



# AIR QUALITY AND GHG MANAGEMENT PLAN

**SOUTH32 WORSLEY ALUMINA**  
**JANUARY 2023**

# Air Quality and GHG Management Plan

## Business Blueprint



Worsley Alumina

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## 1. PURPOSE

### Intent

This Environmental Management Plan (EMP) has been prepared to describe strategies and procedures which have been implemented to ensure that South32 Worsley Alumina Pty Ltd (Worsley) complies with its obligations and objectives in regard to air quality.

This EMP consolidates current management practices and addresses commitments included in previous approval Instruments, namely Ministerial Statement No. 719 (MS719).

The design of this plan, and associated monitoring program, is to meet the requirements of the South32 Environment Standard through the following management objectives:

- Ability to detect emissions trends at the earliest possible opportunity
- Ability to rapidly detect and respond to any environmental impact associated with operational activities;
- Ensure compliance with legal obligations; and
- Determine whether current controls are effective.

## 2. SCOPE

### Scope Overview

The scope of this document includes activities at the Worsley Alumina Refinery (Refinery). Regarding air quality, this includes activities relating to ambient air quality, process emissions, fugitive emissions and greenhouse gases.

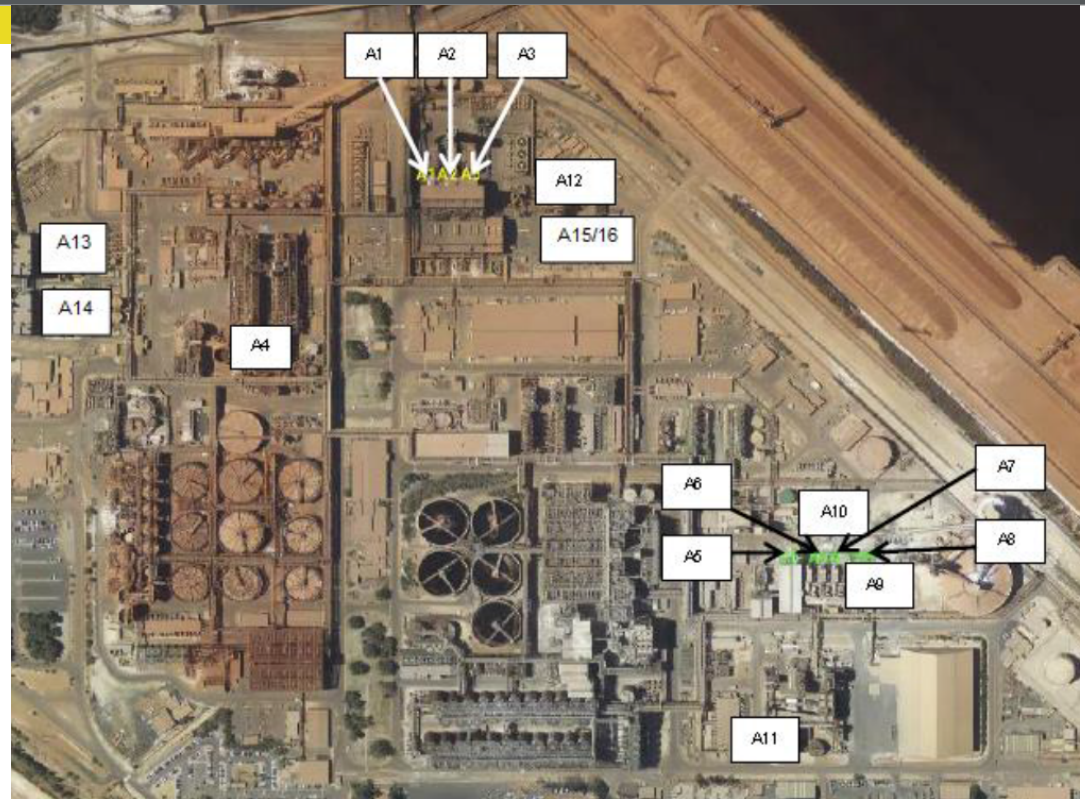
## 3. PROPOSAL

### Proposal Outline

The Worsley Alumina Refinery turns crushed bauxite into alumina via the Bayer process. For the purposes of considering air quality at the refinery, this process consists of:

- Power generation
- Process areas
- Bauxite Residue Disposal Areas (BRDAs).

**Figure 1: Map of Refinery Emission Points**



<b>A1-3:</b> Coal/gas fired power station, boilers 1-3	<b>A4:</b> Digestion RTO
<b>A5-10:</b> Calciners 1-6	<b>A11:</b> Liquor Burner
<b>A12:</b> Gas-fired cogeneration plant (not in use)	<b>A13-14:</b> MFC boilers 5,6
<b>A15-16:</b> Packaged Boilers (gas) 4,5	

## 4. AIR QUALITY

### 4.1. DESCRIPTION OF OPERATIONS

#### Power Generation

Facilities used for the generation of power and steam are contained within the refinery lease area. These produce point source gaseous and particulate emissions, including greenhouse gas (GHG). Power generation facilities which are currently utilised include:

- Coal/gas-fired Power Station or “Powerhouse” (boilers 1,2,3; stacks A1-A3);
- Multi Fuel Cogeneration Power Plant (MFC) (boilers 5,6; stacks A13 & A14);
- Packaged Boiler (gas boilers) stacks A15 and A16.

These facilities are run on a continuous basis (24 hours a day). The extent of the air emissions from these facilities is strongly dependent upon unit operating capacity, fuel feed quality (coal / gas / biomass) and operational performance of scrubbing systems<sup>1</sup>. Through the burning of coal and gas, this area of the Refinery is the principal contributor to the Refinery’s GHG emissions (figure 3).

<sup>1</sup> Pollution control equipment is fitted to power generation facilities - boilers 1, 2 & 3 are fitted with ESPs (Electrostatic Precipitators) and boilers 5 & 6 with bag houses (used in conjunction with lime sand addition).

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<b>Process Areas</b>	<p>The refinery processes bauxite to alumina via the Bayer process. Point source air emissions occur throughout the Bayer process, these source points are represented by the following activities:</p> <ul style="list-style-type: none"><li>• Digestion (via RTO units 1 &amp; 2; stack A4)</li><li>• Calcination (calciners 1-6; stacks A5-A10)</li><li>• Liquor Burning (single burner; stack A11)</li></ul> <p>These facilities are run on a 24hr basis. Digestion and Calcination are gas-fired facilities and therefore contribute to the Refinery's GHG emissions (figure 3).</p>
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<b>BRDAs</b>	<p>The Bauxite Residue Disposal Areas (BRDAs) represent the largest source of fugitive particulate emissions at the refinery. Other sources include material handling and stockpiling facilities (see <a href="#">Appendix A</a>). The BRDAs are considered the primary source of fugitive particulate emissions because they represent most of the cleared land area within the refinery lease. BRDA facilities at the refinery are referenced in Figure 1.</p>
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## 4.2. EXISTING ENVIRONMENT

<b>Refinery Operations</b>	<p>The refinery sits within state forest, proximal to the coal-mining town of Collie. The air quality of the existing environment is gauged by ambient air monitoring at off-site locations, affected by external factors such as bushfires, local traffic and pre-existing industrial and domestic premises in the Collie area.</p>
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## 4.3. POTENTIAL IMPACTS

<b>Summary of Impacts</b>	<p>Air emissions associated with bauxite-alumina refining and associated site activities are known to have potentially serious impacts if not well controlled. In general, a reduction in air quality via excess emissions (whether particulate or gaseous) is known to impact upon human health as well as the health of proximal fauna and flora. Greenhouse gas emissions also contribute to a cumulative, long-term impact on the environment. From an amenity basis, fugitive particulate emissions (dust, PM10) from the BRDAs have the potential to pose more of a visual impact. With both health and environmental implications, the control and monitoring of air quality is paramount in the protection of the health and amenity of refinery employees and lease neighbours as well as the surrounding environment.</p>
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<b>Power Generation</b>	<p>Specific impacts on local air quality resulting from the use of power generating facilities include:</p> <ul style="list-style-type: none"><li>• Point source particulate emissions; which may result in excessive PM10 levels</li><li>• Point source gaseous emissions (including GHG); which may result in excessive air pollution</li></ul> <p>The dispersive nature of these emissions into the external environment means that they have the potential to impact upon the amenity of nearby residents, public recreational areas and natural ecosystems. Production from these facilities occurs on a 24hr basis and therefore public exposure to potential impacts from these point sources is continuous.</p>
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<b>Process Areas</b>	<p>Specific impacts on local air quality resulting from the use of power generating facilities include:</p> <ul style="list-style-type: none"><li>• Point source particulate emissions; which may result in excessive PM10 levels</li><li>• Point source gaseous emissions (including GHG); which may result in excessive air pollution</li></ul> <p>The dispersive nature of these emissions into the external environment means that they have the potential to impact upon the amenity of nearby residents, public recreational areas and natural ecosystems. Production from these facilities occurs on a 24hr basis and therefore public exposure to potential impacts from these point sources is continuous.</p>
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<b>BRDAs</b>	<p>Any impacts on air quality arising from the BRDAs will result from fugitive particulate emissions (dust).</p>
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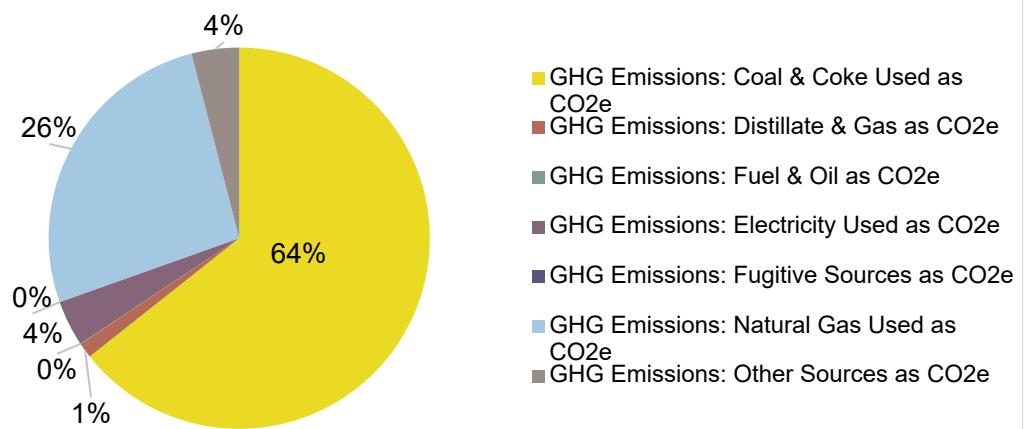
- Dust arising from the BRDAs may result in excessive PM10 levels

Similarly, fugitive particulate emissions may arise from material handling arounds site, although the volume produced from the BRDAs is much more likely to impact air quality.

### GHG Impacts

The impact of GHG emissions from the refinery will come predominantly from the burning of coal and coke during power and steam generation. Natural gas combusted in the process areas (digestion and calcination) is also a key contributor to the GHG emissions profile for the Refinery (see figure 2 for relevant percentages, measured over 5 years to 2018). GHG emissions from the licenced discharge point (existing common stack A1 to A3 as shown figure 1) are expected to reduce as each boiler is converted from coal to gas.

**Figure 2: % Contributions to GHG (CO2e) Emissions, 2013-2018**



## 5. CONDITION REQUIREMENTS

### 5.1. GOVERNING LEGISLATION

#### Ministerial Statement

Requirements for the management of air quality and greenhouse gas are legislated via sections 14 and 6 of [Ministerial Statement](#) 719 respectively. MS719 requires implementation of this management plan – inclusive of an emissions monitoring program, actions to control emissions and annual emissions reporting.

#### Environmental Licence

The Refinery operates under a [licence](#) issued by the DWER under Part V of the [Environmental Protection Act 1986](#). Conditions within the licence refer to prevention, reduction and control of emissions as well as associated monitoring and reporting (licence sections 2 & 3). Conditions in the licence are considered in parallel with those in MS719.

#### NGER Act

Under the [National Greenhouse and Energy Reporting Act 2007](#) (NGER Act), the Refinery must report annually on greenhouse gas emissions, energy production and energy consumption. Reports are produced for every financial year and are uploaded via the Emissions and Energy Reporting System (EERS).

Information provided through the NGER scheme provides the basis for assessment of liability under the [safeguard mechanism](#) - the safeguard mechanism forms part of the [Emissions Reduction Fund](#), a voluntary scheme (of which Worsley is a participant) incentivising facilities to reduce their emissions.

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### National Pollutant Inventory (NPI)

Under the [National Environment Protection \(National Pollutant Inventory\) Measure](#) or NEPM NPI, the Refinery must provide data on key emissions to the NPI on an annual basis. The need to report these metrics is detailed in the [EMP Provisions](#) section of this plan.

## 5.2. INTERNAL STANDARDS

### Environment Standard

The South32 Environment Standard forms the basis of all environmental activities performed at each operation and throughout the region. The Standard is formulated to minimise environmental impacts and to maintain controls against environmental risk. This is comprised of 5 key sections:

- Environmental Commitments
- Environmental Resources Management
- Energy & Emissions
- Water Resources
- Land, Biodiversity & Rehabilitation

The Environment Standard requires the Refinery to have a forecast for GHG emissions and, in parallel with that, to have a list of GHG abatement projects. These are maintained and updated in the Worsley Life of Operations Plan.

### Climate Change Strategy

South32's Climate Change Strategy aims to mitigate or adapt to climate change risks, take advantage of opportunities and support global action. In doing so, Emission Reduction is a key focus of the strategy, supported by these two targets:

- Short-term emission reduction target – to hold our Scope 1 emission profile at FY2015 baseline levels in FY2021.
- To conduct a five-yearly review of South32's approach to emission reductions (from 2021), in line with Intergovernmental Panel on Climate Change (IPCC) updated scientific reports. In doing this, to ensure that a pragmatic and affordable transition is made toward the global goal of achieving net zero scope 1 emissions by 2050.

## 6. RATIONALE AND APPROACH

### 6.1. SURVEY AND STUDY FINDINGS

#### Air Emissions Impact Assessment Project

The Air Emissions Impact Assessment (AEIA) Project (2008) was commissioned to examine the potential risks of Refinery emissions on the health of the workforce and on the health and amenity of the local community. Actions from this prompted an [improvement project](#) pipeline for air quality and the construction of an air emissions inventory.

GHG modelling was also conducted as part of the AEIA project. The results of which are included in the [AEIA report](#).

#### Air Emissions Inventory

Version 3 of the Air Emissions Inventory was completed upon the completion of the most recent expansion project (January 2018) and was a requirement of *Environmental Protection Act 1986* Licence L4504/1981/17 (condition 4.1.2 IR1).

The Version 3 inventory shows that material emissions are:

- Carbon Monoxide (CO)
- Sulphur Dioxide (SO<sub>2</sub>)



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- Nitrogen Dioxide (NO<sub>x</sub>)
- Particulates
- Odour
- Volatile Organic Compounds (VOCs)

### Field Odour Assessments

Worsley has conducted field odour surveys on both the 16 December 2007 and 17 January 2008. A separate VOC and odour monitoring campaign was conducted in autumn 2006 to determine the rate of emissions from the RCL and associated processes. Odour emission monitoring results are included in the Air Emissions Inventory (V2 and 3).

### Climate Change Modelling

Climate change modelling is integrated into planning and investment decisions at Worsley and comprises a major part of ongoing studies to ensure resilience to the physical impacts of climate change (changes in rainfall, temperature and extreme weather events).

Our climate modelling showed that there is a significant and likely ongoing drying trend in the South West of Western Australia. The forecast magnitude and timing of this trend will be used to develop future mitigation strategies including continuing efficiencies, recycling and reuse, or exploring different sources of water supply.

### Worsley Life of Operations Plan

Material GHG emissions are forecast within the Worsley Life of Operations Plan (LoOP). The forecast considers Scope 1 and Scope2 emissions through to 2021, as per South32's Climate Change Strategy. Short-term GHG considerations and updates to forecasting are held within Worsley's two-year budget – this ensures that short term operational planning is aligned with the LoOP and also that the long-term LoOP GHG forecast is regularly updated with data from the budget.

Forecast data for the identified production variables and associated emissions intensities are contained within the GHG forecast and help to drive the GHG improvement project pipeline. A potential pipeline of GHG abatement projects through to 2021 has already been identified through this process ([Appendix B](#)).

Net operational emissions include total Scope 1 and 2 emissions (calculated using methodologies and emissions criteria in the NGER Safeguard Mechanism Rule 2015, and adjusted to account for net emissions balance between import and export electricity between the Refinery and the SWIS (and may include electricity supplied through renewable energy power purchase agreements).

### Community Consultation

The Refinery Community Liaison Committee (CLC) was formed to provide an opportunity, amongst other things, for community feedback on environmental impacts (noise, dust, etc.) and the operation's mitigation of such impacts, through environmental monitoring programs and investigations. The CLC is independently chaired by a Community member and meets quarterly.

The CLC has an interest in the development and implementation of air quality issues and provides a key communication channel with the local community. The CLC helps in the development of communications with stakeholders.

The refinery CLC has representation from the following organisations / communities:

- Independent Chair from Collie Community
- Shire of Collie
- Shire of Harvey
- Shire of Dardanup
- City of Bunbury
- Collie Chamber of Commerce
- Bunbury Chamber of Commerce
- South West Development Commission
- Department of Parks and Wildlife

- Department of Education WA
- Ngalang Boodja Aboriginal Corporation
- Chamber of Minerals and Energy WA
- Special Interest Groups (Environment, Employment, Education, Social Welfare)
- Community nominees (Collie, Capel and Brunswick)
- Worsley representatives.

### 6.2. KEY IMPROVEMENT PROJECTS / FUTURE SURVEYS

#### BRDA Dust Suppression Trials

The Refinery has an ongoing investigation into the use of different dust controls in the BRDA areas. This includes testing the factors for significant dust creation and the effects of different dust suppressant products. Using a combination of dust suppressant and ripping of the BRDA surface, the project aims to find a more effective way to manage dust creation from the BRDAs.

#### Collie Airshed

The Collie Airshed Study aims to establish a reliable database and accompanying model with which to analyse Sulphur Dioxide emissions from coal fired power stations in the Collie area and surrounds. The intent is that a verified model will establish a reliable scientific foundation on which to formulate an airshed management strategy. The study is being undertaken by Worsley in conjunction with local coal-fired power stations and in consultation with the DWER. The Collie Airshed Study was completed in 2021 and is currently under review by the DWER Air Quality Branch.

#### Worsley Decarbonisation Concept Study

Concept level assessment has been completed, defining a potential pathway to carbon neutrality by 2050 for Worsley.

The next step is to take the short-listed 'short-medium term' decarbonisation initiatives through to study (FY20) to firm up investment case for execution from FY21/22 onwards.

The current focus (FY20/21) to remain on building confidence and supply capability with biomass, targeting up to 90 ktpa per annum.

### 6.3. MANAGEMENT APPROACH – CONTROL OF EMISSIONS

#### Power Generation

Controls enacted on emissions from the Powerhouse and MFC are threefold:

- Emissions release is negated through operation and maintenance of the pollution control equipment – ESPs and baghouses;
- Continuous monitoring of emissions data via CEMS (see [Section 7.2.1](#)) is undertaken through the central control room. Alarms and alerts notify of emission levels;
- Feed control: Feed rate of raw materials may be altered in reaction to continuous emissions monitoring.

#### Process Areas

Area specific management of emissions is detailed via controls in [Section 7.2.2](#). In general, controls are similar to those of Power Generation:

- Emissions release is negated through operation and maintenance of the pollution control equipment – RTOs, ESPs and baghouses;
- Continuous monitoring of emissions data via CEMS is undertaken through the central control room. Alarms and alerts notify of emission levels.

#### BRDAs

Daily management of the BRDAs includes processes to both mitigate and to control dust production:

- Ploughing and ripping of BRDA surface;
- Use of water carts and sweeping in dry weather;
- Use of dust suppressants.

### 6.4. RATIONALE FOR CHOICE OF PROVISIONS

#### Summary

The Refinery air quality monitoring program is driven by licensing conditions and by [internal standards](#). These documents should ensure that we minimise the impact of air emissions on the environment and surrounding communities. As previous surveys and projects have informed the current monitoring program, so future surveys and air quality analysis should aim to continuously improve the monitoring and management of air quality at the refinery. Therefore, it should be expected that the monitoring regime as laid out here will change over time.

With regards to GHG, rationale for provisions is continuously updated via the 2 year budget and five year plan within the LoOP. The provisions for GHG will look to offset and abate GHG emissions, again informed both by previous studies and by future studies.

## 7. EMP PROVISIONS

### 7.1. MONITORING EQUIPMENT

#### Summary

Monitoring equipment installed at the Refinery is currently comprised of:

- Continuous Emissions Monitoring Systems (CEMS); and
- Ambient Air Quality Particulate Monitors (various).

Equipment should be sited, installed, maintained and removed in accordance with governing legislation for air quality at the Refinery; any amendments to the monitoring equipment should be made to best provide accurate information for assessing air quality impacts. Equipment maintenance regimes and calibration procedures should be recorded and logged for assurance purposes.

### 7.2. POINT SOURCE MONITORING

#### 7.2.1. POWER GENERATION

**Table 1: Coal/gas-fired Power Station (boilers 1, 2 & 3)**

Parameter	Target <sup>2</sup>	Control Actions	Monitoring Program	Reporting
SO <sub>2</sub>	2200 mg/m <sup>3</sup>	Independent NATA certified laboratory to monitor sulphur content of coal	Quarterly stack test & CEMS	Exceedances are reported to the DWER (as per licence conditions) and logged as an Isometrix event
CO	88 mg/m <sup>3</sup>	Optimise combustion conditions, assess emission trends	Quarterly stack test & CEMS	
NO <sub>x</sub>	990 mg/m <sup>3</sup>	Optimise combustion conditions, assess emission trends	Quarterly stack test & CEMS	
Fluoride	4.8 mg/m <sup>3</sup>	Assess emission trends	Quarterly stack test	
Mercury	-	Assess emission trends	Biannual stack test	Values included in NPI reporting
Metals	-	Annual testing for NPI	Yearly stack test	Values included in NPI reporting
Total VOCs	-	Annual testing to assess trends	Yearly stack test	Values included in NPI reporting
Particulates	150 mg/m <sup>3</sup>	<ul style="list-style-type: none"> <li>• maintain ESPs and assess emission trends;</li> <li>• notify CEO in writing 7 days prior to commencement</li> </ul>	Quarterly stack test & CEMS	Exceedances are reported to the DWER (as per licence

<sup>2</sup> Refer to sections 2 & 3 of Refinery Environmental Licence for reference on units of measurement.

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of annual CEMS calibration curve correlation and send calibration certificate once complete

conditions) and logged as an Isometrix event

**Table 2: MFC (boilers 5&6)**

Parameter	Target	Control Actions	Monitoring Program	Reporting
SO <sub>2</sub>	600 mg/m <sup>3</sup>	<ul style="list-style-type: none"> <li>independent NATA certified laboratory to monitor sulphur content of coal;</li> <li>maintain feed of limestone; and</li> <li>maintain accuracy via a Relative Accuracy Test Audit (RATA)</li> </ul>	CEMS	Exceedances are reported to the DWER (as per licence conditions) and logged as an Isometrix event
CO	100 mg/m <sup>3</sup>	<ul style="list-style-type: none"> <li>Optimise combustion conditions;</li> <li>assess emission trends; and</li> <li>maintain accuracy via RATA</li> </ul>	CEMS & quarterly stack test	
NO <sub>x</sub>	500 mg/m <sup>3</sup>	<ul style="list-style-type: none"> <li>Optimise combustion conditions;</li> <li>assess emission trends; and</li> <li>maintain accuracy via RATA</li> </ul>	CEMS & quarterly stack test	
Fluoride	2.0 mg/m <sup>3</sup>	Assess emission trends	Quarterly stack test	
Mercury	-	Assess emission trends	Bi-annual stack test	
Metals	-	Annual testing for NPI	Yearly stack test	Values included in NPI reporting
Total VOCs	-	Annual testing to assess trends	Yearly stack test	Values included in NPI reporting
Particulates	80 mg/m <sup>3</sup>	<ul style="list-style-type: none"> <li>operate and maintain baghouses;</li> <li>assess emission trends;</li> <li>maintain accuracy via RATA; and</li> <li>notify CEO in writing 7 days prior to commencement of annual CEMS calibration curve correlation and send calibration certificate once complete</li> </ul>	Quarterly stack test & CEMS	Exceedances are reported to the DWER (as per licence conditions) and logged as an Isometrix event

### 7.2.2. PROCESS AREAS

**Table 3: Digestion (via RTO units 1 & 2)**

Parameter	Target <sup>2</sup>	Control Actions	Monitoring Program	Reporting
CO	100 mg/m <sup>3</sup>	<ul style="list-style-type: none"> <li>optimise operating conditions and operate and maintain RTOs; and</li> <li>assess emission trends</li> </ul>	Quarterly stack test	Exceedances are reported to the DWER (as per licence conditions) and logged as an Isometrix event
Benzene	3.5 mg/m <sup>3</sup>			
Mercury	67.2 mg/m <sup>3</sup>			
Acetaldehyde	7 mg/m <sup>3</sup>			
Formaldehyde	6.3 mg/m <sup>3</sup>			
Metals	-	Annual testing for NPI	Yearly stack test	Values included in NPI reporting
Total VOCs	-	Annual testing to assess trends	Yearly stack test	Values included in NPI reporting
Temperature	700 °C	Maintain average temperature of RTO beds above target temperature. If temperature falls below this, initiate shut down of RTO unit	Continuous	-

**Table 4: Calciners (units 1-6)**

Parameter	Target	Control Actions	Monitoring Program	Reporting
CO	330 mg/m <sup>3</sup> (c1-5)	<ul style="list-style-type: none"> <li>optimise operating conditions and</li> </ul>	Quarterly stack test &	Exceedances are reported

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	120 mg/m <sup>3</sup> (c6)	operate and maintain ESPs (calciners 1-5) & baghouse (calciner 6); • assess emission trends; and • maintain accuracy via RATA	CEMS	to the DWER (as per licence conditions) and logged as an Isometrix event
NO <sub>x</sub>	220 mg/m <sup>3</sup>			
Benzene	2 mg/m <sup>3</sup>			
Acetaldehyde	14.4 mg/m <sup>3</sup>			
Formaldehyde	11.5 mg/m <sup>3</sup>			
Mercury	-	Annual testing for NPI	Yearly stack test	Values included in NPI reporting
Metals	-	Annual testing for NPI	Yearly stack test	Values included in NPI reporting
Total VOCs	-	Annual testing to assess trends	Yearly stack test	Values included in NPI reporting
Particulates	250 mg/m <sup>3</sup> (c1-4) 150 mg/m <sup>3</sup> (c5) 80 mg/m <sup>3</sup> (c6)	• operate and maintain ESPs (calciners 1-5) & baghouse (calciner 6); • assess emission trends; • maintain accuracy via RATA; and • notify CEO in writing 7 days prior to commencement of annual CEMS calibration curve correlation and send calibration certificate once complete	Quarterly stack test & CEMS	Exceedances are reported to the DWER (as per licence conditions) and logged as an Isometrix event

**Table 5: Liquor Burner (via RTO)**

Parameter	Target	Control Actions	Monitoring Program	Reporting
CO	100 mg/m <sup>3</sup>	<ul style="list-style-type: none"> <li>operate and maintain RTO &amp; wet scrubber;</li> <li>operate and maintain baghouses – if failure of 3+ baghouse cells is identified, immediate shut down of liquor burner is required;</li> <li>assess emission trends;</li> <li>maintain accuracy via RATA; and</li> <li>notify CEO in writing 7 days prior to commencement of annual CEMS calibration curve correlation and send calibration certificate once complete</li> </ul>	Quarterly stack test (all) & CEMS (CO only)	Exceedances are reported to the DWER (as per licence conditions) and logged as an Isometrix event
NO <sub>x</sub>	245 mg/m <sup>3</sup>			
Benzene	3.5 mg/m <sup>3</sup>			
Acetaldehyde	7 mg/m <sup>3</sup>			
Formaldehyde	6.3 mg/m <sup>3</sup>			
Mercury	-	Annual testing for NPI	Yearly stack test	Values included in NPI reporting
Metals	-	Annual testing for NPI	Yearly stack test	Values included in NPI reporting
Total VOCs	-	Annual testing to assess trends	Yearly stack test	Values included in NPI reporting

### 7.3. FUGITIVE PARTICULATE EMISSION MONITORING

**Table 6: BRDAs & Other<sup>3</sup>**

Parameter	Target	Control Actions	Monitoring Program	Reporting
Particulates	50µg/m <sup>3</sup> (pm10)	<ul style="list-style-type: none"> <li>alternate ploughing &amp; deep ripping;</li> <li>dust-suppression trials and develop / implement subsequent BRDA dust suppression program;</li> <li>use of sweeping and water carts in dry conditions;</li> </ul>	Continuous monitoring at licence boundary (4XNW, 5S, Hamilton); ongoing opportunistic observations for visual airborne dust	PM10 is monitored at the licence boundary (according to NEPM standard) and is reported in the AER

<sup>3</sup> The BRDAs represent the majority of fugitive particulate emissions, other sources include roads, tracks and construction areas as well as areas of material handling.

		<ul style="list-style-type: none"> <li>• operate and maintain enclosed load-out facility; and</li> <li>• operate and maintain train washdown facility</li> </ul>		
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### 7.4. AMBIENT AIR MONITORING

**Table 7: Ambient Air Reference Station**

Parameter	Target <sup>2</sup>	Control Actions	Monitoring Program	Reporting
SO <sub>2</sub>	200ppb	<ul style="list-style-type: none"> <li>• maintain ambient station</li> <li>• limit point source emissions</li> </ul>	Continuously monitored at point J; also to be monitored as part of the Collie Airshed, until completion of the data capture period	Reported within the scope of the Collie Airshed through provision of data

## 8. ADAPTIVE MANAGEMENT AND REVIEW OF THE EMP

### Compliance Auditing

Worsley will report on its compliance with this Air Quality Management Plan (AQMP) and with MS719 generally, at the end of every fiscal year and covering the preceding twelve-month period in the Annual Environmental Report. The AQMP will be fully audited and reviewed every three years and a performance assessment conducted every five years, in accordance with Conditions 6 & 14 of MS719. Worsley will submit the annual compliance reports no later than 30 September each year.

### Document Review

Worsley will review and revise the AQMP as necessary in-line with the following criteria:

- On a three-yearly basis;
- When major changes occur to the project or its operations;
- In response to licence changes;
- In response to issues raised by the DWER;
- In response to issues raised through the Community Liaison Committee;
- In response to any incident which results in a failure to meet any of the commitments of this EMP; or
- In response to significant changes or improvements in technology.

Due to the relationship between this Management Plan and MS719, any changes to the management measures described in the plan must remain consistent with the requirements of MS719. Additionally, the applicable regulator must be notified of any changes to the plan.

### Reporting

Worsley is required as part of its environmental licence to provide the DWER with an annual monitoring report by 30 September. This report contains a summary of data collected from 1 July of the preceding year to 30 June of the reporting year and includes a discussion of the monitoring data and other collected data and related to historical data (trend analysis), known standards, and targets set in the licence. The number of verified complaints is also reported.

Additionally, the Refinery must provide the following on an annual basis:

- Data on key emissions to the National Pollutant Inventory (NPI); and
- A report on greenhouse gas emissions, energy production and energy consumption – submitted to the EERS in accordance with the NGER act.

Reporting will also be conducted (as required) in the event of a non-compliance, in accordance with the Environmental Licence.

### Complaints

Any complaints regarding air quality are recorded and tracked in accordance with an internal complaints procedure, which requires follow-up and response to all complaints. Complaints are reported in the Annual Environmental Report. The internal complaints procedure is reviewed on a regular basis.

## 9. STAKEHOLDER CONSULTATION

### Ongoing

Worsley maintains ongoing consultation with key government agencies through the Environmental Management Liaison Group (EMLG). EMLG members include; Department of Jobs, Tourism, Science and Innovation (DJTSI), Department of Biodiversity, Conservation and Attractions (DBCA), Department of Water and Environmental Regulation (DWER), Department of Mines, Industry Regulation and Safety (DMIRS), Department of Primary Industries and Regional Development (DPIRD).

Stakeholder engagement is ongoing with the Community Liaison Committees (CLC), which include representatives from local Shires and conservation groups.

## 10. DEFINITIONS, TERMS AND ABBREVIATIONS

Term	Description
AEIA	Air Emissions Impact Assessment Project
AQMP	Air Quality Management Plan
BRDA	Bauxite Residue Disposal Area
CEO	Chief Executive Officer
CLC	Community Liaison Committee
CO	Carbon monoxide
CO <sub>2</sub> e	Carbon dioxide equivalent
CEMS	Continuous Emission Monitoring System
DWER	Department of Water and Environment Regulation
EMP	Environmental Management Plan
EERS	Emissions and Energy Reporting System
ESP	Electrostatic Precipitator
GHG	Greenhouse Gas(es)
Ha	Hectare(s)
Hr(s)	Hour(s)
IPCC	Intergovernmental Panel on Climate Change
LoOP	Life of Operations Plan
MFC	Multi Fuel Cogeneration Power Plant
mg/m <sup>3</sup>	milligram per cubic metre
MS719	Ministerial Statement 719
Mtpa	Million tonnes per annum
NATA	National Association of Testing Authorities

# Air Quality and GHG Management Plan

## Business Blueprint



Worsley Alumina

Term	Description
NEPM	National Environment Protection Measure
NGER	National Greenhouse and Energy Reporting
NO <sub>x</sub>	Oxides of Nitrogen
NPI	National Pollutant Inventory
PM10	Particulate Matter <10 microns
ppb	parts per billion
RATA	Relative Accuracy Test Audit
Refinery	Worsley Alumina Refinery
RCL	Refinery Catchment Lake
RTO	Regenerative Thermal Oxidiser
SO <sub>2</sub>	Sulphur dioxide
TEOM	Tapered Element Oscillating Microbalance
µg/m <sup>3</sup>	microgram per cubic metre
VOC	Volatile Organic Compounds
Worsley	South32 Worsley Alumina Pty. Ltd

## 11. REFERENCES

	<a href="#">MS719</a>
	<a href="#">Environmental Licence</a>
	<a href="#">Climate Change Strategy</a>
	<a href="#">Environment Standard</a>
External Reports	<ul style="list-style-type: none"> <li>• Strategen 2005, Air Emissions Impact Assessment Report - Mid-Term Progress Report, Prepared for Worsley Alumina Pty Ltd, Leederville Western Australia, December 2005.</li> <li>• ChemSearch Consulting Pty Ltd (ChemSearch) 2007, Worsley Alumina Pty Ltd Air Emissions Impact Assessment Project – Air Emissions Inventory (Version 2), Prepared for Worsley Alumina Pty Ltd, Woodlands, Western Australia, March 2007.</li> <li>• Environmental Alliances Pty. Ltd. (ENVALL) 2018, South32 Worsley Alumina Refinery Air Quality Assessment for Proposed Production Increase to 5.1MTPA – Air Emissions Inventory (Version 3), Prepared for South32 Worsley Alumina Pty. Ltd., January 2018.</li> </ul>



## 12. DOCUMENT CONTROL

### Reviewer Circulation

Role	Name	Endorsed	Date
Environment Supervisor	Craig Kimpton	✓	21 12 2022

### Approval Circulation

Role	Name	Approved	Date
Environment, Heritage and Approvals Manager	Claire Reid	✓	16 01 2023

## 13. APPENDICES

### 13.1. APPENDIX A: OTHER SOURCES OF FUGITIVE PARTICULATE EMISSIONS

Table 8: Other Sources of Fugitive Emissions

Source	Parameter	Control Actions	Monitoring
Roads, tracks and construction areas	Particulates	Implement dust suppression techniques during dry conditions – includes sweeping and application of water from water carts	Opportunistic observations for airborne dust
Bauxite Reclaimers	Particulates	Stockpiles constructed as to minimise dust creation	Opportunistic observations for airborne dust
Alumina load-out facility	Particulates	Operate and maintain enclosed load-out facility with telescopic loading hoods and dust extraction system to baghouse; operate and maintain train washdown facility	Opportunistic observations for airborne dust
Stockpiles	Particulates	Stockpiles constructed as to minimise dust creation	Opportunistic observations for airborne dust

# Air Quality and GHG Management Plan

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Worsley Alumina

**Figure 3: Map of Exposed Areas (with potential for dust creation)**



## 13.2. APPENDIX B: WORSLEY GHG ABATEMENT PROJECTS

The below table contains the current projects list developed for the Worsley operation associated with the FY23-FY29 public target period.

**Table 9: GHG Abatement Project Pipeline**

Goal / Period	Project Abatement	Notes
FY23 – FY29	Boiler Coal to Gas Conversion Project	<ul style="list-style-type: none"> <li>• Conversion of the three boilers over three stages:                             <ul style="list-style-type: none"> <li>○ Stage 1: Boiler 3 (A3) – expected Q2 2023</li> <li>○ Stage 2: Boiler 1 (A1) – expected Q4 2023 (indicative only).</li> <li>○ Stage 3: Boiler 2 (A2) – expected 2024-2029 (indicative only).</li> </ul> </li> </ul>