Alcoa World Alumina Australia

Kwinana Alumina Refinery

Source Emissions Characterisation Plan

9 February 2006

FOREWARD

This document has been prepared in accordance with Ministerial and works approval conditions granted for the Kwinana Emissions Reduction Project – Liquor Burner, and is intended to reflect Alcoa's public commitment to transparency in its environmental management program. Public comments and submissions on its contents may be forwarded by mail to:

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This document is based on drafts prepared for Alcoa by consultants Central Chemical Consulting. It will be reviewed and amended from time to time, and a current version will be maintained on Alcoa's website.

This report has taken into account comments and advice from advisory agencies.

TABLE OF CONTENTS

Page No.

LIST OF TABLES

LIST OF APPENDICES

EXECUTIVE SUMMARY

The purpose of this Source Emissions Characterisation Plan is to augment existing requirements of Alcoa senior management to improve the emissions information available for the Kwinana Alumina Refinery and meet the Ministerial Conditions (in Ministerial Statement No. 678) for the implementation of the Kwinana Liquor Burner Emissions Reduction. Results will be compiled and reported as a refinery atmospheric emissions inventory to be submitted within 18 months of the commissioning of the Liquor Burner fitted with the upgraded emissions reduction equipment. The primary sources considered within this plan are from all substantive point, fugitive and area sources. Equipment on the Kwinana site that have been identified as substantive point sources of emissions are; the fluidised bed Calciners and Vacuum Pumps, Slurry Storage Tanks, Vapour Containment Tank, Digestion Heaters, Oxalate Belt Filters and the Powerhouse Boilers.

The following are the main groups of substances emitted from the refining process:

- *Particulate matter*
- *Volatile Organic Compounds;*
- *Combustion gases; and*
- *Trace metals.*

These groups of substances are emitted from different stages of the alumina refining process and are not released from all point sources identified. Samples of emissions from substantive sources where there is not sufficient existing data will be analysed for those substances which were detected during a recent survey at Alcoa's Pinjarra Alumina Refinery. Minor point and open area sources scattered throughout the refinery have been identified by comparison to the equivalent source at the Pinjarra Refinery. The nature of these emissions will be described in the refinery emissions inventory report.

The characterisation program specifically outlines what substances are being measured and the sampling methodology used. The program has two distinct phases, these are:

- *Identification and evaluation of substantive sources to characterise the emissions contribution, and;*
- *Reporting, review and revision (if required) of the source emissions characterisation.*

Data gathered from the substantive source sampling program will be compared against baseline data from the Pinjarra Refinery. Any point sources which have VOC emission rates significantly different to Pinjarra may be re-sampled to better identify the variation.

The progress of continuing emissions evaluation at the Wagerup RDAs will be reviewed prior to the completion of the Kwinana Refinery Atmospheric Emissions Inventory. A comparison of the key refinery parameters which characterise the emissions from each RDA will be performed. This study will identify both how to extrapolate Wagerup RDAs emissions data to Kwinana RDAs, and any further investigative work to complete the full characterisation of emissions (if required).

Department of Environment, Department of Health, Kwinana Industries Council and Department of Industry and Resources have reviewed the draft Plan and provided advice. Where appropriate, comments and changes have been incorporated into this Plan.

1 INTRODUCTION

1.1 TYPES OF AIR EMISSION

Emissions can occur from two types of sources; area or point. The term "area source" is used to refer to diffuse emissions, including those from fugitive sources, that occur generally within a locality and its surrounds. "Point source" is used to describe emissions that are released directly from a defined point or location such as a stack or chimney. The focus of this Source Emissions Characterisation Plan is to identify and classify emissions from the Kwinana Refinery as being either substantive or minor sources, and to scope a program to characterise substantive sources.

Substantive point sources on site include major equipment located in areas of Digestion, Calcination and the Powerhouse. Multiple minor point sources such as tank vents and vacuum pump stacks are scattered throughout the refinery and are described in this report for completeness.

Some of the following groups of substances are emitted from different stages of the alumina refining process:

- Particulate matter;
- Volatile Organic Compounds;
- Combustion gases; and
- Trace metals.

1.2 PURPOSE AND SCOPE OF PLAN

The purpose of this Source Emissions Characterisation Plan (SECP) is to:

- Augment existing requirements of Alcoa senior management to improve the emissions information available for the Kwinana Refinery; and
- Meet the Ministerial Conditions (in Ministerial Statement No. 678) for the implementation of the Kwinana Liquor Burner Emissions Reduction Project.

It is envisaged that this plan will help determine the nature and relative contribution of identified substantive emission sources at the Kwinana Refinery.

This document also details the selection of major sources and outlines the sampling program adopted to capture baseline data for comparison with reduced emissions following commissioning of the Liquor Burner with the upgraded emissions reduction equipment.

The scope of this characterisation plan does not include the following aspects:

- Measurement of minor sources of emission within the Refinery; and
- Greenhouse gas emissions (addressed in separate greenhouse gas reporting requirements).

1.3 ENVIRONMENTAL LICENCE LIMITS

The operating Licence for the Kwinana Refinery issued in September 2005 (Licence No 5245/9) applies emission limits for particulates and oxides of nitrogen for Calciner stacks, and for oxides of nitrogen and carbon monoxide for Powerhouse stacks when measured at a quarterly frequency using appropriate United States Environmental Protection Agency (USEPA) Methods.

The Licence also requires that combustion gas emissions including oxides of nitrogen (NO_x) and carbon monoxide (CO) are measured quarterly from each Calciner stack and Powerhouse boiler, plus sulphur dioxide (SO_2) from the Calciner stacks. These are reported to the DoE annually (Alcoa, 2005b).

1.4 MINISTERIAL STATEMENT AND OTHER STATUTORY COMMITMENTS

Within the Environmental Referral (Environ 2004) submitted to the Environmental Protection Authority for review for approval to undertake the Kwinana Liquor Burner Emission Reduction Project, Alcoa made commitments to update and maintain an Atmospheric Emissions Inventory at the refinery.

In June 2005 Alcoa received the Ministerial “Statement that a Project May be Implemented” No. 678, related to the installation of emissions control equipment on the Liquor Burner at Kwinana Refinery. This statement included Ministerial Conditions requiring the preparation of a Source Emissions Characterisation Plan for identification and quantification of atmospheric emissions from the Kwinana Alumina Refinery operations prior to commissioning the Liquor Burner, to the requirements of the Minister for the Environment on advice of the Environmental Protection Authority.

In accordance with requirements of the Ministerial Statement Condition 4-1, the contents of this Source Emissions Characterisation Plan including the proposed sampling program have been developed and submitted for comment to the following key organisations:

- Department of Environment (DoE),
- Department of Health (DoH),
- Department of Industry and Resources (DoIR); and
- Kwinana Industries Council (KIC).

Operating Licence No 5245/9 also requires Alcoa to include in the Source Emissions Characterisation Plan the findings of an evaluation of the applicability of the study entitled “*Emissions to Air from Residue Storage Disposal Area – Assessment of Emissions from Diffuse Area Sources*” by GHD for

Alcoa World Alumina, dated March 2005, conducted at the Alcoa Wagerup Alumina Refinery, to the characterisation of gaseous emissions from the Kwinana Refinery residue areas.

It is noted that the Department of Consumer and Employment Protection (DoCEP) through DoIR suggested that Alcoa confirm if the Liquor Burner stack dimensions are adequate to avoid significant influence of building downwash effects. This issue has been addressed in the draft Source Emissions Verification Monitoring Plan which has been circulated to the four agencies identified above for comment and advice. A copy of the letter which is the expert advice of a specialist dispersion modelling consultant that the Liquor Burner stack will not be significantly influenced by building downwash effects after consideration of the new stack height and adjacent buildings dimensions is included in the Source Emissions Verification Monitoring Plan.

The Ministerial Conditions include specific requirements for the delivery timetable and content of the Source Emissions Characterisation Plan. In particular, the Ministerial Conditions require that the Source Emissions Characterisation Plan set out an implementation program and procedures to enable five key points which are addressed below.

1.4.1 Identification of the nature and range of atmospheric emissions

Extensive emissions characterisation work previously completed at Kwinana, Pinjarra and Wagerup Refineries over many years has provided Alcoa with thorough knowledge of emission points and the nature of materials emitted. Section 2 and 3 of this report detail the nature and range of atmospheric emissions, including odour, from all substantive point, fugitive and area sources, identifying the nature of excluded sources.

1.4.2 Quantification of identified atmospheric emissions

The program established in this report will have the substantive sources identified and quantified for inclusion in the Atmospheric Emissions Inventory, to be completed within 18 months of the commissioning of the Liquor Burner. Baseline data will be determined from existing relevant information or from additional monitoring work described in this report. Baseline mode of the Refinery is considered to be a daily production rate of 5800 tpd. Significant variation of the emission rates is only considered to occur with refinery production rate variation of +/- 10% for more than 3 months and continued operation of the Liquor Burner for more than 12 months. The Atmospheric Emissions Inventory will describe other factors which affect variability of emissions and the potential off-site impacts of variations from the baseline mode.

1.4.3 Development of an Air Emissions Inventory

The report sets out the program to meet the Ministerial Conditions for the completion of Atmospheric Emissions Inventory within 18 months following the commissioning of the Liquor Burner. Section 3 sets out the program in detail.

1.4.4 Description of air pollution control equipment

A list of the emissions control equipment currently in operation at the refinery is listed in Section 1.5.

1.4.5 Source locations and emissions with potential for significant off-site impacts

The Atmospheric Emissions Inventory will identify the mass emission rates for substantive sources. This will aid in the determination of significant off site impacts.

1.5 EXISTING AIR EMISSION CONTROL EQUIPMENT

The following equipment and systems are in place to control air emissions at the Kwinana Refinery:

Digestion Area:

- Containment tank for the collection and condensation of digestion and re-digestion vapours,
- Dust collection devices on bauxite conveyors,
- Sprinklers for control of dust from the bauxite stockpiles,
- Dust collection devices on lime storage tanks and on conveyors transferring lime, and
- Vapour scrubbers on lime mixing tanks.

Clarification Area:

- Dust collection devices on lime storage tanks and on conveyors transferring lime, and
- Vapour scrubbers on lime mixing tanks

Calcination and Liquor Burning:

- Multiclone dust collectors and electrostatic precipitators for dust control on each Calciner,
- Dust collection devices on conveyor transfer points, and
- Dust collectors, wet scrubber and Regenerative Thermal Oxidiser (RTO) on the Liquor Burner.

Shipping Area:

- Dust collection devices on product storage tanks and conveyor transfer points, and
- Multi choke dust control equipment on the ship loader

Residue area:

- Residue Dust Control Reticulation System activated in response to weather forecasting, high winds and visual monitoring, and
- Multiple techniques for passive dust control including revegetation, bitumen emulsion, blue metal application, water trucks etc.

2 CLASSIFICATION OF AIR EMISSIONS

In early 2005 an Air Quality Management Plan for Point Source (Stack) Emissions for Alcoa's Pinjarra Refinery (Alcoa, 2005a) documented Pinjarra's existing air monitoring program for the Pinjarra Refinery and updated it with the additional sampling created as a result of the Pinjarra Efficiency Upgrade Project. This work identified the following six major point sources:

- Oxalate Kiln Stack;
- Digestion RTO Stack;
- Calciner Stacks;
- Alumina Leach Dryer Stack;
- Powerhouse Boilers; and
- Building 45 Cooling tower.

Previous emissions source identification work at the Kwinana Refinery has been utilised with the Pinjarra emissions inventory to classify Kwinana sources as either substantive or minor, allowing for site-specific differences. Since both the Kwinana and Pinjarra Refineries receive ore from the same mine site and make use of similar process technologies, a direct comparison of Pinjarra emission inventory data to the process units at Kwinana can be made.

2.1 IDENTIFICATION OF SUBSTANTIVE POINT SOURCES

An initial comparison of sources excludes the Oxalate Kiln and Alumina Leach Dryer Stacks as substantive sources since these process units (or equivalents) are not used at the Kwinana Refinery. The Building 45 cooling tower at Pinjarra makes use of large quantities of water, a significant proportion of which is recycled process water[1]. In contrast to this, all cooling towers in the Kwinana Refinery only use potable and de-hardened bore water. VOC emissions are thus expected to be very low from all Kwinana cooling towers and may present considerable difficulties in quantifying reliably. Cooling towers are therefore not considered as a substantive emission source at the Kwinana

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[1] Approximately 40% (by volume) of the feed water is lake water from residue storage areas around Pinjarra.

Refinery. Consistent with the commitment to review the SECP made in Section 5 of this Plan, Alcoa will consider the impact of any recycled process water use in the cooling towers in the future.

To identify substantive point sources, the VOCs emission rate from all equipment at Kwinana was estimated using emissions data on the equivalent equipment at the Pinjarra Refinery. Odour data collected from surveys previously undertaken at the Kwinana Refinery (The Odour Unit, 2001) has been used to confirm the choice of substantive sources. The VOC emissions from all units used directly in the alumina refining process at Kwinana were calculated by allowing for the considerably lower bauxite ore and alumina hydrate feed rates at Kwinana. On the basis of Pinjarra data, the sources identified below would account for 88% of all VOC emissions at Kwinana (see Appendix B). These substantive sources include:

- Digestion Vapour Containment Tank Stack;
- Digestion Heater Vents;
- Oxalate Belt Filter Vacuum Pump Stack;
- Calciner Stacks;
- Calciner Vacuum Pump Stacks, and
- Powerhouse Boiler Ducts.

When an adjustment of 50% is made to the VOCs data from the equivalent Pinjarra process units due to the difference in bauxite ore and alumina hydrate feed rates at the two refineries, the identified substantive sources are estimated to contribute 88% of VOC emissions at the Kwinana Refinery (see Appendix 2 for raw data). The Oxalate Belt Filter Vacuum Pumps have been included as a substantive emission source at the Kwinana Refinery on the basis of a relatively high odour emission rate measured in the refinery odour survey performed in 2000 (Appendix C; The Odour Unit, 2001). Data compiled during the odour survey of the Kwinana Refinery has been used to confirm the choice of substantive emission points (see Table 1). The capability of odour emissions data to reliably predict the VOCs emission has been established in an extensive review at the Wagerup Refinery (Alcoa, 2005c).

The emissions from Calciner Stacks 1 and 3 at the Kwinana Refinery were sampled in 2003 for VOCs, SVOCs, TSP and trace metals (unpublished data, 2003). The relative contribution that this source makes to the total compound emissions at Kwinana will be calculated using this data and reported in the refinery air emissions inventory. Additional sampling and analysis for fine particulates PM_{10} and $PM_{2.5}$ will be undertaken in one Calciner stack (see Section 3.5).

There is an extensive particulate monitoring programme at the Residue Area. Five High Volume Dust Samplers are located in areas adjacent to the Residue Area that have the highest potential to receive fugitive dust. PM_{10} monitoring via TEOMs is in place at two of the monitoring sites. In addition, a Partisol monitor was established temporarily at one of the sites to monitor $PM_{2.5}$ as part of an Alcoa WA Operations monitoring programme aiming to quantify the contribution that Alcoa WA Refineries make to regional dust levels. This data will be included in the Air Emissions Inventory.

The Bayer process is a wet minerals process that, apart from the Calcination building, does not produce significant particulate emissions. For example, the rod mills crush bauxite as a wet slurry in caustic solution in rotating mills.

An average gas flow through each of the 8 boilers was calculated from data reported in the Alcoa Kwinana 2004 Environmental Review (Alcoa 2005b). These gas flow rates were used together with the average VOC emission concentration from all boilers at Pinjarra to calculate a source estimate for the Power house boilers at the Kwinana Refinery[2].

Alcoa has two remaining 7 ML capacity diesel storage tanks, of which only one contains diesel at any one time. There are an additional four small diesel storage tanks at various points at the refinery that have approximately 20 kL capacity each. These tanks are at ambient temperature and are not agitated. Alcoa does not consider these to be a substantive source of emissions in the context of refinery emissions. Emissions from vehicles are calculated on a regional basis within the NPI, where-as the intent of this SECP is to determine emissions of an industrial nature. Emissions from vehicles within the refinery are minor in comparison to vehicles on roads in the immediate area and so are not considered substantive sources.

Alcoa sampled and analysed for a number of compound classes as part of the Alcoa Wagerup Emissions Inventory Report in 2002 (Alcoa, 2002). One of the main purposes of that Emissions Inventory work was for the purposes of extrapolating emissions data to Alcoa's other Alumina Refineries in Western Australia. Therefore small emission levels of low toxicity compounds detected at one refinery does not in itself warrant sampling and analysis at other refineries.

Compound classes in addition to VOCs, SVOCs, Aldehydes & Ketones, gases of combustion, trace metals and particulates were detected at Wagerup (Alcoa, 2002). Ammonia, amines, halides, halogens, organosulphides, mercaptans, hydrogen sulphide and a carboxylic acid were detected in the Digestion area, ammonia was detected in Mill vents, and ammonia, amines and mercaptans were detected in the Slurry Storage vents. However of these, only organosulphides and mercaptans, hydrogen sulphide, ammonia and amines would warrant further investigation as sources of odour at

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[2] A similar range of VOC compounds is expected from the boilers at both refineries since they are all fuelled by natural gas.

the appropriate locations (Digestion and Slurry Storage). The other compounds identified above were detected infrequently at Wagerup and when detected were at very low levels, or were not significantly toxic or hazardous. It is also noted that the pH of collected sample condensate at Wagerup was not found to have any relevance to assessing emissions.

Table 1: Contribution of individual refinery emission sources identified as substantive.

Emission Source (number of release points)		**VOC emission** (% mass contribution)		**Odour** (% contribution.)*
Kwinana Refinery	Pinjarra Equiv.	Pinjarra (mean)	Kwinana* (ave./adjusted)	Kwinana 2000 Survey
25A Slurry Storage (2)	25A Slurry Storage (6)	7	7	7
30 Digestion Vapour Cont. (1) & Heater Vent (5)	30 Digestion Excess BO (7) & Vac. Pump (2)	15	15	23
Oxalate Filter Vac. Pump (2)	Oxalate Filter Vac. Pump (1)	1	1	4
50 Calciner Vac. Pump (2)	50 Calciner Vac. Pump (2)	7	7	nm
Calciners (3)	Calciners (3)	47	45	63
Powerhouse Boilers (8)	Powerhouse Boilers (6)	10	13[#]	nm
Other Sources	Other Measured Sources	12	12	3
Total emission (g/s)		3.6	2.6	-
TOTAL of SUBSTANTIVE (%)		87	88	97[+]

* The contribution of the Liquor Burner to the total refinery VOC and odour emission before voluntary shutdown in 2002 has not been included. Mass VOC emission rates from Digestion and Calcination areas of the Kwinana Refinery have been adjusted by 50% in approximate agreement with the large difference in bauxite ore and alumina hydrate feed rates at the two refineries.

[#] The VOC mass emission rate from Kwinana Boilers was determined from multiplying the Pinjarra emission rate by {total calculated dry flow rate at Kwinana / measured total dry flow rate at Pinjarra}.

[+] Percentage of substantive sources that were measured in the Kwinana Refinery 2000 odour survey.

nm : not measured

2.2 SAMPLING OF SUBSTANTIVE SOURCE EMISSIONS

All sampling of point sources indicated will be undertaken by Environmental Consultancy Services in accordance with appropriate USEPA Methods or NATA-accredited Methods.

The point of release from most of the 7 substantive emission sources will not meet the requirements of an ‘ideal’ sampling location. Sampling at these locations may never be fully representative due to turbulence in the duct work. Alcoa has commenced engineering of these sample points such that, as far as practically possible, they meet the requirements of AS4323.1 1995 for stationary source sampling. Several other practical difficulties exist regarding the gas collection due to the nature of release to the atmosphere. Vapour from equipment in the digestion area (slurry storage tanks, digestion vapour containment tanks and digestion heaters) can have a high moisture content and be released at high pressure. Standard techniques developed during the sampling of these sources at the Wagerup Refinery which maximise dry volume collection will be used to identify and measure the compounds emitted.

Where sampling points don’t comply with AS4323.1 (or alternatively USEPA Method 1), Alcoa will state in the Air Emissions Inventory report the reasons for the non-compliance and include a statement on how it is likely to have affected the data obtained, and what compensatory measures were taken to address the non-compliance.

The standard procedure for sampling emissions to measure trace metals includes a requirement for collection without disturbing the release flow of vapour. A disturbance to the release flow usually results in a sample that is not representative. As metal emissions from boilers are negligible, Alcoa will report trace metal data for the boilers as determined by calculation using the recommended method in the National Pollution Inventories manual for estimation of emissions from alumina refineries (NPI 2005).

Those substantive sources having more than one release point of the same process and equipment configuration will be sampled from one point (in duplicate) and the data used to estimate emissions from that group. For example, Alcoa will arrange for sampling of emissions from a single Calciner vacuum pump stack and assume similar emissions data from the other Calciner vacuum pump stack. Emissions will be scaled up to different flow rates or capacity for the other sources in that group as appropriate. The assumptions of this approach are firstly that the same process will emit the same compounds at comparable concentrations, and secondly that the error associated with extrapolation is well within the natural variability of the process (Alcoa, 2002).

Substantive sources within similar processes but with different equipment design that will potentially produce significantly different emissions will be sampled from a point representative for that equipment configuration. An example of this is for the boilers where there are two designs installed.

2.3 MINOR POINT EMISSION SOURCES

Many point sources including small vents and vacuum pumps stacks were identified at the Pinjarra Refinery within a baseline emissions study as emitting moist vapour containing some VOCs. Individually, the majority of these sources were found to contribute between 1% and 5% of the total refinery VOC emissions (Alcoa 2005a). Point source emissions equivalent to those identified in the Pinjarra air emission inventory calculated to contribute between 1% and 5% of total refinery VOC emissions will be included in the Kwinana emissions inventory as minor sources. These are identified as (excluding area sources):

- B30 Digestion Blow-off Tanks;
- B35A Sand Disposal Tank;
- B35C Mud Washer Tank;
- B35F Mud Washer Overflow Tank;
- B35F Mud Thickener Tank;
- B35F Mud Thickener Overflow tanks; and
- B42 Evaporation Vacuum Pump.

Due to their minor nature and number, Alcoa will not be obtaining samples from all minor emission sources. For those minor sources where there are multiple pieces of equipment of the same configuration, Pinjarra or Wagerup emissions data from a subset of sources will be used to estimate emissions from that group. An estimate of compound emissions from each comparable minor point source will be presented in a report documenting the atmospheric emissions inventory.

A number of point sources that were either not measured or could not confidently be compared to equipment at the Pinjarra Refinery have been identified in a survey of the Kwinana Refinery to be a minor source of emissions. Alcoa will undertake an emission assessment of each of the following minor point sources:

- Bauxite Milling vents;
- Building 25 Slurry Mixers;
- Building 35 Classifier Tanks;
- Building 45A Evactor Vacuum Pumps; and
- Building 45 Seed Wash Tank.

The criteria to be used in the assessment will include the measurement and/or calculation of emission flow rates, qualitative odour comparisons and similarity of the process units to those at Pinjarra. The assessment process will characterise the nature of emissions from these minor points and be included in the report on Kwinana Refinery atmospheric emissions inventory.

2.4 OPEN AREA SOURCES ON THE REFINERY

A survey of all emission sources on the Kwinana Refinery has identified a number of areas where bauxite ore, lime, condensate and process liquor are open to the atmosphere. The potential emissions from these source types include dust, caustic mist and liquor vapour containing VOCs. Odour studies completed at Wagerup (Alcoa 2005c) have identified these VOC sources as minor in nature. Other area source emissions are classified as minor because of the relatively low process temperatures involved or because of there are emission controls in place. A description of all fugitive sources (excluding residue storage) and the nature of emissions are shown below in Table 2.

Table 2: Potential fugitive and open area source emissions identified at the Kwinana Refinery.

Location	Description	No. of sources	Emission	Reason for exclusion as a substantive source
B15&16–Bauxite Storage	Partially Open sheds	2	Dust	Protected by tanks and roof – no visible dust emissions
B17-Bauxite unloading	Temporary stock pile	1	Dust	Dust control facilities
B25-Rod Mills	Open seals and overflow box	7 of 9	Liquor vapour (VOCs)	Low temperature – 65 °C.
B35-Rotary sand classifiers	Gap between rotary and sand classifiers	9	Liquor vapour (VOCs) & steam	Medium temperature – 100 °C, downstream of high temperature area
B35-Sand classification	Sand disposal, open topped cone bottomed	5	Liquor vapour (VOCs) & steam	Medium temperature – 100 °C, downstream of vented high temperature area
B36-Filtration	Tanks with unsealed lids	42	Steam & caustic mist	Tanks are kept closed during normal operation and only opened for inspection
B36-Sand disposal	Open end tanks	3	Water vapour & caustic mist	Low temperature – 60 °C
B5C-Lime Holding	Lime unloading tank	1	Alkaline Dust; (PM_{10})	Dust control facilities
B8-Starch mixing & storage	Mixing tank, open top	1	Odour	Low temperature
B45-Precipitation	Precipitation, open tanks	205	Liquor vapour & caustic mist	See Table 3
B45-Precipitation	Launder system, open troughs connecting tanks	Many	Liquor vapour & caustic mist	As for Precipitation tanks
B45-Precipitation	Primary thickener, open tanks	12	Liquor vapour & caustic mist	See Table 3
B45-Precipitation	Tray thickener, overflow open boxes	16	Liquor vapour (VOCs)	As for Precipitation tanks
B45-Precipitation	Cyclone, open troughs	42	Liquor vapour & caustic mist	As for Precipitation tanks
B45-Precipitation	Seed wash tank side vents	3	Steam & condensate vapour	As for Precipitation tanks
B46-Oxalate removal	Crystalliser, open tanks	4	Water vapour & caustic mist	See Table 3
B46-Oxalate removal	Oxalate seed, open tanks	1	Liquor vapour (VOCs)	As for oxalate removal crystalliser
B46-Oxalate removal	Vacuum filters, exposed surface	9	Caustic mist	As for oxalate removal crystalliser
B46-Oxalate removal	Vacuum filter overflow, open tank	1	Liquor vapour (VOCs)	As for oxalate removal crystalliser
B46-Oxalate removal	Cooling towers, open roof	1	Water vapour	Make up supply is bore water.
B46-Oxalate removal	Vacuum filtrate, open seal tanks	2	Water vapour & caustic mist	As above for oxalate removal
B46-Oxalate removal	Tray thickener, overflow open boxes	2	Liquor vapour (VOCs)	As above for oxalate removal
B50-Calcination	Calciner pan filters, exposed surface	6	Steam & caustic mist; trace VOCs	Low temperature and low liquor concentration
B50-Calcination	Vacuum seal water cooling tower	2	Steam, water treatment chemicals	Low temperature and low liquor concentration.
B50-Calcination	Cooling towers, open tanks	1	Steam, water treatment chemicals	Make up supply is bore water. Low concentration water treatment chemicals.
B50-Calcination	Weak filtrate, open tanks	2	Steam & caustic mist; trace VOCs	Low temperature and low liquor concentration.
B50H-Calcination	Specials hydrate pan filter, exposed surface	1	Dust, Steam & caustic mist; trace VOCs	Low temperature and low liquor concentration.
B50H-Calcination	Bright hydrate pan filter, exposed surface	1	Dust, Steam & caustic mist; trace VOCs	Low temperature and low liquor concentration.
B110-Powerhouse	Cooling towers, open cells	7	Water droplets	Makeup supply is bore water. Low concentration water treatment chemicals.

Alcoa will provide an estimate of the emissions from each area source likely to contribute in excess of about 1% to the total VOCs at the refinery. These area sources are shown in Table 3 below.

Table 3: Area sources and the basis for being assessed as minor sources.

Minor Area Source	Reason
Building 45 Precipitation Tanks	Source odour testing conducted in 2000 by The Odour Unit Pty Ltd (The Odour Unit, 2001), showed low levels of measured odour emissions from the Precipitation tanks. Process liquor is maintained at a moderate temperature of 68-77°C with agitation.
Building 45 Primary Thickener Tanks	Separation of process liquor and fine hydrate from coarse hydrate is carried out at a moderate temperature of 65-68°C under minimal agitation.
Building 46 Oxalate Removal – Crystalliser tanks	Process liquor is maintained at a moderate temperature of 60°C with minimal agitation.
Building 46 Vacuum Filter Overflow Tank	The air flow volume from the seal tank is considerably lower than from the oxalate filter vacuum pumps which have been identified as contributing about 4% of total refinery odour (see Table 1).
Building 46 Vacuum Filtrate Seal Tanks	The proportion of feed process liquor which overflows the filtrate seal tank is small and sporadic.

Alcoa maintains a program for ambient dust monitoring at the Kwinana Refinery to determine ambient dust levels in the receiving environment. Ambient monitoring is conducted at locations both at the refinery and the residue storage areas (see Alcoa 2005b). Open area particulate emissions from the refinery and residue area will be reported based on methodologies used for reporting in the National Pollutant Inventory (NPI). Alcoa's NPI methodology has been endorsed by both the Department of Environment in Western Australia and the Federal Department of the Environment and Heritage (then Environment Australia). This method uses the extensive, daily ambient monitoring data collected during the NPI reporting period to determine particulate emission levels.

2.5 RESIDUE STORAGE AREAS

The Wagerup Refinery ERMP has, probably for the first time by any alumina refinery internationally, attempted to characterise VOC and odour emissions from bauxite residue disposal areas (RDAs). Two emerging techniques have been used to identify the RDAs as a minor contributor to the total refinery emissions:

- Direct measurement by USEPA isolation flux chamber, as the main exploratory technique; and

- Upwind/downwind monitoring combined with dispersion modelling, to provide confirmation of VOC and odour data for use in impact assessment studies.

An internal review of the study “Emissions to Air from Residue Disposal Area – Assessment of Emissions from Diffuse Area Sources” (GHD, 2005) concluded that:

- The emissions data obtained over three separate sampling programs has shown large variability; and
- Further development of each innovative approach is required at the Wagerup Refinery before the data can be used as a basis for the characterisation of VOCs and odour emission from the Kwinana RDAs.

The progress of continuing emissions sampling at the Wagerup RDAs will be reviewed prior to the completion of the Kwinana Refinery Atmospheric Emissions Inventory. A comparison of the key refinery parameters which characterise the emissions from each RDA will be performed. This study will identify:

- How to extrapolate Wagerup RDAs emissions data to Kwinana RDAs, and
- Any further investigative work to complete the full characterisation of emissions (if required).

Consistent with the approach outlined in the Ministerial Conditions Alcoa will focus on the identification of substantive sources, which does not include the Residue Area emissions as these are considered likely to be a minor VOC and odour emission source at Kwinana. The Kwinana Refinery Atmospheric Emissions Inventory and Wagerup RDAs emissions data will be used in future assessments to aid in the assessment off site impacts at Kwinana as necessary.

3 SOURCE EMISSIONS CHARACTERISATION PLAN

This section outlines additional specific emissions characterisation for each of the substantive point sources identified within Section 3.1 where existing data is not considered sufficient to enable the development of an Atmospheric Emissions Inventory. In designing the monitoring program, consideration was given to the point source’s contribution to the total emission for each type of substance. A summary of the potential emissions from the identified substantive point sources is provided in Table 4 below.

Table 4: Sampling of air emissions from substantive point sources

Emission source	Release type	Potential emissions	Comments
Building 25A Slurry Storage	1 of 2 vents	Aldehydes & Ketones, VOCs, SVOCs, trace metals, organosulphides and mercaptans, hydrogen sulphide, ammonia and amines.	One vent will be adapted to a stack to allow representative sampling.
Building 30 Digestion Containment Stack	1 stack	Aldehydes & Ketones, VOCs, SVOCs, trace metals, organosulphides and mercaptans, hydrogen sulphide, ammonia and amines.	Minor engineering of release to collect representative air sample.
Building 30 Digestion Heater Vents to Floor	1 of 7 vents	Aldehydes & Ketones, VOCs, SVOCs, trace metals, organosulphides and mercaptans, hydrogen sulphide, ammonia and amines.	One vent will be adapted to allow more representative sampling.
Building 46 Oxalate Filter Vacuum Pumps	1 stack	Aldehydes & Ketones, VOCs, SVOCs and trace metals.	Minor engineering of the stack to collect representative air samples.
Building 50 Calciners	1 of 3 stacks	PM_{10} and $PM_{2.5}$	No engineering work is required to existing sample ports.
Building 50 Calciner Vacuum Pumps	1 of 2 stacks	Aldehydes & Ketones, VOCs and SVOCs.	Minor engineering of one release to collect representative air samples.
Building 110 Powerhouse Boilers	1 of 8 ducts to 4 stacks	Combustion gases, Aldehydes & Ketones, VOCs and trace metals.	Minor engineering of one duct to collect representative air samples. Most recent available data on NO_x, SO_2 and CO will be used.

For Building 50 Calciner stacks, emissions data collected in 2003 from stacks 1and 3 for Aldehydes & Ketones, VOCs, SVOCs and trace metals will also be reported (see Section 2.1), and the most recent available data on NOx, CO and TSP used.

Details on the sampling and analysis program for each identified substantive source are contained in the Sections below.

3.1 SLURRY STORAGE BOX VENTS

The bauxite slurry formed by hot caustic milling is stored in two large tanks to allow time for excess silica to be removed from the ore. Flash vapour from the digestion process is used to heat the slurry in the tanks causing a release of vapour through box-shaped vents on top of the tanks.

3.1.1 Nature of Emissions

The largest proportion of emissions from the slurry storage tanks is water vapour, producing an often visible plume. These vents have been identified by comparison to Pinjarra emission data to be a substantial contributor to total emissions of VOCs and trace metals at the Kwinana Refinery.

3.1.2 Sampling Program

The release of emissions through the existing box vents does not allow for collection of representative gas samples. To better comply with AS4323.1 1995 for stationary source sampling, a portable stack will be temporarily placed over one box vent. The stack will be prefabricated with an appropriate diameter and have a sample port that complies with AS4323.1 1995 as far as practicably possible. Details of the sampling and analysis methods for each compound class emitted from the slurry storage tank are shown below in Table 5.

Table 5: Sampling of air emissions from Building 25A Slurry Storage Tanks

Potential Emissions	Sampling/Analysis Method	Reporting
Aldehydes & Ketones	ECS Method 6[3]	Duplicate samples reported within the Kwinana Air Emissions Inventory report.
VOCs (incl. Benzene & Toluene)	USEPA SW 846 0030 (VOST)	Duplicate samples reported within the Kwinana Air Emissions Inventory report.
SVOCs	USEPA Modified Method 5	Duplicate samples reported within the Kwinana Air Emissions Inventory report.
Trace Metals	USEPA Method 29	Duplicate samples reported within the Kwinana Air Emissions Inventory report.
Organosulphides	USEPA Method 18, Tube method	Duplicate samples reported within the Kwinana Air Emissions Inventory report.
Mercaptans	USEPA Method 18 Bag Method	Duplicate samples reported within the Kwinana Air Emissions Inventory report.
Hydrogen Sulphide	USEPA Method 11	Duplicate samples reported within the Kwinana Air Emissions Inventory report.
Ammonia	ECS Method 1[3]	Duplicate samples reported within the Kwinana Air Emissions Inventory report.
Amines	ECS Method 5[3]	Duplicate samples reported within the Kwinana Air Emissions Inventory report.

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[3] ECS Methods 1, 5 and 6 are NATA certified methods used by Environmental Consultancy Services for sampling aldehydes and ketones, ammonia, and amines respectively.

3.2 DIGESTION VAPOUR CONTAINMENT STACK

The liquor slurry formed by digestion is flash cooled to present at a lower temperature to the clarification and precipitation stages of the process. Whilst most flash vapour is recovered to provide heating, such as to the slurry storage tank, the excess is released to atmosphere through a blow-off and containment tank system.

3.2.1 Nature of Emissions

The emissions from the vapour containment tank are primarily alkaline water vapour that often produces a visible plume. This emission source has been identified by comparison to Pinjarra emission data to be a substantial contributor to the total VOCs and trace metals at the Kwinana Refinery.

3.2.2 Sampling Program

The location of the vapour containment tank and release of emissions through the existing stack does not allow for safe collection of gas samples. To provide safer access for collecting the gas samples, an additional sample port permitting upwind collection will be added to the existing stack. The sample port will comply with AS4323.1 1995. Details of the sampling and analysis methods for each compound class from the vapour containment tank stack, and the timing of reporting are shown below in Table 6.

Table 6: Sampling of air emissions from Building 30 Vapour Containment Tanks

Potential Emissions	Sampling/Analysis Method	Reporting
Aldehydes & Ketones	ECS Method 6	Duplicate samples reported within the Kwinana Air Emissions Inventory report.
VOCs (incl. Benzene & Toluene)	USEPA SW 846 0030 (VOST)	Duplicate samples reported within the Kwinana Air Emissions Inventory report.
SVOCs	USEPA Modified Method 5	Duplicate samples reported within the Kwinana Air Emissions Inventory report.
Trace Metals	USEPA Method 29	Duplicate samples reported within the Kwinana Air Emissions Inventory report.
Organosulphides	USEPA Method 18, Tube method	Duplicate samples reported within the Kwinana Air Emissions Inventory report.
Mercaptans	USEPA Method 18 Bag Method	Duplicate samples reported within the Kwinana Air Emissions Inventory report.
Hydrogen Sulphide	USEPA Method 11	Duplicate samples reported within the Kwinana Air Emissions Inventory report.
Ammonia	ECS Method 1.0	Duplicate samples reported within the Kwinana Air Emissions Inventory report.
Amines	ECS Method 5.0	Duplicate samples reported within the Kwinana Air Emissions Inventory report.

3.3 DIGESTION HEATER VENTS

The liquor slurry from the slurry storage tanks is heated to a higher temperature by passing through a number of steam-powered heaters. Vapour released from the rapid heating of liquor flows to the shell side of the heaters and is discharged mainly as condensate by pumping out from the coolest heater. The non-condensable gases within the vapour are released to air through a number of small vents.

3.3.1 Nature of Emissions

The largest proportion of emissions from the digestion heaters is water vapour, producing an often visible stream of moist gas. This emission source has been identified, by comparison to Pinjarra Refinery data to be a substantial contributor to the total emissions of VOCs and trace metals at the Kwinana Refinery.

3.3.2 Sampling Program

The release of emissions through the existing vents does not allow for collection of representative gas samples. To better comply with AS4323.1 1995 for stationary source sampling, an extension will be attached to the end of one vent during sampling. The extension used will be of an appropriate diameter and length to allow representative sampling via a needle tap and valve. Details of the sampling and analysis methods for each compound class emitted from the digestion heater vents, and the timing of reporting are shown below in Table 7.

Table 7: Sampling of air emissions from the Building 30 Digestion Heaters

Potential Emissions	Sampling/Analysis Method	Reporting and Review
Aldehydes & Ketones	ECS Method 6	Duplicate samples reported within the Kwinana Air Emissions Inventory report.
VOCs (incl. Benzene & Toluene)	USEPA SW 846 0030 (VOST)	Duplicate samples reported within the Kwinana Air Emissions Inventory report.
SVOCs	USEPA Modified Method 5	Duplicate samples reported within the Kwinana Air Emissions Inventory report.
Trace Metals	USEPA Method 29	Duplicate samples reported within the Kwinana Air Emissions Inventory report.
Organosulphides	USEPA Method 18, Tube method	Duplicate samples reported within the Kwinana Air Emissions Inventory report.
Mercaptans	USEPA Method 18 Bag Method	Duplicate samples reported within the Kwinana Air Emissions Inventory report.
Hydrogen Sulphide	USEPA Method 11	Duplicate samples reported within the Kwinana Air Emissions Inventory report.
Ammonia	ECS Method 1.0	Duplicate samples reported within the Kwinana Air Emissions Inventory report.
Amines	ECS Method 5.0	Duplicate samples reported within the Kwinana Air Emissions Inventory report.

3.4 OXALATE FILTER VACUUM PUMPS

The liquor slurry from digestion contains dissolved organic matter that becomes incorporated in alumina hydrate during precipitation. To reduce contamination, some organic impurity is removed as sodium oxalate from a side stream of the process liquor. The warm liquor is removed from the oxalate rich solid on belt filters under suction provided by vacuum pumps. The shell side of each vacuum pump discharges the non-condensable component of the vapour to a single containment tank which releases excess vapour to air through a long stack.

3.4.1 Nature of Emissions

The emissions from the oxalate filter vacuum pumps stack are primarily water vapour that often produces a visible, white plume. This emission source has been identified by comparison to previous odour data to be a substantial contributor to the total VOCs emitted from the Kwinana Refinery.

3.4.2 Sampling Program

To provide safer access for ECS consultants collecting the gas samples from the vacuum pump vapour containment tank, a sample port will be added to the existing stack. The sample port will comply with

AS4323.1 1995. Details of the sampling and analysis methods for each compound class emitted from the oxalate belt filters, and the timing of reporting are shown below in Table 8.

Table 8: Sampling of air emissions from the Building 45 Oxalate Filter Vacuum Pumps

Potential Emissions	Sampling/Analysis Method	Reporting
Aldehydes & Ketones	ECS Method 6	Duplicate samples reported within the Kwinana Air Emissions Inventory report.
VOCs (incl. Benzene & Toluene)	USEPA SW 846 0030 (VOST)	Duplicate samples reported within the Kwinana Air Emissions Inventory report.
SVOCs	USEPA Modified Method 5	Duplicate samples reported within the Kwinana Air Emissions Inventory report.
Trace Metals	USEPA Method 29	Duplicate samples reported within the Kwinana Air Emissions Inventory report.

3.5 CALCINER STACKS

Alumina hydrate slurry is washed and then heated to about 1000ºC in gas-fired Calciner vessels to drive off the chemically combined water to produce alumina (Al_20_3). Exhaust gases from the process is discharged to air through long stacks. Exhaust from the six Calciner units are vented to three calciner stacks.

3.5.1 Nature of Emissions

The emissions from the Calciners are primarily water vapour that usually produces a visible, white plume. This source has been identified by comparison to Pinjarra Refinery emissions data as a substantial contributor to the total VOCs emitted from the Kwinana Refinery. Particulates and gases of combustion are also emitted at these emission points.

3.5.2 Sampling Program

Sampling of Aldehydes and Ketones, VOCs, SVOCs was completed in 2003 from 2 of the three stacks. Sampling for both TSP and gases of combustion is undertaken on a monthly basis from these stacks. Additional sampling for fine particulates (PM_{10} and $PM_{2.5}$) will be undertaken as part of this project. Details of the sampling and analysis methods for each compound class emitted from the calciner vacuum pumps, and the timing of reporting are shown below in Table 9.

Table 9: Sampling of air emissions from the Building 50 Calciner stacks

Potential emissions	Sampling/Analysis Method	Reporting
PM_{10} & $PM_{2.5}$	USEPA Method 201A	Duplicate samples reported within the Kwinana Air Emissions Inventory report.

3.6 CALCINER VACUUM PUMP STACK

The alumina hydrate solids underflow from precipitation is collected on large surface area pan filters in Calcination Building 50. Vacuum pumps are used to quickly and effectively remove liquor from the solid hydrate. The moist, caustic vapours from the spent liquor and condensate wash of hydrate are released from the shell side of the vacuum pumps to air through long stacks.

3.6.1 Nature of Emissions

The emissions from the calciner vacuum pumps are primarily water vapour that often produces a visible, white plume. This source has been identified by comparison to Pinjarra Refinery emissions data as a substantial contributor to the total VOCs emitted from the Kwinana Refinery.

3.6.2 Sampling Program

The release of VOCs from the calciner vacuum pumps occurs through two long stacks that are not currently accessible for collection of gas samples. Representative gas samples will be collected by introducing a sampling port at an appropriate distance from the exit to atmosphere on one stack. A scaffold will be constructed to allow access for safe collection of samples. Details of the sampling and analysis methods for each compound class emitted from the calciner vacuum pumps, and the timing of reporting are shown below in Table 10.

Table 10: Sampling of air emissions from the Building 50 Calciner Vacuum Pumps

Potential emissions	Sampling/Analysis Method	Reporting
Aldehydes & Ketones	ECS Method 6	Duplicate samples reported within the Kwinana Air Emissions Inventory report.
VOCs (incl. Benzene & Toluene)	USEPA SW 846 0030 (VOST)	Duplicate samples reported within the Kwinana Air Emissions Inventory report.
SVOCs	USEPA Modified Method 5	Duplicate samples reported within the Kwinana Air Emissions Inventory report.

3.7 POWERHOUSE BOILERS

The electricity used to power operations on the Kwinana Refinery is generated by eight natural gas fired boilers located in Building 110. Emissions from boilers pairs pass via separate ducts and released to air through a tall stack.

3.7.1 Nature of Emissions

The emissions from the Powerhouse boilers are primarily combustion gases such as CO_2 and CO with minor amounts of VOCs and trace metals. A comparison of emissions data from the Pinjarra Refinery indicates that the boilers may be a substantial contributor of VOCs at the Kwinana Refinery. The main fuel source for the boilers is natural gas. Ultra-low-sulphur diesel is used for test firing purposes and for providing gas supplies to Western Power to ensure continuation of electricity supplies to the Western Australian grid during times of supply shortfalls. The percentage of boiler hours that diesel was burnt during 2005, a year when gas curtailments were historically frequent, was less than 1%. In 2001, the percentage of boiler hours that diesel was burnt was 0.02%. Therefore, as emissions as a result of diesel burns would not be considered a substantive source (see Section 2.1), sampling will be undertaken when boilers are in normal operation, which is when burning natural gas.

3.7.2 Sampling Program

The release of emissions through the existing tubular vents were modified during 2004 and early 2005 to collect representative samples. This will enable representative gas samples to be collected from a port on one of the boiler vents. Details of the sampling and analysis methods for each compound class emitted from the Powerhouse boilers, and the timing of reporting are shown below in Table 11.

Table 11: Sampling of air emissions from Building 110 Powerhouse Boilers

Potential emissions	Sampling/Analysis Method	Reporting
CO, NO_x & SO_2	Method 10 (CO), Method 7E (NO_x) & Method 6C (SO_2)	Most recent quarterly sampling data will be reported within the emissions inventory report.
Aldehydes & Ketones	ECS Method 6	Duplicate samples reported within the Kwinana Air Emissions Inventory report.
VOCs (incl. Benzene & Toluene)	USEPA SW 846 0030 (VOST)	Duplicate samples reported within the Kwinana Air Emissions Inventory report.
Trace Metals	USEPA Method 29	Duplicate samples reported within the Kwinana Air Emissions Inventory report.

4 QUALITY CONTROL

Quality control is an essential component of the air emissions characterisation program to ensure that the results are representative of actual contaminant concentrations.

Alcoa will undertake the following actions to ensure quality control in all of its air sampling programs at the Kwinana Refinery (see Table 12).

Table 12: General quality control commitments

Implementation Phase	Action
Sampling	All sampling for regulatory compliance will be conducted by parties holding NATA accreditation for that activity, where available.
	Sampling will be performed in accordance with the relevant USEPA methods. When variations to these methods are employed, the variation will be recorded and explained.
	Standard methods will be used to determine the temperature, moisture and volumetric flow rate each time a stack test is performed, where possible, to enable reasonable interpretation of monitoring results.
	Sufficient volumes of gas will be collected to achieve suitable limits of detection for each key compound.
	Stack samples will be collected under steady state operating conditions to ensure they are representative.
	Field blanks and duplicates will be included in sampling runs.
	Samples will be preserved in accordance with relevant standards and analysed as soon as possible after collection.
	Records of the chain of custody will be maintained for all samples.
Analysis	All analysis for regulatory compliance will be conducted by parties holding NATA accreditation for that activity, where available. Where a NATA accredited laboratory is not available, analysis will be performed at a laboratory with sound quality control procedures in place.
	Analysis will be performed in accordance with the relevant USEPA methods where possible. When variations to these methods are employed, the variation will be recorded and justified.
Reporting	All reports will include the date and time of sample collection, and any unusual operating conditions at the time of collection.
	All results will be presented with limits of detection for each compound measured.

5 REVIEW OF SOURCE EMISSIONS CHARACTERISATION PLAN

This characterisation plan may be altered from time to time to reflect changes to production requirements, or to stakeholder expectations. However, any alterations to the document will be consistent with the purpose and scope stated in Section 1.3. Alcoa will review the characterisation plan approximately every five years or when there is a substantial change in operations.

Alcoa will undertake an appropriate level of stakeholder consultation during the planning and development of significant projects.

6 REPORTING OF SOURCE EMISSIONS CHARACTERISATION PLAN

The Source Emissions Characterisation Plan will be made available to the following parties:

1). Department of Environment;
2). The Kwinana Environmental Improvement Plan Working Group; and
3). The wider community and general public.

1) Department of Environment

In accordance with the Ministerial Statement and Works Approval conditions, Alcoa will provide the Plan to Audit and Licensing Branches of the Department of Environment before new technology Liquor Burner start up (beginning of 2006).

2) The Alcoa Kwinana Environmental Improvement Plan Working Group

During March 2005 Alcoa established an Environmental Improvement Plan (EIP) Working Group to develop environmental targets, aims and actions with direct input from Alcoa employees, representatives from community groups and neighbours, local and state government representatives and environmental regulators. The Working Group has been formed as the key community consultation forum to advise Alcoa on aspects of its operations. The Kwinana Refinery EIP will be reviewed with the Working Group to assess our progress and provide input to future goals and actions.

Following submission to the Audit Branch of the Department of Environment the Plan will be tabled at the next available Environmental Improvement Plan (EIP) Working Group meeting. This will provide the opportunity to comment on the existing monitoring program.

3) Wider Community and General Public

Following submission to the Audit Branch of the Department of Environment the Plan will be made publicly available to the wider community and general public.

Alcoa will request the DoE to advertise the availability of the plan for public comment within their weekly DoE advertisement found within each Monday's edition of '*The West Australian*'. Hardcopies of the Plan will be made available in government and local libraries as summarised in Table 13.

Table 13: Locations for viewing of hardcopies of the emissions characterisation plan.

Location	**Address**	**Copies Available**
DoE library	Westralia Square Level 8, 141 St Georges Terrace Perth WA 6000 Tel: +61-8-9222 7010	2 hardcopies
Battye Library	Battye Library, Alexander Library Building, Cultural Centre, Perth WA 6000 Tel: +61-8-9427 3111	2 hardcopies
Kwinana Public Library	Hub Shopping Centre, Challenger Ave Kwinana Town Centre WA 6167 Tel: +61-8- 9439 0237	1 hardcopy

The plan will also be electronically available from Alcoa's website at:

http://www.alcoa.com/australia/en/info_page/Environmental_Management.asp

Further information about the Emissions Characterisation Plan can be obtained by contacting Alcoa.

7 ADVISORY AGENCY CONSULTATION

The advisory agencies identified in Section 1.4, being Department of Environment, Department of Health, Kwinana Industries Council and Department of Industry and Resources, have reviewed the draft Plan and provided advice. Where appropriate, comments and changes have been incorporated into this Plan. Copies of the advice is included in Appendices F to I.

8 REFERENCES

Alcoa (2002), *Wagerup Refinery Air Emissions Inventory, Final Report, September 2002.*

Alcoa, 2005a, *Pinjarra Alumina Refinery Efficiency Upgrade - Air Quality Management Plan Point Source (Stack) Emissions.*

Alcoa, 2005b, *Kwinana Refinery and Bauxite Residue Operations Annual Environmental Review 2004, 1 April 2005.*

Alcoa, 2005c, *Wagerup Refinery Environmental Review and Management Plan 2005, 1 April 2005.*

Environ, 2003a, *Pinjarra Refinery Efficiency Upgrade, Air Quality Data, Environmental Protection Statement,* 28 October 2003.

Environ, 2003b, *Pinjarra Refinery Efficiency Upgrade Environmental Upgrade Environmental Protection Statement,* December 2003.

Environ, 2004, *Kwinana Liquor Burner Emissions Reduction Project, Alcoa World Alumina Australia, Environmental Referral, November 2004*

GHD, 2005, *Emissions to Air from Residue Disposal Area – Assessment of Emissions from Diffuse Area Sources, March 2005*

NPI, 2005, National Pollutant Inventory: *Emission Estimation Technique Manual for Alumina Refining,* Environment Australia.

SKM, 2004, *Kwinana Residue Area Dust Emission Modelling, October 2004.*

SKM, 2003, *Pinjarra Refinery Efficiency Upgrade – Air Dispersion Modelling,* December 2003.

The Odour Unit, 2001, *Kwinana Refinery – Odour Emissions Study.*

9 GLOSSARY

Abbreviations

SECP	Source Emissions Characterisation Plan
CO	Carbon monoxide
ESP	Electrostatic precipitator
KIC	Kwinana Industries Council
PM_{10}	Particulates smaller than 10 micron
NATA	National Association of Testing Authorities
NO_x	Oxides of nitrogen
RTO	Regenerative thermal oxidiser
SO_2	Sulphur dioxide
SRG	Stakeholder reference group
USEPA	United States Environmental Protection Agency
VOC	Volatile organic compounds
SVOC	Semi volatile organic compounds

Units

g/s	grams per second
mg/m^3	milligram per cubic metre (expressed dry at 0 degrees Celsius and 1 atmosphere)
tpd	tonnes per day
%	percent

Appendix A

Ministerial Statement Approval Conditions

Appendix B

Executive Summary of Pinjarra Alumina Refinery Efficiency Upgrade - Air Quality Management Plan Point Source (Stack) Emissions (Alcoa, 2005a)

EXECUTIVE SUMMARY

The purpose of this Air Quality Management Plan is to document Pinjarra's existing air sampling monitoring program for point sources within the Refinery and update it with additional sampling created as a result of the Pinjarra Efficiency Upgrade Project. The point sources considered within this plan are those where emissions are released directly from individual locations such as stacks, chimneys, kilns, cooling towers, tank vents or pipes. The major equipment on site that results in point source emissions are; the Oxalate Kiln Stack, Calciner Stacks, Powerhouse Boiler, Alumina Leach Dryer, Digestion and 45T Cooling Tower. Smaller point sources scattered throughout the refinery, such as tank vents, which have also been monitored in the past are also included within this plan.

The following groups of substances are emitted from the refining process:

- *Particulate matter (e.g. total particulates measured, less than 10 µm in size)*
- *Volatile Organic Compounds (e.g. aldehydes, ketones, toluene and formaldehyde);*
- *Combustion Gases (e.g. nitrogen oxides, sulphur dioxide and carbon monoxide); and*
- *Trace Metals (e.g. nickel, cadmium and mercury).*

These groups of substances are all emitted from different stages within the alumina refining process and are not present at all point source locations. Having a defined monitoring program as outlined within this Air Quality Management Plan creates a framework for collating data and interpreting the results. It will also assist in identifying continual improvement within Pinjarra's refinery operations.

The monitoring program specifically outlines what substances are being sampled, the frequency of sampling and the methodology used. The program has three distinct phases based on production and operation. These are:

- *Verification monitoring where there is a more intensive investigation of emissions immediately following the commissioning of new buildings associated with the Pinjarra Efficiency Upgrade Project;*
- *Interim monitoring which involves the first 12 months following commissioning of buildings associated with the Efficiency Upgrade. The purpose of this phase is to keep a closer eye on conditions as the Efficiency Upgrade approaches completion; and*
- *Ongoing monitoring which relates to normal operating conditions once the Efficiency Project has been completed and the increased production levels have stabilised.*

Data gathered during the Verification monitoring phase and the Interim phase will be used to compare emissions after the Efficiency Upgrade is completed against baseline data collected before the upgrade works commenced. The intention is that commitments made within the Environmental Protection Statement submission to the Department of Environment can be verified using the emission data collected.

Appendix C

Executive Summary of Kwinana Refinery – Odour Emissions Study (The Odour Unit, 2001)

EXECUTIVE SUMMARY

In October 2000 The Odour Unit Pty Ltd carried out an odour emissions survey at the Kwinana Refinery owned and operated by Alcoa World Alumina Limited. The objective of the survey was to develop an odour emission inventory for the plant, as a first step towards developing odour impact reduction strategies for the refinery.

The survey involved the use of dynamic olfactometry to determine the odour concentration of each emission sampled. Alcoa provided emission flow rate information for all sources. The product of the odour concentration and the emission flow rate determined the odour emission rate for each point source of odour. .

Supra-threshold olfactometry testing was used to establish the relationship between odour concentration and the perceived intensity of the three principal odour sources, in accordance with the German method VDI 3882. This test acknowledges that odours of different character may have different levels of ‘perceptibility’, and can produce data that can be used to prioritise a group of odours present at a particular concentration. The Department of Environmental Protection has indicated that it is considering an odour policy based on the use of intensity measurement and has suggested a concentration equivalent to an intensity score of three, on the 7-point VDI scale. A default odour concentration of 2 OU/m3 has been proposed, in the absence of odour intensity results.

The survey sampled and tested emissions from thirteen sources within the six main process areas of the refinery. The sources and process areas are shown in Table E1 on the following page, which also summarises the odour emission inventory results.

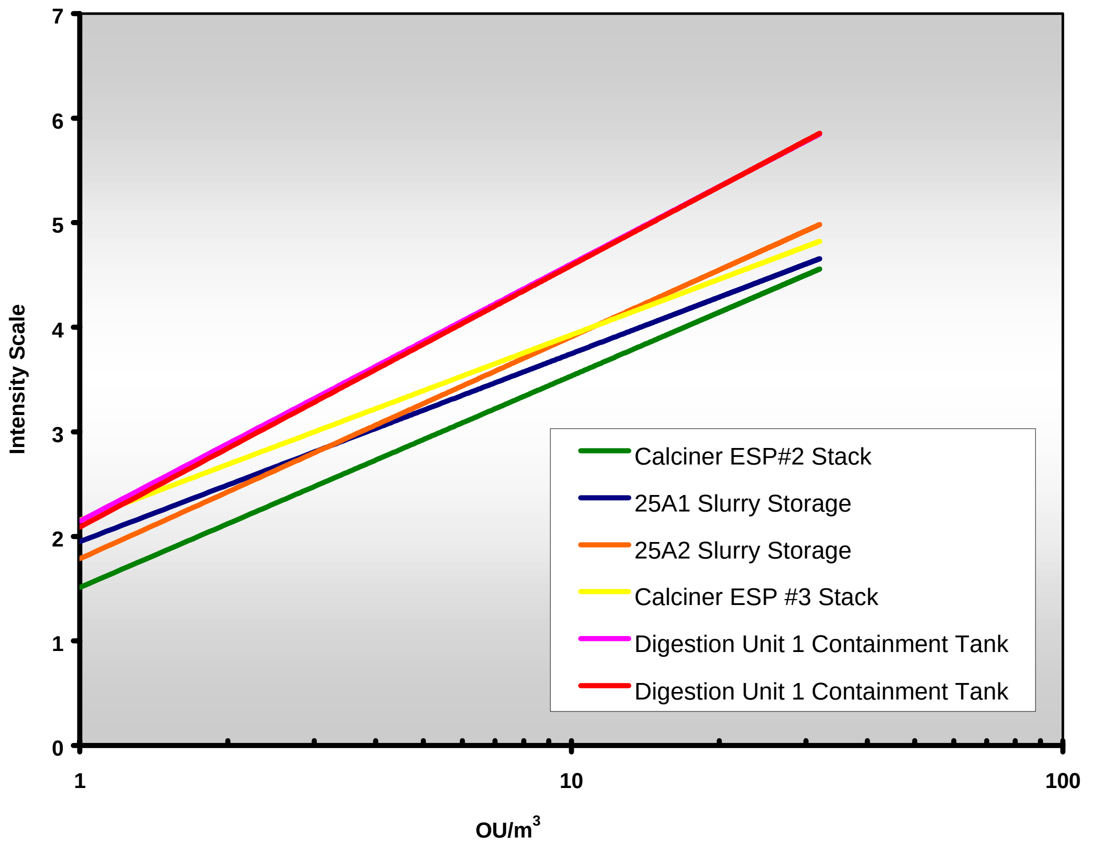
The survey results indicated that ninety five per cent of the measured odour emissions from the refinery emanated from the Calcining, Liquor Burning and Digestion operations, including digestion pre-treatment. The overall level of odour emission (1,389,000 OU/s) was very similar to that determined for the Wagerup Refinery (1,260,000 OU/s), in the weeks prior to the Kwinana survey.

The intensity testing component of the study, which was limited to six samples from three process areas, found that the three types of odour had similar odour concentration/intensity relationships, despite having identifiably different odour characters. This effect is demonstrated in Table E2 and Figure E1 below. Table E2 lists odour concentrations corresponding to an intensity score of three (distinct) on the German VDI scale. The results from a similar study at the Wagerup Refinery are shown for comparison.

TABLE E2: ODOUR CONCENTRATIONS AT INTENSITY SCORE 3 (DISTINCT)

SOURCE	KWINANA 2000	WAGERUP 2000
Digestion	3 OU/m^3	4 OU/m^3
Slurry Storage	4 OU/m^3	20 OU/m^3
Calcining	3 to 5 OU/m^3	Not tested
Liquor Burning (Stack)	Not tested	20 OU/m^3

Figure E.1
ALCOA KWINANA REFINERY
INTENSITY TREND LINES - ALL SOURCES



Given the increasing emphasis by the DEP on odour intensity as a means of defining exposure to odour, it is recommended that additional intensity testing of the four process sources shown in Table E2 be carried out. The data gained from this testing may be useful in the future to negotiate a higher odour concentration in the community than the 2 OU/m^3 currently preferred by DEP. It may also be used in the development of an effective odour abatement strategy for the Kwinana Refinery.

TABLE E1: KWINANA REFINERY – 2000 ODOUR EMISSION INVENTORY

LOCATION	**UNITS**	**OER (OU/s)**	**% OF PLANT**
DIGESTION			
Pre Treatment	Rod Mill Stacks	1,800	0.1
Pre Treatment	Slurry tanks 25A-1 and 2,	64,600	4.7
Digestion Circuit	Heat exchanger vents	116,000	8.4
	Sealwater tank vent	300	0.0
	Containment tanks	140,700	10.1
	Blow-off tank stacks.	7,300	0.5
	Sub-total	**330,700**	**23.8**
CLARIFICATION			
Mud Washers	All units.	3,400	0.3
Thickeners	All units.	13,900	1.0
Sand Building	Sand classifier 35, Units 1,2 and 3	2,700	0.2
	Sub-total	**20,000**	**1.4**
PRECIPITATION			
Precipitators	All units	**3,500**	**0.2**
OXALATE PLANT			
Oxalate Plant	Oxalate Belt Filters 1 and 2	**38,200**	**2.7**
CALCINING			
Calcination	All Calcining Stacks (1,2 and 3)	**665,500**	**48.0**
LIQUOR BURNING			
Liquor Burning Stack	Main stack	**331,200**	**23.9**
TOTAL REFINERY		**1,389,000**	**100.0**

Appendix D

Average emission flow rate from sources at the Kwinana Refinery and mass emission of total VOCs from identified emission sources at the Pinjarra Refinery.

Sample Point	**Kwinana Refinery**				**Pinjarra - Ave, Pre-upgrade Mean Emission (g/s)**		
	No. of emission sources	Average Velocity (m/s)	Diameter (m)	Flow Rate (m^3/s)	Flow Rate (m^3/s)	**VOC Sum Emission (g/s)**	**VOC % Contribn.**
Rod Mill Stack	9	1.69	0.6	0.48	nc	nc	nc
25A Slurry Storage	2	2.02	0.40	0.25	0.42	0.245	**7%**
30 Digestion Containment Tank (PJ vac pumps)	1	18.2	1.38	27.2	0.15	0.527	**15%**
30 Digestion Heater Vents to Floor (PJ vac pumps)	5	34.6	0.0508	0.07			
30 Digestion Excess Blow-off Tank	5	nm	nm	nm	0.11	0.040	1%
35 Sand Classifier Vent	6	2.25	0.6	0.64	0.24	nc	nc
35A Sand Disposal Tank	5	nm	1.35	nm	0.08	0.055	2%
35C Mud Washer Tank	140	nm	nm	nm	0.53	0.190	5%
35F Thickener & Thickner Overflow Tank	6	0.28	0.25	0.08	0.36	0.109	3%
35F Mud Washer Overflow Tank	4	1.11	0.12	0.01	0.25	0.036	1%
Seal Water Tank	1	0.55	0.485	0.41	nc	nc	nc
40 Precipitation Tanks	205	nm	nm	nm	nc	nc	nc
42 Evaporation Vacuum Pump	3	nm	nm	nm	0.13	0.003	0.1%
46 Oxalate Belt Filter Vacuum Pump (PJ OBF vac pump)	9	nm	nm	nm	2.78	0.040	**1%**
50 Calciner Stacks Combined	3	17.4	1.78	43.65	102	1.623	**47%**
50 Calciner Vac Pump (PJ East/West)	2	nm	nm	nm	0.97	0.252	**7%**
110 Powerhouse Boilers Stack	4	nm	nm	149	187	0.355	**10%**
					Substantive Total	3.042	87%
					TOTAL	3.475	100%

Notes: nm = not measured. nc = not calculated. **Bold** typeface indicates a substantive source.

Appendix E

Odour and estimated total VOCs mass emission from all point sources at the Kwinana Refinery

Sample Point	**No. of emission sources**	**Kwinana Odour**		**Total VOC Kwinana Estimated Mass Emission**	
		OU/sec	% of measured	(g/sec)	% of compared
Rod Mill Stack	9	1800	0%	nc	nc
25A Slurry Storage	2	**64,600**	**6%**	0.147	**7%**
30 Digestion Containment Tank (PJ vac pumps)	1	**140,700**	**13%**	0.316	**15%**
30 Digestion Heater Vents to Floor (PJ vac pumps)	5	**116,000**	**11%**		
30 Digestion Excess Blow-off Tank	5	7,300	1%	0.024	1%
35 Sand Classifier Vent	6	2,700	0%	nc	nc
35A Sand Disposal Tank	5	nm	nc	0.033	2%
35C Mud Washer Tank	140	nm	nc	0.114	5%
35F Thickener & Thickner Overflow Tank	6	13,900	1%	0.065	3%
35F Mud Washer Overflow Tank	4	3,400	0%	0.022	1%
Seal Water Tank	1	300	0%	nc	nc
40 Precipitation Tanks	205	3,500	0%	nc	nc
42 Evaporation Vacuum Pump	3	nm	nc	0.002	0%
46 Oxalate Belt Filter Vacuum Pump (PJ OBF vac pump)	9	**38,200**	**4%**	0.024	**1%**
50 Calciner Stacks Combined	3	**665,500**	**63%**	0.974	**45%**
50 Calciner Vac Pump (PJ East/West)	2	nm	nc	0.151	**7%**
110 Powerhouse Boilers Stack	4	nm	nc	0.282	**13%**
TOTAL OF SUBSTANTIVE		1,025,000	86%	1.89	88%
TOTAL		1,057,900	100%	2.15	100%

<u>Notes</u>: nm = not measured. nc = not calculated.

(a) Average concentration & mean flow rate estimated (using PJ refinery data) mass emission of VOCs from minor point sources at the Kwinana Refinery.

Pinjarra Emission point	Equivalent Kw Emission point	Mass Emission (g/s)							
		VOC	**Acetone**	**Acetaldehyde**	**MEK**	**Benzene**	**Toluene**	**Xylene**	**PAHs**
Excess BO - PRT & CT	B30 Digestion B/O	0.020	0.011	0.004	0.002	2.78E-05	3.35E-04	3.13E-05	nd
35F Vents	B35F Mud Washer Overflow Tank	0.018	0.005	0.001	0.001	1.25E-05	2.25E-03	8.88E-04	6.85E-04
35F & D Vents	B35F Mud Thickner & Thickner Overflow Tanks	0.054	0.013	0.006	0.003	5.69E-05	7.28E-03	2.13E-03	1.67E-04
35A Vents	B35A Sand Disposal Tank	0.027	0.007	0.003	0.002	3.33E-05	3.77E-03	3.99E-03	5.56E-04
35C Washer Area Vents - Banks	B35C Mud Washer Tank	0.095	0.039	0.012	0.018	nd	6.44E-03	7.40E-03	1.11E-03
B42 Vac Pumps	B42 Evaporation Vacuum Pump	0.001	0.000	0.000	0.000	3.93E-04	1.13E-04	8.59E-06	nd
All comparable minor emissions		0.216	0.074	0.027	0.026	6.89E-04	2.02E-02	1.44E-02	2.52E-03

Notes: nd = not detected

(b) Maximum concentration, peak flow rate estimated (using PJ refinery data) mass emission of VOCs from minor point sources at the Kwinana Refinery.

Pinjarra Emission point	Equivalent Kw Emission point	Mass Emission (g/s)							
		VOC	**Acetone**	**Acetaldehyde**	**MEK**	**Benzene**	**Toluene**	**Xylene**	**PAHs**
Excess BO - PRT & CT	B30 Digestion B/O	0.027	0.013	0.006	0.002	5.97E-05	6.57E-04	5.97E-05	nd
35F Vents	B35F Mud Washer Overflow Tank	0.019	0.005	0.002	0.001	2.69E-05	2.55E-03	2.42E-03	1.75E-04
35F & D Vents	B35F Mud Thickner & Thickner Overflow Tanks	0.097	0.023	0.010	0.006	1.31E-04	1.45E-02	7.85E-03	7.07E-04
35A Vents	B35A Sand Disposal Tank	0.033	0.008	0.004	0.002	4.48E-05	5.10E-03	2.33E-03	2.28E-04
35C Washer Area Vents - Banks	B35C Mud Washer Tank	0.216	0.048	0.022	0.022	2.84E-04	3.23E-02	1.47E-02	1.45E-03
B42 Vac Pumps	B42 Evaporation Vacuum Pump	0.002	0.000	0.000	0.000	4.23E-04	1.22E-04	nd	9.31E-05
All comparable minor emissions		0.395	0.097	0.044	0.033	9.69E-04	5.52E-02	2.74E-02	2.65E-03

Notes: nd = not detected

Appendix F

Comments and advice from Department of Environment (DoE)

Department of Environment
Government of Western Australia

Your ref:
Our ref: 745/05
Enquiries: Filipe Dos Santos
Direct tel: 92227041

Mr L Whitewood
Environment and Community Relations Manager
Alcoa World Alumina Australia
PO Box 161
KWINANA WA 6167

Dear Mr Whitewood

KWINANA LIQUOR BURNER, EMISSIONS REDUCTION PROJECT KWINANA (STATEMENT 678) COMMENTS ON SOURCE EMISSIONS CHARACTERISTATION PLAN

Thank you for your letter of 17 November 2005 and the accompanying Source Emissions Characterisation Plan as required by condition 4 of statement 678. The Department of Environment's (DoE) Air Quality Division and Kwinana-Peel Regional office have reviewed the Plan and provides the following comments.

Comments:

1. The SECP uses VOCs as the basis for deciding which emissions sources are significant, while particulate emissions should also be used to determine significant sources. For example, the RDAs are a significant source of particulates, although they are only a minor source of VOCs. It is likely some refinery sources, such as the rod mill stack, are also significant sources of particulates. Particulate sampling is also ignored in the SECP, except it is noted that recent TSP data for the Calciner stacks will be used. Significant particulate emissions sources, especially the Calciner stacks, should be sampled for TSP, PM_{10} and $PM_{2.5}$.

2. Compound classes that were sampled and analysed for as part of the Alcoa Wagerup Emissions Inventory Report in 2002, hut weren't included in the Kwinana SECP, are:

    - PM10 and PM25
    - carboxylic and dicarboxylic acids;
    - halides and halogens;
    - methanol and ethanol;
    - ammonia and amines;
    - organosuiphides and mercaptans;
    - hydrogen suiphide;
    - cyanide and compounds;
    - Cl -C6 hydrocarbon compounds;
    - dioxins and furans (although, none were detected); and

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- pH (collected sample condensate).

Of these compound classes, ammonia, amines, halides, halogens, organosulphides, mercaptans, hydrogen sulphide and a carboxylic acid were all detected at Wagerup in the Digestion area, ammonia was detected in mill vents, and ammonia, amines and mercaptans were detected in the slurry storage vents. Therefore, there is a good case for including them in the Kwinana SECP.

3. Alcoa should justify their proposal to only sample one source within an ‘emissions source’. For example, Alcoa proposes to sample only one powerhouse boiler duct out of eight, while each duct may behave differently and emit different levels of pollutants. For instance, the flow rates of each boiler are often different: in January 2004 Boiler 1 had a flow rate of 64 001 m3/hr, while Boiler 4 had a flow rate of 101 369 m3/hr, and the concentrations of CO and NOx are generally higher from Stack 1 (i.e. Boilers I and 2) than the other stacks.

4. Alcoa burns diesel in its Powerhouse on a regular basis, due to gas shortages. Therefore, Alcoa should sample the boiler ducts during diesel burning as well as during gas burning as part of the SECP, so that the differences in emissions can be determined.

5. Alcoa propose to use ECS Method 6 for the sampling and analysis of aldehydes and ketones - has this method been approved by AQD?

6. Where sampling points don’t comply with AS4323.1 (or alternatively USEPA Method 1), Alcoa will need to state in the Kwinana Air Emissions Inventory report the reasons for the non-compliance and a statement on how the non-compliance is likely affect the data obtained.

7. Alcoa have stated that non-normal operating conditions during sampling will be noted in the Kwinana Air Emissions Inventory report, however, sampling should not be undertaken during non-normal operations.

The Department wishes to advise that the submitted accompanying Source Emissions Characterisation Plan does not fully detail the atmospheric emissions from the Kwinana Alumina Refinery operations and requires additional information as specified in the points discussed above. Accordingly, the Plan requires further revision so as to include this additional information and be re-submitted for approval.

Yours sincerely,

Filipe Dos Santos
A/Manager
Statement Management Section
Environmental Impact Division
Department of Environment

Date: 10 January 2006

Cc: D Morgan (DoE Kwinana-Peel Regional Operations)
L Chandler (DoE Audit Section)
A Stuart (DoE Air Quality Division)

Appendix G

Comments and advice from Department of Health (DoH)

Department of Health
Government of Western Australia

Your ref:
Our ref: 04-06878
Enquiries: N Major 9388 4919

Mr Lance Whitewood
Environment and Community Relations Manager
Alcoa World Alumina Australia
P0 Box 161
KWINANA **WA 6167**

Dear Mr Whitewood

ALCOA KWINANA REFINERY SOURCE EMISSIONS CHARACTERISATION PLAN REVIEW

Thank you for your letter dated 17 November 2005 requesting Department of Health (DOH) advice on the Source Emissions Characterisation Plan (SECP) for the Alcoa Kwinana Refinery. This is in accordance with the requirements of Ministerial Statement No. 678, which defines the approval conditions for the implementation of the Kwinana Liquor Burner Emissions Reduction Project. Officers of the DOH have reviewed the draft SECP and their comments are provided below.

The DOH recognises that the procedures and implementation program outlined by the draft SECP are consistent with the requirements of Ministerial Statement No. 678, Condition 4-1. However, the following aspects of the report are identified that are deemed to require further consideration or review:

- The SECP states (p 6) that ‘the Atmospheric Emissions Inventory (AEI) will describe other factors which affect the variability of the emissions’. The AEI should also discuss how such variations may influence potential off-site impacts. This is regarded as consistent with the intended use of the AEI to aid in the determination of off-site impacts (p 7).

- The reports entitled Pinjarra Alumina Refinery Efficiency Upgrade - Air Quality Management Plan Point Source (Stack) Emissions (Alcoa, 2005) and Kwinana Refinery - Odour Emissions Study (The Odour Unit, 2001) are considered essential references to the classification of air emissions within the SECP. While applicable data tables for each report are provided in Appendix B and C respectively, further discussion and summary of the works undertaken is deemed warranted. In this regard, it may prove sufficient and expedient to include the executive summary of each report in the relevant Appendix. This will allow for appropriate discussion of the assumptions and limitations associated with the current use of the data - an element of reporting that is generally lacking within the SECP.

- The SECP suitably justifies the designation of the Kwinana Refinery cooling towers as a non-substantive emission source on the basis that, in contrast with the Pinjarra Refinery, the cooling towers do not use recycled process water (p 8). Although it is recognised that any significant alteration of the Kwinana Refinery design or processes would instigate a

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review of the SECP (p 23), a statement within the current report that addresses the potential future use of recycled process water in the cooling towers may be of benefit.

- The SECP states (p 9) that ‘when an adjustment of 60% is made to the VOCs data from the equivalent Pinjarra process units due to the difference in bauxite and alumina hydrate feed rates at the two refineries, the identified substantive sources are estimated to contribute to 88% of VOC emissions at the Kwinana Refinery’. However, Table I (p 10) indicates that ‘mass VOC emission rates from Digestion and Calcination areas of the Kwinana Refinery have been adjusted by 50% in approximate agreement with the large difference in bauxite ore and alumina hydrate feed rates at the two refineries’. Clarification is required, preferably with the provision of appropriate sample calculations.

- The SECP states (p 11) that ‘Alcoa may decide to report trace metal data for the boilers as determined by calculation using the recommended method in the National Pollutant Inventories (NPJ) manual for estimation of emissions from alumina refineries’. The process to be adopted should be finalised. It is also noted that particulate emissions from the refinery and residue storage areas will be reported based on NP! methods (p 13). The DOH is not convinced of the accuracy or suitability of NPI emission estimation methods for the intended purposes of the AEI. The application of NPI estimates to the Kwinana emissions inventory must be appropriately justified.

- For sources with multiple release points of the same configuration the SECP proposes that data obtained from one sampling point may be used to estimate emissions from the group (pp 11-12). While the approach is considered reasonable, suitable justification for this method is not provided within the text. Further discussion of the limitations and assumptions associated with the approach is recommended.

- Increased transparency regarding the process to determine which area sources are likely to present a minor contribution to the total refinery emissions (p 13) is recommended. The current discussion lacks specificity.

- The SECP identifies that data on emissions to air from residue disposal areas (RDAs) displays large variability (p 15). The DOH considers it likely that under unfavourable meteorological conditions the RDAs may present a major emission source at Kwinana. It is anticipated that this aspect will be appropriately considered in the eventual extrapolation of Wagerup RDA emissions data to Kwinana RDAs, with particular regard given to the use of the AEI to aid in the determination of off-site impacts.

I trust that this information is useful. If you have any questions in relation to this assessment, please contact Nathan Major of the Toxicology Branch on 9388 4919.

Yours sincerely

Jim Dodds
DIRECTOR
ENVIRONMENTAL HEALTH BRANCH

29 December 2005

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Appendix H

Comments and advice from Kwinana Industries Council (KIC)

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19 January 2006

Mr Lance Whitewood
Environmental and Community Relations Manager
Alcoa World Alumina Australia
P0 Box 161
KWINANA WA 6167

Dear Lance

Draft Kwinana Alumina Refinery Source Emissions Characterisation Plan

Thank you for referring the above document to the Kwinana Industries Council (KIC) for advice, under the conditions of the Ministerial Statement No. 678 required for the implementation of Alcoa's proposal for the construction and operation of air pollution control equipment for the liquor burner at the Kwinana Alumina refinery.

As you will be aware, representatives of member companies of the Kwinana Industries Council have considered the Plan within the context of technical monitoring, environmental impact and health impact and offer the following comments:

1. It is the view of the KIC that the monitoring of emissions is better done in the ambient air shed, rather than at source. The broadly based ambient air monitoring program currently being conducted by the Department of Environment (and supported by the KIC) is the best mechanism for ascertaining the actual air quality in the Kwinana/Rockingham region, and whether any particular contaminants are of concern and may require further investigation. Notwithstanding this, KIC recognizes that Alcoa has legal obligations to meet in preparing this plan.

2. Monitoring all emissions at substantive point and fugitive sources is considered by the KIC to be an impractical and unnecessary impost on industry, when the basis of the EP Act licensing reforms over recent years has been to concentrate on controlling and reducing emissions of concern to the environment or public health. The ambient study referred to above is, in KIC's view, the best vehicle for deciding the emissions in need (if any) of further review.

3. Using the data from the ambient air quality to identify significant pollutants that require further investigation would serve to develop a consistent approach to monitoring air emissions across all industry in the Kwinana Industrial Area and will provide a more strategic framework on which to address cumulative air emissions, both from individual industries, and the combined KIA group of industries.

4. The approach outlined in the draft Plan, in KIC's view, adequately addresses the requirements of section 4 of the Ministerial Statement. It is always possible of course to do more, but given that resources are not unlimited, there is still an absence of an identified health or environmental threat from planned liquor burner emissions, and the initial results from the ambient air shed study seem to be suggesting that the Kwinana/Rockingham air shed is not under pressure in terms of health standards.

   While KIC believes your proposal will adequately address the issue detailed by the Minister in the Statement, from a technical perspective it is suggested that Alcoa consider other significant non-process fugitive emissions such as those from fuel storage tanks and vehicles in determining substantive sources.

The KIC acknowledges the resources required to produce the draft Plan and commends Alcoa Alumina Australia for the thorough and consultative approach in developing the Plan.

Yours sincerely

Tonia Swetman
Director

cc
Jim Dodds - Department of Health
Declan Morgan - Department of Environment
Filipe Dos Santos — Department of Environment
Mike James - Department of Industry and Resources
Roger Dean — Chair, Kwinana Industries Coordinating Committee
Mike Rowe - DOCEP

Appendix I

Comments and advice from Department of Industry and Resources (DoIR)

Department of
Industry and Resources

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Lance Whitewood
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Dear Lance

ALCOA KWINANA REFINERY SOURCE EMISSIONS CHARACTERISATION PLAN REVIEW

I refer to your letter of 17 November 2005, with the attached Source Emissions Characterisation Plan.

You may be aware, that as of *1* July 2005, responsibility for the management of the Mine Safety Inspection Act has moved to the Department of Consumer and Employment Protection (DOCEP), ie Resource Safety Division.

However, I have provided a copy of the Source Emissions Characterisation Plan to Mike Rowe of DOCEP, who provided the following comments.

1. The principles involved ie identification of emissions, their characterisation and control have been covered by Alcoa’s hard won experiences at Wagerup and Pinjarra, plus the shared information with Worsley over its upgrades. The difficult work had already been done and the design of the control system and the sampling programs to be conducted are well refined.

2. Kwinana is Alcoa’s oldest plant, the basic design and operation is the same as the others, so the key emission sources should be readily identified, pius the types of emissions (dust, caustic, VOC’s etc) have been well researched.

3. Alcoa to confirm if the Liquor Burner stack dimensions are adequate to avoid significant influence of building downwash effects (a requirement of the Assessment, point 5.1.5). With the stack of 70m height and the projected exit volume and temperature are known; it is assumed that this will be adequate. However, siting of the stack in relation to adjoining infrastructure is not satisfactorily known, nor the exit dimensions for the stack - which will determine exit velocity.

4. Consequently, Alcoa may need to provide a more detailed elevation drawing to complement the basic Figure 1 in the Plan. Plus, they could then provide the exit velocity to demonstrate adequacy of design, location and operation.

These should be readily available as part of emission modelling work Alcoa would have done.

As there are no further issues, it is considered by DoIR that the plan is satisfactory and that the Liquor Burner should be commissioned forewith.

Yours sincerely

Mike James
GENERAL MANAGER - OPERATIONAL CLIENT SERVICES
INVESTMENT SERVICES GROUP

5 January 2006

CC. Mike Rowe, Resources Safety Division - DOCEP

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