licence; and
- (d) for those following records, be retained until the expiry of the Licence and any subsequent licence:
  - (i) off-site environmental effects; or
  - (ii) matters which affect the condition of the land or waters.

5.1.2 The Licensee must submit to the CEO by 30 September after the end of the annual period, an Annual Audit Compliance Report indicating the extent to which the Licensee has complied with the Conditions in the Licence for the annual period.

5.1.3 The Licensee shall implement a complaints management system that as a minimum records the number and details of complaints received concerning the environmental impact of the activities undertaken at the Premises and any action taken in response to the complaint.

5.2 Reporting

5.2.1 The Licensee shall submit to the CEO an Annual Environmental Report by 30 September after the end of the annual period. The report shall contain the information listed in Table 5.2.1 in the format or form specified in that table.

Table 5.2.1: Annual Environmental Report

Condition or table (if relevant)	Parameter	Format or form[1]
-	Summary of any failure or malfunction of any pollution control equipment and any environmental incidents that have occurred during the annual period and any action taken.	None specified
5.1.4	Complaints summary	None specified
1.3.3	Plan of the location of landfill cells used during the annual reporting period	Map
1.3.7	Production summary of the quantity of alumina refined during the annual period	None specified
1.3.4 (c)	Summary of entries into the waste register including the total volume of each waste type	Table
3.3.1	Summary of Digestor RTO bed temperature monitoring for each unit over the annual period	None specified
Table 3.2.1	Results of quarterly, biannual and annual stack testing	Table and/or graph
	Summary of CEMS data	
Table 3.6.1	Summary of results for each parameter over the annual period.	None specified
	Average daily coal sulphur content for five days preceding stack test monitoring carried out in accordance with Table 3.2.1(emission points A1to A3)	Table and/or graph
	Biomass substitution during stack test monitoring carried out in accordance with Table 3.2.1 (emission points A13 and A14)	Table and/or graph

5.2.2 The Licensee shall ensure that the Annual Environmental Report also contains an assessment of the information contained within the report against previous monitoring results and Licence limits and/or targets.

5.2.3 The Licensee shall submit the information in Table 5.2.2 to the CEO according to the specifications in that table.

Table 5.2.2: Non-annual reporting requirements

Condition or table (if relevant)	Parameter	Reporting period	Reporting date	Format or form[1]
Tables 2.1.2 and 2.1.4	Target exceedances	Quarterly	Within 30 days of the end of the quarter	ET1
3.2.4	Relative Accuracy Test Audit (RATA)	Annually in accordance with CEMS Code	Within 60 calendar days of the RATA	RATA1
-	Copies of original monitoring reports submitted to the Licensee by third parties	Not Applicable	Within 14 days of the CEOs request	As received by the Licensee from third parties

Note 1: Forms are in Schedule 2

5.2.4 The Licensee shall ensure that results from CEMS are made available on request as tabulated data and time series graphs including:
(a) times and dates;
(b) unavailability of abatement;
(c) target or limit exceedances; and
(d) an assessment of the information contained within the report against previous submissions and Licence limits and/or targets.

5.3 Notification

5.3.1 The Licensee shall ensure that the parameters listed in Table 5.3.1 are notified to the CEO in accordance with the notification requirements of the table.

Table 5.3.1: Notification requirements

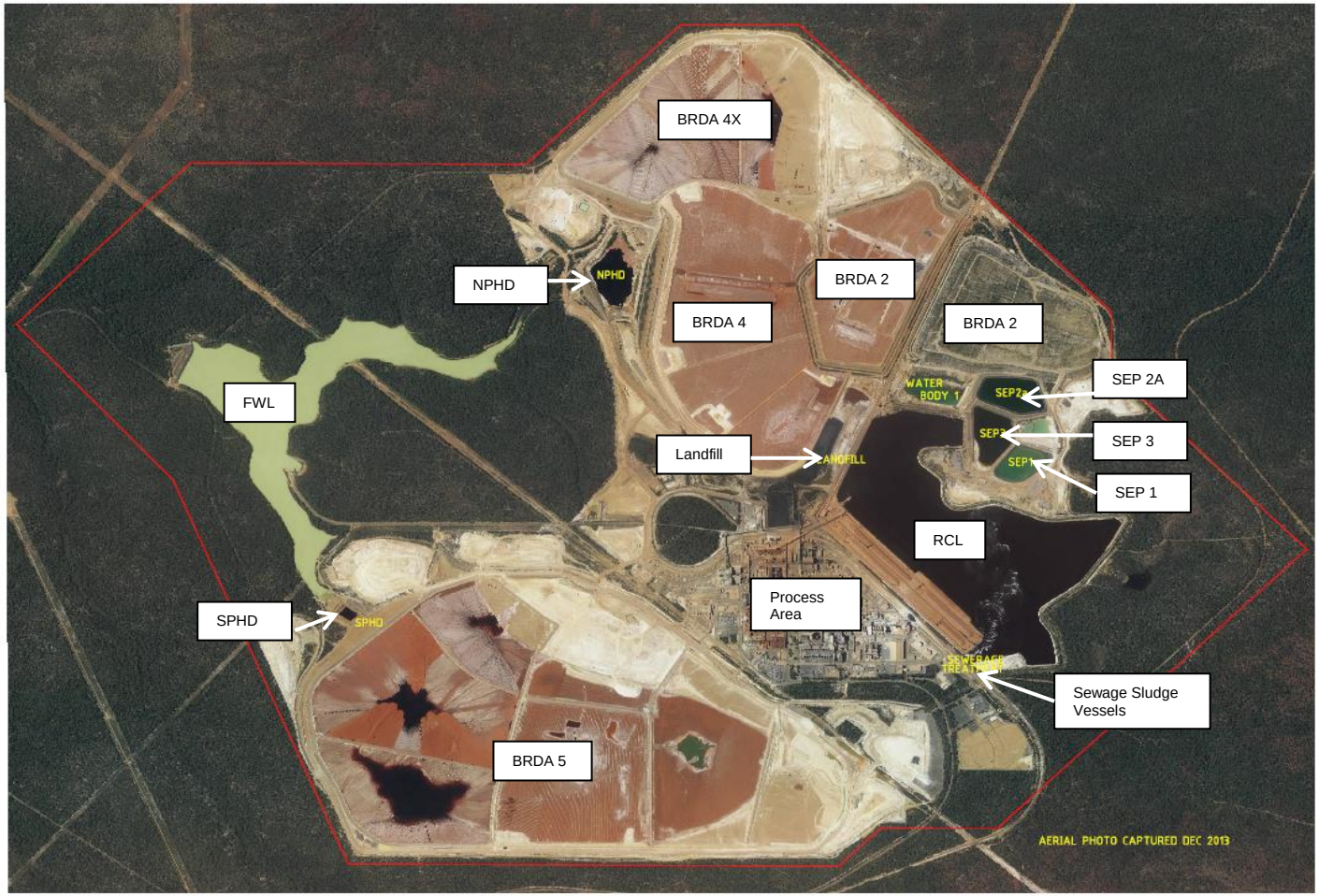
Condition or table (if relevant)	Parameter	Notification requirement[1]	Format or form[2]
3.1.5	Calibration report	As soon as practicable.	None specified
2.6.2	Breach of any limit specified in the Licence	Part A: As soon as practicable but no later than 5pm on the next usual working day. Part B: Within 7 working days of becoming aware of the exceedance.	N1
Table 2.2.2	Exceedance of any descriptive or numerical target	Within 30 days of becoming aware of the exceedance.	ET1

Note 1: Forms are in Schedule 2

Schedule 1: Maps

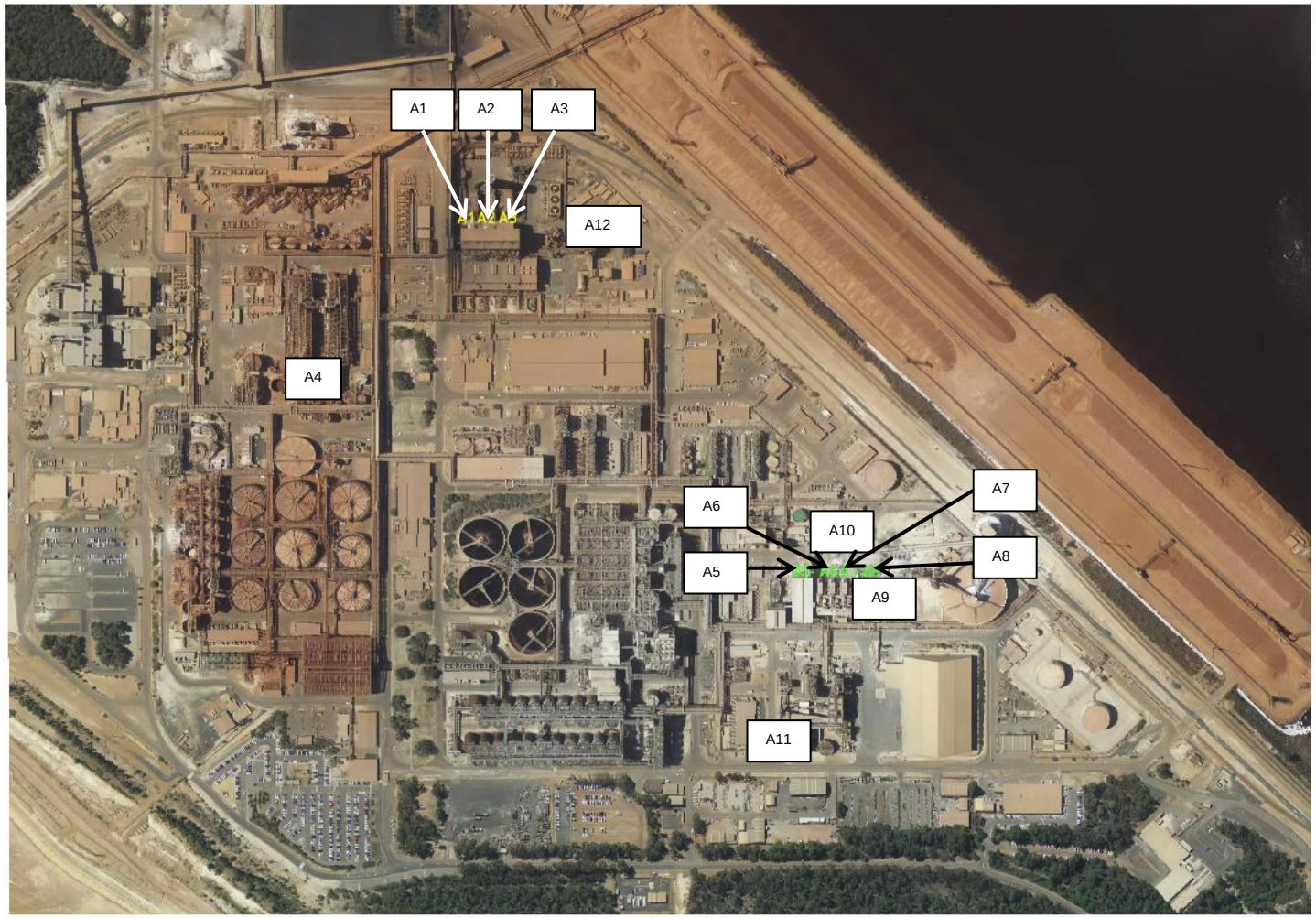
Map of premises and containment infrastructure

The Premises is shown on the map below. The red line depicts the Premises boundary.
The locations of the containment infrastructure identified in Table 1.2.3 are shown below.



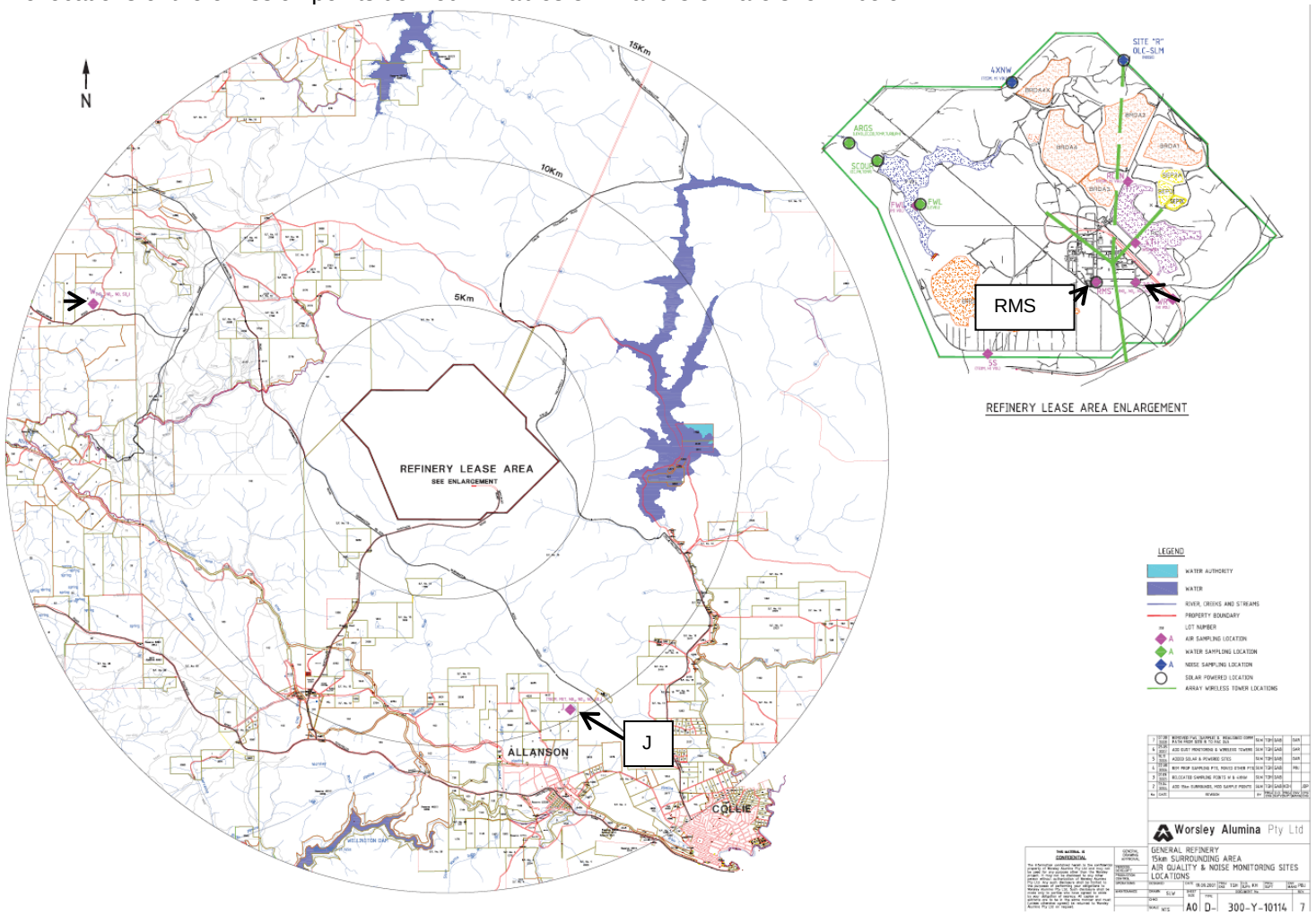
Map of emission points

The locations of the emission points defined in Table 2.2.1 are shown below.

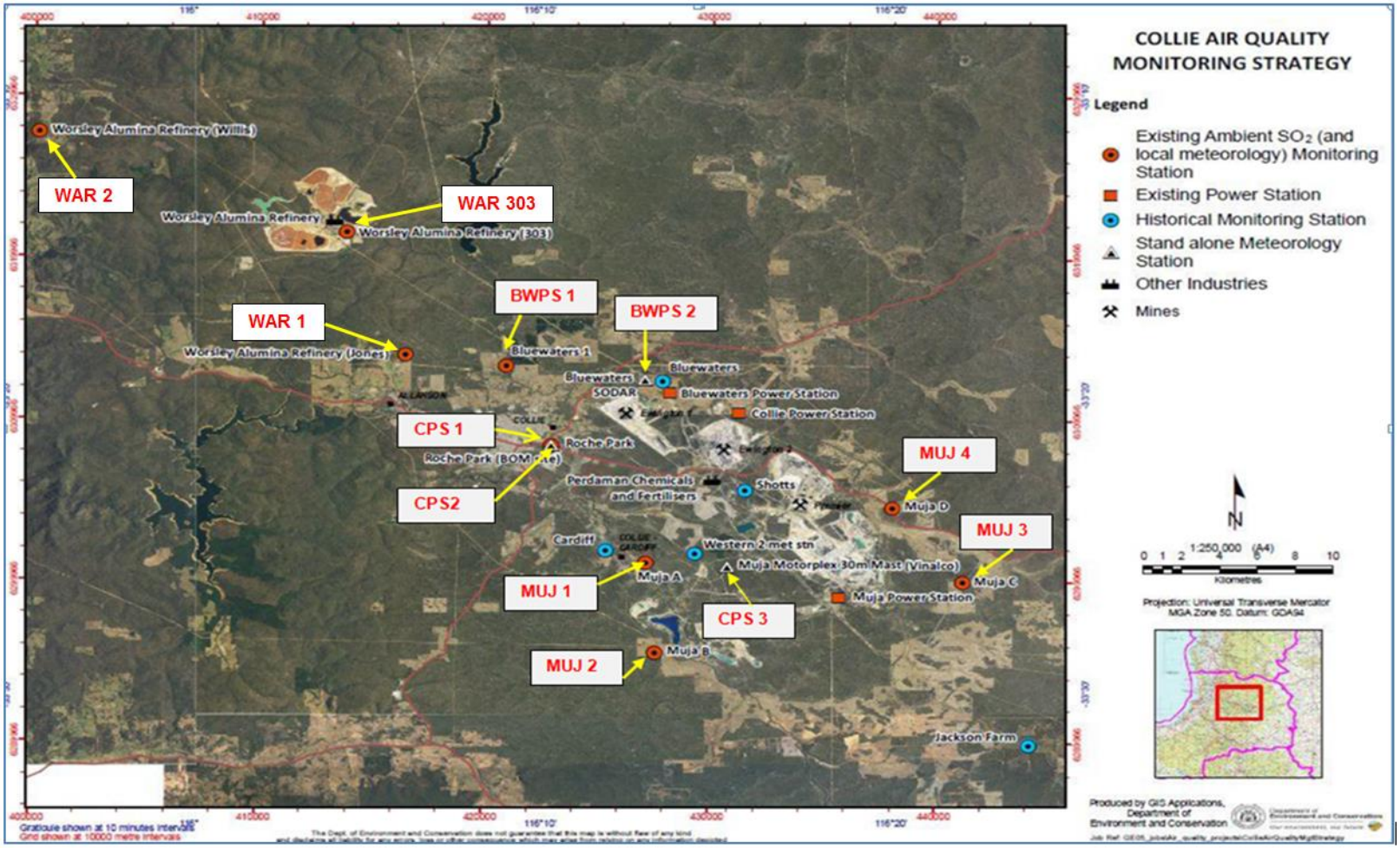


Map of ambient air emission monitoring sites

The locations of the emission points defined in Tables 3.4.1 and 3.5.1 are shown below.



Map of ambient air emission monitoring sites operated and maintained by Collie airshed power generators


COLLIE AIR QUALITY MONITORING STRATEGY
Legend
Existing Ambient SO_2 (and local meteorology) Monitoring Station
Existing Power Station
Historical Monitoring Station
Stand alone Meteorology Station
Other Industries
Mines
WAR 2
WAR 303
WAR 1
BWPS 1
BWPS 2
CPS 1
CPS2
MUJ 1
MUJ 2
MUJ 3
MUJ 4
CPS 3
Worsley Alumina Refinery (Willis)
Worsley Alumina Refinery
Worsley Alumina Refinery (303)
Worsley Alumina Refinery (Jones)
Bluewaters 1
Bluewaters
Bluewaters SODAR
Bluewaters Power Station
Collie Power Station
Roche Park
Roche Park (BOM site)
Perdaman Chemicals and Fertilisers
Shotts
Muja D
Cardiff
Western 2 met stn
Muja Motorplex 30m Mast (Vinalco)
Muja A
Muja C
Muja Power Station
Muja B
Jackson Farm
Kilometres
Projection: Universal Transverse Mercator MGA Zone 50. Datum: GDA94
Produced by GIS Applications, Department of Environment and Conservation

Licence: L4504/1981/17
Form: RATA1
Name: Monitoring of CEMS Performance

Licensee: South32 Worsley Alumina Pty Ltd
Period :

Form AR2: RATA							
Emission point	**Parameter**	**Reference Method**	**Run**	**Sample date & times**	**Reference Result**	**CEMS Result**	**Unit**
A12	Carbon Monoxide	USEPA Method 10	1				
			2				
			3				
			4				
			5				
			6				
			7				
			8				
			9				
			10				
			11				
			12				
Relative Accuracy							%
Bias							%

Signed on behalf of South32 Worsley Alumina Pty Ltd: …….. Date: ……..

Licence: L4504/1981/17
Form: ET1
Name: Target exceedances

Licensee: South32 Worsley Alumina Pty Ltd
Period:

Form ET1: Target exceedances
Please provide an analysis of the target exceedances for the quarter, including but not limited to: (a) the emission point (b) the date and time of the exceedance and period over which the exceedance occurred (c) the root cause analysis for the exceedances; (d) any common or contributory factors including but not limited to fuel, mass emissions, gas flow rates, inlet & exit temperature, abatement status; (e) a description of remedial measures taken or planned to be taken, including those taken to prevent recurrence of the exceedances; (f) complaints received that may have been caused by this exceedance; and (g) for those exceedances that may have caused complaints, meteorological details: temperature, wind speed and wind direction, humidity.

Signed on behalf of South32 Worsley Alumina Pty Ltd: …….. Date: ……

Licence: L4504/1981/17 Licensee: South32 Worsley Alumina Pty Ltd
Form: N1 Date of breach:

Notification of detection of the breach of a limit

These pages outline the information that the operator must provide. Units of measurement used in information supplied under Part A and B requirements shall be appropriate to the circumstances of the emission. Where appropriate, a comparison should be made of actual emissions and authorised emission limits.

Part A

Licence Number	
Name of operator	
Location of Premises	
Time and date of the detection	

Notification requirements for the breach of a limit	
Emission point reference/ source	
Parameter(s)	
Limit	
Measured value	
Date and time of monitoring	
Measures taken, or intended to be taken, to stop the emission	

Part B

Any more accurate information on the matters for notification under Part A.	
Measures taken, or intended to be taken, to prevent a recurrence of the incident.	
Measures taken, or intended to be taken, to rectify, limit or prevent any pollution of the environment which has been or may be caused by the emission.	
The dates of any previous N1 notifications for the Premises in the preceding 24 months.	

Name	
Post	
Signature on behalf of: BHP Billiton South32 Worsley Alumina Pty Ltd	
Date	

Government of Western Australia
Department of Environment Regulation

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

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 ☐ New Licence ☐ Licence amendment ☒ Works Approval amendment ☐	
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 Application fee paid	Date: 5 August 2016 Date: 26 August 2016	
Works Approval has been complied with Compliance Certificate received	Yes☐ No☐ N/A☒ Yes☐ No☐ N/A☒	
Commercial-in-confidence claim	Yes☐ No☒	
Commercial-in-confidence claim outcome		
Is the proposal a Major Resource Project?	Yes☒ No☐	
Was the proposal referred to the Environmental Protection Authority (EPA) under Part IV of the *Environmental Protection Act 1986*?	Yes☒ No☐	Referral decision No: 1526 Managed under Part V ☐ Assessed under Part IV ☒
Is the proposal subject to Ministerial Conditions?	Yes☒ No☐	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 *Environmental Protection Act 1986*)?	Yes☐ No☒ Department of Water consulted Yes ☐ No ☒	
Is the Premises within an Environmental Protection Policy (EPP) Area Yes☐ No☒		
Is the Premises subject to any EPP requirements? Yes☐ No☒		

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: • Condition1.2.1 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 *Environmental Protection (Unauthorised Discharges) Regulations 2004*. • 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 *Environmental Protection Act 1986* *Environmental Protection (Unauthorised Discharge) Regulations 2004*

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	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 SO_2. The siting for this monitor does not meet the siting requirements specified under AS/NZS 3580.1.1:2016 *Methods for sampling and analysis of ambient air-Guide to siting air monitoring equipment*, 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. 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 SO_2 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.	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	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. 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.	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 Environmental Protection Act 1986* 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.ai/your-environment/reporting-pollution.	Section 72 of *Environmental Protection Act 1986.*

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	The Licensee identified typographical errors in Table 2.2.2 (NOx, CO and CEMS averaging period for Boiler 5 and Boiler 6 emission targets). 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.	The Boiler 5 and Boiler 6 NOx and CO emission targets were changed to reflect the works approval and commissioning data sets. 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.

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 *(*SO_2), nitrogen dioxide (NO_2), 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 SO_2, NO_2 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/m^3)

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 the1-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 Refinery[1]

Contaminant	Average Time	NEPM Guideline (µg/m3)	Maximum ground level concentration (µg/m3) at 4.7Mtpa	
			Worsley Alumina Refinery	Combined Worsley Alumina 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;
- SO_2 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 development 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 SO_2 emissions is increased from 600mg/m^3 as specified in the works approval to 800mg/m^3. The 600mg/m^3 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/m^3. 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 SO_2 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 SO_2 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 SO_2 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