



Application for Licence

Part V Division 3 of the *Environmental Protection Act 1986*

Licence Number	L4504/1981/17
Applicant	South32 Worsley Alumina Pty Ltd
ACN	008 905 155
File number	DER2017/001998-1
Premises	Worsley Alumina Refinery Gastaldo Road ALLANSON WA Legal description Lease No 3116/7574 being Wellington Locations 5314 – 5317 on Plan 220209 As defined by the coordinates in Schedule 1 of the Revised Licence
Date of report	24/05/2023
Proposed Decision	Licence granted

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1. Decision summary

This decision report documents the assessment of potential risks to the environment and public health from the removal of the burners from three existing coal fired boilers (boilers 1-3) within Facility 110 at the Worsley Alumina Refinery; and retrofitting eight natural gas burners to each boiler and installation of associated infrastructure. The conversion works are considered relatively minor in nature and suitable for assessment under a Licence amendment rather than a Works Approval. As a result of this assessment, the amended Licence L4504/1981/17 has been granted.

2. Scope of assessment

2.1 Regulatory framework

In completing the assessment documented in this decision report, the Department of Water and Environmental Regulation (the department; DWER) has considered and given due regard to its regulatory framework and relevant policy documents which are available at <https://dwer.wa.gov.au/regulatory-documents..>

2.2 Application summary and overview of premises

On 21 February 2023, South32 Pty Ltd submitted an application for a Licence amendment to the department under section 54 of the *Environmental Protection Act 1986* (EP Act).

The application includes information on the proposal to:

- remove the existing coal burners and gas igniters from the three boilers that comprise the 110 MW Facility 110 (emission points A1-A3 within Licence L4504/1981/17);
- eight gas burners and igniters will be retrofitted to each boiler;
- new conveyance piping and valve trains will support the supply natural gas to each boiler;
- a gas pressure reduction station, and
- upgrades to the instrumentation used to monitor and control the boiler combustion processes will be installed.

The conversion works will be undertaken in 3 stages and will be planned around scheduled maintenance shut down works for each boiler and are anticipated to occur according to the following timeframes:

- Stage 1: Boiler 3 (A3) planned for Quarter 2 2023
- Stage 2: Boiler 1 (A1) planned for Quarter 4 2023;
- Stage 3: Boiler 2 (A2) planned for between 2024 and 2029

There will no change to emission points, air emission targets or monitoring under the Licence as a result of this amendment.

This Licence will be granted subject to the determination of the current application before the Environmental Protection Authority (EPA) (see Section titled: Part IV Environmental Protection Act 1986 below).

Background

Alumina refining is an energy intensive industry, and Worsley Alumina Refinery relies on a mix of fuels to meet energy demands. Coal is the primary fuel source used at the site and to lesser but increasing degree natural gas is used. The site has two Multi Fuel Cogeneration (MFC)

Plant Boilers 5 and 6 which are capable of being run on biofuel and coal and which are reported to have been operated exclusively on biofuel (waste timber biomass) since 2018 (2022 Annual Environmental Report, South 32). A summary of power generating infrastructure and fuel sources at the site is summarised in Table 1.

Table 1: Summary of energy generating infrastructure at Worsley Alumina Refinery

Power Generating infrastructure	Power generating capacity	Fuel source
Gas fired co-generation plant Emission point A12	120MW	Natural gas
Facility 110 (Boilers 1-3) Emission points A1-A3	110MW	Coal converting to natural gas under this amendment
Coal fired Power Station Multi- Fuel Cogeneration Plant (Boilers 5 and 6) Emission points A13 and A14	100 MW (thermal) 400 MW (electrical)	Coal and biomass (maximum biomass use of 30%)
Packaged Boilers 4 and 5 (alternative capacity) Emission points A15-A16	120MW	Natural gas

Source: Adapted from MS 719 (EPA, 2016).

Over recent years the South32 has increasingly had to source coal from interstate or overseas to meet demands as there has not been a reliable availability of high quality locally sourced coal from coal mines within the Collie area. The importance of finding alternate fuel sources is therefore important from a business continuity perspective and also to meet South32's commitment towards reducing the company's effect on climate change.

South32 intends to reducing carbon emissions and has commenced a number of projects including the current Boiler Coal to Gas Conversion Project (BCGCP) as part of their Climate Change Action Plan. Although this conversion project represents a fraction of the sites total energy generating capacity, it enables the company the capability of sourcing most of their energy requirements from natural gas at any one time. The site also requires thermal heating for bauxite refining with a total energy demand (electricity plus heating) at the licence production rate of 4.7Mtpa being approximately 1570MW. Between 20-25% of this is already sourced from natural gas for the package boilers and calcining furnaces. The BCGCP allows an additional ~45% of energy demand to be sourced from natural gas, with the remainder of energy requirements being met by coal supply to the MFC boilers. This BCGCP has the added benefits of minimising the environmental and financial costs associated with interstate or international coal transportation, as Western Australia is a significant producer of natural gas.

The change of fuel source within Facility 110 (Boilers 1-3) relates to the subsidiary prescribed activity category 52: electric power generation, which is used to power the bauxite refining activities. Electrical power is generated at a maximum production capacity of 260 MW in accordance with Schedule 1 of the *Environmental Protection Regulations 1987* (EP Regulations) and as defined in licence L4504/1981/17.

Part IV Environmental Protection Act 1986

The State Government's *Greenhouse Gas Emissions Policy for Major Projects* (Major Projects GHG Policy) was published in August 2019; and the EPA's *Environmental Factor Guideline - Greenhouse Gas Emissions* (April 2020) gives agency to the government decision making for proposals with significant potential for GHG emissions and endorses the assessment and management of proposals with emissions over 100,000 tonnes of carbon dioxide equivalent (CO₂-e) under Part IV of the EP Act.

GHG emissions from Worsley Alumina Refinery meet the threshold criteria whereby the CEO may give consideration for GHG emissions as part of any Part IV assessment, or amendment thereof. The changes proposed by this amendment will alter the power and steam raising facilities as depicted in Table 2 of Ministerial Statement 719 where this infrastructure is listed as coal fired infrastructure. An application was submitted to the EPA on 23 January 2023 (Application number: APP-0000224). Whilst this change to infrastructure will not lead to an increase in GHG emissions and the current amendment to the project may not require a new EIA consideration of EPA Guideline might form part of environmental considerations to the amendment to Ministerial Statement 719, given the nature of the EPA and its functions.

The amendment to Licence cannot be determined without the above application to amendment to Ministerial Statement 719 being granted. Should this application be granted, this amendment will be issued.

3. Location and receptors

3.1 Siting context

The Premises is located approximately 15 km northwest of Collie on the Darling Plateau, 145km south of Perth. The Premises is nearly entirely situated within the upper reaches of the Augustus River catchment, which is a tributary of the Brunswick River.

The location of the BCGCP located within Facility 110 is shown in yellow in Figure 1 below.

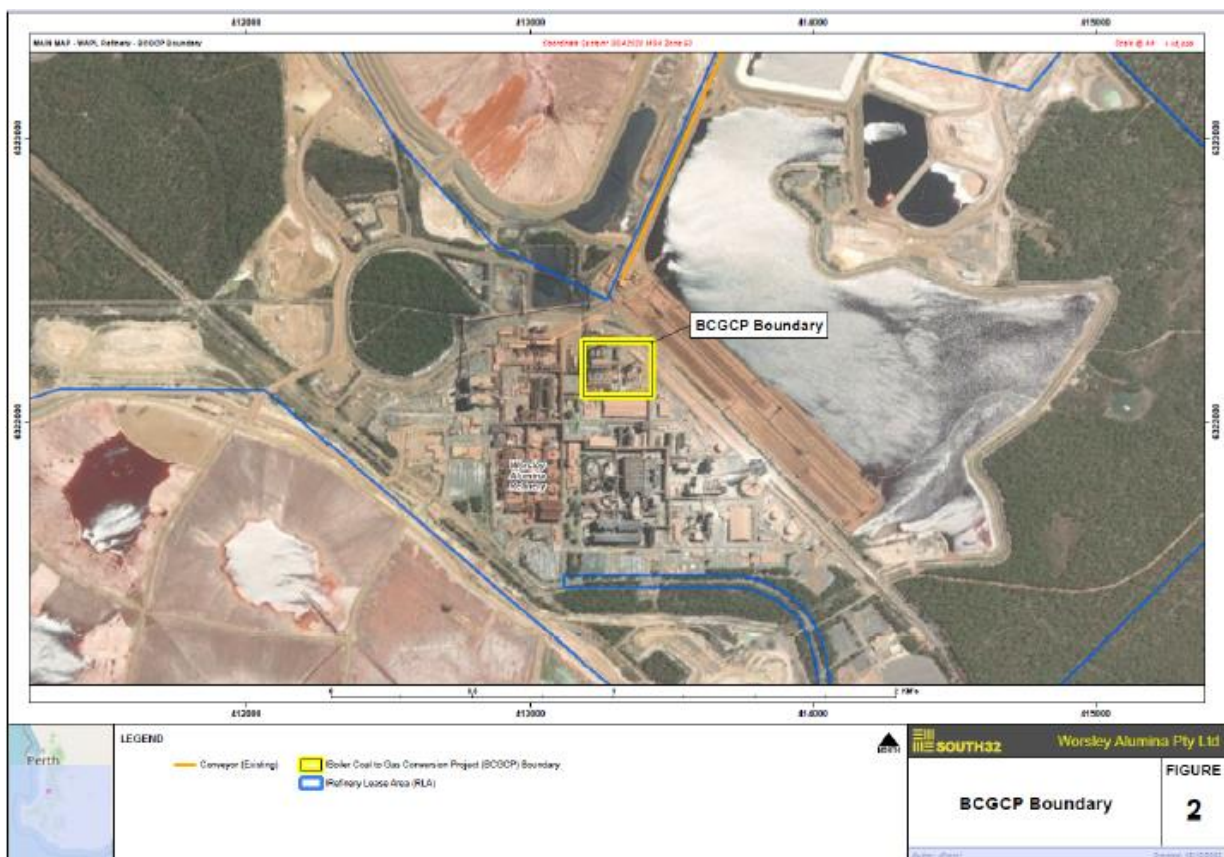


Figure 1: Location of the Boiler Coal to Gas Conversion Project located within Facility 110 (shown in yellow)

Source: from Figure 2, Appendix 3 of the Application form (South32, 2023)

3.2 Residential and sensitive receptors

The distances to residential and sensitive receptors are detailed in Table 2.

Table 2: Receptors and distance from proposed works

Residential and sensitive premises	Distance from the proposed works
Single Rural Dwellings:	Single residential dwelling approximately 7.5 km northeast of the proposed works.
Township of Allanson	Allanson is approximately 10.5 km south of the proposed works.

4. Risk assessment

The department assesses the risks of emissions from prescribed premises and identifies the potential source, pathway and impact to receptors in accordance with the *Guideline: Risk Assessments* (DWER 2020).

To establish a risk event there must be an emission, a receptor which may be exposed to that emission through an identified actual or likely pathway, and a potential adverse effect to the receptor from exposure to that emission.

4.1 Risk ratings

Risk ratings have been assessed in accordance with the *Guideline: Risk Assessments* (DWER 2020) for each identified emission source and takes into account potential source-pathway and receptor linkages as identified in Table **Error! Reference source not found.**. Where linkages are in-complete they have not been considered further in the risk assessment.

Where the applicant has proposed mitigation measures/controls these have been considered when determining the final risk rating. Where the delegated officer considers the applicant's proposed controls to be critical to maintaining an acceptable level of risk, these will be incorporated into the licence as regulatory controls.

Additional regulatory controls may be imposed where the applicant's controls are not deemed sufficient. Where this is the case the need for additional controls will be documented and justified in 3.

Licence L4504/1981/17 that accompanies this decision report authorises emissions associated with the operation of the premises.

The conditions in the issued licence, as outlined in Table 3 have been determined in accordance with *Guidance Statement: Setting Conditions* (DER 2015).

Table 3: Risk assessment of potential emissions and discharges from the premises during operation

Risk events				Risk rating ¹	Reasoning	Regulatory Controls (refer to the conditions of the granted instrument)
Sources / activities	Potential emission	Potential Receptors pathways and impact	Applicant controls	C = consequence L = likelihood		
Operation						
Operation of Boilers 1-3 using natural gas	<p>Air emissions from the combustion of natural gas</p> <ul style="list-style-type: none"> • Particulate matter (PM₁₀) • Nitrogen oxides (NO_x) • Sulphur dioxide (SO₂) • Volatile organic compounds (VOCs) • Carbon monoxide (CO). 	<p><u>Receptor</u>: nearest residential receptors</p> <p>Global atmospheric greenhouse gases</p> <p><u>Pathway</u>: air/windborne</p> <p><u>Impact</u>: additive effects of cumulative greenhouse gas emissions contributing to climate change</p>	<p>Boilers 1-3 engineering controls:</p> <ul style="list-style-type: none"> • Continuous Air Emissions Monitoring as per Licence Condition 3.2.1 • Stack monitoring for VOC's and CO • Boilers will be subject to scheduled maintenance. • Daily visual inspection of Facility 110 • Rotational use of boilers to allow for periodic shut down 	<p>C = Slight</p> <p>L = Rare</p> <p>Low Risk</p>	See section 4.2 below.	<p>New Condition 1.2.8 will allow for plant installation works for Stages 1, 2 and 3.</p> <p>New Conditions 1.2.9 and 1.2.10 requires the Licence Holder to undertake an audit and to prepare and submit a compliance report of the staged works.</p> <p>Existing Licence Condition 2.2.1 Table 2.2.1 will be updated to allow emission points A1, A2 and A3 to be fired by natural gas or coal until the staged conversion works are completed.</p> <p>Existing Licence Condition 2.2.2 and 3.2.1 emission monitoring will continue to apply.</p>

Note 1: Consequence ratings, likelihood ratings and risk descriptions are detailed in the *Guideline: Risk Assessments* (DWER 2020).

4.2 Decision

The implementation of the changes proposed under this amendment will have immediate benefits on air emissions, with a significant reduction of particulates (PM₁₀), Oxides of nitrogen (NO_x) and sulphur dioxide (SO₂) following completion of the conversion works. Volatile Organic compounds (VOC's) and carbon monoxide (CO) emissions are predicted to increase but these increases form a minor portion of the total emissions. Full implementation of this project may not occur until 2029. A summary of the staged conversion works and the associated changes to air emissions is detailed in Table 4

Table 4: Boiler Coal to gas Conversion Project- Staged project

Annual Emissions (tonner per annum)							
Emission	Three Coal Fired Boilers	Stage 1 Boiler 3 Converted	% Change	Stage 2 Boiler 1 and 3 converted	% Change	Stage 3 Boilers 1, 2 and 3 converted	% Change
	Current	2023		2024		~2029	
PM10	139	112	-19%	85	-39%	58	-58%
NOx	2,046	1,805	-12%	1,565	-23%	1,325	-35%
CO	107	134	25%	161	50%	187	74%
SO2	5,363	3,578	-33%	1,793	-67%	9	-99.8%
VOCs	20	28	38%	35	76%	43	114%

Source: Adopted from Table 10 Technical memorandum: South32 – Boiler to Coal gas Conversion project
(WSP Golder 11/01/2023)

The overall impact of this project is a significant reduction in carbon emissions and this has been assessed as carbon dioxide equivalents (CO₂-e) and includes other Green House Gas's (GHG) that are driving climate change. The predicted benefits from combustion alone (not including transportation of coal) have been determined to be a 41% reduction in GHG from the three boilers over an annual period as detailed below in Table 5.

Table 5: Boiler Coal to gas Conversion Project- Air emissions summary

Annual Green House Gas (GHG) Emissions (CO ₂ -e tonnes per annum)							
Emission	Three Coal Fired Boilers	Stage 1 Boiler 3 Converted	% Change	Stage 2 Boiler 1 and 3 converted	% Change	Stage 3 Boilers 1, 2 and 3 converted	% Change
	Current	2023		2024		~2029	
GHG	1,720,000	1,480,000	-14%	1,250,000	-28%	1,010,000	-41%

Source: Adopted from Table 11 Technical memorandum: South32 – Boiler to Coal gas Conversion project
(WSP Golder 11/01/2023)

The reduction of coal combusted at the premises also has the added benefits of reducing the generation and need for disposal of coal combustion by products: fly and bottom ash. Flyash is a very fine, light weight product that can be difficult to manage. It is high in SiO₂, Al₂O₃, CaO, metal particulates and readily leachable. Currently flyash is slurried and disposed of within the Bauxite Residue Disposal Areas (BRDA's) at the premises.

Following completion of these works, coal will continue be used at the premises within the Multi Fuel Cogeneration (MFC) Plant Boilers 5 and 6 (emission points A13 and A14 on the Licence).

The Licence Holder was provided with the draft Amendment Report and draft Licence 17 March 2023. The Licence Holder provided comments on the 14 April 2023 and 4 May 2023 and a summary of these and how they have been included within the current assessment is provided within Appendix 1 to this Amendment Report.

5. Conclusion

Based on the assessment in this decision report, the delegated officer has determined that a licence will be granted, subject to the granting of the current amendment application to Ministerial Statement 719 under Part IV of the Environmental Protection Act. Conditions commensurate with the determined controls and necessary for administration and reporting requirements are included.

Appendix 1: Summary of applicant's comments on risk assessment and draft conditions

Condition	Summary of applicant's comment	Department's response
Condition 1.1.2	<p>Replace "<i>Civil Engineer</i>' means a person who: (a) holds a tertiary qualification in civil engineering; and (b) has a minimum of ten years of experience working in the area of Liquid Natural Gas Engineering; and (c) holds membership of the Institute of Engineers Australia, or is otherwise approved by the CEO to act in this capacity."</p> <p>With the standard definitions for "Chemical/Electrical Engineer' including updating the reference to 'Liquid Natural Gas Engineering' and replacing with 'natural gas combustion'.</p>	Change made
Condition 1.2.8	<p>Correct typographical error:</p> <p>Delete the extra "and" in line item (b) and shift the 'and' from line (c) to line (d). .</p>	Change made
Condition 1.2.8, Table 1.2.8 row 1-3, column 3	<p>Further information provided on burners:</p> <p>Retrofit eight gas burners (Tangentially fired, air/gas mixing for low NOx, tilting mechanism and manufactured by John Zink Hamworthy Combustion)</p>	Change made
Condition 1.2.8, Table 1.2.8 row 1-3, column 3	<p>Further information provided on burners:</p> <p>Retrofit eight gas burners (Tangentially fired, air/gas mixing for low NOx, tilting mechanism and manufactured by John Zink Hamworthy Combustion)</p>	Change made
Condition 1.2.8, Table 1.2.8, row 3, column 4	<p>Typographical error identified:</p> <p>Replace "<i>A3 in Map of emissions Points in Schedule 1</i>" With "<i>A2 in Map of emissions Points in Schedule 1</i>".</p>	Change made

Condition	Summary of applicant's comment	Department's response
Condition 1.2.8, Table 1.2.8, row 2, column 5	Add "if required" after December 2024. Boiler 1 may not require conversion	Change not made as this was part of the works applied for under the Amendment. The Applicant was advised they could apply to amend the licence to remove these works if the company changed its position in relation to these works. A change to completion timeframe was made from December 2024 to December 2027.
Condition 1.2.8, Table 1.2.8, row 3, column 5	Add "if required" after December 2029. Boiler 2 may not require conversion	Change not made as this was part of the works applied for under the Amendment. The Applicant was advised they could apply to amend the licence to remove these works if the company changed its position in relation to these works.
Condition 1.2.8, Table 1.2.8 row 4, column 3	Delete row 4 of Table 1.2.8 - Gas pressure reduction station (Infrastructure number 4).	Removed as already constructed
Condition 1.2.8, Table 1.2.8 row 5, column 3	Delete row 5 of Table 1.2.8 - Natural gas supply piping and instrumentation (Infrastructure number 5).	Removed as already constructed
Condition 1.2.9	Typographical error: The condition refers to a 'works approval holder' and should say "licence Holder"	Change made
Condition 1.2.10	Typographical error: Numbering (letter) bullets to start at 'a'.	
Condition 1.2.10 (d)	Replace " <i>certification by an independent Civil Engineer</i> " With " <i>certification by an independent Chemical/Electrical Engineer</i> "	Change made
Condition 2.2.1, Table 2.2.1 row 1, column 4 Condition 2.2.1, Table 2.2.1 row 2, column 4	The electrostatic precipitator is not required once a boiler is gas fired. Therefore Replace " <i>Coal Fired Power Station Boiler; or Gas-fired boilers with low NOx burners (Please specify type of burners if known) Unit 1 via Electrostatic Precipitator</i> ".	Change made

Condition	Summary of applicant's comment	Department's response												
Condition 2.2.1, Table 2.2.1 row 3, column 4	With "Coal Fired Power Station Boiler Unit 1 via Electrostatic Precipitator; or Gas-fired boilers with low NOx burners (Tangentially fired, mixed low NOx nozzle with a tilting mechanism burners)													
Section 3.2, Table 3.2.1, row 9, all columns	<p>PM₁₀ monitoring requirements (same) have been listed twice for emissions points A1-A3 and A5-A10.</p> <p>It should also be noted that it is anticipated that CEMS and Quarterly stack testing for PM₁₀ would not be required once a boiler has been converted and operating using natural gas.</p> <p>Delete the following row in Table 3.2.1:</p> <table border="1" data-bbox="528 571 1357 708"> <tr> <td data-bbox="528 571 667 624">A1 - A3</td> <td data-bbox="667 571 804 624">PM10</td> <td data-bbox="804 571 943 624">mg/m³</td> <td data-bbox="943 571 1081 624">Stack test (minimum 60 minute average)</td> <td data-bbox="1081 571 1220 624">Annual</td> <td data-bbox="1220 571 1357 624">USEPA Method 201A</td> </tr> <tr> <td data-bbox="528 624 667 708">A5 - A10</td> <td data-bbox="667 624 804 708"></td> <td data-bbox="804 624 943 708">g/s</td> <td data-bbox="943 624 1081 708"></td> <td data-bbox="1081 624 1220 708"></td> <td data-bbox="1220 624 1357 708"></td> </tr> </table>	A1 - A3	PM10	mg/m ³	Stack test (minimum 60 minute average)	Annual	USEPA Method 201A	A5 - A10		g/s				Change to condition removed upon further advice from Licence Holder (4 May 2023).
A1 - A3	PM10	mg/m ³	Stack test (minimum 60 minute average)	Annual	USEPA Method 201A									
A5 - A10		g/s												
NA Decision Report	Replace "South32" With "Worsley Alumina". Throughout document	Change not made as South 32 Pty Ltd is the occupier of the Premises.												
NA Decision Report	Typographical error- Table of Contents, List of Tables - Table numbers are not in numerical order (should be Table 1 - Table 5).	Change made												
NA Decision Report	The Decision Report should refer to "natural gas" throughout as required, to avoid confusion with other forms of gas such as LNG. This should be updated through the entirety of the document.	Changes made												
NA Decision Report	Replace " <i>Although this conversion project represents a fraction of the sites total energy generating capacity, it enables the company the capability of sourcing most of their 260 MW energy requirements from LNG at any one time. The company advises that the current works to gas are a short-term interim measure as part of a larger long-term goal of decarbonising their operations, including at the Worsley Alumina Refinery. This BCGCP also has the added benefits of minimising the environmental and financial costs associated with interstate or international coal transportation, as Western Australia is a significant producer of LNG.</i> "	Changes to wording accepted in part.												

Condition	Summary of applicant's comment	Department's response
	<p><i>With "Although this conversion project represents a fraction of the sites total energy generating capacity, it enables the company the capability of sourcing most of their 1570 MW energy requirements from natural gas at any one time. The current works to gas are a short-term interim measure as part of a larger long-term goal of de-carbonising their operations, including at the Worsley Alumina Refinery. The BCGCP also has the added benefits of minimising the environmental and financial costs associated with interstate or international coal transportation, as Western Australia produces natural gas."</i></p>	