Consideration of potential health and amenity impacts of dust in determining the size of a buffer for urban development in the Mandogalup area



Advice of the Environmental Protection Authority to the Minister for Environment under Section 16(e) of the *Environmental Protection Act 1986*

June 2017

Environmental Protection Authority 2017, *Consideration of potential health and amenity impacts of dust in determining the size of a buffer for urban development in the Mandogalup area*, Advice of the Environmental Protection Authority to the Minister for Environment under section 16(e) of the *Environmental Protection Act 1986*. June 2017. EPA, Western Australia.

This document is available in alternative formats upon request.

National Relay Service
TTY: 133 677
(To assist persons with hearing and voice impairment)

More information

EPA services, Department of Water and Environmental Regulation
Level 4, The Atrium
168 St Georges Terrace
Perth WA 6000
Locked Bag 33,
Cloisters Square WA 6850
p: 08 6364 6545
e: info@epa.wa.gov.au
w: www.epa.wa.gov.au

1 Introduction

In June 2016, the Minister for Environment requested the Environmental Protection Authority (EPA) provide advice on the size of a land use planning buffer relating to health and amenity impacts of dust, now and into the future, in respect of potential urban development in the Mandogalup area. The request stemmed from the previous Government's consideration of establishing legislation to control new sensitive land uses in the vicinity of the Kwinana industrial area.

This report presents the EPA's advice pursuant to section 16(e) of the *Environmental Protection Act 1986* (EP Act). Further information related to this advice is set out in a separate supplementary report which outlines the technical material the EPA considered in forming this advice.

This advice principally focuses on the technical aspects of the generation of dust in the Mandogalup area and its potential for health and amenity impacts. The EPA recognises that there are other matters which may be taken into consideration in determining appropriate buffer size to separate urban development and industrial activities in the area and has provided brief comments on these matters in this report.

In preparing this advice the EPA has considered:

- Alcoa of Australia Limited (Alcoa) environmental licence compliance reports
- air quality monitoring data for the area
- Alcoa's Long Term Residue Management Strategies (2012 and 2013) for the residue disposal area (RDA)
- technical reports, including air quality modelling and air quality assessments
- meteorological data for the area
- dust complaint information in the Mandogalup and surrounding areas
- meetings with key stakeholders, including government, industry, and landowners, and
- public submissions on potential dust impacts in the area.

Figure 1 below shows the Mandogalup area to which this advice relates.

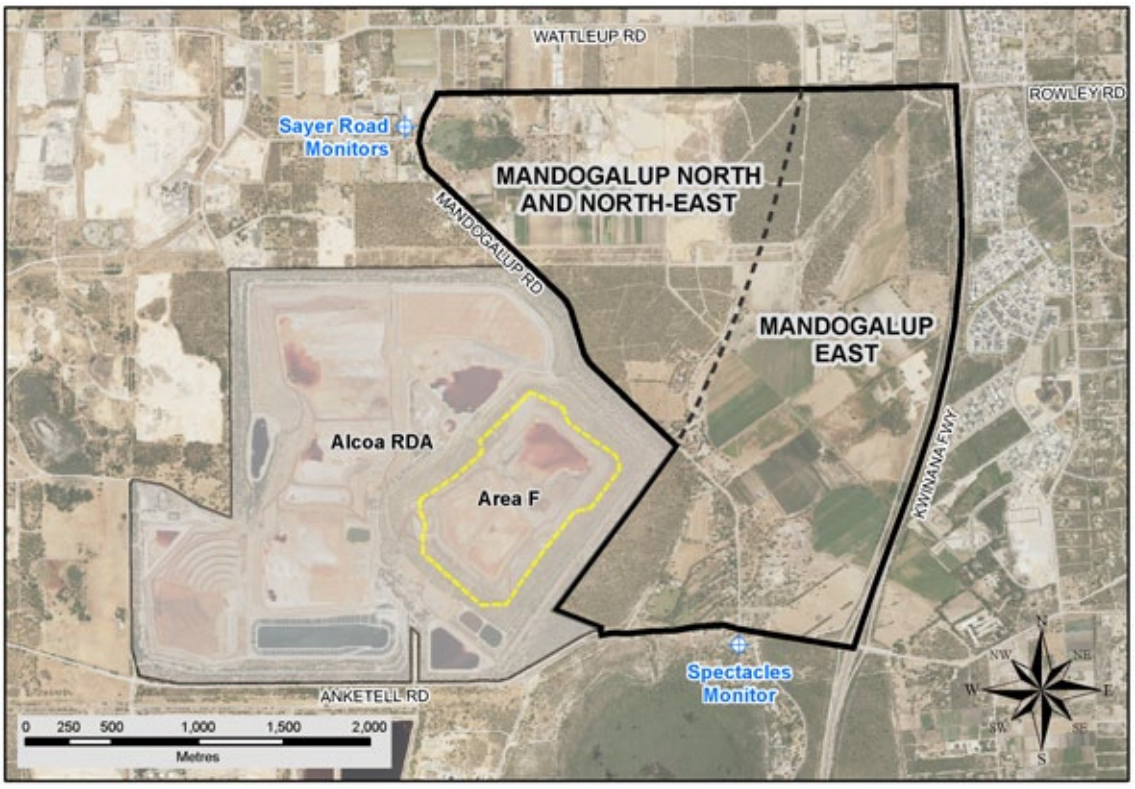


Figure 1: Mandogalup and surrounding areas, including the location of two air quality monitoring sites

2 Potential for dust in the Mandogalup area

Advice

- The potential for dust from Alcoa's RDA is a primary determinant for the size of a buffer required in the Mandogalup area.
- Existing dust control measures limit the frequency and amount of dust currently blown from the RDA.
- Due to the wind pattern in the locality, dust which is blown from the RDA is predominantly blown to the north and north-east of the RDA.
- There is limited potential for dust to be blown to the east of the RDA.
- New technology being installed at the RDA facilities has potential to reduce the amount of dust blown from the RDA site in the future.
- Sand and limestone quarrying in the Latitude 32 Industry area and north-western part of Alcoa's RDA property also have significant potential to affect dust levels in the northern Mandogalup area.

Alcoa's Kwinana residue disposal area (RDA), located immediately to the west of the Mandogalup area, is the largest individual potential source of dust impacting the area. The RDA currently operates some 160 hectares (ha) of residue drying beds. The existing

Kwinana Buffer in Mandogalup is based on distances from the northern, eastern and southern edge of the RDA.

A number of studies have shown that fine residue can be picked up and blown from the RDA surfaces when wind speeds are in excess of about 23 km/h, if they become dry.

Alcoa has implemented a number of improvements to its dust management practices since 2005, including an advanced sprinkler system which is operated in response to daily weather forecasts and residue area conditions, and continuous dust monitors situated around the residue area. This limits the occurrence of dust currently being blown from the RDA.

Alcoa's Kwinana Long Term Residue Management Strategy 2012 indicates that the risk of dust being blown from the RDA is greatest between the months of October and April. The predominant winds during this period are moderate to strong south-westerly winds. The speed of these winds together with the higher ambient temperatures over summer, and therefore faster mud drying rates, results in the highest potential for dust to be blown off site.

The combination of wind speed and directions, together with drying rates, means that any dust blown from the RDA is predominantly to the north and north-east of the RDA. The potential for dust to be blown from the RDA in other directions is limited.

Alcoa is currently implementing a new technology for depositing residue at the RDA, called residue filtration. The filtration process produces a dry residue cake by filtering the mud slurry through a membrane.

Filtering the mud and depositing the residue as a dry cake will reduce the amount of residue disposed to drying beds. While the operation of drying beds may still be required in the future for any shut-down periods of the filtrate system, overall there is potential for dust from the RDA to be reduced in the future.

There are a number of other potential sources of dust affecting the Mandogalup area, both within and outside the area. In particular there are large areas of sand and limestone quarrying in the Latitude 32 Industry area which abuts Mandogalup's north-west boundary, and on the north-western side of Alcoa's RDA land, which have significant potential to affect dust levels in the northern Mandogalup area.

3 Potential for health impacts from dust in the Mandogalup area

Advice

- Based on health risk assessments of emissions from RDAs, and air quality monitoring and modelling information, there appears to be negligible risk of health impacts from dust in the eastern part of the Mandogalup area away from the RDA.
- However, air quality to the north and north-east of the RDA does not appear to meet the current NEPM goal for particulates smaller than 10 microns (PM_{10}) which was adopted in February 2016. There appears to be a number of sources of dust affecting this area, both within and outside the area, including dust from the RDA.
- While the current air quality to the north and north-east does not pose an immediate health risk, there is a need for investigations to determine the contribution of dust from the various sources resulting in the NEPM exceedances and for corrective measures to be undertaken, if practicable, to achieve the NEPM air quality goal in this area.

Alcoa has undertaken a review of health risk assessments relating to potential acute, chronic and incremental carcinogenic health effects of alumina refineries in Australia, including dust from residue disposal areas.

The review concluded that the risks of acute health effects from emissions from refineries and RDAs are adequately controlled, and the risks of chronic health effects and incremental carcinogenic risks are negligible.

The review also noted that a previous study had found that based on its size distribution and composition, red mud dust appears to be no more hazardous to human health than urban particulate matter.

Alcoa's Kwinana Long Term Residue Management Strategy 2012 indicates that *"Residue dust is slightly alkaline and could be an irritant if high enough concentrations occurred – however extensive monitoring data shows this is very unlikely as the level of dust emitted from the residue area is well below the levels likely to cause any health impacts".* As part of developing this section 16(e) advice, Alcoa provided further information supporting this position.

The review of health risk assessments by Alcoa showed that the primary potential for health effects from RDA dust emissions was associated with the dust increasing PM_{10} levels in the air.

Western Australia has a goal of achieving the National Environment Protection Standard for PM_{10} in ambient air, in line with the National Environment Protection (Ambient Air Quality) Measure (NEPM).

Up until February 2016, the NEPM goal for PM_{10} was that daily PM_{10} level not exceed 50 µg/m^3, with allowance for up to five exceedances per year under specific circumstances. The NEPM goal was varied in February 2016 for daily PM_{10} not to exceed 50 µg/m^3, but with exceedances only allowed for 'exceptional' events, such as bushfires.

Based on air quality monitoring and modelling information, air quality in the eastern part of the Mandogalup area, away from the RDA, is consistent with the NEPM goal for PM_{10}. Air quality to the area immediately to the east of the RDA may also be consistent with the NEPM goal, however it is considered that further air quality monitoring is required in that area to confirm this.

While monitoring and modelling information indicates air quality to the north and north-east of the RDA generally met the previous NEPM goal, it does not appear to meet the current goal. This is illustrated in the air quality results for the Sayer Road monitoring site located about 700 metres north of the RDA (see Figure 1) presented in Table 1 below. The results are compared with two other air quality monitoring sites in the metropolitan area.

Table 1: PM_{10} dust levels exceedances above NEPM daily standard of 50 µg/m^3

YEAR	NEPM Goal: maximum number of exceedances[(i)]	SAYER ROAD	SOUTH LAKE	DUNCRAIG
2016	0	9	0	0
2015	5	5	2	1
2014	5	4	0	1
2013	5	2	0	0
2012	5	8	2	2
2011	5	5	1	1

[(i)]NEPM revised in February 2016; exceedances only allowed for 'exceptional' specific events, such as bushfires.

Air quality modelling indicates that dust from the RDA is a significant contributor to dust in the north and north-eastern Mandogalup area and may contribute to exceedances of the NEPM PM_{10} daily standard of 50 µg/m^3 in this area.

However other sources, both within and outside the Mandogalup area are also likely to contribute to the exceedances in this area. This includes quarrying in the Latitude 32 Industry area which abuts Mandogalup's north-west boundary, and on the north-western part of Alcoa's RDA land.

A single exceedance of the NEPM PM_{10} daily standard does not necessarily mean there will be health effects. However, regular exceedances over a considerable period of time or a significant exceedance, could lead to acute or chronic health effects.

There is a need for further investigation to be done to determine the principle sources of dust contributing to the exceedances of the NEPM dust standard in the area to the north and north-east of the RDA and for corrective measures to be undertaken if practicable.

4 Potential for amenity impacts from dust

Advice

- Based on air quality monitoring, air quality modelling and licence compliance reporting there appears to be low likelihood of dust from the RDA causing unreasonable amenity impacts in the eastern part of the Mandogalup area away from the RDA.
- Based on air quality modelling information, the frequency and magnitude of dust events from the RDA to the north and north-east has potential to cause amenity impacts.

There are issues in assessing the potential for amenity impacts from dust. Amenity values can be very subjective and people generally have different tolerances to dust levels. There are no air quality standards for the level of dust in air which is likely to cause unacceptable amenity impacts. In addition, as covered further in Section 6, complaints can occur even at low levels of dust, or even due to perception of amenity impacts.

Within this context, the EPA has sought to evaluate the potential for dust to cause actual impacts due to deposition or soiling which can cause amenity impacts.

Unreasonable amenity impacts may occur principally through two means:

- Regular dust events over several weeks leading to gradual build-up of dust on surfaces.
- Short period dust events of very high concentrations which cause rapid build-up of dust on surfaces, or soiling, if dust deposition rates are high.

The air quality modelling for the RDA indicates that, because of the predominance of stronger south-westerly winds during the summer months when the residue disposal beds are dryer, the frequency and magnitude of dust events from the RDA to the north and north-east is high, presenting considerable potential to cause amenity impacts.

The modelling indicates an extremely low frequency of dust events predicted to the east away from the RDA, and that the magnitude of the few dust events which are predicted

to occur are low in comparison to background dust levels. This indicates there is limited potential for dust from the RDA to cause amenity impacts to the east of the RDA.

Alcoa has submitted that significant dust events which could impact amenity could occur to the east of the RDA, albeit at a lower frequency than events to the north and north-east of the RDA.

The air quality modelling indicates that the probability of a significant dust event to the east of the RDA under current operations is very low. Modelled with current operations, no significant events were predicted to occur in three years. Modelled under a potential future operating scenario for the RDA (2030) one event (of one hour) was predicted to occur in three years. However this latter scenario did not include any allowance for a potential reduction in dust emissions which could be achieved in the future through the introduction of the new filtration technology, or through potential other management measures to reduce dust emissions.

Alcoa's compliance monitoring indicates it has contributed to only one exceedance of its licence 'target' dust level at the Spectacles air quality monitoring site located to the south-east of the RDA (Figure 1) in the last five years (in 2012) and received only one complaint for that exceedance.

The EPA therefore considers there appears to be a low likelihood of dust emissions from the RDA causing unreasonable amenity impacts in the area to the east of the RDA.

5 Consideration of potential health and amenity impacts of dust in determining the size of a buffer for urban development in the Mandogalup area

Advice

- Any land use planning buffer separating industrial and urban development in the Mandogalup area should take into account the potential health and amenity impacts of dust in the area.
- The risk of health and amenity impacts of dust varies across the Mandogalup area and is primarily dictated by the prevailing winds. This risk of impacts from dust is not a uniform distance in all directions from the RDA property boundary.
- Based on the considerations above, the EPA considers the risk of potential health and amenity impacts of dust in the Mandogalup area, now and into the future, are best reflected in four areas as shown in Figure 2.

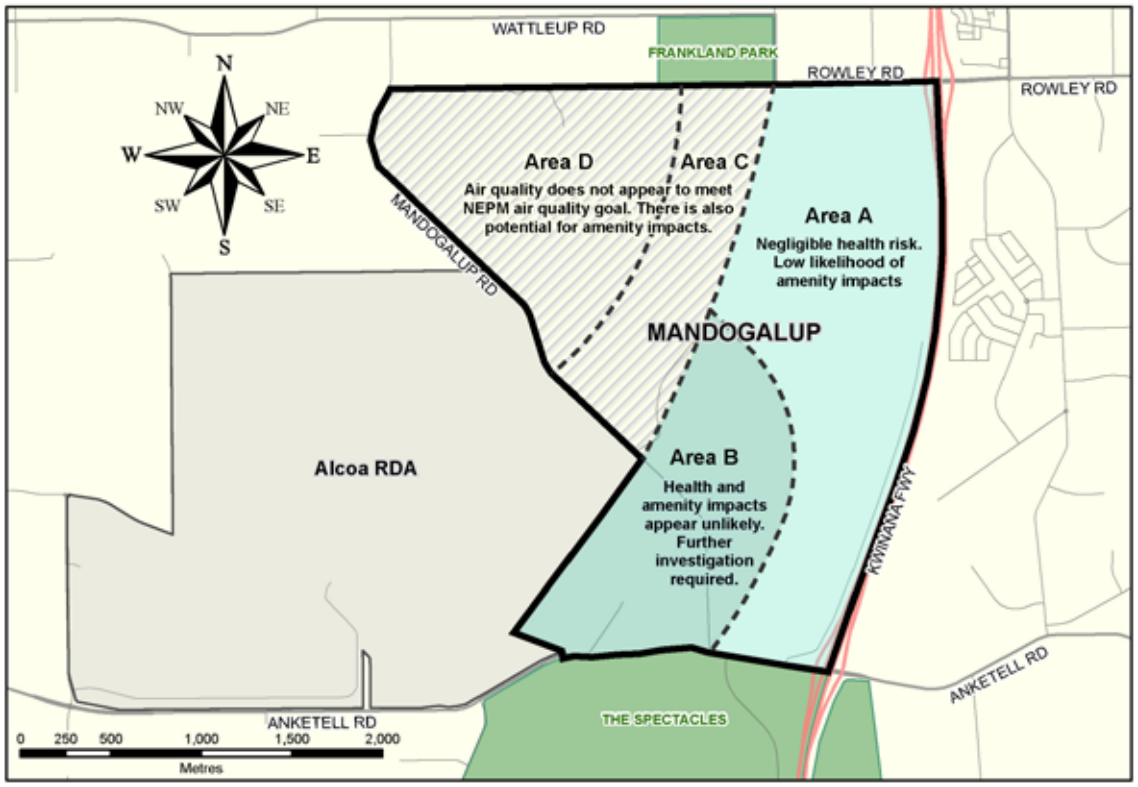


Figure 2: Guidance on potential health and amenity impacts of dust in respect of potential urban development in the Mandogalup area

- **Area A** is located sufficiently far away from the RDA, and outside the predominant wind field that generates dust from the RDA, that there is negligible health risk or likelihood of unreasonable amenity impacts in this area from RDA dust.
- **Area B** is also outside the predominant wind field that generates dust from the RDA and as such, it appears unlikely that there is an increased health risk or unreasonable amenity impacts from RDA dust in this area.
  - However, there is currently no air quality monitoring in this area and air quality modelling results are not as reliable in this area. Air quality monitoring should be undertaken in this area to confirm that health risks are negligible and amenity impacts unlikely.
  - The area is close to current drying areas of the RDA. Alcoa has previously indicated that RDA drying bed F (Figure 1), immediately to the west of Area B is to be closed. The closure drying bed F would reduce the likelihood of any amenity impacts from dust in this area.
- Air quality in **Area C** does not appear to currently meet the revised NEPM goal for PM_{10}. Also, dust events from the RDA may cause occasional amenity impacts in this area under current operation.
  - RDA drying bed F is located immediately upwind of this area in terms of the predominant wind directions. Once drying bed F is closed, air quality may meet the NEPM goal in Area C, and the likelihood of dust events causing amenity impacts will be reduced. Further investigation of this is required.

- **Area D** - Air quality does not appear to meet the revised NEPM goal for PM_{10} in this area under the current or planned future RDA operation. Also, dust events from the RDA may cause occasional amenity impacts in the area under current and future operations.
  - There is a need for further investigation to determine the sources of dust contributing to the exceedances of the NEPM goal in this area and for corrective measures to be undertaken if practicable to achieve the NEPM air quality goal in this area.

It should be noted that the boundaries of these areas should not be taken as 'absolute' lines to be adopted for planning purposes. The increased risk of health and amenity impacts is a graduation and cannot be specified as acceptable on one side of a line and unacceptable on the other side.

It is recognised that land use planners can take a range of matters into consideration in determining planning boundaries such as cadastral boundaries, intended future land uses, etc.

6 Other matters

Locating residential development in proximity to industrial activities

The EPA's advice on buffer size provided above relates to potential health and amenity impacts of dust.

Alcoa submitted that *"given the strategic importance of the KIA, including Alcoa's RSA [Residue Storage Area], Alcoa's strong preference would be for planning controls that prevent encroachment or intensification of sensitive land uses within two kilometres of the RSA boundary"*.

However, through the public submission process, when asked what future land uses should be in the Mandogalup area, the majority response was 'residential' (36 out of 57 submissions) with a combination of 'rural and residential' the second preferred use (9 out of 57 submissions). Respondents (36 out of 57 submissions) felt these were appropriate land uses because Mandogalup was a 'prime position' for residential development and a semi-rural lifestyle.

The Department of State Development, Alcoa and the Kwinana Industries Council raised concerns in their submissions to the EPA that locating residential development in proximity to industrial activity can lead to increased complaints. This can be due to an increased awareness of the industrial activity but also simply due to an increase in the number of people who could potentially be affected by emissions (and complain).

The Department of Health and Alcoa also both noted that, even where dust levels do not exceed health standards, where residential development is located near industry there is potential for some members of the community to perceive or assert health or amenity impacts.

The existing complaints data for the area does not provide a basis to make judgements in this case of the potential for increased complaints if residential development occurs in the eastern part of the Mandogalup area.

Also, as indicated, the EPA advice above relates to potential health and amenity impacts from dust. There may be other potential impacts in the area, such as from noise or light, which could impact amenity and result in complaints.

Kwinana Industrial (including Air Quality) Buffer

In 2010 the Western Australian Planning Commission (WAPC) endorsed:

- a revised Kwinana Air Quality buffer line of one kilometre north, north east and east from the boundary of the Alcoa Residue Disposal Area land holding; and
- an additional 0.5 km extension of the one kilometre buffer as a non-residential and sensitive uses 'transition zone'.

The WAPC reaffirmed these buffer lines in 2011 and resolved that the extent and location of the buffer around the Alcoa RDA should be reviewed in five years (i.e. 2016).

In respect of the existing buffer line, the EPA notes that dust levels predicted by the air quality modelling for dust blown from the RDA are similar at both 1 and 1.5 km, and that the 'shape' of the existing buffer does not seem to reflect the wind patterns for the area with the predominate south-westerly wind.

Potential for urban development in the Mandogalup area to constrain future development in the KIA

The Department of State Development and the Kwinana Industries Council raised concerns that urban development in the Mandogalup area could constrain future development in the Kwinana Industrial Area.

There is currently no strategic plan for the Kwinana Industrial Area which indicates the types of industries likely to establish in the area in the future.

In recent years the EPA has formally assessed proposals for two waste-to-energy facilities in the area, and informally considered a proposed lithium plant. While it is uncertain what industries may propose to establish in the Kwinana Industrial Area in the future, modern pollution control equipment is capable of significantly reducing offsite impacts. It is the expectation of the EPA that industry premises should be designed and operated to avoid or minimise emissions, and ensure that unacceptable emissions do not occur beyond the boundary of the premises.

The location of the Mandogalup area and predominate wind directions, also mean that the area would be less likely to be impacted by dust or any other air emissions from any new industry established in the Kwinana area. This applies particularly to the eastern part of the Mandogalup area. The land uses to the south-west of this area are 'nature reserve' and 'residential' which would not be expected to generate any new dust sources in the future which could affect the area.

Future operation of the RDA

The dust risk from the RDA under anticipated changes in climate has been posed, given that the local climate has been drying over the past decades, consistent with the broad forecasts from models underpinning the Intergovernmental Panel on Climate Change Fifth Assessment Report. However, it is the view of the EPA that the influence of a future climate on dust impacts is too uncertain to draw any conclusions.

The first reason for this is that current climate models cannot resolve future weather patterns, particularly wind, (or even form agreement among models) to usefully inform

these considerations. The second reason is that the RDA is a manageable and well-managed system, particularly with respect to surface moisture. Therefore, as the climate changes in the future, the EPA expects Alcoa's management of the RDA to adapt to the changes and ensure its ongoing best practice dust suppression techniques.

Alcoa's plans for future operation and subsequent closure of the RDA are set out in its 2012 Long Term Residue Management Strategy (LTRMS), and 2013 interim review. The 2013 interim review provided some limited updated information on planned future operation of the RDA following introduction of the new residue filtrate system.

The EPA understands that the new filtrate system has now been commissioned and Alcoa is seeking to ramp up to full capacity by the middle of 2017.

The 2012 LTRMS is due to be updated shortly based on its five yearly review cycle and it is considered this should provide more detail on the potential to reduce dust from the site through introduction of the filtrate system or any other measures.

The 2012 LTRMS also indicates that Alcoa is required, under State Agreement, to ensure that the RDA land is capable of supporting development of light industry when closed.

At the time the residue deposits are closed the residue will still contain large quantities of leachable alkali. This is likely to result in considerable long term management issues for the land, beyond the closure of the area, as alkali is leached from the residue. This may have implications for the types of, and timing of, feasible land use on the land.

The 2012 LTRMS indicates that the current rehabilitation program is designed to maintain flexibility such that a range of final land uses can be considered. For example:

- a green belt between industrial and residential land uses
- light industry
- community recreational facilities such as playing fields, and
- passive recreation (such as walking trails).

It is unusual for such a large industrial residue disposal facility, particularly based on solar drying, to be located within 25 km of the CBD of a major capital city, and to occupy some 400 ha of a major industrial area.

Given the significance of the land holding due to its location and size, it is considered the next update of the LTRMS should include considerably more detail on the achievability and viability of potential long-term land use of the site.