Wagerup Alumina Refinery – Production to a Maximum Capacity of 4.7 Million Tonnes Per Annum and Associated Bauxite Mining Ministerial Statements 728 and 1069

Request for Section 46 Review of Conditions

Final Report

Prepared for
Alcoa World Alumina Australia
by Strategen-JBS&G

October 2019

www.jbsg.com.au

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October 2019

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Client: Alcoa World Alumina Australia

Report Version	Revision No.	Purpose	Strategen-JBS&G author/reviewer	Submitted to Client	
				Form	Date
Preliminary Draft Report	R001	Internal Review	Kim Taylor / Kane Moyle	N/A	N/A
Draft Report	R002	Client Review	KT / Diane Dowdell	Email	2 April 2019
Draft Report	R003	Client Review	KT / DD	Email	7 May 2019
Draft Report	R004	Client Review	KT / KM / DD	Email	20 June 2019
Draft Report	R005	Client Review	KT / KM / DD	Email	12 August 2019
Final Draft Report	R006	Final Client Review	KT / KM / DD	Email	22 August 2019
Final Report	R007	Final Report	KT/ KM / DD / Simon Butterworth	Email	2 Sept 2019
Final Report	R008	Final Report	KT/ KM / DD / Simon Butterworth	Email	17 Oct 2019

Executive Summary

In 2004, Alcoa World Alumina Australia (Alcoa) referred a revised proposal for the Wagerup alumina refinery to increase production from 2.4 million tonnes per annum (Mtpa) up to 4.7 Mtpa. At the time it was considered optimal for expansion of the refinery to occur in one stage, through construction of a Third Production Unit.

The revised proposal was approved with conditions set in Ministerial Statement 728 (MS 728) issued in 2006. MS 728 has since been amended by MS 1069 but the conditions are still based essentially on a refinery expansion occurring in one stage to 4.7 Mtpa through a Third Production Unit.

Pursuant to the existing conditions and Part V licencing provisions of the Environmental Protection Act 1986 (EP Act), since the issue of MS 728 production from the refinery has been increased in two small increments to 2.85 Mtpa primarily by increasing efficiency and yield of existing equipment.

It is not currently practical to expand the refinery from the existing production of 2.85 Mtpa to 4.7 Mtpa through the construction of a single-stage Third Production Unit.

Alcoa is therefore seeking changes to the Ministerial conditions to permit production of the refinery to be increased in increments, with an initial increase in production to 3.3 Mtpa. Further increments to increase production to a maximum capacity of 4.7 Mtpa would proceed later, subject to future planning.

In seeking to amend the existing conditions to permit increments of increase in production, Alcoa proposes that the fundamental principles of the existing conditions applying to the expansion to 4.7 Mtpa would be maintained. These include:

1. Works will be undertaken to ensure there is no overall increase in emissions of Volatile Organic Compounds (VOC) or odour from the refinery.
2. A Detailed Design Report will be prepared setting out details of the emission control measures for expansion works and will be subject to review by an Independent Design Review Team where required.
3. Air dispersion model validation will be undertaken using the latest available meteorological data, emissions data and modelling parameters for each expansion.
4. An Air Quality Verification Plan, setting out emissions verification monitoring will be prepared for each expansion.
5. A Noise Management Plan will be prepared if required to set out how noise associated with expansion works will be managed to comply with the approved noise levels for the refinery.

A key issue in the Environmental Protection Authority's (EPA) assessment of the revised proposal for the Third Production Unit (EPA Bulletin 1215) was the potential for emissions from the expansion to cause health impacts.

Comprehensive studies and investigations carried out as part of the assessment showed that predicted and measured ground level concentrations of compounds emitted from the refinery met established national and international air quality health standards.

A peer reviewed Health Risk Assessment (HRA) also indicated that predicted ground level concentrations should not result in chronic health impacts or increased cancer risk to the surrounding community. Even with conservative assumptions and uncertainty estimates applied, the HRA indicated ground level concentrations of pollutants should not cause adverse health impacts.

Consistent with this, the EPA found that refinery expansion to 4.7 Mtpa should not pose an increased public health risk for the general community.

However, the EPA concluded that periodic occurrences of short-term ground level concentrations under certain meteorological conditions may lead to health symptoms in certain individuals susceptible to chemical sensitivities. The EPA therefore recommended that if the refinery expansion proceeded, a process should be put in place *"to enable people who have concerns regarding chemical sensitivity symptoms to relocate from the area without disadvantage"*.

At the time, Alcoa had an existing property purchase program (the Land Management Plan) to purchase properties in certain locations in proximity to the refinery, referred to as Areas A and B. In line with the EPA's recommendation, following the issue of MS 728, Alcoa implemented a further substantial property purchase program, referred to as the Supplementary Property Purchase Program. This program was administered by an independent State Government appointed Administrator and enabled any property owners outside of the existing Land Management Plan areas to also sell their properties to Alcoa if they had concerns regarding the existing refinery operations or Third Production Unit expansion. Through these property purchase programs Alcoa has now acquired a substantial area around the refinery. Details of Alcoa's property purchase programs are described within Part B, Environmental Assessment, of this document.

Alcoa also continues to implement a comprehensive emissions and air quality monitoring program for the refinery. Details of these are also provided within Part B, Environmental Assessment, of this document.

The proposed changes to conditions to allow for works to increase production up to 3.3 Mtpa will not result in any additional environmental impacts to those assessed in the assessment of the Third Production Unit revised proposal. While the primary reason to request the review of the conditions to allow increases in refinery production to occur in increments is due to practicalities of the refinery expansion, Alcoa considers increasing the refinery production in increments will also provide benefits in enabling emissions reductions to be monitored and verified in steps as production increases, rather than in one large single-stage expansion to 4.7 Mtpa.

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Part A: Proponent information and proposal description

1. Proponent information			
Name of the proponent/s (including Trading Name if relevant)		**Alcoa of Australia Limited**	
Australian Company Number(s) ☒ **OR** Australian Business Number(s) ☐		**004 879 298**	
Who is referring this request to change implementation conditions?		☒ Proponent ☐ Authorised representative (an authorisation from the proponent should be provided).	
Name Simon Butterworth		**Signature** Butterworth	
Position	Chief Operating Officer – Alumina	Organisation	Alcoa of Australian Limited
Email	*Simon.Butterworth@alcoa.com*	Phone	(08) 9316 5111
Address	181-205	Davy Street	
	BOORAGOON	WA	6154
Date	17 October 2019		
Does the referrer request that the EPA treat any part of the proposal information in the referral as confidential? *Provide confidential information in a separate attachment.*		☐ Yes ☒ No	
Referral declaration for proponent and Authorised representative: I, SIMON NICOLAS BUTTERWORTH, *(full name)* of ALCOA OF AUSTRALIA LTD declare that I am authorised to refer this request on behalf of the proponent, and further declare that the information contained in this form is true and not misleading.			
Provide contact details for purposes of the assessment, if different from the above. *Include: name, physical address, phone, email.*		Diane Dowdell Environmental Program Manager Alcoa of Australia Limited Cnr Davy and Marmion Streets Booragoon WA 6154 (08) 9316 5893 0407 190 571 *Diane.Dowdell@alcoa.com*	

2. Pre-referral discussions	
Identify outcomes of any pre-referral discussions with EPA Services	Pre-referral discussions have occurred with the EPA Services and DWER regarding: • Condition 8 Emissions Inventory; • Condition 9.1 Air quality modelling data acquisition and investigations; and • Procedure 1 Independent Design Review Team. to assist Alcoa in considering proposed changes to the conditions and procedures. No formal outcomes were decided as part the discussions.
3. Proposal information	
Title of the proposal	Wagerup Alumina Refinery – Production to a maximum capacity of 4.7 million tonnes per annum and associated bauxite mining.
Ministerial Statement Number/s	MS 728 and MS 1069.
Proposal description	The construction and operation of the Wagerup Alumina Refinery to a maximum production capacity of 4.7 million tonnes per annum and its associated bauxite mining.
Previous changes to the proposal	Nil.
Is this a revised proposal?	No.

4. Type of change to conditions request

Tick all that apply:

- Change to implementation conditions (section 46)
  - Change or variation of conditions [X]
  - Removal of conditions
  - Extension of Time Limit of Authorisation for Proposal Implementation
  - Statement consolidation or amalgamation
- Change to proposal***** and change to conditions (section 45C + section 46) – a change to proposal request should also be submitted
- Interim conditions and procedures (section 46A)
- Minor changes to conditions (section 46C).

5. Summary of proposed changes to conditions

In 2004, Alcoa World Alumina Australia (Alcoa) referred a revised proposal for the Wagerup alumina refinery to increase production from 2.4 million tonnes per annum (Mtpa) up to 4.7 Mtpa. At the time it was considered optimal for expansion of the refinery to occur in one stage, through construction of a Third Production Unit.

The revised proposal was approved with conditions set in Ministerial Statement 728 (MS 728) issued in 2006. MS 728 has since been amended by MS 1069 but the conditions are still based essentially on a refinery expansion occurring in one stage to 4.7 Mtpa through a Third Production Unit.

Pursuant to the existing conditions and Part V licensing provisions of the *Environmental Protection Act 1986* (EP Act), since the issue of MS 728 production from the refinery has been increased in two small increments to 2.85 Mtpa. This has been done through additional equipment and process enhancements, without the need to commence construction of a Third Production Unit.

It is currently not practical to expand the refinery from the existing production of 2.85 Mtpa to 4.7 Mtpa through the construction of a single-stage Third Production Unit.

Alcoa is seeking changes to the Ministerial conditions to permit increase in production of the refinery to occur in increments, with the initial increase in production to 3.3 Mtpa. Further increments to increase production to a maximum capacity of 4.7 Mtpa would proceed later, subject to future planning.

In seeking to amend the existing conditions to permit increments of increase in production, Alcoa proposes that the fundamental principles of the existing conditions applying to the expansion to 4.7 Mtpa would be maintained.

While the primary reason to request the review of the conditions to allow increases in refinery production to occur in increments is due to practicalities of refinery expansion, Alcoa considers expanding the refinery production in increments also provides benefits in enabling emissions reductions to be monitored and verified in steps as production increases, rather than in one large single-stage expansion to 4.7 Mtpa.

Part B Environmental Assessment

1. Overview of proposed changes to conditions

In 2004, Alcoa World Alumina Australia (Alcoa) referred a revised proposal for the Wagerup alumina refinery to increase production from 2.4 million tonnes per annum (Mtpa) up to 4.7 Mtpa. At the time it was considered optimal for expansion of the refinery to occur in one stage, through construction of a Third Production Unit.

The revised proposal was set out in the 2005 Wagerup Expansion ERMP (Environ, 2005a) (the **2005 ERMP**). The revised proposal was assessed by the EPA and reported on in EPA Bulletin 1215.

MS 728 was issued in 2006 to permit expansion of Wagerup alumina refinery to a maximum capacity 4.7 Mtpa. MS 728 has since been amended by MS 1069, but the conditions are still based essentially on a refinery expansion occurring in one stage to 4.7 Mtpa through a Third Production Unit.

Pursuant to the existing conditions and Part V licensing provisions of the *Environmental Protection Act 1986* (EP Act), since the issue of MS 728 production from the refinery has been increased in two small increments to 2.85 Mtpa. This has been done through additional equipment and process enhancements, without the need to commence construction of a Third Production Unit.

It is currently not practical to expand the refinery from the existing production of 2.85 Mtpa to 4.7 Mtpa through the construction of a single-stage Third Production Unit.

Alcoa is seeking changes to the Ministerial conditions to permit increases in production of the refinery to occur in increments, with the initial increase in production to 3.3 Mtpa. Further increments to increase production to a maximum capacity of 4.7 Mtpa would proceed later, subject to future planning.

Alcoa understands that this will require a change to the following conditions:

- Condition 4: Time Limit for Implementation of the Third Production Unit
- Condition 8: Best Practice Pollution Control Measures to be Applied
- Condition 9: Air Dispersion Model Validation
- Condition 10: Operational Performance Verification
- Condition 11: Noise
- Condition 12: Water Use.

Alcoa understands changes will also be required to Schedule 1 to amend the description of the revised proposal to remove reference to the Third Production Unit.

Alcoa is also proposing changes to Procedures 1 and 4 associated with the conditions.

The proposed changes to each of these conditions and relevant procedures are set out below with an environmental assessment of the proposed changes.

2. Changes to Condition 4 - Time Limit for Implementation of the Third Production Unit

2.1 Identification of existing condition

2.1.1 Condition number and title

Condition 4 - Time Limit for Implementation of the Third Production Unit

2.1.2 Intent of existing condition

Condition 4 sets a Time Limit by which implementation of the Third Production Unit must be commenced.

This is to require that if the Third Production Unit is not substantially commenced by the specified date, Alcoa will need to request a s. 46 change to the condition to extend the Time Limit. This would enable any new environmental factors and issues to be considered in any decision to extend the Time Limit.

2.1.3 Justification for proposed change

The revised proposal set out in the 2005 ERMP and approved in MS 728, was for expansion of the refinery from approximately 2.4 Mtpa up to a maximum capacity of 4.7 Mtpa through the Bayer process. The term Third Production Unit was used as a title in Alcoa's 2005 ERMP to describe the combination of new equipment, in particular a third Digestion Unit, and the upgrade of existing equipment to increase to 4.7 Mtpa.

It is not currently practical to expand the refinery from the existing production to 4.7 Mtpa through the construction of a single-stage Third Production Unit.

Alcoa is seeking changes to the Ministerial conditions to permit increases in production of the refinery up to 4.7 Mtpa to occur in increments, with an initial increase to 3.3 Mtpa. As part of this Alcoa would like to remove the term Third Production Unit from the Ministerial Statement as expansion will not occur as a single Third Production Unit.

The proposed change to Condition 4 does not alter the Time Limit of the condition.

2.1.4 EPA Environmental factors and objectives

There are no EPA Environmental factors and objectives specific to the Time Limit of Implementation.

2.2 Proposed changes to condition

2.2.1 Proposed revised wording

4 Time Limit for Implementation of the Expansion Works ~~Third Production Unit~~

4-1 The proponent shall not commence implementation of that portion of the revised proposal being the ~~third production unit~~ Expansion Works, as documented and described in Schedule 1, after 27 September 2022, and any commencement prior to this date must be substantial.

4-2 Any commencement of implementation of that portion of the revised proposal being the ~~third production unit~~ Expansion Works, as documented and described in Schedule 1, on or before 27 September 2022 must be demonstrated as substantial by providing the Chief Executive Officer* with written evidence, on or before 27 September 2022.

2.2.2 Relevant EPA Environmental factors, objectives, policies and guidelines

There are no EPA Environmental factors, objectives, policies or guidelines specific to the Time Limit of Implementation.

2.2.3 Effect of proposed changes to condition

The proposed change to Condition 4 will not affect the intent of the condition. The change essentially relates to terminology for the portion of the revised proposal set out in the 2005 ERMP.

2.2.4 Expected environmental outcome following the changes to condition

The proposed change to Condition 4 will not affect the environmental outcome expected for the revised proposal and Expansion Works. If the Expansion Works are not substantially commenced by the Time Limit, Alcoa will need to request a Section 46 change to the condition to extend the Time Limit. This would enable any new environmental factors and issues to be considered in any decision to extend the Time Limit.

3. Changes to Condition 8 - Best Practice Pollution Control Measures to be Applied

3.1 Identification of existing condition

3.1.1 Condition number and title

Condition 8 - Best Practice Pollution Control Measures to be Applied

3.1.2 Intent of existing condition

The intent of the existing condition is to:

i. Ensure best practice pollution control measures are applied to the Expansion Works.
ii. Require that a Detailed Design Report is prepared setting out the 'base emission rates' for Expansion Works.
iii. Require that the Detail Design Report set out ‘design emission targets’ for Expansion Works and that the design of the Expansion Works will reasonably achieve specified reductions from base emission rates for certain refinery emission sources.
iv. Require that the Detailed Design Report is subject to independent peer review (in accordance with Procedure 1).

3.1.3 Justification for proposed change

As indicated in Section 1, it is currently not practical to expand the refinery from the existing production of 2.85 Mtpa to 4.7 Mtpa through the construction of a single-stage Third Production Unit.

Alcoa is seeking changes to Condition 8 to permit increases in production of the refinery to occur in increments, with the initial increase in production to 3.3 Mtpa.

Since Condition 8 was set in 2006, considerable work has been undertaken to further improve the estimates of emissions. In particular, the number of sources for which emissions from the refinery are estimated has been increased, and further work has been done to improve the measurement and estimate technique for various sources and pollutants. The current Emissions Inventory for the refinery now includes 21 key pollutants and 25 emissions sources (compared with 17 sources at the time of the 2005 ERMP. There is, therefore, a need to revise the term base emission rates in the condition.

With the improvements in Emissions Inventory, there is also a need to review design emission targets for the Expansion Works, and the specified reductions to be achieved for refinery emission sources in the condition.

The approach of increasing production of the refinery in increments, rather than one large single-stage increase to 4.7 Mtpa, will also provide benefits in enabling emissions reduction measures to be monitored and verified in steps as production increases in increments.

3.1.4 EPA Environmental factors and objectives

There are three EPA Environmental factors and objectives relevant to this condition.

Environmental factor	Environmental objective
Air Quality	To maintain air quality and minimise emissions so that environmental values are protected.
Human Health	To protect human health from significant harm.
Social Surroundings	To protect social surroundings from significant harm.

3.2 Proposed changes to condition

3.2.1 Proposed revised wording

8 Best Practice Pollution Control Measures to be Applied

8-1 ~~Prior to submitting a~~ As part of any Works Approval application (under Part V of the *Environmental Protection Act 1986*) for works included in that portion of the revised proposal being the ~~third production unit~~ Expansion Works, as documented and described in schedule 1, to increase refinery production up to 3.3 Mtpa the proponent shall prepare and submit a Detailed Design Report that details the best practice pollution control measures employed to minimise emissions from the Refinery.~~, to the requirements of the Minister for the Environment, on the advice of the Environmental Protection Authority.~~

The Detailed Design Report shall set out the base emission rates for the major sources for the Refinery and the design emission targets for the expanded works. In particular, the Detailed Design Report shall demonstrate that the design of the expansion works will effectively capture and destroy Volatile Organic Compound (VOC) and odour emissions from the following sources ~~reasonably achieve the following reductions from base emission rates~~:

1. ~~At least a 75% reduction in peak and average emission rates of Volatile Organic Compounds (VOCs) and odour from the 25A~~ slurry storage tanks vents (25A tanks).
2. ~~At least a 50% reduction in peak and average emission rates VOCs and odour from clarification tanks – 35A green Liquor.~~
3. ~~Reduction to negligible emissions of VOCs and odour from clarification tanks- 35J causticisation.~~
4. ~~At least 50% reduction in peak and average emission rates VOCs and odour from cooling towers.~~
5. ~~2. Reduction to negligible emissions of VOCs and odour from~~ calciner vacuum pumps exhaust ~~low volume~~ vents ~~emissions~~ for any new calciner~~(vacuum pumps, Dorrco and Filter Scroll Hoods~~).
6. ~~The mass of VOCs discharged to the cooling pond shall not increase by more than 50%.~~
7. ~~No increase in particulate emissions from the Residue Disposal Area.~~

Note: the term “base emissions rates” for production increases up to 3.3 Mtpa means emission rates based on the Wagerup Refinery 2018 Emissions Inventory for the current refinery licence capacity of 2.85 Mtpa ~~determined from monitoring from July 2002 to March 2004~~.

8-1A As part of any Works Approval application (under Part V of the *Environmental Protection Act 1986*) for works included in that portion of the revised proposal being the Expansion Works, as documented and described in schedule 1, to increase refinery production from 3.3 Mtpa up to 4.7 Mtpa, the proponent shall prepare and submit a Detailed Design Report that details the best practice pollution control measures employed to minimise emissions from the Refinery.

The Detailed Design Report shall set out the base emission rates for the major sources for the Refinery and the design emission targets for the expanded works. In particular, the design emission targets in Detailed Design Report shall demonstrate that the design emission targets of the expansion works will reasonably achieve no overall increase in VOC or odour emissions from the Refinery through the application of best practice pollution control measures. The Detailed Design Report shall consider potential emission reduction measures for the following sources:

1. Milling vents (building 25).
2. Seed filtration stacks (building 44).
3. Filtration tank vents (35A unit) and Causticisation tank vents (35J unit).
4. Sand separation stacks (building 26).
5. Boilers and Turbines stacks (building 110).
6. Calciner stacks.
7. Calciner vacuum pumps exhaust vents.

Note: the term "base emissions rates" for production increases between 3.3 Mtpa up to 4.7 Mtpa means emission rates set out in the Wagerup Refinery Emissions Inventory, as updated and approved by the CEO.

8-2 The Detailed Design Reports required by conditions 8-1 and 8-1A shall address how the design emission targets in conditions 8-1 and 8-1A will be met during stable operations. The Detailed Design Reports shall also address how best practice will be applied to minimising emissions during unstable operating conditions such as during shut-downs, start-up, and equipment failure.

8-3 In the case where best practice pollution control measures do not achieve the individual reductions in base emission rates in condition 8-1, the Detailed Design Report required by the condition shall provide alternative measures to achieve equivalent overall reductions.

8-4 The Detailed Design Reports referred to in conditions 8-1 and 8-1A shall be subject to independent peer review (refer to Procedure 1), if required by the CEO.

8-5 Notwithstanding the requirements of conditions 8-1, 8-1A, 8-2, 8-3 and 8-4, the proponent may implement individual works of this proposal, as described in schedule 1 of this statement, subject to the requirement of a Works Approval and Licence under Part V of the *Environmental Protection Act 1986,* on the *proviso* that the individual works:

(i) have effect in reducing or offsetting emission from the existing refinery, where possible; and
(ii) do not significantly increase the production capacity of the refinery.

Note: Best practice pollution control measures include technology, practices and equipment which are:

- proven reliable in full-scale operation and applied in similar applications to achieve lower emissions; and
- reasonable and practicable given the level of emissions and risk of health and/or amenity impacts from the emissions.

3.2.2 Relevant EPA Environmental factors, objectives, policies and guidelines

As indicated above, there are three Environmental factors and objectives relevant to Condition 8, Air Quality, Human Health and Social Surroundings. The EPA has prepared Environmental Factor Guidelines for each of these factors setting out 'considerations' for Environmental Impact Assessment (EIA) for these factors, and current 'issues' relating to the factors.

For the purposes of EIA, consideration of possible impacts to human health in relation to emissions to air are considered through the Environmental factor and objective for Air Quality and associated Environmental Factor Guideline. The Environmental Factor Guideline - Human Health deals only with possible impacts to human health arising from the emission of radiation and is therefore not relevant to Condition 8.

Key considerations and issues identified in Environmental Factor Guidelines for Air Quality and Social Surroundings which are relevant to Condition 8 and proposed changes are summarised below.

Environmental Factor Guideline - Air Quality

Considerations for EIA for the factor Air Quality include, but are not necessarily limited to:

- whether analysis of potential health and amenity impacts has been undertaken using recognised criteria and standards, where relevant, informed by Australian and international standards
- the application of technology appropriate to the potential environmental impacts and risks
- whether proposed mitigation is technically and practically feasible
- characterisation of potentially harmful emissions and the pathways by which they may be released to air

- whether location of the proposal's main emission sources takes into consideration current and future sensitive land uses.

The following issues are matters that are commonly encountered by the EPA due to the nature of proposals that are referred to it.

Reasonable and practicable measures to minimise harmful emissions to air

Consistent with the principle of waste minimisation as set out in section 4A of the EP Act, the EPA encourages the application of all reasonable and practicable measures to minimise harmful emissions to air. This might include facility design, technology choice, operation and closure. Reasonable and practicable measures include those measures which are reasonably practicable, having regard to, among other things, local conditions and circumstances (including costs) and the current state of technical knowledge.

Under some circumstances, the EPA may expect more stringent standards such as Maximum Extent Achievable, particularly where hazardous contaminants are involved. Maximum Extent Achievable requirements incorporate technology and environmental management procedures which are the most stringent measures available and achievable, at a scale relevant to the proposal, to control the level of risk imposed by the hazardous pollutants being considered. Hazardous contaminants include known or suspected carcinogens, mutagens, teratogens, highly toxic or highly persistent substances.

In undertaking EIA, the EPA will consider the choice of technology to ensure that it is capable of achieving appropriate emission standards and minimising emissions commensurate with the risk to the environment.

Maintaining ambient air quality to protect human health

It is well recognised that air pollution can have an adverse effect on human health. Maintaining or improving ambient air quality is important for public health outcomes. When undertaking EIA and making judgements about the acceptability of potential impacts to ambient air quality and, therefore, human health, the EPA's assessment will typically be informed by accepted air quality standards and criteria, which are based on epidemiological studies.

Where there is an absence of a recognised standard or criteria to determine likely risk to human health, there may be the need to develop standards based on the available information and knowledge and, where appropriate, consultation with technical experts. This will depend on the circumstances and identified sensitive receptors.

Environmental Factor Guideline - Social Surroundings

Considerations for EIA for the factor Social Surroundings include:

- that emissions of noise, odour or dust are considered in the context of relevant legislation, criteria or standards
- the level of confidence with which the predicted impacts to social surroundings have been made, and what is the risk should those predictions be incorrect
- whether proposed management or mitigation of impacts to aesthetic, cultural, economic and/or social surroundings is technically and practically feasible.

The following issues are matters that are commonly encountered by the EPA due to the nature of proposals that are referred to it.

Separating industry and sensitive land uses

Most issues to do with amenity relating to noise, odour and dust can be avoided with appropriate separation distances. The application of separation distances between industry and sensitive land uses, through the land use planning system, can ensure that both intended and unintended emissions do not adversely impact on people. Without separation, problems can arise which cause high levels of concern for individuals and communities and which are difficult to solve.

The EPA expects proponents or, in the case of a scheme, planning authorities, to consider and/or design proposals with appropriate distances in mind, informed by recognised published separation distance guidelines to ensure human health and wellbeing, local amenity and aesthetic enjoyment continue.

As the Wagerup refinery is also licensed under Part V of the EP Act in respect of emissions, there are also Department of Water and Environmental Regulation (DWER) policies and guidelines relevant to Condition 8. The key of these are:

DWER Regulatory best practice principles (September 2018)

This includes:

1. *Risk based*
    - *DWER will make regulatory decisions proportionate to the level of risk posed to public health, the environment and water resources with consideration of cumulative impacts.*
    - *DWER resources will be targeted to the greatest risks to public health, the environment and water resources.*
2. *Evidence based*
    - *DWER will apply an evidence-based approach based on the best available information including sound science to inform regulatory decision-making.*

Guidance Statement: Risk Assessments (February 2017) Part V, Division 3, Environmental Protection Act 1986

This includes:

> *Objective*
>
> *To provide guidance on the Department's regulatory framework and the application of regulatory controls for works approvals and licences granted under Part V, Division 3 of the Environmental Protection Act 1986 (EP Act).*
>
> *The Department will apply a risk-based approach to its regulatory functions to ensure that there is not an unacceptable risk of harm to public health or the environment. Licensing and approval decisions, including conditions imposed on works approval or licence, will be proportionate to the level of risk (consequence and likelihood) that the activity poses to public health and the environment.*

3.2.3 Effect of proposed changes to condition

Overview

Air quality was a key environmental factor in the EPA's assessment of the revised proposal for the Wagerup refinery expansion (EPA Bulletin 1215).

Comprehensive studies and investigations carried out as part of the assessment showed that predicted and measured ground level concentrations of compounds emitted from the refinery at 4.7 Mtpa met established national and international air quality health standards.

A peer reviewed Health Risk Assessment (HRA) also indicated that predicted ground level concentrations should not result in chronic health impacts or increased cancer risk to the surrounding community. Even with conservative assumptions and uncertainty estimates applied, the HRA indicated ground level concentrations of pollutants should not cause adverse health impacts.

Consistent with this, the EPA found that refinery expansion to 4.7 Mtpa should not pose an increased public health risk for the general community.

However, the EPA concluded that periodic occurrences of short-term ground level concentrations under certain meteorological conditions may lead to health symptoms in certain individuals susceptible to chemical sensitivities. The EPA therefore recommended that if the refinery expansion proceeded, a process should be put in place *"to enable people who have concerns regarding chemical sensitivity symptoms to relocate from the area without disadvantage"*.

At the time, Alcoa had an existing property purchase program (the Land Management Plan) to purchase properties in certain locations in proximity to the refinery, referred to as Areas A and B. In line with the EPA's recommendation, following the issue of MS 728, Alcoa implemented a further substantial property purchase program, referred to as the Supplementary Property Purchase Program. This program was administered by an independent State Government appointed Administrator and enabled any property owners outside of the existing Land Management Plan areas to also sell their properties to Alcoa if they had concerns regarding the existing refinery operations or Third Production Unit expansion.

Through these property purchase programs Alcoa has now acquired a substantial area around the refinery.

Figure 1 shows the extent of land owned by Alcoa around the refinery. Most of the land within 5 km from the refinery is now owned by Alcoa, and property purchase has occurred up to 10 km from the refinery. In 2018, there were only eight dwellings remaining within the Area A boundary. The land purchase programs in Areas A and B continue to operate.

The implementation of the property purchase program is considered consistent with the EPA's objectives for separating industry and sensitive land uses as part of maintaining ambient air quality to protect human health.

Ambient air quality monitoring since the 2005 ERMP has continued to show that air quality in the Wagerup refinery area meets established national and international health standards.

There has been a substantial reduction in the number of complaints relating to the refinery since the 2005 ERMP and issue of MS 728. Importantly, the number of complaints related to potential health symptoms from refinery emissions is now very low.

Table 1 below shows health related complaints for the period prior to the Wagerup Expansion assessment (as presented in Table 3 of EPA's Bulletin 1215) and recent year complaints related to health symptoms reported to Alcoa.

Table 1: Complaints related to health symptoms

	Prior to ERMP assessment				Recent years			
	2002	2003	2004	2005	2015	2016	2017	2018
Total no. health complaints	105	45	110	34	1	2	0	0
No. of properties lodging single complaint.	11	11	12	3	1	2	0	0
No. properties lodging more than one complaint.	12	10	8	7	0	0	0	0
No. new properties lodging more than one complaint		3	1	1	0	0	0	0

The comprehensive air quality studies and substantial property purchase program provide a high level of confidence the EPA's Environmental objective for Air Quality and Social Surroundings will be met. The proposed changes to Condition 8 to allow the refinery production to be increased in increments will also provide a benefit of enabling emissions reduction measures to be monitored and verified in steps as production is increased in increments, rather than one large single-stage production increase to 4.7 Mtpa, further safeguarding human health and amenity.

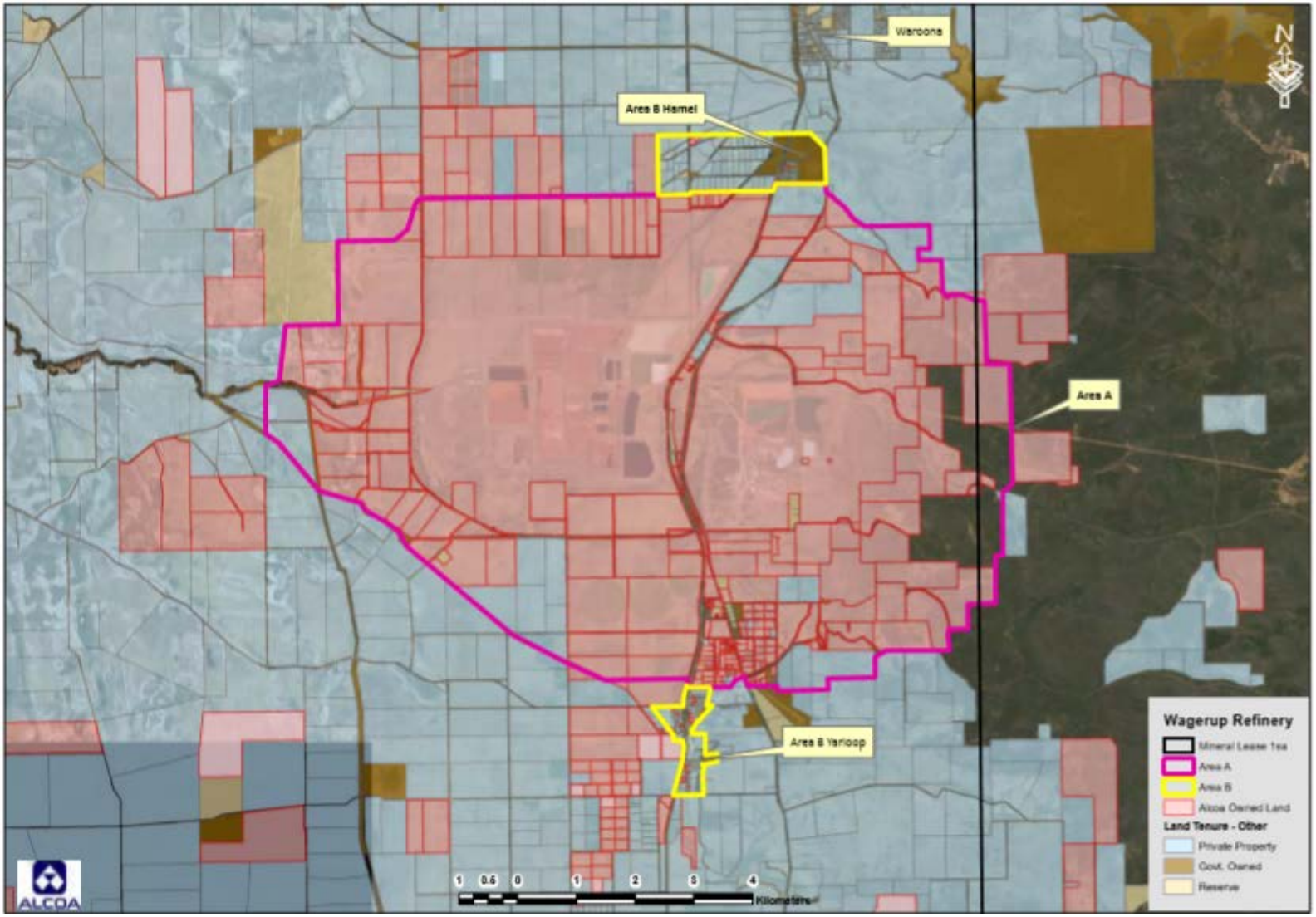


Figure 1: Alcoa Land Management Program

Furthermore, the proposed changes to Condition 8 do not materially change the intent of the existing condition.

i. Ensure best practice pollution control measures are applied to the Expansion Works.

The proposed changes to Condition 8 will not change the intent to ensure that best practice pollution control measures are applied to the Expansion Works.

However, since Condition 8 was set in 2006, the EPA's and DWER's terminology for best practice has evolved, in line with contemporary practices.

As set out in its Air Quality Environmental Factor Guideline, the EPA expects the application of All Reasonable and Practicable Measures to minimise harmful emissions to air. Reasonable and practicable measures include those measures which are reasonably practicable, having regard to, among other things, local conditions and circumstances (including costs) and the current state of technical knowledge, consistent with the definition of 'practicable' in the Act. Alcoa understands that for Condition 8, best practice pollution control measures would include All Reasonable and Practicable Measures.

Alcoa understands that this approach would also be consistent with DWER's Regulatory Best Practice Principles, particularly that DWER will make regulatory decisions proportionate to the level of risk posed to public health. It is also consistent with the Department's Guidance for Risk Assessments for Part V Regulation that it will apply a risk-based approach to its regulatory functions to ensure that there is not an unacceptable risk of harm to public health or the environment and that licensing and approval decisions, will be proportionate to the level of risk that the activity poses to public health and the environment.

As also set out in the Air Quality Environmental Factor Guideline, under some circumstances the EPA may expect more stringent standards such as Maximum Extent Achievable, particularly where hazardous contaminants are involved. Alcoa understands that Maximum Extent Achievable requirements are normally only required where there is a significant level of emission of hazardous contaminants which are known or suspected carcinogens, mutagens, teratogens, highly toxic or highly persistent substances.

Air quality and health studies of emissions from alumina refineries have shown that they do not meet a level which would require the application of Maximum Extent Achievable measures.

Alcoa has also implemented a substantial Land Management Program for the Wagerup Refinery to enable any people who have concerns regarding emissions from the refinery to relocate away from the area.

Best practice pollution control measures are generally determined by reviewing pollution control measures applied by similar industrial facilities to identify the technology or equipment achieving the lowest emissions levels. As part of determining best practice pollution control measures for future expansions at Wagerup, Alcoa will review measures applied in similar applications.

To improve clarity of the condition, Alcoa considers a definition of what the term "best practice pollution control measures" includes should be added to Condition 8 as follows:

Best practice pollution control measures include technology, practices and equipment which are:

- proven reliable in full-scale operation and applied in similar applications to achieve lower emissions; and
- reasonable and practicable given the level of emissions and risk of health and/or amenity impacts from the emissions.

ii. Require that a Detailed Design Report is prepared setting out the 'base emission rates' for Expansion Works.

Existing condition 8-1 requires that a Detailed Design Report is prepared setting out the base emission rates for expansion of the refinery to 4.7 Mtpa through the Third Production Unit.

It is proposed to amend Condition 8-1 to enable production increases initially up to 3.3 Mtpa, and to add a new Condition 8-1A to provide for future production increases up to 4.7 Mtpa. It will still be a requirement to submit a Detailed Design Report setting out the base emission rates for Expansion Works at each production increase.

Change to definition of base emission rates

Existing Condition 8-1 sets out that base emission rates are to be 'determined from monitoring from July 2002 to March 2004.'

Considerable work has been undertaken to improve the estimates of emissions from the refinery since Condition 8 was set in 2006.

Current estimates of emissions from the refinery are set out in the 2018 Wagerup Refinery Emission Inventory, as included at Appendix 1.

The 2018 Emissions Inventory includes a summary of progressive improvements in the estimation of emissions since the initial inventory established before the 2005 ERMP assessment. The 2018 Emissions Inventory now includes 21 key pollutants from 25 refinery emissions sources, comprising 55 individual point sources and 12 fugitive sources, compared to 17 key pollutants from 17 refinery emission sources for the 2005 ERMP assessment.

The 2018 Emission Inventory is also considerably more extensive than previous inventories in the information it presents including in relation to extent of monitoring data for each source and range of monitoring results. It also includes information on sources not included in the inventory and reasons for this.

A key initiative for the 2018 Emissions Inventory has been a change in the estimation of emissions from the precipitation Building 45 Cooling Towers (45K Cooling Towers). The 45K Cooling Towers have previously been identified as a major source of emissions for the refinery, including VOCs. Due to the nature of the facilities and emissions, it has been difficult to measure emissions from the 45K Cooling Towers and there has therefore been a degree of uncertainty regarding previous estimates.

Alcoa has undertaken a number of tasks to improve the reliability of the 45K Cooling Tower VOC emission estimates. These have included:

1. A literature search aimed at identifying alternative sampling methods for cooling towers. Alternative methods were reviewed based on their ability to achieve a lower detection limit for formaldehyde and continuous measurement over a period of time to ascertain emission variability.

2. Implementation of a trial of the sampling method, Open Path Fourier Transform Infrared (OP-FTIR) Spectroscopy, which best addressed these issues.

3. Review of historical conventional stack sampling results in conjunction with historical water quality monitoring of feed water to the cooling towers.

4. Further water quality testing of the feed and recirculation water to enable calculation of mass loads of VOC and mass balance calculations to estimate VOC emission concentrations and rates.

Alcoa considers that the OP-FTIR trial and associated water quality testing have assisted considerably in characterising and quantifying emissions from the 45K Cooling Towers. Alcoa considers OP-FTIR technology provides a much-improved, reliable method for measurement of Cooling Tower emissions, and has potential for other alumina refinery sources which are difficult to measure via conventional sampling methods. Advantages of using the OP-FTIR method include:

- collection and storage of continuous near real-time data for days to weeks, giving very high levels of data confidence
- accurate measurement of emission variations occurring in the process

- simultaneous measurement of organic and inorganic compounds
- statistically valid information from a much larger data set, which would be extremely time consuming and expensive to obtain using single grab sampling methodology
- ability to retrospectively analyse raw data for any compounds with available reference spectra
- capability of measuring formaldehyde.

The OP-FTIR trial was carried out in collaboration and conjunction with international and national experts in the use of this technology.

While OP-FTIR technology has been used and accepted for ambient measurements it has not previously been used for emissions measurement from alumina refinery sources, including cooling towers, and therefore its application for these purposes must be reasonably demonstrated. Based on feedback from DWER, Alcoa proposes to undertake further review of the robustness of the OP-FTIR method before adopting any results from this method for estimating emissions from the refinery.

For the 2018 Emission Inventory, Alcoa has estimated VOC emissions from the 45K Cooling Towers based on a review of the historical conventional sampling results, supported by water quality testing to determine mass loads of VOCs in the feed and recirculating water and mass balance to estimate emission rates and concentrations. This work is presented in Appendix 2.

The key findings are:

1. Water quality testing indicates that acetone and formaldehyde are the only VOCs detected at significant levels in the Cooling Tower feedwater or recirculating water. These are found at low tenths of a mg/L.

2. The mass of acetone in the water is such that concentration of acetone emissions is expected to be in the order of 0.01 mg/m^3 (mass rate less than about 0.015 grams per second (g/s) which is extremely low.

3. The mass of formaldehyde is such that the concentration of formaldehyde emissions is expected to be below about 0.1 mg/m^3 (mass rate in the order of about 0.15 g/s) which is very low.

4. All other VOCs detected in the 45K Cooling Tower feedwater and recirculating water were at concentrations of thousandths of mg/L. These concentrations are such that the mass of any emissions of these compounds would be negligible.

This further work has shown that the 45K Cooling Towers are likely to be only a minor source of acetone and formaldehyde emissions and other VOC emissions.

Another key change in the 2018 Emissions Inventory is the use of measured odour concentrations to estimate average and peak odour emissions from refinery sources. Previous inventories have used an odour/odorant correlation, referred to as 'fitted odour'. While the fitted odour methodology has some benefits, with the substantial measured odour concentration data now collected for the refinery, use of measured odour concentrations is now considered to provide a reliable basis for estimating odour emission rates from the refinery.

To reflect current base estimated emission rates for the refinery it is proposed that the note for Condition 8-1 be amended to:

> the term "base emissions rates" for production increases up to 3.3 Mtpa means emission rates based on the Wagerup Refinery 2018 Emissions Inventory for the current refinery licence capacity of 2.85 Mtpa ~~determined from monitoring from July 2002 to March 2004~~.

Base emission rates of VOCs and odour at current approved refinery capacity of 2.85 Mtpa

Since the issue of MS 728, pursuant to the conditions and Part V licencing under the EP Act, the approved refinery production rate has been increased in two small increments from 2.4 Mtpa to 2.85 Mtpa.

The estimated annual average VOC emission rate from the refinery point sources for 2.85 Mtpa is 2.91 g/s. The estimated emission rate from the various sources and the proportion they make up of the total refinery point sources emissions are shown in Figure 2. For comparison, the estimated annual average VOC emission rate for the refinery for the 2005 ERMP was 2.88 g/s. That is, although the number of refinery emission sources in the inventory has been increased from 17 to 25 and the approved maximum production capacity has been increased from 2.4 Mtpa to 2.85 Mtpa, the estimated rate of VOC emissions has been maintained at the 2005 ERMP base levels.

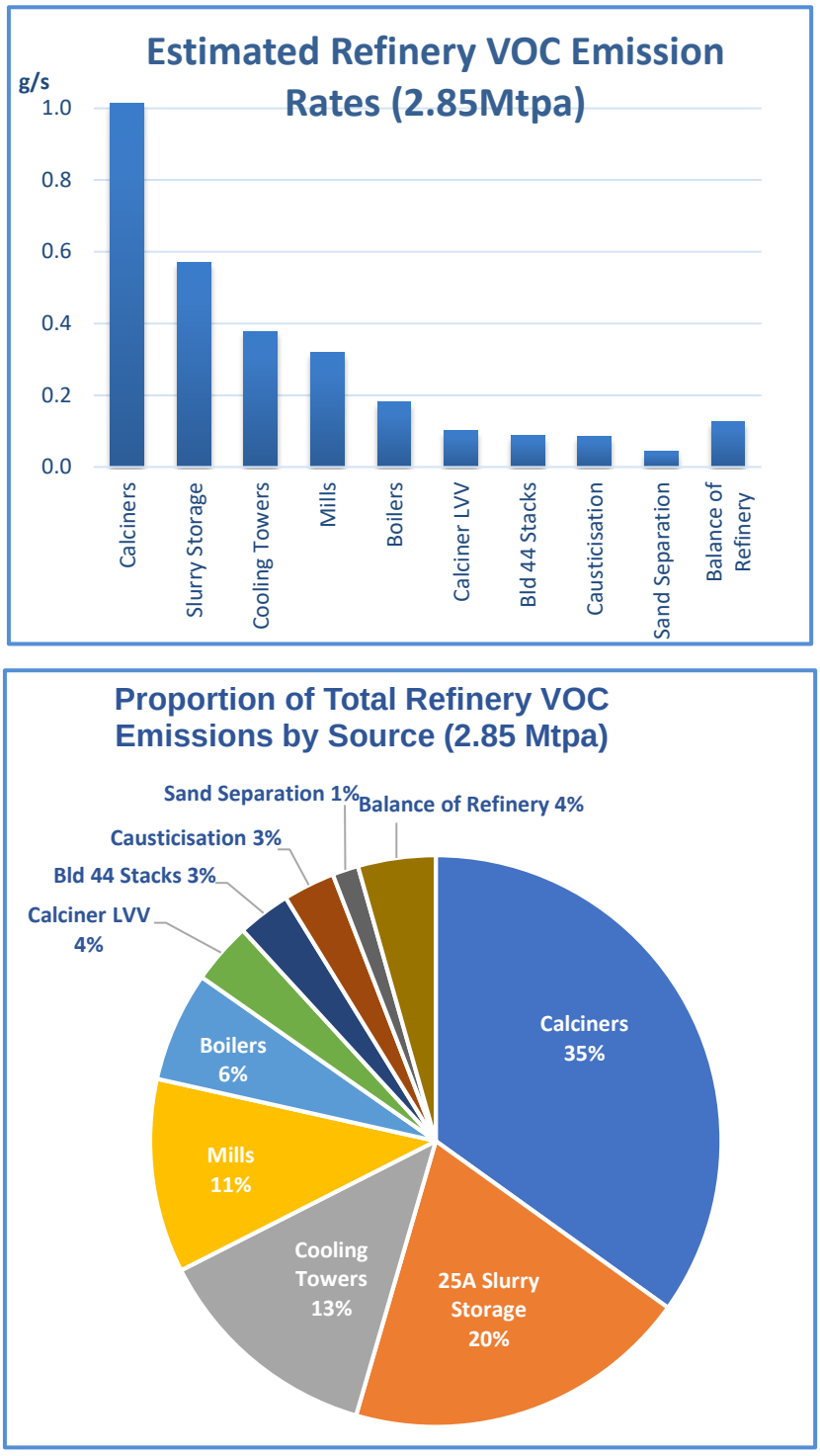


Figure 2: Base emission rates of VOCs (g/s) for refinery sources at 2.85 Mtpa

The estimated annual average odour emission rate from the refinery point sources for 2.85 Mtpa is approximately 1.4 million odour units per second (OU/s). The estimated emission rate from the various sources and the proportion they make up of the total refinery point sources emissions are shown in Figure 3.

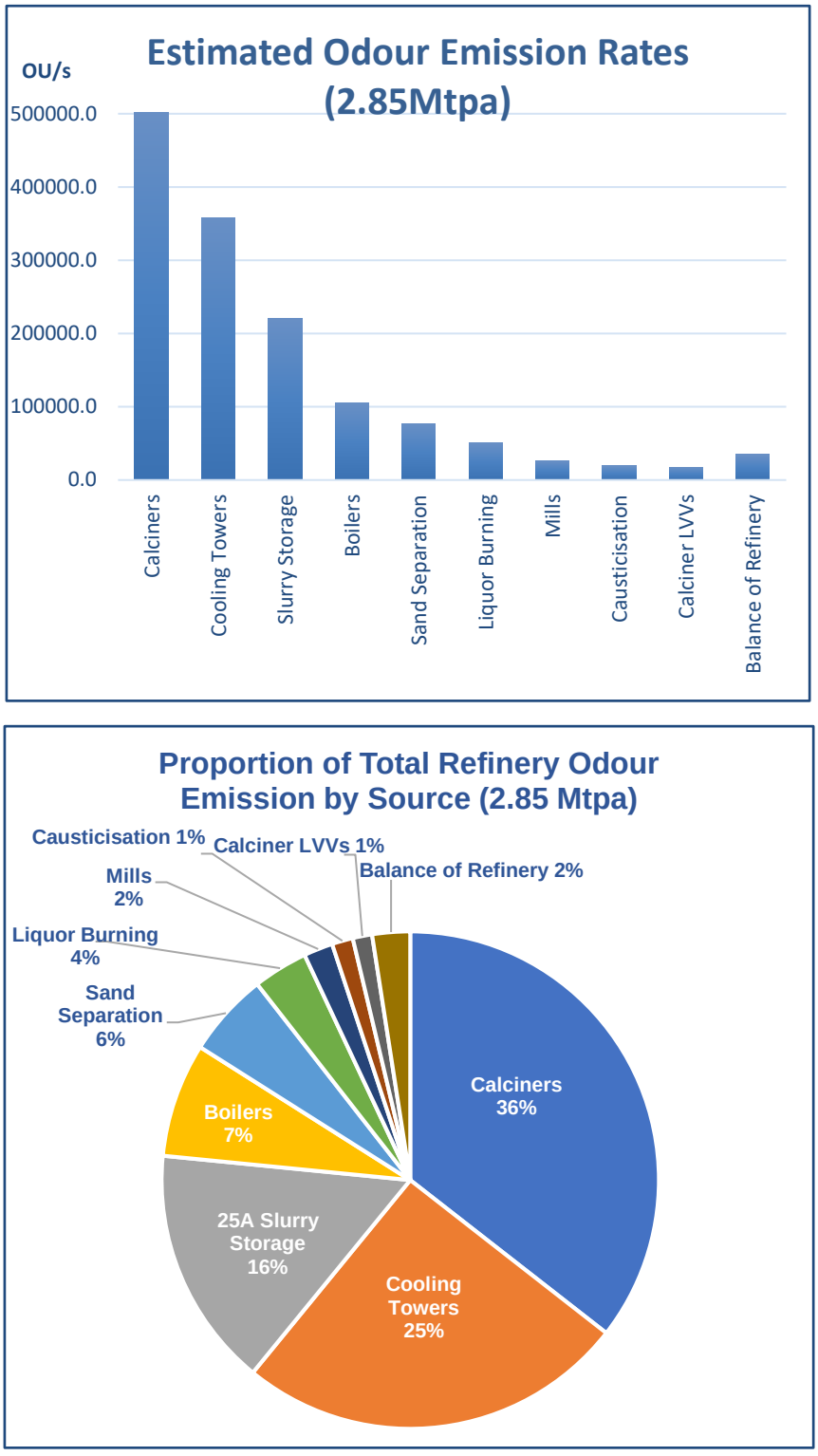
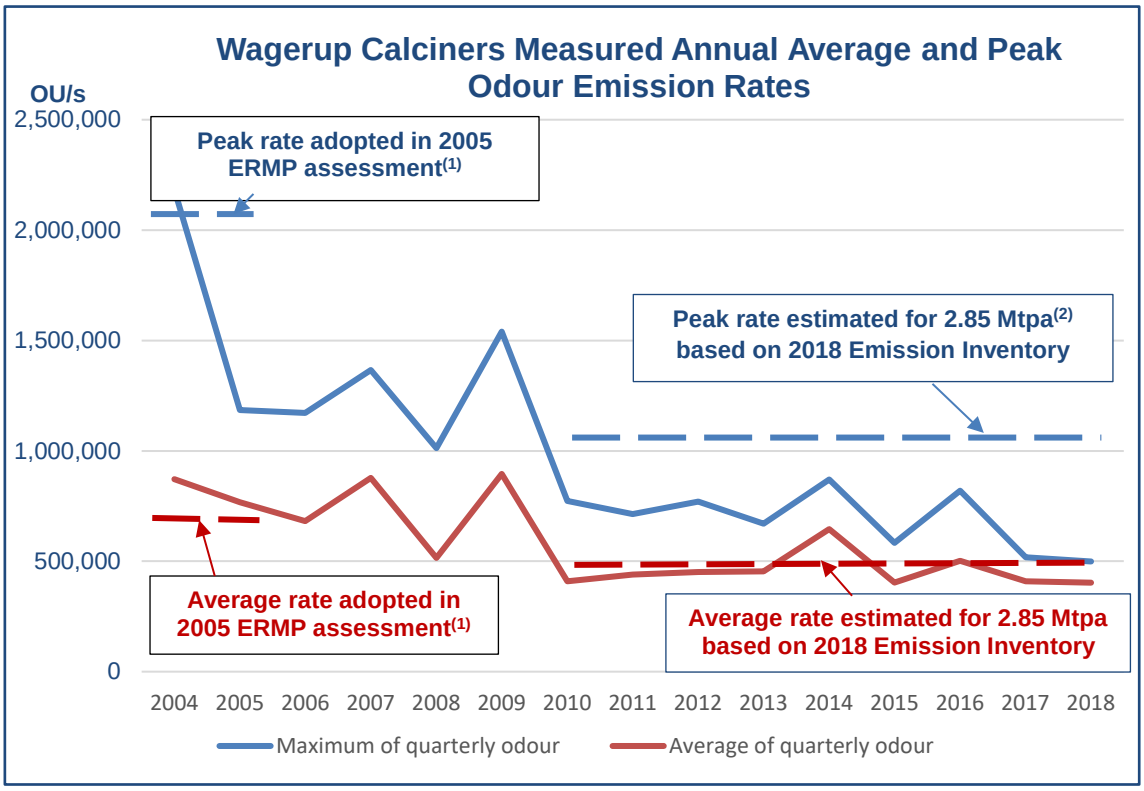


Figure 3: Base emission rates of odour (OU/s) for refinery sources at 2.85 Mtpa

For comparison, the estimated annual average odour emission rate for the refinery for the 2005 ERMP was approximately 1.85 million OU/s.

Monitoring has shown a considerable reduction in both average and peak odour emissions from the Calciners, which are the major source of odour emissions from the refinery. Figure 4 shows the annual average and annual peak odour measured for the Calciners since 2004.



(1) EPA Bulletin 1215 Section 4.1 Table 21
(2) The peak rate estimated for 2.85 Mtpa based on the 2018 Emission Inventory adopts the sum of individual peak of the four Calciners rather than the cumulative peak of the four Calciners, thereby adopting some conservatism.

Figure 4: Annual average and peak odour emission rate (OU/s) from Calciners

Notwithstanding the increase in production of the refinery from 2.4 Mtpa to nearly 2.85 Mtpa, measured annual average and peak odour emissions from the Calciners are now considerably below those adopted for the Wagerup 3 expansion assessment in the 2005, based on measured emissions at the time.

Work planned to further validate emissions

There has now been a considerable amount of work undertaken on investigations and measurement of the refinery's emission sources. However, Alcoa recognises that it is appropriate to continue to investigate best practice techniques for measuring emissions as technology changes and will continue to evaluate new technologies as appropriate, including Advanced Validation Methods such as the OP-FTIR program for the Cooling Tower emissions.

Alcoa also recognises that the measured emission concentration data used in the 2018 Emission Inventory for VOCs and odour for the following sources was collected a considerable time ago.

- Milling vents (Building 25)
- Sand separation (Building 26)
- Blow-off tanks (Building 30)
- Filtration 35A tanks
- Causticisation 35J tanks
- Powerhouse (Building 110).

This data was collected as part of an intensive monitoring program in 2006 and 2007, at a cost of $1.5 million, in accordance with Condition 9.1.

As the source of bauxite and Bayer process utilised in the refinery have not changed materially over time it is not expected the range of emission concentrations from these sources will change materially either. Data from refinery sources which have been monitored over a considerable time shows that there has not been significant change in emission concentrations. Where changes have occurred over time, concentrations have generally been lower.

These sources are relatively minor sources of VOC and odour emission from the refinery, representing in total about 20% of the refinery's estimated emissions. While the concentration data used in the 2018 Emission Inventory for these sources is from 2006-2007, the airflow data used to estimate emissions from these sources is for 2018 plant operation. The airflow rates for each of these sources, except for the Milling vents, was characterised, that is measured or calculated, in 2018. The airflow rates for Milling vents were characterised in 2007, however the airflow rates used to estimate the emissions for this source are based on the number of Milling vents and production for 2018.

Notwithstanding this, the 2018 Emission Inventory includes a specific program of work to further validate emissions estimates for certain sources. This program aligns with plans previously provided by Alcoa as part of continuous improvement of the Emissions Inventory. Table 2 below provides a broad outline of the work program.

Table 2: Proposed Program of Further Monitoring to Improve the Wagerup Emissions Inventory

Timing	Source	Analyte(s)
3 Months	Calcination	Metals
	Powerhouse	Metals Odour VOCs Ammonia
	Precipitation 45K Cooling Towers	Odour VOCs Ammonia
	Refinery (multi sources)	Mercury
12 Months	Mills	Odour VOCs Ammonia
	Seed filtration (building 44)	Odour VOCs Ammonia
	Filtration (35A tanks)	Odour VOCs Ammonia
24 Months	Causticisation (35J tanks)	Odour VOCs Ammonia

Timing	Source	Analyte(s)
	Sand Separation (building 26)	Odour VOCs Ammonia
	Blow-off tanks (building 30)	Odour VOCs Ammonia

The program identifies work areas for the next 3 months, 12 months and 24 months. The Wagerup Refinery Emissions Inventory will continue to be updated as new information is acquired.

To reflect that the Wagerup Emission Inventory will continue to be refined in the future, it proposed a note be included in new Condition 8-1A stating that:

> the term "base emissions rates" for production increases between 3.3 Mtpa up to 4.7 Mtpa means emission rates set out in the Wagerup Refinery Emissions Inventory, as updated and approved by the CEO.

Timing of Detailed Design Report

Existing Condition 8-1 sets out that the Detailed Design Report should be prepared and submitted prior to submitting a Works Approval for any Expansion Works for the refinery. Procedure 1, however, sets out that the Detailed Design Report should be submitted with the Works Approval application and that it is to be considered in preparation of the Works Approval and Licence.

It is considered more efficient if the Detailed Design Report can be submitted with the Works Approval application. The Detailed Design Report can then be subject to review by the Independent Design Review Team in accordance with Procedure 1, if required, as part of consideration and assessment of the application.

It is therefore proposed that the wording of Condition 8-1 be amended to require a Detailed Design Report be submitted as part of any Works Approval application for expansion up to 3.3 Mtpa, and that this also be required in the proposed new condition 8-1A for any Works Approval applications for expansion up to 4.7 Mtpa.

iii. Require that the Detailed Design Report set out design emission targets for Expansion Works and that the design of the Expansion Works will reasonably achieve the specified reductions from base emission rates for certain refinery emission sources.

Existing Condition 8-1 includes a list of emission control measures and associated target emission reduction levels to be implemented as part of expansion of the refinery to 4.7 Mtpa. This was based on evaluation of base emission rates for the refinery at the time determined from monitoring between 2002 – 2004, and predicted emission increases for expansion of the refinery to 4.7 Mtpa through the Third Production Unit, as set out in the 2005 ERMP. As indicated above, Alcoa is seeking to amend Condition 8-1 to enable production increases initially up to 3.3 Mtpa, and to add a new Condition 8-1A to provide for future production increases up to 4.7 Mtpa.

It will still be a requirement to submit a Detailed Design Report setting out the design emission targets for Expansion Works at each production increase and that the design will reasonably achieve specified reductions in emission rates for refinery sources. This will be based on the 2018 Emissions Inventory and best practice emissions control measures.

Evaluation of VOC and odour emission abatement measures

Alcoa has undertaken an assessment of the predicted increase in VOC and odour emissions from the various refinery sources with increases in production and options for further VOC and odour emission control measures. The assessment of options for further emission control measures has considered a number of factors including:

- the current level of emissions from the source
- the predicted increase in emissions due to expansions
- best practice emission control approaches, including any proven, reliable measures applied in full-scale operation in similar applications to lower emissions
- practicability for implementation in terms of engineering taking into account the level of emissions.

This assessment is set out in Appendix 3, Alcoa Wagerup Refinery Efficiency Project Current, Planned and Potential Future Volatile Organic Compounds (VOC) and Odour Emissions Control Measures – Overview Design Report Supporting Ministerial Statement 728 and 1069 Section 46 Application.

VOC emissions

As shown in Figures 2, the largest source of VOC emissions for the refinery is the Calciners (approx. 40%). At this time there are no practicable emission control measures to capture and destroy emissions from Calciner stacks (i.e. 'end-of-pipe' emission control). However, as identified in the Appendix 3 report, Alcoa will continue to investigate opportunities to reduce VOC emissions from the Calciners through management of product into the Calciners and operation of the Calciners. Alcoa considers that some reductions in Calciner VOC emissions may be achievable in the future but not in near-term expansions.

The Slurry Storage (25A) Tanks vents are estimated to be the next largest source of VOC emissions from the refinery (approx. 22%. All other sources are estimated to have relative low VOC emissions.

Proposals as part of expansions up to 3.3 Mtpa will therefore include emission control measures to effectively capture and destroy VOC emissions from the Slurry Storage (25A) Tanks vents. Figure 5 below shows the estimated VOC emission rates for the current refinery approved production rate of 2.85 Mtpa and expansion to 3.3 Mtpa.

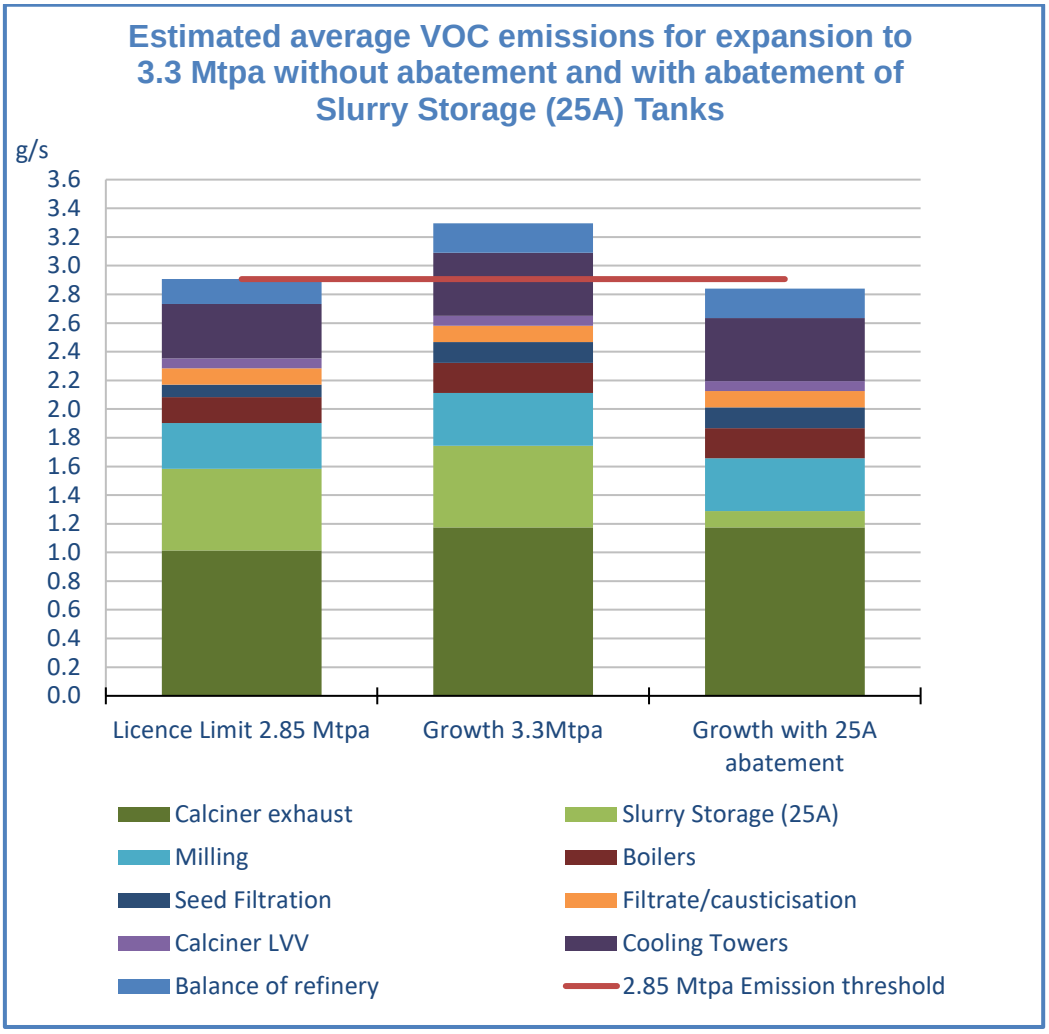


Figure 5: Average VOC emissions for the current approved refinery production of 2.85 Mtpa and expansion to 3.3 Mtpa without abatement and with abatement of Slurry Storage (25A) Tanks

With the abatement of the Slurry Storage (25A) Tanks VOC emissions, the estimated average emissions at 3.3 Mtpa production will be less than the levels at 2.85 Mtpa (2.84 g/s for 3.3 Mtpa compared to 2.91 g/s for 2.85 Mtpa).

As part of the Works Approval application for expansion of the refinery to 3.3 Mtpa, Alcoa will update the HRA for the refinery to confirm predicted GLCs for these emissions meet established air quality health standards.

Odour emissions

As shown in Figure 3, the largest source of odour emissions for the refinery is also the Calciners, about 36%. As indicated above for VOC emissions from the Calciners, at this time there are no practicable emission control measures to capture and destroy emissions from Calciners stacks (i.e. 'end-of-pipe' emission control). However, Figure 4 highlights there has been a significant reduction in measured odour from the Calciners since the 2005 ERMP assessment. Both the annual average and peak odour levels from the Calciners are considerably lower than the odour levels determine at the time (approx. 25% for average and 45% for peak).

The 45K Cooling Towers are currently estimated to be the second largest source of odour emissions from the refinery. The review of VOC emissions from the 45K Cooling Towers has indicated that they are not a key source of VOC emissions for the refinery. As indicated above in the proposed program of further monitoring to improve the Wagerup Refinery Emissions Inventory, further monitoring of odour emissions from the 45K Cooling Towers is proposed over the next three months. It is anticipated this could show odour emission levels from the 45K Cooling Towers is also lower than currently estimated, as has been shown for VOC emissions.

As shown in Figure 3, the Slurry Storage Tanks (25A) vents are the next largest source of odour emissions from the refinery. A systematic odour intensity analysis program was undertaken by Environ Odour Australia Ltd (Environ Odour Australia, 2004) to establish odour intensity/concentration relationships for seven odour sources at Alcoa's alumina refineries. As shown in Table 3, the analysis showed that the Slurry Storage Tanks (25A) vents had the most intense odour among the alumina refinery sources tested. A higher intensity means that an odour will be perceived as being stronger than for the same concentration as a less intense odour. That is, based on its intensity, odour emissions from the Slurry Storage Tanks vents have a greater capacity to impact amenity than for higher concentrations from other sources which have lower intensity. While it is recognised that there are some limitations with the Weber-Fechner relationship that underlies the approach taken in this odour intensity study, it is considered the broad finding that the Slurry Storage Tanks is one of the more intense odour sources at the refinery is valid.

Table 3: Refinery Odour Concentrations at 'Distinct' Intensity

Source Type	Odour Concentration (OU) at 'Distinct' Intensity Level	Relative Intensity
Slurry Storage Tanks (25A)	4.8	More intense than the average refinery odour
Calciners	8.8	Less intense than the average
All sources combined (average)	7.2	Average refinery intensity

Further, as part of the 2005 ERMP assessment, Alcoa also undertook air quality modelling to assess the sensitivity of the predicted ground level odour concentrations to variations in odour emissions from the different refinery sources (Environ, 2005b). This work focussed on predicted changes in ground level concentrations for refinery 'low-level' sources (stacks/vents generally less than 50m, including Slurry Storage (25A) Tanks and cooling towers) and 'high-level' sources (100m multi-flue stacks including Calciners and Liquor Burner). The modelling showed the Slurry Storage (25A) Tanks generally had a higher capacity to affect amenity due to odour emissions than other sources.

Figure 6 shows the estimated odour emission rate for the refinery for production at 2.85 Mtpa and for expansion to 3.3 Mtpa without abatement, and with abatement of the Slurry Storage (25A) Tanks.

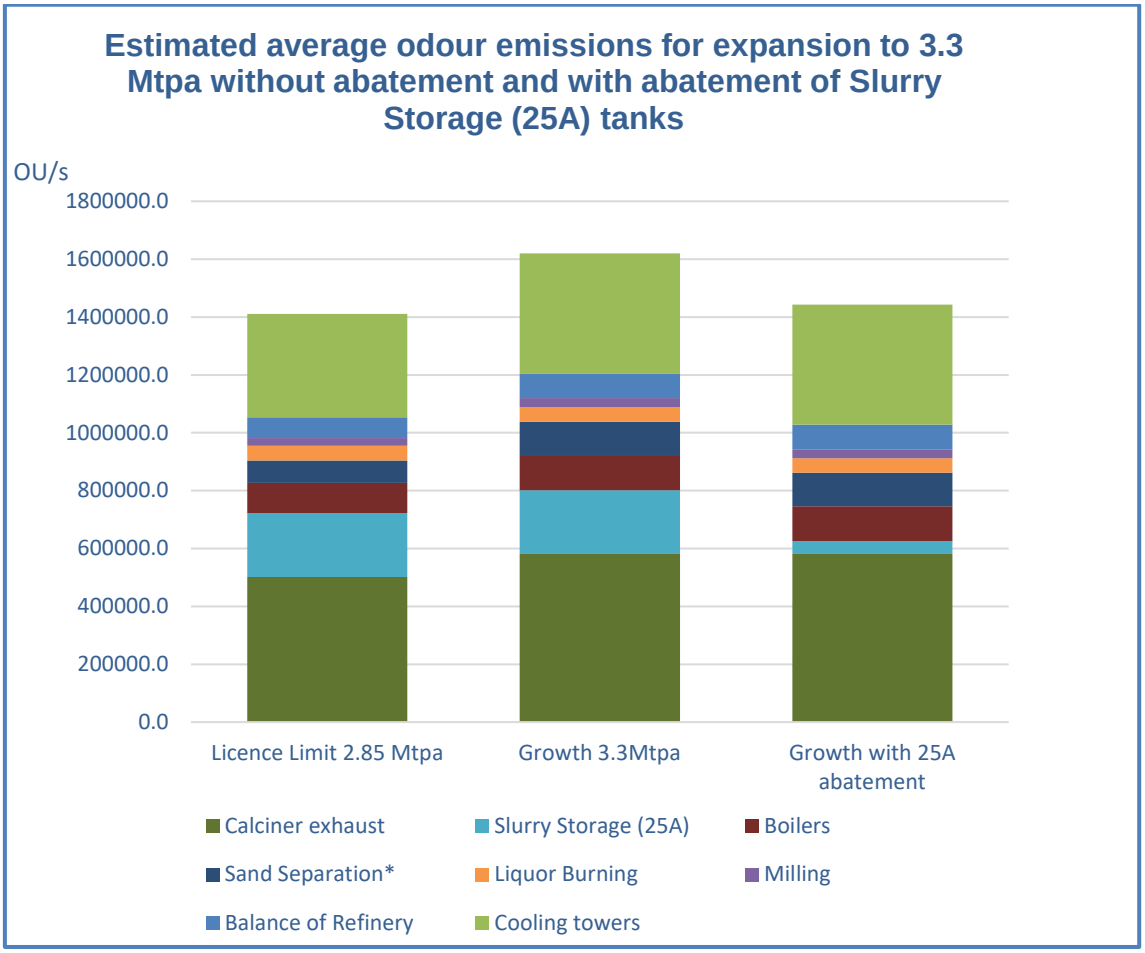


Figure 6: Average odour emissions for refinery for current approved production of 2.85 Mtpa and expansion to 3.3 Mtpa without abatement and with abatement of Slurry Storage (25A) Tanks

With the abatement of the Slurry Storage (25A) Tanks odour emissions, the estimated average odour emissions at 3.3 Mtpa production will be similar to levels at 2.85 Mtpa (1,442,816 OU/s for 3.3 Mtpa compared to 1,411,000 OU/s for 2.85 Mtpa. Given the Slurry Storage (25) Tanks are one of the more intense odour sources from the refinery, and air quality modelling has shown this source to present a higher potential for odour impacts, it is expected the abatement of the Slurry Storage (25A) Tanks odours will reduce the overall potential for odour amenity impacts from refinery.

The number of odour impact complaints regarding the refinery is now reasonably low. As part of the Works Approval application for expansion of the refinery to 3.3 Mtpa, Alcoa will undertake comparative air dispersion modelling in line with the DWER Guideline – Odour emissions, to confirm there will be no significant additional impacts from odour from the expansion.

VOC and odour emission control measures proposed for expansion up to 3.3 Mtpa

Based on evaluation of the options set out in the Appendix 3 report, Alcoa has proposed emission control measures should be implemented for VOCs and odour from the Slurry Storage (25A) Tanks as part of refinery expansions up to 3.3 Mtpa.

It is therefore proposed to amend the list of emission control measures in Condition 8-1 for expansions up to 3.3 Mtpa to require capture and destruction of VOC and odour emissions for the following source:

1. ~~At least a 75% reduction in peak and average emission rates of Volatile Organic Compounds (VOCs) and odour from the 25A~~ slurry storage (25A) tank vents; and
2. ~~At least a 50% reduction in peak and average emission rates VOCs and odour from clarification tanks - 35A green Liquor.~~
3. ~~Reduction to negligible emissions of VOCs and odour from clarification tanks- 35J causticisation.~~
4. ~~At least 50% reduction in peak and average emission rates VOCs and odour from cooling towers.~~
5. ~~2.~~ ~~Reduction to negligible emissions of VOCs and odour from~~ calciner vacuum pumps exhaust~~low volume vents emissions~~ for any new calciner ~~(vacuum pumps, Dorrco and Filter Scroll Hoods).~~
6. ~~The mass of VOCs discharged to the cooling pond shall not increase by more than 50%.~~
7. ~~No increase in particulate emissions from the Residue Disposal Area.~~

With respect to the original item 5 of the list, since the issue of MS 728 Alcoa has implemented measures to abate VOC and odour emissions from vacuum pumps for Calciners 1, 2 and 3 by directing these to the Calciners for destruction. It has not been considered practicable to abate the vacuum pump emissions for Calciner 4 at this time. While the extent of VOC and odour emissions from Calciner vacuum pump exhaust vents are relatively low, it is proposed to retain a requirement to reduce emissions from Calciner vacuum pump vents for any new Calciner established as part of expansions to 3.3 Mtpa, as this is now considered best practice. At this stage it is planned that a new fifth Calciner will be established as part of the expansion to 3.3 Mtpa. If it is, the VOCs and odour from the vacuum pumps will be abated.

While original item 5 of Condition 8 also required capture of emissions from the Calciner low volume vents Dorrco and Filter Scroll Hoods, due to the low level of emissions and configuration of the plant, as proposed in the 2005 ERMP, it is now not considered practicable to do this. Other sources provide more efficient opportunities for emissions reductions.

With respect to items 2 and 3 of existing Condition 8-1, potential reduction in emissions for the 35A Clarification Green Liquor Tanks and 35J Clarification Causticisation Tanks, as part of the 2005 ERMP for expansion of the refinery to 4.7 Mtpa Alcoa proposed to consider the following emission control measures for these sources:

Process area – refinery point sources	Emission control measures
Causticisation/clarification (35J and 35A)	1. 35J causticisation to be replaced with high efficiency units or a technology installed to reduce VOC and odour emissions to negligible levels. 2. New filters to modern day equivalent for 35A. Existing tank vents to be modified to reduce flows and emissions by 50%.

Alcoa has implemented measures for collection of non-condensable and vent gases from these sources for diversion to the Boilers for destruction of their VOC and non-VOC odour content. As identified in the report at Appendix 2, Alcoa will evaluate potential for further emission control measures for the 35A Clarification Green Liquor Tanks and 35J Clarification Causticisation Tanks as part of any expansions between 3.3 Mtpa and 4.7 Mtpa. This is addressed further below in proposed new Condition 8-1A.

With respect to item 4 of existing Condition 8-1, potential reduction in emissions from the cooling towers, as part of the 2005 ERMP for expansion of the refinery to 4.7 Mtpa Alcoa proposed to consider the following emission control measures for these sources:

Process area – refinery point sources	Emission control measures
Cooling towers	1. New cooling requirements in precipitation from fin-fan cooling, or technology that can meet similar emissions reductions. 2. Modification to operation of the cooling towers to achieve a 50% reduction in odorous emissions by reducing suspended particulate matter and water treatment chemical usage.

The review of VOC emissions from the 45K Cooling Towers (Appendix 2) has shown they are now a minor source of VOC emissions for the refinery, as illustrated in Figure 2 above. Further monitoring of odour emissions from the 45K Cooling Towers is proposed over the next three months as part of the program of further monitoring to improve the Wagerup Refinery Emissions Inventory odour component.

Based on the review indicating the 45K Cooling Towers are not a key source of VOC emissions, it is not considered warranted to proceed with the emission control measures identified in the 2005 ERMP for the refinery cooling towers at this time. However, this could be reviewed as part of any expansion beyond 3.3 Mtpa depending on the further odour monitoring of the source.

With respect to item 6 of existing Condition 8,1, discharge of VOCs to the cooling pond, as part of the 2005 ERMP for expansion of the refinery to 4.7 Mtpa, Alcoa proposed to consider the following emission control measures for these sources:

Process area – refinery point sources	Emission control measures
Cooling ponds	1. Limiting the increase of VOC load to the cooling pond to 50% by use of fin-fan cooling or technology that can meet similar emissions reductions.

The review of VOC emissions from the precipitation 45K Cooling Towers has shown they are not a major source of VOC emissions. At this stage it is considered that additional cooling needs for the refinery can be met though use of cooling towers without the need for fin-fan or other technology, as proposed in 2005. There are no proposals to increase the area of the Cooling Ponds to meet any increase in cooling needs. Therefore, there are no significant increases in VOC emissions expected from the Cooling Ponds as a result of future expansions.

With respect to item 7 of existing Condition 8-1, particulate emissions from the Residue Disposal Area, as part of the 2005 ERMP for expansion of the refinery to 4.7 Mtpa Alcoa proposed to consider the following emission control measures for these sources:

Process area – refinery point sources	Emission control measures
Residue dry stack areas	1. Improved design and management of sprinkler system.
Residue wet stack area	1. Conversion of RDA2 from wet-stacking to dry-stacking.

Since the 2005 ERMP, Alcoa has improved design and management of the sprinkler system for the Residue dry stack areas (Alcoa, 2012) and this will continue to be used for any expansion. Alcoa considers the Residue storage area is appropriately managed under the EP Act Part V Licence. Since the 2005 ERMP Alcoa has also converted the RDA2 from wet-stacking to dry-stacking as proposed.

Options for VOC and odour emission control measures for expansions from 3.3 Mtpa up to 4.7 Mtpa

As set out in the Appendix 3 report, Alcoa has also identified focus areas which may provide scope to achieve further emission control measures for expansions between 3.3 Mtpa up to 4.7 Mtpa. These options include emissions from the:

1. Milling vents (building 25).
2. Seed filtration stacks (building 44).
3. Filtration tank vents (35A unit) and Causticisation tank vents (35J unit).
4. Sand separation stacks (building 26).
5. Boilers and Turbines stacks (building 110).
6. Calciner stacks.
7. Calciner vacuum pumps.

Alcoa considers a number of the options identified are beyond current best practice pollution control based on technology, practices and equipment currently applied in similar operations. However, as shown in the report at Appendix 2, achievement of potential emission reductions from these sources could meet the goal of ensuring no overall increase in VOC emissions from the refinery.

Further investigations will be required by Alcoa to evaluate these measures and demonstrate both their practicality to be implemented and scope of emissions reduction achievable. In recognition of this, proposed new Condition 8-1A requires that any Detailed Design Report for Expansion Works from 3.3 Mtpa up to 4.7 Mtpa, demonstrate that design of the expansion works will reasonably ensure that there is no overall increase in VOC or odour emissions from the refinery through the application of best practice pollution control measures.

It is important to note that apart from emissions from the Calciners, emissions of VOCs and odour from other individual refinery sources are generally small (Figures 2 and 3).

iv. Require that the Detailed Design Report is subject to independent peer review (in accordance with Procedure 1)

Existing Condition 8-4 sets out that the Detailed Design Report is to be subject to independent peer review in accordance with Procedure 1. It is proposed that Condition 8-4 be amended to recognise new Condition 8-1A as set out above.

Also, when Condition 8-4 was initially proposed it was intended to increase production from the refinery in one large single-stage through the construction of a Third Production Unit. With the revised proposed conditions, expansions will occur in increments. For some increments, the extent of new equipment and emissions control measures may not require independent peer review, particularly where they are replicating existing proven equipment or emission reduction measures.

Therefore, it is also proposed to amend Condition 8-4 to provide the CEO discretion as to whether an independent review is required for each expansion works.

3.2.4 Expected environmental outcome the changes to condition

The EPA's Environmental objectives relevant to Condition 8 are:

1. To maintain air quality and minimise emissions so that environmental values are protected; and
2. To protect social surroundings from significant harm.

In particular, the EPA has identified the following as key considerations in assessing whether these Environmental objectives can be met in its Environmental factor guidelines:

- the application of technology appropriate to the potential environmental impacts and risks
- whether proposed mitigation is technically and practically achievable
- characterisation of potentially harmful emissions and the pathways by which they may be released to air
- whether proposed management and mitigation of impacts to social surroundings is technically and practically achievable.

The proposed amendments do not materially alter the intentions of existing Condition 8 and support the relevant EPA objectives.

Alcoa considers that the work required by the proposed amended Condition 8, together with the work required by Condition 9 on Air Dispersion Modelling and Condition 10 on Operational Performance Verification provide sound confidence the EPA's Environmental objectives can be met. Condition 8-3 requires that if the verification monitoring indicates pollution control measures implemented do not achieve the target emission rate reductions, then further work is required to identify alternative measures to achieve equivalent overall reductions.

Also, in line with the EPA's recommendations in Bulletin 1215 on its assessment of the 2005 ERMP, Alcoa has implemented a substantial land purchase program to enable people who have concerns regarding chemical sensitivity symptoms to relocate from the area.

Further, the proposed changes to the condition to permit increases in the refinery production in increments will enable the emissions reductions to be monitored and verified as production increases, rather than in one large single-stage production increase to 4.7 Mtpa as for the existing condition.

Ambient air quality monitoring will also continue in line with Condition 10. Substantial ambient air quality monitoring carried out since the 2005 ERMP has indicated air levels well below established health standards.

4. Changes to Condition 9 - Air Dispersion Model Validation

4.1 Identification of existing condition

4.1.1 Condition number and title

Condition 9 - Air Dispersion Model Validation

4.1.2 Intent of existing condition

The intent of the existing condition is to:

i. Require additional data acquisition and investigations to further improve and validate the air dispersion model; and
ii. Require the updated air dispersion model to be re-run with target emission rates for the expansion works, to reasonably demonstrate that GLCs predicted are consistent with those predicted in the 2005 ERMP and associated documents.

4.1.3 Justification for proposed change

Since the 2005 ERMP and issue of MS 728, Alcoa has undertaken additional data acquisition and investigations in line with Condition 9-1. Alcoa is currently preparing a report for DWER setting out the additional work, its sensitivity on model results, and current best configuration of the model.

Alcoa considers this work has achieved the intent of Condition 9-1 to further validate and improve the air dispersion modelling to an acceptable degree for expansion works up to 3.3 Mtpa.

However, the inclusion of vertical profile temperature and wind velocity measurements in the model has proved more difficult than anticipated. Alcoa considers further investigations of techniques for acquiring vertical profile temperature and wind velocity measurements and their inclusion into the model are necessary prior to proceeding with expansions from 3.3 Mtpa up to 4.7 Mtpa. Changes are proposed to Condition 9 in line with this, as set out below.

4.1.4 EPA Environmental factors and objectives

There are two EPA Environmental factors and objectives relevant to Condition 9 (noting that as for Condition 8 above, the Environmental factor and objective for Human Health are considered within the Environmental factor and objective for Air Quality).

Environmental factor	Environmental objective
Air Quality	To maintain air quality and minimise emissions so that environmental values are protected.
Social Surroundings	To protect social surroundings from significant harm.

4.2 Proposed changes to condition

4.2.1 Proposed revised wording

9 Air Dispersion Model Validation

9-1 Prior to submitting a Works Approval application (under Part V of the *Environmental Protection Act 1986*) for works included in that portion of the revised proposal being the ~~third production unit~~ Expansion Works, as documented and described in schedule 1, to increase refinery production from 2.85 Mtpa the proponent shall carry out data acquisition and investigations for the purpose of validation of air dispersion model predictions of ground level concentrations in the Environmental Review and Management Program (May 2005) and associated documents, to the

requirements of the CEO ~~Minister for the Environment, on advice of the Environmental Protection Authority.~~

The data acquisition and investigations shall include:

1. twelve months of meteorological data from an escarpment meteorological station;
2. twelve months of vertical profile temperature and wind velocity measurements using methods acceptable to the CEO ~~Department of Environment and Conservation~~;
3. twelve months of meteorological data (wind speed, direction and temperature) from up to two additional meteorological stations located on the coastal plain, using methods and at locations acceptable to the CEO ~~Department of Environmental and Conservation~~;
4. investigation into the validity of the building wake dispersion scheme used in the air dispersion model, by a suitable qualified modeller;
5. investigation into the validity of modelled multiflued plume rise behaviour, in light of recent findings reported in literature, by a suitable qualified modeller; and
6. twelve additional months of base case emissions rate data for key sources.~~; and~~
~~7. revised emission rates from the Detailed Design Report referred to in condition 8-1.~~

Note: the "key sources" referred to in condition 9-1 are the liquor burner, calciners, 25A tank vents, 35A tanks, 35J tanks and cooling towers.

9-1A Prior to submitting a Works Approval application (under Part V of the *Environmental Protection Act 1986*) for works included in that portion of the revised proposal being the Expansion Works, as documented and described in schedule 1, to increase refinery production from 3.3 Mtpa the proponent shall carry out data acquisition and investigations for the purpose of validation of air dispersion model predictions of ground level concentrations in the Environmental Review and Management Program (May 2005) and associated documents, to the requirements of the CEO.

The data acquisition and investigations shall include:

1. additional investigation of techniques and approaches for measurement and assimilation of vertical wind velocity measurements into the Wagerup air dispersion model using methods acceptable to the CEO.

9-2 The proponent shall make use of the results of the data acquisition and investigations, referred to in conditions 9-1 and 9-1A to:

1. validate the performance of the dispersion model; and
2. provide details on whether ground level concentrations ~~achieve~~ predicted with the updated air dispersion model and design emission targets set out in the Detailed Design Reports referred to in conditions 8-1 and 8-1A are consistent with the predictions presented in the Environmental Review and Management Program (May 2005) and associated documents, both in the near field and the far field, up to ten kilometres from the multiflued stacks.

This work shall be carried out to the requirements of the CEO ~~Minister for the Environment on advice from the CEO Department of Environment and Conservation~~.

9-3 In the case that the validation of the dispersion modelling, referred to in condition 9-2, does not reasonably demonstrate ~~that~~ ground level concentrations ~~similar to that~~ consistent with those predicted in the Environmental Review and Management Program (May 2005) and associated documents will be achieved, the proponent shall make revisions to the detailed engineering design and repeat the air dispersion modelling until reasonable achievement is demonstrated.

9-4 Notwithstanding the requirements of conditions 9-1,9-1A, 9-2 and 9-3, the proponent may implement individual works of this proposal, as described in schedule 1 of this statement, subject

to the requirement of a Works Approval and Licence under Part V of the *Environmental Protection Act 1986,* on the *proviso* that the individual works:

(i) have effect in reducing or offsetting emission from the existing refinery, where possible; and
(ii) do not significantly increase the production capacity of the refinery.

4.2.2 Relevant EPA Environmental factors, objectives, policies and guidelines

As indicated above, there are two Environmental factors and objectives relevant to Condition 9, Air Quality and Social Surroundings.

A number of key considerations and current issues for EIA as set out in the EPA's Air Quality and Social Surroundings Environmental Factor Guidelines were described and discussed in section 3 above on changes to Condition 8.

In addition, the following key considerations and issues identified in the EPA's Environmental Factor Guidelines for Air Quality and Social Surroundings are particularly pertinent to Condition 9 and the proposed changes.

Environmental Factor Guideline – Air Quality

- whether numerical modelling and other analyses to predict potential impacts has been undertaken using recognised standards with accepted inputs and assumptions.

Environmental Factor Guideline – Social Surroundings

- that emissions of noise, odour or dust are considered in the context of relevant legislation, criteria or standards; and
- the level of confidence with which the predicted impacts to social surroundings have been made, and what is the risk should those predictions be incorrect.

4.2.3 Effect of proposed changes to condition

A key part of the EPA's Wagerup 3 assessment (EPA Bulletin 1215) was consideration of the air quality modelling for predicting GLCs of pollutants from the refinery. The predicted GLCs were a primary input to the Health Risk Assessment (HRA) for assessing potential health impacts from expansion of the refinery.

As part of the assessment, Alcoa commissioned CSIRO to undertake air dispersion modelling.

The air dispersion modelling showed that predicted GLCs of compounds emitted from the refinery met established national and international air quality health standards. Table 4 below (from EPA Bulletin 1215) shows a comparison of predicted GLCs with the National Environment Protection (Ambient Air Quality) Measure (NEPM) criteria pollutants (SO2, NO2, CO and PM10) and with investigation levels for the air toxics (benzene, formaldehyde, toluene and xylenes which were being considered for inclusion in an NEPM at the time), as presented in Table 22 of Bulletin 1215. The NEPM (Air Toxics) has since been adopted. The investigation levels adopted in the NEPM (Air Toxics) are similar to the levels being considered at the time of the Wagerup assessment.

Table 4: Comparison of predicted GLCs with NEPM guidelines and investigation levels (from EPA Bulletin 1205)

Pollutant	Guideline/ Inv level	Maximum at any receptor		Yarloop (receptor 4)		Hamel (receptor 10)	
	ug/m^3	ug/m^3	%	ug/m^3	%	ug/m^3	%
Nitrogen dioxide	246 – 1 hour	64.6	26.0%	61	24.8%	42	17.2%
	62 – annual	0.6	1.0%	0.28	0.4%	0.33	0.5%
Carbon monoxide	11,250 – 8 hr	46.9	0.4%	22	0.2%	22	0.2%
Sulphur dioxide	571 – 1 hour	21.5	3.5%	13.0	2.3%	7.3	1.3%
	229 – 1 day	4.5	1.8%	1.7	0.8%	1.6	0.7%
	57 – annual	0.07	0.1%	0.03	0.1%	0.03	0.1%
Particulates as PM_{10}	50 – 24 hour	44.6	89%	6.4	13%	4.9	10%
	5 days/yr	0(1)	0	0(1)	0	0(1)	0
Formaldehyde	54 – 24 hr	0.17	0.3%	0.08	0.1%	0.088	0.2%
Benzene	10.4 – annual	0.0035	<0.1%	0.0011	<0.1%	0.0010	<0.1%
Toluene	4,113 – 24 hr	0.05	<0.1%	0.021	<0.1%	0.013	<0.1%
Xylenes	1,183 – 24 hr	0.009	<0.1%	0.002	<0.1%	0.002	<0.1%

Note(1): -predicted number of days exceeding guideline.

The CSIRO modelling was subject to peer review during the assessment. The peer review noted a number of limitations and uncertainties regarding the modelling but found that: *"…the modelling undertaken for the Wagerup 3 Refinery expansion adequately assesses the potential impacts on the local atmosphere so long as a degree of conservatism is taken into account when applying the uncertainty factors from the modelling results presented by CSIRO in the HRA".*

In line with this, during the assessment, sensitivity analysis for the predicted GLCs was undertaken incorporating conservative allowance for uncertainties in the dispersion modelling such as for emissions uncertainty, inter-annual variability in meteorological conditions, and localised variations in wind speed. The sensitivity of the HRA was also analysed by applying a factor of two.

As part of its assessment the EPA found that: *''Whilst the EPA considers that dealing with uncertainty in the air dispersion modelling by applying the factor of 2 is adequate for this assessment, the EPA on advice from the DoE, considers that further work is required so that the modelling can be improved in the future, to enable post commissioning performance verification, if the proposal is approved."*(underling added).

Since the EPA assessment and issue of MS 728, Alcoa has continued to undertake data acquisition and investigation work to further validate the model in conjunction with CSIRO and other air quality modelling experts and implemented improvements where appropriate.

The proposed changes to Condition 9 do not change the intent of the existing condition as described above.

i. Require additional data acquisition and investigations to further validate and improve the air dispersion model

In line with existing Condition 9-1, Alcoa has carried out additional data acquisition and investigation including:

1. twelve months of meteorological data from an escarpment meteorological station;
2. twelve months of vertical profile temperature and wind velocity measurements;
3. twelve months of meteorological data (wind speed, direction and temperature) from up to two additional meteorological stations located on the coastal plain;
4. investigation into the validity of the building wake dispersion scheme used in the air dispersion model;
5. investigation into the validity of modelled multiflued plume rise behaviour; and
6. twelve additional months of base case emissions rate data for key sources.

Alcoa is currently preparing a report for DWER setting out the additional work, its sensitivity on model results, and current best configuration of the model. Alcoa has also proposed that the data acquisition and investigations work be undertaken to the requirement of the CEO rather than the Minister for Environment in the advice of the EPA. Alcoa understands that this is now normal practice for conditions actions to be undertaken to the requirements of the CEO.

Alcoa considers the data acquisition and investigation work has resulted in improvements to the model. As part of the work, Alcoa reviewed alternative prognostic models for meteorology and air dispersion model options to evaluate the best configuration for the Wagerup refinery. The following model configurations have been evaluated:

Configuration	Description	Meteorology Predicted by	Refinery Concentrations Predicted by	Fugitive Sources Concentrations Predicted By
1	As used in the 2005 HRA	TAPM(1)	TAPM	CALPUFF
2	Evaluation of TAPM versus CALPUFF dispersion by comparing cases 1 and 2 and of TAPM versus WRF(2) meteorology by comparing cases 2 and 3 of TAPM	TAPM	CALPUFF	CALPUFF
3	WRF only Meteorology	WRF	CALPUFF	CALPUFF
4	Evaluation of CALMET for meteorology	CALMET	CALPUFF	CALPUFF

(1) The Air Pollution Model
(2) Weather Research and Forecasting Model

Based on this work Alcoa considers that configuration 4 presents the best overall prediction of meteorology and ambient GLCs.

Details of the further data acquisition and investigation work and prognostic meteorology and air dispersion models adopted will be provided in reports to be submitted in respect of Conditions 9-1 and 9-2.

Alcoa considers the additional data acquisition and investigation work together with the evaluation of alternative prognostic meteorological and air dispersion models has achieved the intent of proposed amended Conditions 9-1 and 9-2 of further improving and validating the air dispersion modelling to provide reasonable confidence in predicting GLC predictions and HRA analysis for expansion works up to 3.3 Mtpa. This is particularly the case given the conservatisms adopted in the modelling for predicting maximum GLCs and HRA analysis.

As noted above, key considerations of the EPA's Environmental factors and objectives for Air Quality and Social Surroundings are:

- whether numerical modelling and other analyses to predict potential impacts have been undertaken using recognised standards with accepted inputs and assumptions; and
- the level of confidence with which the predicted impacts to social surroundings have been made, and what is the risk should those predictions be incorrect.

As recognised in Air Assessments 2017, major conservatism can be adopted into modelling through the predicted pollutant emissions rates adopted. For example, in modelling at Wagerup to date, a significant degree of conservatism has been adopted in the derivation of the maximum emission case used for the 1-

hour and 24-hour average concentration predictions, which are then compared with health standards and used in the HRA. This conservatism includes:

i. Using the maximum measured concentrations of emissions over the years of monitoring, multiplied by the maximum measured flow rate irrespective of whether the two occurred together to derive the maximum emission rate;
ii. Assuming that for all the different sources, the maximum emissions measured over the years of monitoring of the individual sources occur at the same time. The probability of this occurring for all refinery sources simultaneously is essentially zero; and
iii. Assuming that these emissions occur together, continuously for the whole year. Therefore, for determining maximum 1-hour concentration it assumes that the maximum emission rates occurred at the same time as the worst-case dispersive condition (which in itself is a rare occurrence), decreasing the real probability of these concentrations occurring even further.

These approaches apply a substantial level of conservatism in the emission rates used to predict maximum GLCs for comparison with the health standards and undertaking the HRA.

With respect to item 2 of the additional data acquisition and investigation work, vertical profile temperature and wind velocity measurements, the following work has been undertaken:

a) Radiosonde measurements:

   12 months of radiosonde measurements of temperatures, humidity and wind speed profiles throughout the lowest 2 km of the atmosphere was undertaken daily (morning) or twice daily (morning and evening) as part of the Wagerup winter 2006 and winter 2007 air quality studies undertaken jointly by Alcoa with CSIRO, WA Chemistry Centre and the then Department of Environmental Regulation; and

b) Sodar measurement:

   Continuous vertical wind and temperature profiles measurements were carried out using a Sodar measurement device for approximately three months, coinciding with the winter 2006 study.

The current modelling configuration using CALMET prognostic meteorology has enabled integration of the radiosonde and sodar vertical profile temperature and wind velocity measurements into the Wagerup air quality model for the first time. This is a significant step in the model evolution and improvement.

Notwithstanding the further validation work and improvements to the model to date, and significant degrees of conservatism adopted in the modelling, Alcoa considers further investigations of techniques for acquiring vertical wind and temperature measurements and additional data assimilation into the model should be undertaken for consideration of expansions beyond 3.3 Mtpa and up to 4.7 Mtpa due to the likelihood that there may be improvements to modelling and monitoring technology over time.

Therefore, Alcoa proposes a new Condition 9-1A be added as follows:

9-1A Prior to submitting any Works Approval application (under Part V of the *Environmental Protection Act 1986*) for works included in that portion of the revised proposal being the Expansion Works, as documented and described in schedule 1, to increase refinery production from 3.3 Mtpa up to 4.7 Mtpa the proponent shall carry out data acquisition and investigations for the purpose of validation of air dispersion model predictions of ground level concentrations in the Environmental Review and Management Program (May 2005) and associated documents, to the requirements of the CEO.

The data acquisition and investigations shall include:

1. additional investigation of techniques and approaches for measurement and assimilation of vertical wind velocity measurements into the Wagerup air dispersion model using methods acceptable to the CEO.

Alcoa has also proposed that existing Condition 9-1 be amended to provide that the data acquisition and investigations required by the conditions be to the requirement of the CEO rather than the Minister for Environment in the advice of the EPA. Alcoa understands that this is now normal practice for conditions actions to be undertaken to the requirements of the CEO. This has also been applied to proposed new Condition 9-1A.

Alcoa has also proposed that item 7 (revised emission rates from the Detailed Design Report referred to in condition 8-1) be deleted from the additional data acquisition and investigations listed in Condition 9-1 as it does not appear consistent with the other data acquisition and investigation matters in the condition. The revised ('target') emission rates will be set out in the Detailed Design Reports.

ii *Require the updated air quality model to be re-run with design target emission rates for the expansion works, to reasonably demonstrate that GLCs predicted are consistent with those predicted in the 2005 ERMP and associated documents.*

The intention of Conditions 9-2 and 9-3 is to require the updated air quality model to be re-run with design target emission rates for the Expansion Works, to reasonably demonstrate that GLCs predicted are consistent with those predicted in the 2005 ERMP and associated documents

Minor amendments are proposed to Conditions 9-2 and 9-3 to reflect the proposed inclusion of new Conditions 8-1A and 9-1A as below. It is proposed the wording of the conditions also be amended slightly to require demonstration that the GLCs are 'consistent with' the 2005 ERMP predicted GLCs rather than 'achieve' or 'similar to'. This is because the amended Condition 9-2 will require the air dispersion modelling to be done at various production rates from 3.3 Mtpa up to 4.7 Mtpa as production is increased in increments. The predicted GLCs in the 2005 ERMP are only for production at 4.7 Mtpa. The term 'consistent with' enables a determination whether the GLCs predicted for expansion increments are congruous with the 2005 ERMP predicted GLCs having regard for the objective of meeting health standards and for input to the HRA. These amendments do not change the intention of Conditions 9-2 and 9-3.

9-2 The proponent shall make use of the results of the data acquisition and investigations, referred to in conditions 9-1 and 9-1A to:

1. validate the performance of the dispersion model; and
2. provide details on whether ground level concentrations ~~achieve~~ predicted with the updated air dispersion model and design emission targets set out in the Detailed Design Reports referred to in conditions 8-1 and 8-1A are consistent with the predictions presented in the Environmental Review and Management Program (May 2005) and associated documents, both in the near field and the far field, up to ten kilometres from the multiflued stacks.

This work shall be carried out to the requirements of the CEO ~~Minister for the Environment on advice from the CEO Department of Environment and Conservation~~.

9-3 In the case that the validation of the dispersion modelling, referred to in condition 9-2, does not reasonably demonstrate ~~that~~ ground level concentrations ~~similar to that~~ consistent with those predicted in the Environmental Review and Management Program (May 2005) and associated documents will be achieved, the proponent shall make revisions to the detailed engineering design and repeat the air dispersion modelling until reasonable achievement is demonstrated.

These amendments do not change the intention of Conditions 9-2 and 9-3.

4.2.4 Expected environmental outcome following the changes to condition

The EPA's Environmental objectives relevant to Condition 9 are:

1. To maintain air quality and minimise emissions so that environmental values are protected; and
2. To protect social surroundings from significant harm.

The EPA has identified the following as key considerations in assessing whether these Environmental objectives can be met in its Environmental factor guidelines:

- whether numerical modelling and other analyses to predict potential impacts has been undertaken using recognised standards with accepted inputs and assumptions; and
- the level of confidence with which the predicted impacts to social surroundings have been made, and what is the risk should those predictions be incorrect.

The proposed amendments do not materially alter the intentions of existing Condition 9. While there will always be a degree of uncertainty in air dispersion modelling, Alcoa considers the work required by the proposed amended Condition 9, together with the conservatism adopted into the modelling, provides sound confidence the EPA's Environmental objectives can be met.

Also, in line with the EPA's recommendations in Bulletin 1215 on its assessment of the 2005 ERMP, Alcoa has implemented a substantial land purchase program to enable people who have concerns regarding chemical sensitivity symptoms to relocate from the area.

Further, the proposed changes to the condition to permit increases in the refinery production in increments will enable the emissions reductions to be monitored and verified as production increases in increments, rather than in one large single-stage production increase to 4.7 Mtpa as for the existing condition.

Substantial ambient air quality monitoring carried out since the 2005 ERMP has indicated air levels remain well below established health standards and consistent with model predictions (CSIRO, 2013).

5. Changes to Condition 10 - Operational Performance Verification

5.1 Identification of existing condition

5.1.1 Condition number and title

Condition 10 – Operational Performance and Verification

5.1.2 Intent of existing condition

The intent of the existing condition is to:

i. Require the preparation of an air quality verification plan which includes:
   a. an emissions and ambient air quality monitoring program for verification monitoring;
   b. management procedures for achieving design emission targets; and
   c. a program of independent audit and review of the monitoring and performance review.
ii. Require the verification plan to be subject to independent peer review in accordance with Procedure 1; and
iii. Require that if the performance verification monitoring indicates that the design emission targets are not being reasonably achieved, revisions are made to operational procedures and/or engineering design to ensure compliance with the design emission targets.

5.1.3 Justification for proposed change

Changes are proposed to Condition 10 principally to align it with proposed amended Conditions 8 and 9 to enable expansions in refinery production to occur in increments. A change is also proposed in the timing of the requirement for the air quality verification plan to be prior to 'commissioning' rather than prior to 'Works Approval application'.

5.1.4 EPA Environmental factors and objectives

There are two EPA Environmental factors and objectives relevant to Condition 10 (noting that as for Conditions 8 and 9 above, the Environmental factor and objective for Human Health are considered with the Environmental factor and objective for Air Quality).

Environmental factor	Environmental objective
Air Quality	To maintain air quality and minimise emissions so that environmental values are protected.
Social Surroundings	To protect social surroundings from significant harm.

5.2 Proposed changes to condition

5.2.1 Proposed revised wording

10 Operational Performance Verification

10-1 Prior to commissioning ~~submitting a Works Approval application (under Part V of the *Environmental Protection Act 1986)* for~~ any works included in that portion of the revised proposal being the ~~third production unit~~ Expansion Works, as documented and described in schedule 1, the proponent shall prepare and submit an ~~revised~~ Air Quality ~~Management~~ Verification Plan for those works to the satisfaction of the CEO. ~~Minister for the Environment on advice from the Environmental Protection Authority.~~

The ~~revised~~ Air Quality ~~Management~~ Verification Plan shall include:

1. an emission and ambient ~~A~~air ~~Q~~quality ~~M~~monitoring ~~P~~program, for performance verification monitoring, that addresses emissions monitoring for the works ~~Point Source Emission (for the key emission sources, refer to condition 9-1), Diffuse Source Emissions~~ and ambient air quality, including where practicable and appropriate, continuous monitoring, and
2. management procedures with the objective of achieving the design emission targets referred to in conditions 8-1 and 8-1A for the works under stable operating conditions, and minimising emissions during unstable operating conditions such as during start-up, shut down and equipment failure as referred to in condition 8-2.~~; and~~
3. ~~a program for independent audit and review of the results of monitoring undertaken in accordance with the Air Quality Management Plan.~~

Note ~~1~~: ~~In the preparation of advice to the Minister for the Environment, the Environmental Protection Authority expects that the advice of the following agencies will be obtained:~~

- ~~Department of Environment and Conservation (Air Quality Management Branch); and~~
- ~~Department of Health.~~

~~2~~1: During the development of the ~~Emissions and Ambient~~ Air Quality ~~Monitoring Program~~Verification Plan, the proponent must consult with community and stakeholders.

10-2 The Air Quality ~~Management~~Verification Plans referred to in condition 10-1 shall be subject to independent peer review (refer to Procedure 1) if required by the CEO.

10-3 The proponent shall implement the Air Quality ~~Management~~Verification Plans referred to in condition 10-1 throughout the commissioning and operational phase of each Refinery expansion. ~~to the requirements of the Minister for the Environment on advice of the Environmental Protection Authority.~~

10-4 The proponent shall make the Air Quality ~~Management~~Verification Plans referred to in condition 10-1 publicly available to the requirements of the CEO.~~Minister for the Environment on advice from the Environmental Protection Authority.~~

10-5 In the case that the performance monitoring referred to in condition 10-1 indicates that the design emission targets referred to in the Detailed Design Reports required by conditions 8-1 and 8-1A ~~and 8-2~~ and the management procedures referred to in condition 10-1 are not being reasonably achieved, the proponent shall make revision to the operational procedures and/or engineering design to ensure compliance with the design emission targets.

10-6 The proponent shall regularly review and, where appropriate, employ adaptive management practices to facilitate continuous improvement in key source emissions management at the refinery in line with current best practice management.

Note: It is expected the requirements of condition 10-6 will be implemented through Part V of the *Environmental Protection Act 1986.*

10-7 Notwithstanding the requirements of conditions 10-1, 10-2, 10-3, 10-4, 10-5 and 10-6, the proponent may implement individual works of this proposal, as described in schedule 1 of this statement, subject to the requirement of a Works Approval and Licence under Part V of the *Environmental Protection Act 1986,* on the *proviso* that the individual works:

(i) have effect in reducing or offsetting emission from the existing refinery, where possible; and
(ii) do not significantly increase the production capacity of the refinery.

5.2.2 Relevant EPA Environmental factors, objectives, policies and guidelines

As indicated above, there are two Environmental factors and objectives relevant to Condition 10, Air Quality and Social Surroundings.

The key considerations and current issues for EIA as set out in the EPA's Air Quality and Social Surroundings Environmental Factor Guidelines were described and discussed in sections 3 and 4 above on changes to Conditions 8 and 9. These are also relevant to Condition 10.

5.2.3 Effect of proposed change to condition

The proposed changes do not change the intent of existing Condition 10 as described in section 5.1.2 above.

i *Require the preparation of an air quality verification plan*

The primary intent of Condition 10 is to require verification that design emission targets for expansion works are achieved.

In line with this, the proposed amended Condition 10-1 still requires the preparation of an air quality verification plan for each refinery expansion with the plan to include:

1. an emission and ambient Air Quality Monitoring Program, for performance verification monitoring, that addresses emissions monitoring for the works ~~Point Source Emission (for the key emission sources, refer to condition 9-1), Diffuse Source Emissions~~ and ambient air quality, including where practicable and appropriate, continuous monitoring, and
2. ~~2.~~ management procedures with the objective of achieving the design emission targets referred to in conditions 8-1 and 8-1A for the works under stable operating conditions, and minimising emissions during unstable operating conditions such as during start-up, shut down and equipment failure as referred to in condition 8-2.~~; and~~
3. ~~a program for independent audit and review of the results of monitoring undertaken in accordance with the Air Quality Management Plan.~~

The proposed changes align Condition 10-1 with the proposed amended Conditions 8 and 9 to enable expansions in refinery production to occur in increments. The timing of requirement for the AQVP has also been revised to 'prior to commissioning' rather than 'prior to Works Approval application'. This is to reflect that the AQVP is required for verification of performance and not prior to Works Approval.

Alcoa has also proposed that Condition 10 be amended to provide that the Air Quality Verification Plan is prepared to the requirement of the CEO rather than the Minister for Environment in the advice of the EPA. Alcoa understands that this is now normal practice for conditions actions to be undertaken to the requirements of the CEO.

ii *Require the air quality verification plan to be subject to independent peer review in accordance with Procedure 1*

Existing Condition 10-2 sets out that the air quality verification plan is to be subject to independent peer review in accordance with Procedure 1.

When Condition 10-2 was initially set, expansion of refinery production was proposed to occur in one large single-stage through the construction of a Third Production Unit. With the revised proposed conditions, expansions will occur in increments. For some increments, the extent of new equipment and emissions control measures may be limited. Independent peer review may now not be required for each air quality verification plan, particularly where they are replicating existing proven equipment or emission reduction measures

It has therefore been proposed to amend Condition 10-2 to provide the CEO discretion.

iii *Require that if the performance monitoring indicates that the design emission targets are not being reasonably achieved, revisions are made to operational procedures and/or engineering design to ensure compliance with the design emission targets.*

Condition 10-5 is amended to reflect that with the revised proposed conditions the refinery expansions will occur in increments and therefore, that the performance monitoring will need to be carried out for design emission targets for each Detailed Design Report referred to in conditions 8-1, 8-1A and revisions made to the operational procedures and/or engineering design to ensure compliance with the design emission targets.

5.2.4 Expected environmental outcome following the changes to condition

The EPA's Environmental objectives relevant to Condition 10 are:

1. To maintain air quality and minimise emissions so that environmental values are protected.
2. To protect social surroundings from significant harm.

The proposed amendments do not materially alter the intentions of existing Condition 10. In particular, performance verification will be required to demonstrate design emission targets for refinery expansions are being reasonably achieved, and if not, revisions are made to the operational procedures and/or engineering design to ensure compliance with the design emission targets.

This will ensure the EPA's Environmental objectives are met.

Further, the proposed changes to the condition to permit increases in the refinery production in increments will enable the emissions reductions to be monitored and verified as production increases in increments, rather than in one large single-stage production increase to 4.7 Mtpa as for the existing condition. This will assist to further ensure the EPA's Environmental objective is met.

6. Change to Condition 11 - Noise

6.1 Identification of existing condition

6.1.1 Condition number and title

Condition 11 – Noise

6.1.2 Intent of existing condition

The intent of the existing condition is to ensure that all reasonable and practicable measures to control noise emissions are incorporated in design and construction of the expansion works and that noise levels from the refinery meet approved levels.

6.1.3 Justification for proposed change

As part of the assessment of the 2005 ERMP, the EPA also carried out an assessment of an application to exceed noise standards prescribed in the *Environmental Protection Noise Regulations 1997* (**Noise Regulations**). The EPA recommended that an approval be granted for this, subject to conditions.

An approval, the *Environmental Protection (Wagerup Alumina Refinery Noise Emissions) Approval 2012* (the **Noise Approval**) was granted to Alcoa in June 2012 pursuant to regulation 17 of the Noise Regulations. The approval has subsequently been amended in 2013 and 2014.

Pursuant to the conditions of the Noise Approval, Alcoa has applied for an extension of the duration of the approval. This application is currently under consideration.

The Noise Approval sets out approved noise levels to be achieved by the refinery. The Noise Approval also sets conditions which include the requirement for:

- preparation of a Noise Amelioration Plan
- appointment of an appropriately qualified independent noise monitoring consultant
- a Noise Monitoring Plan
- reporting on land management
- public availability of reports.

6.1.4 EPA Environmental Factors and objectives

There is one EPA Environmental factor and objective relevant to Condition 11, that being Social Surroundings.

Environmental factor	Environmental objective
Social Surroundings	To protect social surroundings from significant harm.

6.2 Proposed change to condition

As indicated above, since the issue of MS 728 Alcoa has been issued an approval, the *Environmental Protection (Wagerup Alumina Refinery Noise Emissions) Approval 2012* as amended pursuant to regulation 17 of the Noise Regulations.

Alcoa considers that noise from the refinery is now appropriately regulated under this Noise Approval and the provisions of Part V of the Act related to Works Approval and Licences. As indicated above, the Noise Approval is subject to comprehensive conditions including noise monitoring which have been set subsequent to Condition 11 being set in MS 728. The information required in the Condition 11 can be required by the CEO as part of any Works Approval if necessary.

Alcoa therefore requests that Condition 11 be removed.

If, removal of the condition is not acceded to, Alcoa request that the wording be revised as follows.

6.2.1 Proposed revised wording

11 Noise

11-1 ~~Prior to submitting~~ As part of any Works Approval application (under Part V of the *Environmental Protection Act 1986)* for works included in that portion of the revised proposal being the ~~third production unit~~Expansion Works, as documented and described in Schedule 1, the proponent shall ~~revise the~~ submit a Noise Management Plan for those works ~~submitted in Section 10 of the Wagerup Refinery Unit Three Expansion ERMP (May 2005),~~ to provide detail on all reasonable and practicable measures to control noise emissions incorporated in design and construction of the expansion works, to the requirements of the CEO~~Minister for the Environment on advice of the Environmental Protection Authority.~~

The Plan shall include details of:

1. all significant noise sources, options considered for noise control, noise control measures proposed to be adopted and design target Sound Power Levels relevant to the works;
2. acoustic modelling of noise emission levels in the surrounding environment utilising the design target Sound Power Levels relevant to the works;
3. procedures for verifying that the design target Sound Power Levels have been achieved and total noise emissions from the works meet those predicted in the acoustic modelling undertaken in respect of 2;
4. ~~procedures for approval of noise emissions during construction and commissioning under noise regulation 13;~~ and
5. ~~5.~~ 4. parties engaged in the design, acoustic modelling and noise verification as covered by conditions 11-1(1) to 11-1(4).

11-2 The proponent shall make the Noise Management Plans required by condition 11-1 publicly available to the requirements of the CEO ~~Minister for the Environment on advice from the Environmental Protection Authority~~ following approval of the report required by condition 11-1.

11-3 The proponent shall implement the Noise Management Plans required under condition 11-1 to the requirements of the CEO ~~Minister for the Environment on advice from the Environmental Protection Authority.~~

11-4 Notwithstanding the requirements of conditions 11-1, 11-2 and 11-3, the proponent may implement individual works of this proposal, as described in schedule 1 of this statement, subject to the requirement of a Works Approval and Licence under Part V of the *Environmental Protection Act 1986,* on the *proviso* that the individual works:

(i) have effect in reducing or offsetting emission from the existing refinery, where possible; and
(ii) do not significantly increase the production capacity of the refinery.

6.2.2 EPA Environmental factors, objectives, policies and guidelines

As indicated above, there is one EPA Environmental factor and objective relevant to Condition 11, that being to protect social surroundings from significant harm.

Key considerations identified by the EPA for EIA for the factor Social Surroundings include:

- application of the mitigation hierarchy to avoid or minimise impacts on social surroundings, where possible
- that emissions of noise, odour or dust are considered in the context of relevant legislation, criteria or standards.

6.2.3 Effect of proposed changes to condition

Alcoa considers that these key considerations can be managed through the existing Noise Approval and Part V of the Act relating to Works Approval and Licencing.

The Noise Approval sets noise levels which Alcoa must achieve for the refinery and conditions requiring independent noise monitoring and publicly available monitoring results. The information required in the Condition 11 can be required by the CEO as part of any Works Approval process if necessary.

Removal of the condition would not compromise achievement of the EPA's objective.

If removal of the condition is not acceded to, then Alcoa request the wording be revised to allow for a Noise Management Plan to be prepared for expansion works for each increment of refinery production increase and submitted with the Works Approval application. The '2005 Plan' referred to in the existing condition is not considered contemporary, and it would be better to prepare a new Plan than update the 2005 Plan.

The proposed revised wording for the condition is still consistent with the key considerations of the EPA to apply the mitigation hierarchy to avoid or minimise noise impacts and to comply with relevant legislation, criteria or standards.

6.2.4 Expected environmental outcome following the changes to condition

The EPA's Environmental objective for Social Surroundings will still be achieved if Condition 11 is removed.

If removal of the condition is not acceded to, then the revised wording for the condition will also ensure the EPA Environmental objective will be met.

7. Proposed changes to Condition 12 - Water Use

7.1 Identification of existing condition

7.1.1 Condition number and title

Condition 12 – Water Use

7.1.2 Intent of existing condition

The intent of the existing condition is to ensure minimisation and re-use practices are employed in the refinery expansion so that minimum practicable water use is achieved.

7.1.3 Justification for proposed change

Alcoa is subject to water licensing under the *Rights in Water and Irrigation Act 1914.* Since the issue of MS 728 Alcoa has continued to review its water use practices and employs water efficient processes and reuses water as far as practicable.

7.1.4 EPA Environmental factor and objectives

There is one EPA Environmental factor and objective relevant to Condition 12, that being Inland Waters.

Environmental factor	Environmental objective
Inland Waters	To maintain the hydrological regimes and quality of groundwater and surface water so that environmental values are protected

7.2 Proposed changes to condition

As indicated above, Alcoa is subject to water licensing under the *Rights in Water and Irrigation Act 1914* for both surface and groundwater use for the refinery.

Alcoa considers that water use at the refinery is effectively regulated under this legislation.

Alcoa therefore requests that Condition 12 be removed.

If, removal of the condition is not acceded to, Alcoa request that the wording be revised as follows.

7.2.1 Proposed revised wording

12 Water Use

12-1 As part of any Works Approval application (under Part V of the *Environmental Protection Act 1986)* for works included in that portion of the revised proposal being the ~~third production unit~~Expansion Works, as documented and described in Schedule 1, the proponent shall prepare a Water Use Management Plan for those works to the requirements of the CEO~~Minister for the Environment on the advice of the Environmental Protection Authority~~. The Water Use Management Plan shall describe the water use minimisation and re-use practices that will, be employed so as to achieve the minimum practicable water use at the refinery for those works.

12-2 The proponent shall implement and comply with the Water Use Management Plans referred to in condition 12-1.

12-3 The proponent shall make the Water Use Management Plans referred to in condition 12-1 publicly available.

7.2.2 Relevant EPA Environmental factors, objectives, policies and guidelines

As indicated above, there is one EPA Environmental factor and objective relevant to Condition 12, that being to maintain the hydrological regimes and quality of groundwater and surface water so that environmental values are protected

Key considerations identified by the EPA for EIA for the factor Inland Waters include:

- the current state of knowledge of inland waters
- the baseline hydrological regime and quality, at the proposal site, and downstream and/or the surrounding water resource
- whether all analyses are undertaken to a standard consistent with recognised published guidance and appropriate accreditation
- application of the mitigation hierarchy to avoid and minimise impacts to inland waters, where possible.

7.2.3 Effect of the proposed changes to condition

Alcoa considers that these key considerations can be managed through the water licensing legislation. In particular, the water licensing process requires adequate assessment of the hydrologic regime and potential impacts on inland waters and their environmental values. The licensing also requires consideration of water use efficiency.

Removal of the condition would not compromise achievement of the EPA's objective.

If removal of the condition is not acceded to, then Alcoa request the wording be revised to allow for a Water Use Plan to be prepared for expansion works for each increment of the refinery production increase.

The proposed revised wording for the condition is still consistent with the key considerations of the EPA to apply the mitigation hierarchy to avoid or minimise impacts to inland water where possible.

7.2.4 Expected environmental outcome following the changes to condition

The EPA's Environmental objective for Inland Waters will still be achieved if Condition 12 is removed.

If removal of the condition is not acceded to, then the revised wording for the condition will also ensure enable the EPA Environmental objective to be met.

8. Proposed change to Schedule 1 – Proposal description and Key proposal characteristics

8.1 Existing Schedule 1

8.1.1 Justification for change to Schedule 1

The revised proposal set out in the 2005 ERMP which was assessed in EPA Bulletin 1215 and approved in MS 728, was for expansion of the refinery from approximately 2.4 Mtpa up to a maximum capacity of 4.7 Mtpa through the Bayer process. The term Third Production Unit was used as a title in Alcoa's 2005 ERMP to describe the combination of new equipment, in particular a third Digestion Unit, and the upgrade of existing equipment to increase to 4.7 Mtpa.

Changes have been proposed above to the Ministerial conditions to permit increases in refinery production to occur in increments. As the expansion will not occur as a single Third Production Unit, and in line with the proposed revised conditions, it is considered appropriate to revise Schedule 1 to remove reference to the term Third Production Unit. A number of refinements are also proposed to remove elements which are not considered Key Proposal Characteristics as described in the EPA's Instructions on how to define the key characteristics of a proposal.

8.2 Proposed changes to Schedule 1

8.2.1 Proposed revised wording

The Proposal (Assessment No. 1527)

The proponent proposes to expand the Wagerup Alumina Refinery from approximately 2.4 Mtpa to a maximum of 4.7 Mtpa.~~by construction of a third production unit~~. The production increase to 4.7 million Mtpa is to be achieved using the Bayer process through a combination of new equipment and the upgrade of existing equipment to achieve an increase in both capacity and efficiency (the **Expansion Works**). As the Wagerup Refinery has been the subject of previous assessments, this represents a revised proposal pursuant to section 45B of the *Environmental Protection Act 1986*.

Although the expansion will result in an increase in the rate of bauxite mining, there is no proposed increase to the approved mining area.

The main characteristics of the Expansion Works~~proposal~~ are summari~~es~~ed in Table 1 below.

Table 1: Key Proposal Characteristics

Element	~~**Units**~~	**Current Refinery**	**4.7 Mtpa Expansion Works**
Refinery Area			
Refinery footprint	ha	183 ha	183 ha
Production			
Alumina production	Mtpa	Approximately 2.4 Mtpa	~~Approximately~~ Up to 4.7 Mtpa
~~**Raw Materials**~~			
~~Bauxite mining rate~~	~~Mtpa~~	~~9~~	~~16~~
~~Caustic Soda (dry)~~	~~tpa~~	~~141,000~~	~~282,000~~
~~Lime~~	~~tpa~~	~~110,000~~	~~200,000~~
Water	Mtpa	4,800	9,600
Residue Disposal			
Bauxite residue	Mtpa	4.8 Mtpa	9.6 Mtpa
Main Equipment Components			
Milling		• 3 SAG mills	• Increased milling capacity
Ore stockpiles		• Stockpile reclaimer and conveyor • 2 stockpiles plus one emergency	• New reclaimer and conveyors • New dust suppression and cleaning system for conveyor
Slurry storage		• 4 slurry tanks	• New slurry tanks
Digestion		• Digestor banks and flash vessels • Vapour condenser	• Increased digestion capacity • New and upgraded pumps
Evaporation		• Evaporation units • Heat interchange units	• New evaporation units • New heat interchanger
Lime		• 1 lime silo	• Upgrade lime storage and associated equipment
Clarification		• Sand removal units • Washers, thickeners • Filter tanks and presses	• New filter presses • New and upgraded washer facilities • New cyclone system
Residue Disposal Area (RDA)		• Approx. 180 hectares required for drying and storing residue	• Dry stacking area not to exceed 275 hectare drying area • New sand separation • Sand Lake wet sand area not to be increased by more than 50% • No wet stacking area • Oxalate pond not to increase by more than 1 hectare • Upgrade RDA sprinkler system
Precipitation		• Precipitators and seed filters • Thickeners and liquor tanks • Cooling towers and cyclone clusters	• New precipitators and seed filters • New thickeners and liquor tanks • Additional cooling capacity new cyclone clusters
Oxalate removal		• Decommissioned oxalate kiln	• Oxalate kilns with regenerative thermal oxidiser (RTO)
Liquor burning		• Liquor burner	• Install a RTO

Calciners		• 4 calciner units • 100 metre multiflue for calciners 1, 2, 3	• 2 new calciners with multiflue • No.4 calciner connection to new multiflue
Alumina storage		• 2 alumina storage bins and alumina conveyors	• Additional alumina storage • Upgrade or additional conveyor
Powerhouse (optional)[1]		• Turbo-alternators and boilers • Gas turbine with steam generator	• 2 new 270tph boilers • 2 new turbo alternators
Port Facilities		• Alumina storage and handling facilities • Caustic storage	• Upgraded alumina handling facilities
Water Supply		• Licenced surface water sources	• Increased surface water supply

Abbreviations:

Mtpa: million tonnes per annum
tpa: tonnes per annum
tph: tonnes per hour
Mlpa: million litres per annum
MW: megawatts

Note:

1: An option for 2 new 270 tph boilers providing electricity and steam for the Refinery. This option will cease if the Wagerup Cogeneration Plant referred to in EPA Bulletin 1215, Appendix 5 is implemented.

8.2.2 Effect of proposed changes to Schedule

The proposed changes to Schedule 1 amend wording but do not alter the authorised extent of the approval of MS 728.

9. Proposed changes to Procedures and Notes

9.1 Existing Procedures and Notes

9.1.1 Procedures and Notes number and title

Procedure 1 – Independent Design Review Team

Note 4 – Detailed Design Report and Air Quality Management Plan

9.1.2 Justification for proposed change

Changes are proposed to Procedure 1 and Note 4 to align with proposed changes to conditions 8 and 10 set out above, and to include administrative changes.

9.2 Proposed changes to Procedures and Notes

9.2.1 Proposed revised wording

PROCEDURES

1. Independent Design Review Team

   The Department of Water and Environmental Regulation ~~and Conservation~~, in consultation with the proponent, will establish an Independent Design Review Team (IDRT) including specialists in design, construction, commissioning and monitoring of large industrial plants and pollution control equipment. The IDRT shall seek specialist input from international experts where required.

   The IDRT will review the engineering design details for the Wagerup ~~3~~ Expansion Works leading to the Works Approval application to advise the Department of Water and Environmental Regulation ~~and Conservation~~ on whether the design meets international best practice in terms of pollution control, predicted emissions and emissions management and is reasonably likely to achieve the emissions performance levels specified in condition 8.

   The IDRT will also review the Air Quality ~~Management~~Verification Plans required in condition 10 to ensure that the monitoring and management is undertaken in accordance with international best practice.

NOTES

4. The proponent is required to apply for a Works Approval and Licence for this project under the provisions of Part V of the *Environmental Protection Act 1986.* The Works Approval application is to include the Detailed Design Reports referred to in conditions 8-1 and 8-1A ~~and the Air Quality Management Plan referred to in condition 10-1~~, which will be considered in preparation of the Works Approval and Licence.

9.2.2 Effect of proposed changes to Procedures and Notes

The proposed changes to Procedure 1 and Note 4 align the procedures with the proposed changes to Conditions 8 and 10. As set out in section 5 in relation to proposed changes to condition 10, the AQVP is required for Operational Performance Verification, and therefore it is considered it should be submitted and approved prior to commissioning of Expansion Works, not prior to the Works Approval application.

10. Other matters

10.1 Consultation

Alcoa has an established Community Consultative Network (CCN) for the Wagerup Refinery to facilitate dialogue and consultation on key social, economic and environmental issue associated with the refinery.

Alcoa has informed the CCN that it is proceeding with a Section 46 review of the environmental approval conditions for the Wagerup Refinery to permit production of the refinery to be increased in increments, with an initial increase in production to 3.3 Mtpa. Further increments to increase production to a maximum capacity of 4.7 Mtpa would proceed later, subject to future planning.

Once Alcoa has formed its plans of works it intends to implement to expand production to 3.3 Mtpa and submitted its Section 46 Report to the EPA, Alcoa will brief the CNN on the planned expansion and requirements of the proposed amended approval conditions.

Alcoa has also prepared an Engagement Plan to inform other key stakeholders, both government and non-government, of the planned expansion and approach to the proposed amended conditions.

During preparation of the Section 46 Review Document Alcoa has engaged with DWER, including EPA Services, to gain guidance in preparing its proposed changes to the conditions and procedures.

10.2 Management plans

There are no management plans approved in respect of the conditions of Ministerial Statements 728 and 1069 which require review or amendment in regard to this Section 46 review of conditions.

10.3 Spatial information

There is no spatial information associated with the Ministerial Statements 728 and 1069 which requires amendment as part of this Section 46 review of conditions.

11. References

Air Assessments. (2017). *Wagerup Alumina Refinery Air Quality Modelling Evaluation of Alternate Prognostic Winds October 2017.*

Air Assessments. (2019). *Wagerup Alumina Refinery Air Quality Modelling Evaluation of TAPM with Wind Data Assimilation March 2019.*

Alcoa. (2012). *Wagerup Long Term Residue Management Strategy.*

CSIRO. (2013). *Alcoa Wagerup Air Quality Action Plan Sign Off Report prepared for the CSIRO Resolution Committee -Recommendation 13: Short Term Variations in Emission Rates .*

Environ. (2005a). *Wagerup 3 ERMP for Alcoa World Alumina Australia, May 2005.*

Environ. (2005b). *Oudour Analysis -Wagerup Unit Three.*

Environ Odour Australia. (2004). *Alumina Refinery Odour Intensity Study.*