Pinjarra Alumina Refinery Efficiency Upgrade

Alcoa of Australia Limited

Dust Management Plan for the Alcoa Pinjarra Bauxite Residue Storage Area

Alcoa

FOREWARD

This document has been prepared in accordance with Ministerial Statement conditions granted for the Pinjarra Efficiency Upgrade Project, and is intended to reflect Alcoa of Australia Limited's public commitment to transparency in its environmental management program. This document has been updated to reflect the operational phase of the Pinjarra Efficiency Upgrade Project and supersedes earlier versions. Public comments on its contents may be forwarded by mail to:

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Document version	Publication date	Prepared by
Version 1	July 2007	
Version 2	May 2018	

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EXECUTIVE SUMMARY

The purpose of this Dust Management Plan is to document the dust control mechanisms that are deployed by Alcoa of Australia Limited's (Alcoa) Pinjarra Alumina Refinery, and to outline the Pinjarra Refinery's plans and operational controls to minimise fugitive dust emissions from the Residue Storage Area (RSA). The intention of this plan is to complement the Pinjarra Refinery Long Term Residue Management Strategy (LTRMS).

The original version of this Plan was prepared in July 2007 to meet requirements of Condition 2-1 and Commitment 2 of Schedule 2, of Ministerial Statement Number 000646 (MS646) for the Pinjarra Refinery Efficiency Upgrade (PEU). The Plan has been updated to this current version to reflect the operational phase of the PEU. References to the design and construction phases of the PEU have been removed. Consultation on proposed changes to the 2007 version of the Plan was undertaken with the Pinjarra Community Consultative Network (CCN) over several meetings in 2016 and 2017.

The Plan highlights the specific dust control philosophy employed by Alcoa Pinjarra to minimise dust generation at the RSA. To determine the contribution of dust particles from residue areas to the local surrounding environment as well as overall ambient air quality, the refinery has a dust monitoring program in place. The ambient dust monitoring is guided by the national ambient air guidelines outlined by the National Environment Protection Council (NEPC) and is carried out in accordance with the Department of Water and Environment Regulation (DWER) licence conditions and EPA approved Air Quality Management Plan (AQMP, 2018).

1 INTRODUCTION

1.1 BACKGROUND

The Pinjarra Refinery is located within the Shire of Murray in the Peel region south of Perth, Western Australia and approximately 6 km east of the Pinjarra town site, within industrial-zoned land owned by Alcoa. The refinery is sited at the foot of the Darling Scarp and incorporates the refinery footprint, the RSA and surrounding cattle grazing areas encompassing an area of 6,772 ha of freehold property.

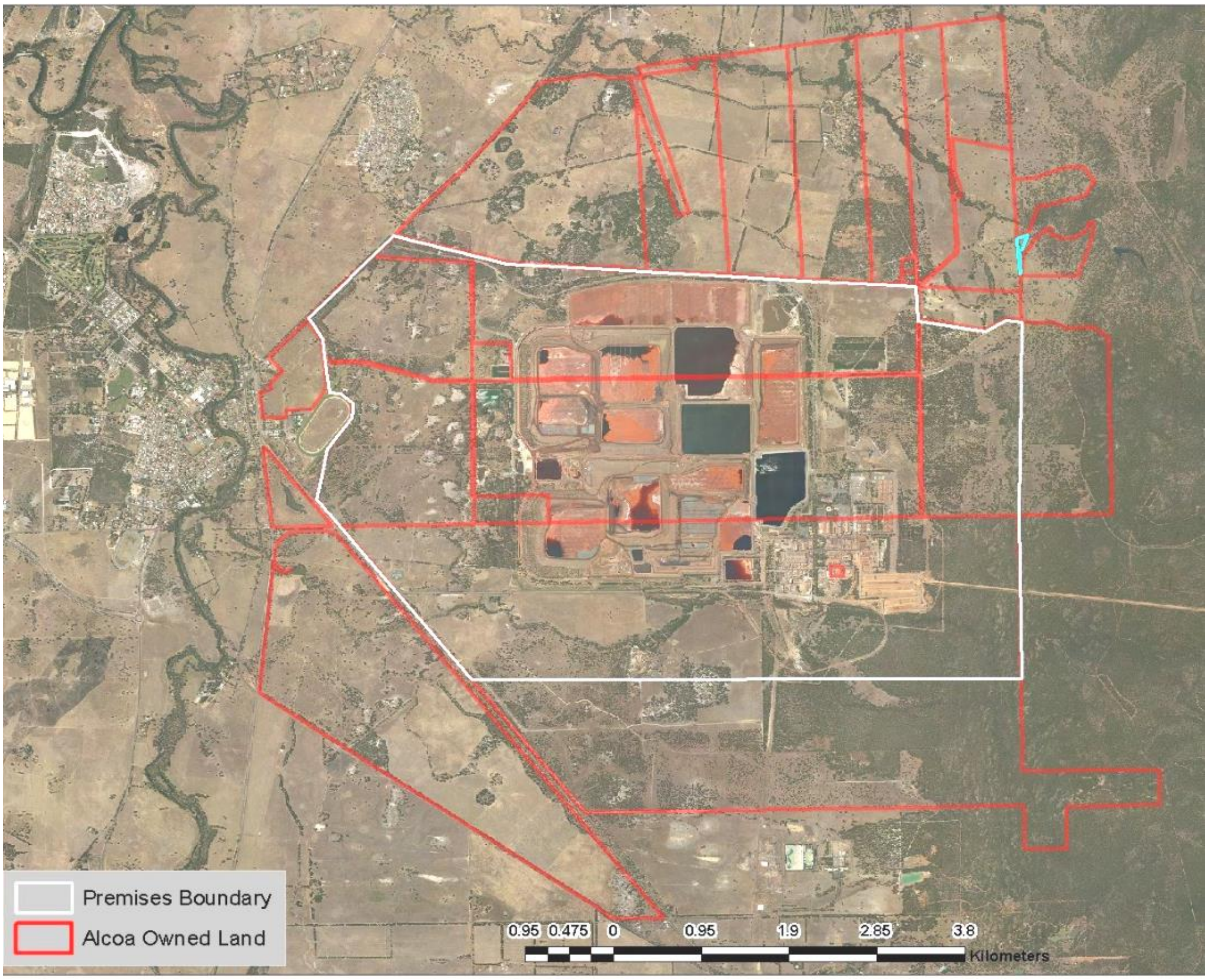
Bauxite is supplied to the refinery from Alcoa's Huntly bauxite mine, sited in State forest to the east of the refinery. Alumina produced at Pinjarra Refinery is transported by rail to Alcoa's Bunbury and Kwinana shipping terminals and then exported to overseas markets or to Alcoa's aluminium smelter in Victoria. The bauxite is low grade by world standards, requiring three tonnes of bauxite to produce one tonne of alumina. As a result, large volumes of bauxite residue are generated and stored in a Residue Storage Area (RSA) west of the refinery. An aerial photograph of the refinery showing the RSA to the west is presented in Figure 1.

In December 2003, Alcoa submitted a proposal for assessment by the Environmental Protection Authority (EPA), to improve the efficiency of the Pinjarra Refinery and enable an increase of alumina production capacity to approximately 4.2 million tonnes per annum (the PEU project). The EPA provided approval for the PEU project and MS646 was subsequently granted to Alcoa on 3 March 2004. Final commissioning of the PEU project was realised on 14 January 2008. In 2015 the EPA approved a non-substantial change to MS646 under section 45C of the *Environmental Protection Act* 1986 (EP Act). Schedule 1 of MS646 was replaced by Attachment 2. Notable changes made to MS646 include increasing the alumina production cap to 5 million tonnes per annum, removing a number of items not considered key proposal characteristics relevant to the environment or otherwise regulated via other legislation, and increasing authorised emissions of carbon monoxide, nitrous oxides, greenhouse gases and bauxite residue.

In August 2015, an updated Air Quality Management Plan (AQMP), as required by Condition 6-1 of MS646, was submitted to the OEPA. The updated AQMP reflects the operational phase of the PEU and this updated plan was approved by the OEPA on 23 October 2015.

This Dust Management Plan was updated in May 2018 to reflect current dust management practices, the ongoing operational phase of the MS646 and to provide a summary of the ambient air quality monitoring undertaken in the area surrounding the Pinjarra Refinery and related operations. This includes details of sampling locations and methods.

Figure 1: Aerial View of the Pinjarra Refinery



1.2 DUST EMISSIONS

One of the ways the refinery can impact on the surrounding community is via dust from the RSA. Dust management and performance is discussed bi-monthly at community consultation network meetings.

Dust generated from the RSA area mostly consists of fine clay particles and sodium carbonate crystals. The sodium carbonate is precipitated on the surface of residue as entrained moisture evaporates. If dry residue surfaces are not correctly managed, wind speeds in excess of 6.5 m/s (23 km/h) can lift and transport the fine residue and carbonate particles. The distance over which these particles are transported depends on a variety of factors including atmospheric conditions, size, shape and mass of the particles.

The residue drying beds, surrounding infrastructure such as roads, embankments and drains can also be a source of airborne dust that must be managed accordingly.

October to April is the period when risk of airborne dust generation is potentially greatest, however Alcoa implements a detailed dust management program throughout the year irrespective of the season. In summer, the predominant winds are moderate to strong east south-easterly and moderate south-westerly winds. Strong and gusty east south-easterly winds often start around midnight, peaking between 2am and 5am, and abating mid-morning. The speed of these winds together with the higher ambient temperatures over summer, and therefore faster mud drying rates, require careful control mechanisms to prevent dust being released.

Residue dust emissions are historically well within licence targets, with no exceedance of licence limits attributable to Alcoa between 2010 and 2017.

During consultation undertaken in 2015 with respect to Pinjarra's Long-Term Residue Management Strategy (LTRMS), the Stakeholder Reference Group (SRG) made a point of acknowledging the significant improvement in dust management practices since the 2011 review of the LTRMS. The sprinkler upgrade project completed in January 2009, as part of the PEU project, together with increased operational focus on dust control measures, is perceived to have made a significant difference to overall dust performance.

1.3 PURPOSE AND SCOPE OF THE PLAN

The purpose of this Dust Management Plan at the time the MS646 was granted, was to document the dust control mechanisms in place at the RSA and to outline Alcoa's plans to minimise fugitive dust emissions from the RSA. The scope of the original management plan included:

- An upgrade of the existing sprinkler system; and
- A review of operational controls.

An upgrade of the existing sprinkler system was completed in early 2009. The original sprinkler designs used at the Pinjarra Refinery were based on 60m x 90m sprinkler spacing, which aimed to provide effective dust control for the major prevailing winds. The design standard was updated to reduce the sprinkler spacing to 60m x 60m to address coverage issues under higher wind speeds and all wind conditions. All RSAs constructed at Pinjarra since 2000 meet the current design standard. A review of operational controls was also undertaken at the time.

The purpose of this upgraded Plan is to document the dust control mechanisms and systems that are in place to minimise fugitive dust emissions from the RSA.

2 OBJECTIVES & TARGETS

The objective of this Plan is to maintain, and improve where practicable, Pinjarra Refinery's dust control mechanisms and systems, to minimise fugitive dust emissions from the RSA.

2.1 TARGETS

The targets for the Plan include:

(a) Maintaining the current dust control measures;

(b) Continuing to research and implement improved methods of control, where possible.

3 RESIDUE OVERVIEW

3.1 RESIDUE MANAGEMENT

The material remaining after the alumina has been extracted from the bauxite ore is commonly termed "bauxite residue". Due to the relatively low grade of Darling Range bauxite, bauxite residue is produced at a rate of approximately two dry tonnes per tonne of alumina. This material is stored in the RSA located to the west of the refinery.

The residue consists of a coarse sand fraction (often termed "red sand") and a fine silt fraction (often termed "red mud"). The mud and sand streams are pumped together to the residue area and separated in the sand separation building located at the residue area. Approximately 55% of the residue stream is sand and 45% is mud. The mud density is increased at the residue area by thickening prior to its final discharge into residue drying areas. The sand is stockpiled and subsequently used for internal construction activities at the RSA.

The red sand fraction is used to construct the dyke walls for the red mud impoundments and also for the construction of road ways. The red mud is then stored via a 'dry stacking" process in the red mud impoundments. This process involves pre-thickening the red mud to approximately 50% solid slurry and then depositing it in layers that are approximately 0.4-0.7 meters thick. After initial drying, the mud is turned by bulldozers or Amphirols which turn the dry top surface in and places the wet mud on the surface. This assists in the drying process and reduces dust emissions. Consecutive layers are then placed on top allowing the area to increase in height which subsequently reduces the overall residue footprint.

To allow more efficient utilisation of existing residue areas, Alcoa commenced construction of Phase 1 of a residue Filtration Facility at Pinjarra Refinery in 2017. With this innovative technology, about 50% of bauxite residue generated from the alumina refining process at the Pinjarra Refinery will be forced through very large filters that squeeze out the waste water, which will be recycled in the refining process.

After completion of the residue filtration facility, several desirable environmental outcomes will be expected and will include but not limited to: -

- Reduction in the amount of land required for residue storage;
- Reduction in ground water usage; and
- Progressive improvements in dust management.

The project follows the successful commissioning of a similar plant at Alcoa's Kwinana Alumina Refinery in Western Australia in 2016. The residue Filtration Facility at Pinjarra will be commissioned in 2019.

3.2 RESIDUE DUST CHARACTERISTICS

Residue mud and sand consist primarily of alumina, silica and iron oxides. The residue mud also contains a higher percentage of trace metals than the sand and can form particles of sodium carbonate on the surface during drying. These can result in a dust source in uncontrolled conditions (Air Assessments, 2004).

3.3 FACTORS AFFECTING DUST EMISSIONS AT THE RESIDUE STORAGE AREA

3.3.1 Wind speeds

Dust emission data and wind data from the residue area have been evaluated by SKM (1997). These studies indicate that in uncontrolled conditions, dust emissions from the residue area initiate at approximately 6.5 m/sec (~20 km/h). Above 11 m/s (40 km/h), dust emissions from the residue area can increase rapidly and for wind speeds above 14.5 m/s (50 km/h) are predicted to be the largest source of dust from the refinery (Air Assessments, 2004).

Using the wind assessment model WAsP (the Wind Atlas Analysis and Application Program used commonly in wind energy studies for sitting wind turbines), the following general statements were made with regard to the effect of the shape and height of residue areas on wind speeds and dust emissions (Air Assessments, 2004):

- Increasing the height of the residue area will increase the wind speed across the residue area and therefore could lead to a higher potential for dust emissions.
- This increase in wind speed is higher for narrower elevated areas that have a cross-section of a hill than a broader plateau.

Alcoa is committed to improving dust control well before the final height of residue is reached.

Analysis of wind data from the residue area at Pinjarra support the conclusion of higher wind speeds on the residue area than surrounding area (Air Assessments, 2004). Apart from the variation of the wind speed with height and shape, the wind speed for easterly winds also varies with distance from the scarp. Generally, the frequency and maximum wind speed of the easterly foothill winds decrease with distance from the foot of the scarp. This would imply there is generally more potential for dust emissions from sources located closer to the scarp. However, the impact of sources further from the scarp may be greater as there is less time for the dispersion of the plume and removal of particles before they reach sensitive receptors (Air Assessments, 2004).

3.3.2 Effect of Shelter Belts

The influence of vegetation on removing sub 10 µm particles from the air has been the subject of much study in the US (Etyemezian et al, 2003). It has been found that the effect of vegetation can be significant in trapping particles. Dense vegetation of uniform height will be less successful in trapping airborne dust than belts of trees as the air will tend to flow over the top. Open grassland with very few trees will also have a low entrapment potential. Belts of trees that are porous and sited near the initial dust source are particularly effective. This is dependent on the porosity of the shelter belt i.e. gaps in the tree belts. Shelter belts with a porosity greater than 50% performing better at filtering the dust (Air Assessments, 2004). Vegetation over which the plume travels can also be effective in increasing dust deposition with rougher surface (e.g. tree belts) leading to higher deposition than grasslands. It is considered that design of downwind shelter belts will be important in capturing dust. Thin belts of trees that are semi porous to the wind, separated by grassland may be quite effective in removing particles.

4 DUST MANAGEMENT STRATEGIES

The nature of the residue and the deposition and drying process results in a range of differing materials and surface textures that have the potential to become dusty under windy conditions. As such the dust management systems in place are complex and consist of a range of both proactive and reactive strategies. These control mechanisms include Long-Term (annual), Mid-Term (Weekly) and Day-to-Day controls.

<u>Long Term Controls (annual)</u>

These measures aim to ensure that:

- Dust control mechanisms are in place for any newly constructed or exposed embarkment before stronger winds are forecast:
    - new or exposed internal embankments likely to remain in place undisturbed for an extended period are planted with native vegetation or grasses during winter to allow them to establish an effective long-term dust control cover and;
    - embankments or areas that are not required in the shorter term are covered with aggregate or mulch.

<u>Mid-Term Controls (weekly)</u>

Dust management activities are tracked at weekly review meetings. Weekly activities include: -

- Inspections and surveys carried out to check effectiveness of dust controls;
- Review of weekly and seasonal weather forecast to ensure preparedness for conditions conducive for dust generation e.g. operations sprinklers well ahead of forecast winds;
- Regular turning over the mud in the drying area thereby leaving wet mud on the surface;
- Spraying exposed banks and roads with dust suppressant;
- Restricting vehicle access to exposed areas; and
- Detailed investigations into exceedances of internal targets to prevent recurrence.

<u>Day to Day Controls</u>

The day to day control mechanism is based on a three-day weather forecast that is received on a daily basis. The forecast includes a Dust Risk Rating that takes into account anticipated rain, wind speed and wind direction. Dust emissions from the drying beds are managed by use of the sprinkler system which is operated in response to internal dust alarms and proactively to wet down areas prior to forecast weather conditions.

4.1 CONTROL PHYLOSOPHY

A variety of dust control methods are employed at the RSA. More proactive strategies which focus on reducing the amount of open area requiring surface treatment by applying long term stable surface treatments are preferred. Specific dust controls in place include:

- Turning over the red mud; and
- The use of sprinklers and water carts.

Other controls applied to residue soil and surfaces other than mud drying beds include dust suppression controls such as: -

- Bitumen emulsion application;
- Crushed rock aggregate application;
- Emulsified waste oil application;
- Planting grasses or other vegetation; and
- Applying wood mulch.

Further discussion on these methods is provided in the following sections.

4.1.1 Turning over Mud

Wide-track bulldozers or Amphirols are used to turn over the top 0.5 to 1 m of residue. This process reduces exposure of dry residue which is prone to dusting, while accelerating overall drying rates. When conditions conducive to dust generation are forecast, the frequency of mud turnover can be increased.

4.1.2 Sprinkler Systems

A comprehensive sprinkler network exists at the RSA and is the primary control for the mud drying areas. The sprinkler system is operated in response to daily weather forecasts and residue area conditions, and the results from continuous dust monitors located around the RSA.

Sprinkler system checks are performed regularly to ensure the integrity of the reticulation system, associated pumps and pipe work.

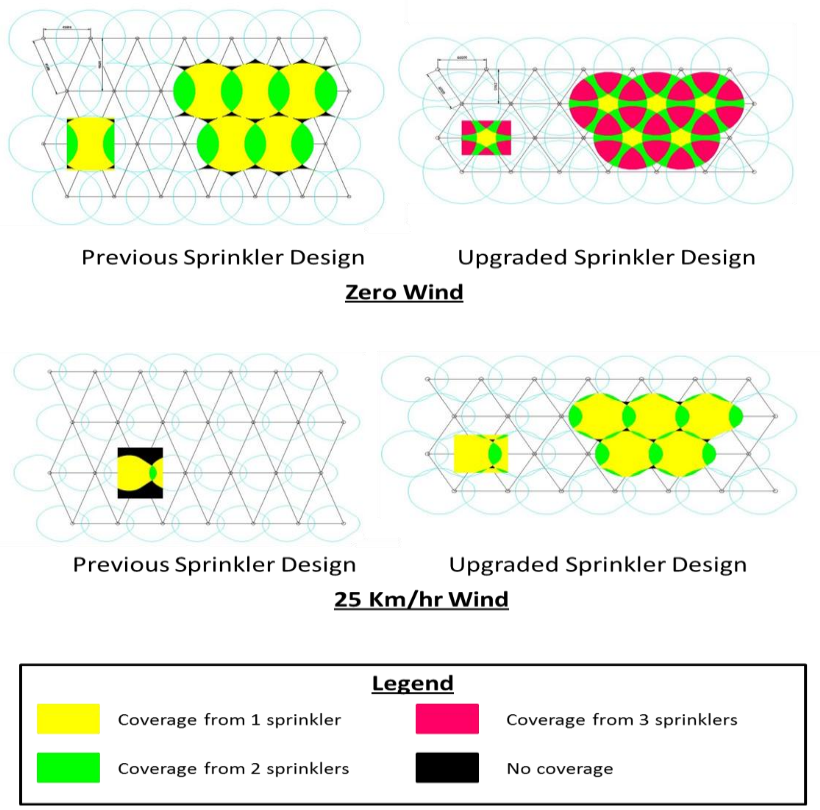
The original sprinkler designs were based on 60 m x 90 m sprinkler spacing. The design was aimed at providing the best dust control for the major prevailing wind. All RSAs constructed prior to 2000 were constructed with sprinklers systems based on this design standard. Further review of the sprinkler network found that this design standard had some limitations in high wind conditions as the area covered by each sprinkler changes shape from a circle to a pear shape leaving sections of the residue surface unprotected.

As part of Alcoa's commitment to continuous improvement, the design standard was changed to reduce the spacing to 60 m x 60 m to address coverage issues under higher wind speeds and all wind conditions. All RSAs constructed at Pinjarra since 2000 meet the current design standard.

During 2004, Alcoa performed internal reviews and commissioned independent external advice on its sprinkler design and operation before deciding to retrofit the new sprinkler spacing to residue areas built before 2000. The sprinkler upgrade project commenced at Pinjarra in 2005 and was completed in early 2009. Figure 2 shows the impact of the change in sprinkler design.

A comprehensive equipment management strategy and maintenance program is in place for the dust suppression system, which includes the sprinkler systems and all associated pumps, valves and piping. The strategy ensures the reliability, availability and effectiveness of the equipment, significantly reducing the potential for equipment failure.

Figure 2: Old and New Sprinkler Designs



4.1.3 Bitumen Emulsion

Bitumen emulsion is applied periodically to a range of different surfaces including inner dyke walls and sand stockpiles (Figure 3). The procedures for applying bitumen are detailed within Alcoa's controlled document system and include guidance on appropriate application rates.

Figure 3: Bitumen Emulsion Being Sprayed to Reduce Dust Emissions from Embankment Walls

4.1.4 Crushed Rock Aggregate

Crushed rock aggregate (blue metal) is used as an effective dust suppressant on flat sand areas that are not scheduled for work in the short term. This particular suppressant material is very effective and highly durable.

4.1.5 Wood Mulch

Wood mulch is spread on sand areas to provide a long-term, low-maintenance form of dust control and is used as an alternative to grass cover.

4.1.6 Application of emulsified waste oil

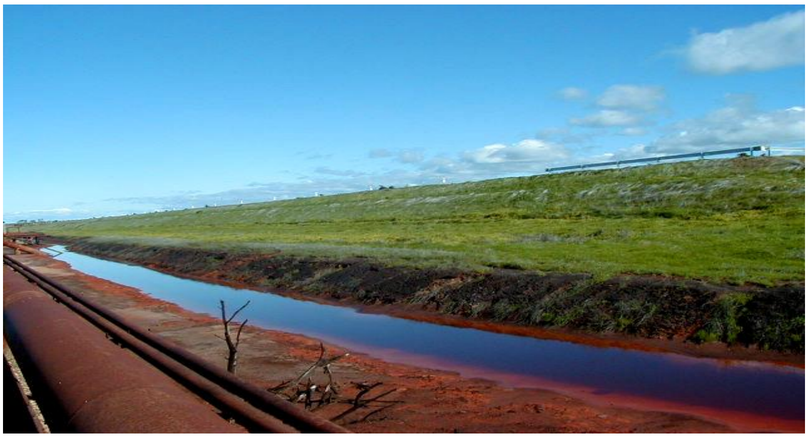
Waste oil collected from the refinery and associated mine sites is emulsified with water and sprayed onto designated roads within the RSA. This method of dust suppression has been approved by the Department of Water and Environment Regulation.

The waste oil has a short life-span in the RSA environment due to chemical reactions that occur with caustic and due to natural biodegradation. This, and the physical containment of the RSA, ensure ground water is protected.

4.1.7 Planting Grasses and Native Vegetation

In areas where there is no work planned for long periods of time, such as dyke walls or finalised batters, grass, and in some areas, native plants have been shown to be very successful in preventing dust emissions (Figure 4).

Figure 4: Grassed Areas on Internal Embankments



4.2 OTHER OPERATIONAL CONTROLS

The deployment of water trucks is viewed as a short-term control option for dust. If an area requires a water truck, then the area is reviewed to determine whether a longer-term treatment such as bitumen, mulch, grass, or rock aggregate would be a more effective means of control.

Daily-average ambient dust readings above 90 ug/m^3 (approximately one third of Pinjarra's environmental license target of 260 ug/m^3) are promptly investigated and appropriate control measures aimed at preventing future exceedances are applied. Maintaining dust levels below 90 ug/m^3 at the Pinjarra Racecourse and minimising the risk of dust generation from the RSAs are key objectives of Alcoa's dust control and management activities. Internal and licence targets for dust emissions are detailed in Section 6.1.

Another form of dust suppression is limiting vehicle traffic on less-used roads in predicted high wind events (Figure 5).

Figure 5: Less Trafficked Roads are Blocked off to Reduce Dust Emissions

5 AMBIENT AIR QUALITY MONITORING OVERVIEW

Alcoa maintains a program for ambient air quality monitoring at the Pinjarra Refinery to ascertain the impacts of its atmospheric emissions on the receiving environment. Ambient monitoring is conducted at locations both on and off the refinery site. Ambient Air monitoring systems at the refinery include:

- Dust monitoring; and
- Meteorological monitoring.

The Ambient Air Dust monitoring program in operation off the Pinjarra refinery site is the RSA Dust Emissions monitoring program.

High volume air samplers (HVAS) are used to measure boundary line dust levels by producing daily averaged dust concentrations. Real-time dust monitors are also used to continuously monitor dust emission levels at the RSA boundary and internal strategic locations to enable proactive dust management. These real-time monitors produce digitally averaged six-minute dust concentrations and are linked to process control systems, allowing real-time alarming and providing immediate feedback to operators that dust levels may be of concern.

Weather monitoring occurs at a meteorological station located to the south of the refinery, at Oakley South. Parameters such as wind speed, wind direction, rainfall, ambient temperature and relative humidity are monitored. Meteorological monitoring does not provide samples for analysis, however dust monitoring using HVAS intrinsically requires gravimetric analysis of filter papers. All analyses are carried out by a laboratory that is NATA-accredited for gravimetric analysis of ambient air filter papers and analysis is conducted in accordance with the relevant Australian Standards.

6 DUST MONITORING

6.1 AMBIENT DUST STANDARDS AND GUIDELINES

The National Environment Protection Council (NEPC) has produced the following national ambient air quality guidelines for the protection of human health:

- The National Environment Protection Measure (NEPM) (NEPC, 1998) set national air quality standards for SO_2, NO_x, Ozone, CO, particulate (as PM_{10}) and lead;
- Variation to the National Environment Protection Measure (NEPC, 2002) set an interim Advisory Reporting Standard for particulate (as $PM_{2.5}$); and
- Variation to the National Environment Protection Measure (NEPC, 2016) established the 2002 Advisory Reporting Standard for particulate (as $PM_{2.5}$) as a full Standard, and established an annual Standard for particulate (as PM_{10}).

A summary of the current NEPM standards relevant to dust management is provided in Table 1.

Table 1: National Environmental Protection Measure – Ambient Air Standards

Pollutant	**Averaging Period**	**Ambient Standard**		**Maximum allowable exceedances**
		(ppm)	**(µg/m³) [1]**	
Ambient Air NEPM		*Standard*		
Particles as PM_{10}	1 day	-	50	None
	1 year	-	25	None
Variation to the Ambient Air NEPM		*Standard*		
Particles as $PM_{2.5}$	1 day	-	25	None
	1 year	-	8	None

Note 1: Referenced to a temperature of 0 ºC and absolute pressure of 101.3 kPa.

There is no ambient air quality standard established in the NEPM for Total Suspended Particulate (TSP), total dust load. Ambient dust level targets at the Pinjarra Racecourse are defined in the refinery's DWER environmental licence. This specifies that the 24-hour average ambient dust level (as TSP) measured at the Racecourse monitoring station shall not exceed 260 micrograms per normal cubic metre ($\mu g/m^3$).

In addition to the licence limits set by regulatory agencies, Alcoa has established its own Internal TSP measure. This Internal measure of 90 $\mu g/m^3$ (at Pinjarra Racetrack) is approximately one third of the licence limit. The purpose of the internal measure is to drive continuous improvement in dust control and ensure that a higher level of performance than that determined by the environmental regulatory authorities is achieved.

The current NEPM Standard for $PM_{2.5}$ is 25µg/m^3 in one day. Voluntary measurements undertaken by Alcoa to assist in assessment against the Standard have shown that $PM_{2.5}$ values at the Pinjarra Racetrack are between 4 and 13 µg/m3 per day and therefore well within the standard.

6.2 EXISTING DUST MONITORING SYSTEM

Dust monitoring around the Pinjarra refinery is undertaken through a network of monitors. The dust monitoring network has been revised over time, with some HVAS monitors changing to real-time units, monitoring location changes and some units being removed from the network in consultation with the Pinjarra Community Consultation Network (CCN). Dust monitors with size selective inlets (for PM_{10} and $PM_{2.5}$) were used for a period of time as a basis for a detailed study of the distribution of dust and the associated metal oxides carried out for Alcoa's Western Australian Operations (WAO) during 2005-6 (Air Assessments, 2008).

A summary of the monitors is presented in Table 2 with their locations presented in Figure 6. Figure 7 shows a licenced High-Volume Air Sampler (HVAS), which measures dust concentration over an averaging period (usually 24 hours) using a filter paper.

Dust emissions from the RSA are monitored daily. This data is then used to gauge the effectiveness of dust control measures. As seen in Figure 6, Alcoa has eight ambient dust monitoring sites surrounding the refinery, including compliance monitoring sites located at the Pinjarra Racecourse, Fairbridge Airstrip and Oakley South. These sites are located to measure ambient dust concentrations due to emissions from the Pinjarra Refinery and RSA.

Table 2: Summary of the Alcoa Pinjarra Refinery Dust Monitoring Network

Monitoring Site Name	Licence Requirement	Monitor Type	Size Fraction Measured	Averaging Period	Sampling Methods
Pinjarra Racecourse	Yes	HVAS	TSP	24-hour	3580.9.3:2015
	No	Real time	TSP	6-minute	AS/NZS 3580.9.8-2008
Fairbridge Airstrip	Yes	HVAS	TSP	24-hour	3580.9.3:2015
RSA10 W	No	Real time	TSP	6- minute	AS/NZS 3580.9.11-2016
RSA north	No	Real time	TSP	6-minute	AS/NZS 3580.9.8-2008
RSA south	No	Real time	TSP	6-minute	AS/NZS 3580.9.11-2016
Oakley South	Yes	HVAS	TSP	24-hour	3580.9.3:2015
Hillgrove	No	Real time	TSP	24-hour	AS/NZS 3580.9.11-2016

The monitors are used by Pinjarra Refinery for:

- control purposes including the use of the real time monitors as proactive controls, and the Racecourse real time monitor as a reactive control;

- compliance with licence conditions; and
- estimation of the refinery's particulate emissions for reporting to the National Pollutant Inventory.

Figure 6: Ambient Dust Monitoring Locations

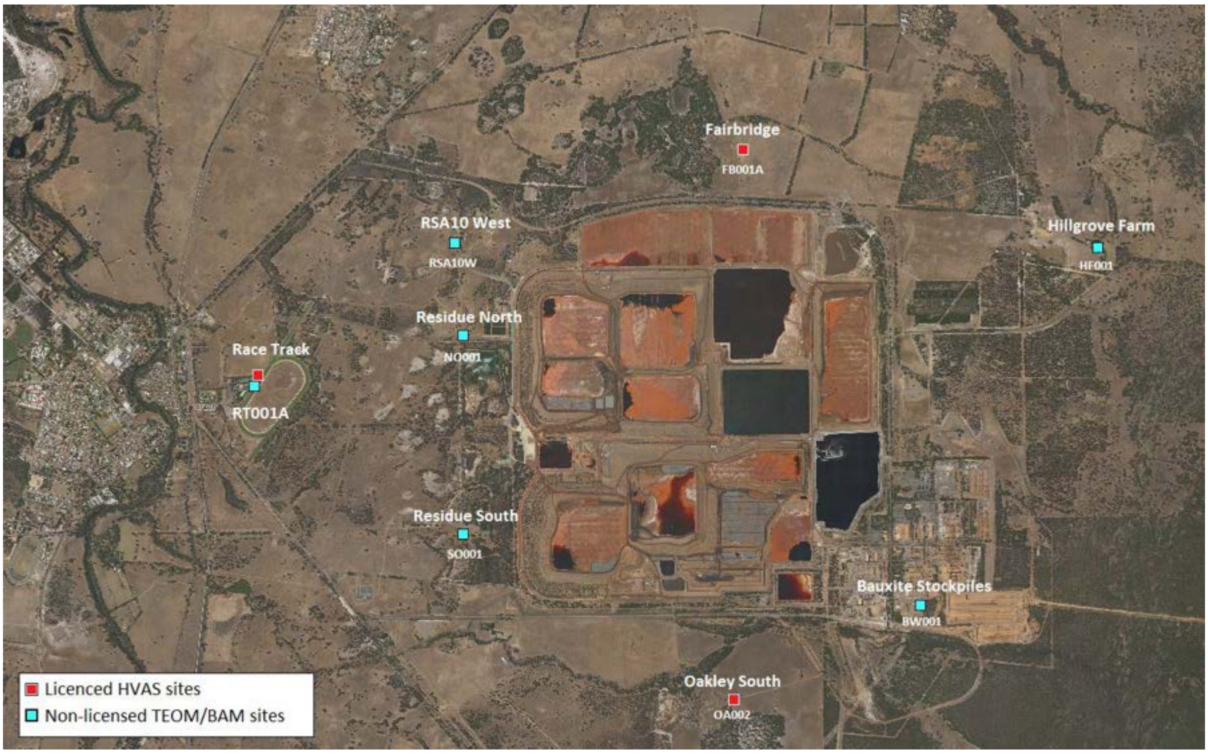


Figure 7: Dust Sampling Equipment at Pinjarra Racecourse (including spare trailer-mounted HVAS unit)

7 HEALTH RISK ASSESSMENT

The results of the studies of gaseous pollutants and dusts described in the previous sections were used to refine the estimates of atmospheric emissions and health risk factors at receptors in the region of the refinery. This was done through the development of an Air Quality Model for the refinery (Air Assessments, 2008) and subsequently a Health Risk Screening Assessment (Environ, 2008) after the commissioning of the PEU in early 2008. Potential health effects arising from the predicted short-term (acute) and long-term (chronic) exposure to non-carcinogenic compounds, and potential carcinogenic risks were considered in the Health Risk Screening Assessment by comparing the predicted exposure concentrations at the discrete receptor locations with health protective guidelines for ambient air developed by reputable authorities such as the National Environment Protection Council (NEPC), World Health Organisation (WHO) and the U.S Environmental Protection Agency (US EPA). The results indicated that:

- the potential for emissions from the Upgraded Refinery to cause acute or chronic non-carcinogenic health effects is low;
- the potential for emissions from the Upgraded Refinery to contribute significantly to an increase in the incremental carcinogenic risk in the exposed population is low; and
- the Acute and Chronic health indexes, and incremental carcinogenic risk are predicted to be lower at all of the receptor locations for the Upgraded Refinery emissions scenario compared to the pre-upgrade scenario.

The results of the 2008 modelling and assessment were subjected to peer reviews (CH Environmental, 2008 and Professor Philip Weinstein, 2008) prior to submission to the EPA. The outcomes were also presented to stakeholder groups including the PEU Stakeholder Reference Group and the Pinjarra Community Consultative Network.

In 2014, the refinery's 2018 Health Risk Screening Assessment (Environ, 2015) was updated to reflect Alcoa's intent to incrementally increase the refinery's alumina production capacity to 5 million tonnes per annum. The results of the 2014 Health Risk Screening Assessment (2014 HRA) indicated that, in relation to the proposed refinery incremental increase in the alumina production capacity, the potential for emissions to cause acute or chronic non-carcinogenic health effects as well as the potential for emissions to contribute to the incidence of cancer in the exposed population remains low. The results of the 2014 HRA were subjected to peer review (Professor Philip Weinstein, 2015), with the outcomes of the 2014 HRA and the peer review (available at www.alcoa.com.au) submitted to the WA Environmental Protection Authority.

8 ONGOING RESEARCH

Alcoa is committed to conducting further research into dust monitoring and management. The current focus is on using different dust treatment products and additives to control dust.

9 REVIEW OF MANAGEMENT PLAN

The Pinjarra Refinery reviews dust management performance and practices regularly with the Pinjarra CCN. In 2016, the refinery rationalised the monitoring network in consultation with the CCN group. The group were presented with data sets for a number of preceding years and agreement with the community was reached to remove a number of existing ambient air monitors.

A summary of community consultation that has been undertaken and comments provided is provided in Table 3 below**.**

Table 3: Management Plan Consultation

Consultation	Summary of Comments
Preliminary draft of Dust Management Plan presented to SRG in January 2005	No comments received.
Dust performance updates provided to CCN on a regular basis (usually every 2 months). Ongoing activity with CCN	Comments and questions are discussed with the group as they arise. No concerns have been raised. The CCN agreed with proposed changes to the Pinjarra dust monitoring network after consultation with the group at the June 2016, and August 2016, CCN meetings.
A SRG was formed in 2017 during revision of Pinjarra's Environmental Improvement Plan. Alcoa's current dust management practices, as detailed in this plan were presented to the SRG.	No comments received. General acknowledgment of the improvements in dust management at the refinery in recent years.

This management plan may be altered from time to time to reflect changes to production requirements, or to stakeholder expectations.

Alcoa will undertake an appropriate level of stakeholder consultation regarding dust management and this management plan. The level of consultation will be dependent upon the nature and significance of alterations.

The Wider Community and General Public

This plan will be available on Alcoa's public website.

10 REFERENCES

Air Assessments. 2014. *Pinjarra Alumina Refinery, Air Quality Modelling for 2014 Health Risk Assessment.*

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11 GLOSSARY

Term	Definition
AQMP	Air Quality Management Plan
CCN	Community Consultative Network
EP Act	Environmental Protection Act 1986
EPA	Environmental Protection Authority
DMP	Dust Management Plan
DWER	Department of Water and Environment
HVAS	High volume air samplers
HRA	Health Risk Assessment
LTRS	Long Term Residue Management Strategy
MS	Ministerial Statement
NEPC	The National Environment Protection Council
NEPM	National Environment Protection Measure
NPI	National Pollutant Inventory.
OEPA	Office of the EPA
PEU	Pinjarra Refinery Efficiency Upgrade
PM	Particulate Matter
RSA	Residue Storage Area
SRG	Stakeholder Reference Group
TEOM	Tapered Element Oscillating Microbalance
tpa	Tonnes Per Annum
TSP	Total Suspended Particulate
WAsP	Wind Atlas Analysis and Application Program