7.6 AIR QUALITY

7.6.1 Introduction

An air quality assessment has been conducted by Holmes Air Sciences to quantitatively assess air quality impacts associated with the operation of the proposed RDC. The details of the analysis are presented in detail in Technical Report No 5. The assessment undertaken by Holmes Air Sciences is based on the procedures outlined in the New South Wales DEC (formerly NSW EPA) document titled "Approved Methods and Guidance for the Modelling and Assessment in NSW" (NSW EPA, 2001).

This section of the EAR presents information on the air quality goals which relate to the project, existing meteorological conditions, existing air quality, estimated dust emissions from the RDC, proposed mitigative measures and an assessment of the predicted impacts.

7.6.2 Local Climatic Conditions

The RDC site is contained within a broad rain shadow, which affects the wider Penrith area, created by the higher coastal plateau capturing rain from the prevailing south east winds. Seasonal rainfall is variable, with more rain during summer months (Bannerman & Hazelton, 1990).

The Bureau of Meteorology collects climatic data from Prospect Dam approximately 6 km south east of the site. Temperature data show that January is typically the warmest month with a mean daily maximum of 28 ^{o} C. July is the coldest month with a mean daily minimum of 6.1 ^{o} C. Rainfall data collected at Prospect Dam show that March is the wettest month with a mean rainfall of 98 mm over 11 rain days. Annually the area experiences, on average, 879 mm of rain per year.

The DEC has collected meteorological data in the area from St Marys, approximately 7 km to the west of the RDC site. This data consists of hourly records of wind speed, wind direction and temperature and have been prepared into a form suitable for dispersion modelling. Data for 2003 was available for the air quality study.

The data indicated that the most common winds were from the South South West, South and North. This pattern is evident in all seasons to various degrees. In the summer months winds from the East South East were also common. Of the 8,760 hours of records available the wind speed was less than 0.5 m/s for 23% of the time.

7.6.3 Existing Air Quality and Air Quality Goals

Air quality standards and goals refer to pollutant levels which include the project and existing sources.

Air Quality Goals

Tables 7.6 and 7.7 summarise the air quality assessment criteria that apply to the proposed RDC. The air quality goals relate to the total dust burden in the air and not just the dust emissions predicted from the proposed RDC. In other words, some consideration of background levels needs to be made when using these goals to assess impacts.

Table 7.6
Air Quality Assessment Criteria for Particulate Matter Concentrations

Pollutant	Standard / Goal	Averaging Period	Agency
Total suspended particulate Matter (TSP)	90 $\mu g/m^3$	Annual mean	NHMRC
Particulate matter < 10 μm (PM_{10})	50 $\mu g/m^3$	24-hour maximum	DEC
	30 $\mu g/m^3$	Annual mean	DEC
	50 $\mu g/m^3$	(24-hour average, 5 exceedances permitted per year)	NEPM
Particulate matter < 2.5 μm ($PM_{2.5}$)	8 $\mu g/m^3$	Annual mean	NEPM*
	25 $\mu g/m^3$	24-hour maximum	NEPM*

** Long-term reporting goal, not applied to projects in NSW.*

In addition to health impacts, airborne dust also has the potential to cause nuisance impacts by depositing on surfaces. Table 7.7 shows the maximum acceptable increase in dust deposition over the existing dust levels. These criteria for dust fallout levels are set to protect against nuisance impacts.

Table 7.7
NSW DEC Criteria for Dust Fallout

Pollutant	Averaging period	Maximum increase in deposited dust level	Maximum total deposited dust level
Deposited dust	Annual	2 g/m^2/month	4 g/m^2/month

Existing Air Quality

To fully assess impacts against all the relevant air quality standards and goals it is necessary to have information or estimates on existing dust concentration and deposition levels in the area in which the project is likely to contribute to these levels.

The DEC operate an air quality monitoring station at St Marys and at Blacktown. Concentrations of PM_{10} are measured continuously at these sites. Monitoring data from the DEC's St Marys and Blacktown sites for 2003 are shown below in Table 7.8.

Table 7.8
DEC Monitoring Data for the Area

Month	PM_{10} concentrations by TEOM ($\mu g/m^3$)			
	St Marys		Blacktown	
	Average	Maximum 24-hourly value	Average	Maximum 24-hourly value
January 2003	29	***71***	31	***76***
February 2003	19	31	18	27
March 2003	20	***211***	23	***187***
April 2003	16	***57***	14	28
May 2003	11	30	14	23
June 2003	7	28	17	32
July 2003	13	32	17	35
August 2003	15	31	18	31
September 2003	18	42	23	49
October 2003	13	23	16	24
November 2003	18	35	18	35
December 2003	19	41	19	33
Annual 2003	**17**	**211**	**19**	**187**

One of the main reasons for analysing monitoring data is to determine existing air quality so that the assessment criteria can be determined in accordance with the DEC's modelling guidelines.

The annual average PM_{10} concentration recorded in 2003 at the St Marys and Blacktown sites by TEOM was 17 and 19 $\mu g/m^3$ respectively. This is below the DEC air quality goal of 30 $\mu g/m^3$.

Maximum 24-hour concentrations were above the DEC 50 $\mu g/m^3$ goal on several occasions at both the St Marys and Blacktown sites. The highest 24-hour average PM_{10} concentration were generally measured in the warmer months of the year. Bushfires were reported in January and March of 2003 at locations that would have influenced PM_{10} measurements at St Marys and Blacktown.

Neither TSP concentrations nor dust deposition are measured at the St Marys or Blacktown sites and a value of 45 $\mu g/m^3$ has been assumed to represent the existing annual average TSP concentration. This value has been derived from the annual average PM_{10} (18 $\mu g/m^3$) and assumes that 40% of the TSP is PM_{10}. Holmes Air Sciences determined that a value of between 2 and 3 g/m^2/month would appear to be a reasonable estimate of the annual average dust deposition at the RDC site.

From the monitoring data available the following background concentrations apply at the nearest residences:

- Annual average TSP of 45 $\mu g/m^3$;
- Annual average PM_{10} of 18 $\mu g/m^3$; and

- Annual average dust deposition of 3 g/m^2/month.

In addition, the DEC guidelines require an assessment against 24-hour PM_{10} concentrations. This assessment adopts the approach that the predicted 24-hour average PM_{10} concentration from the development should be less than 50 μg/m^3 at the nearest residences.

7.6.4 Dispersion Modelling

Dispersion modelling has been used for the air quality assessment. The computer model used for the assessment, AUSPLUME, requires information about the dispersion characteristics of the area including wind speed, wind direction, atmospheric stability and mixing height. Technical Report No 5 provides further detail of the dispersion modelling methodology.

The St Marys data was considered representative of the conditions experienced at the RDC site and have been used in the dispersion modelling.

7.6.5 Estimated Dust Emissions

Dust emissions would arise from a range of activities associated with the RDC. Total dust emissions due to the project have been estimated by analysing the activities taking place at the site.

The operations which apply in each case have been combined with emission factors developed, both locally and by the US EPA, to estimate the amount of dust produced by each activity. The emission factors applied are considered to be the most up to date methods for determining dust generation rates. The fraction of fine, inhalable and coarse particles for each activity has been taken into account for the dispersion modelling.

The operational description for the RDC has been used to determine truck movement distances and routes, stockpile locations and areas, activity operating hours, truck sizes and other details that are necessary to estimate dust emissions.

The assessment has taken a conservative approach to estimating dust emissions as it has been assumed that the amount of material unloaded from trains and diverted to the radial stacker would be at a maximum of 10%. This increases the quantity of material that is rehandled by front end loader to the reclaim hopper for transfer to the main storage bins. As the radial stacker has been proposed as a fail safe measure this method of transfer would be minimal in each year. Operations at the Concrete Batching Plant have assumed that annual production would be 200,000 m^3/yr.

Also, a street sweeper would be employed to minimise dust emissions from vehicles travelling on-site. The calculated dust emissions for this assessment have not taken into account any reduction in dust emissions with the operation of a street sweeper due to the scientific uncertainty of likely reductions. The estimated dust emissions from vehicles travelling on-site are therefore considered to be conservative.

7.6.6 Proposed Mitigation Measures

The controls that are available for the RDC can be summarised in three broad categories:

- Engineering controls;
- Planning controls (which increase the separation between dust emission sources on the plant and sensitive areas); and

- Operational controls which vary operations when adverse meteorological conditions occur.

Engineering controls involve measures such as covering and enclosing conveyors, enclosing transfer points and using dust collection systems at the rail unloading station, transfer points and the concrete plant loading point and installation of spray systems on stockpiles etc.

Planning controls include the maintenance of adequate buffer distances between dust sources and sensitive receptors. In this respect the dust generating activities at the plant would have a reasonable separation distance of over 500 m from the nearest residential areas. OneSteel and the M7 Motorway separate the project site from the residential areas to the west.

The dust control measures that are proposed for the RDC include:

- All transfer, load-out and unloading points would be enclosed and include dust control equipment;
- All material carrying conveyors would be covered or enclosed on three sides;
- Enclosed storage bins;
- Water sprays would be used periodically on stockpiles;
- Cementitious products would be loaded to silos pneumatically using well-proven technology;
- A dry-dust collection system would be used to control dust at the point where transit trucks are loaded in the Concrete Batching Plant and this area would be enclosed on three sides; and
- Paved areas likely to generate wind borne dust would be swept as required by a permanently stationed street sweeper to minimise wind erosion dust.

7.6.7 Impact Assessment

In August 2001 the NSW DEC published new guidelines for the assessment of air pollution sources using dispersion models (refer Technical Report No 5). The guidelines specify how assessments based on the use of air dispersion models should be undertaken. They include guidelines for the preparation of meteorological data to be used in dispersion models, the way in which emissions should be estimated and the relevant air quality criteria for assessing the significance of predicted concentration and deposition rates from the proposal. The approach taken in the air quality assessment follows as closely as possible the approaches suggested by the guidelines.

Dust concentrations and deposition rates due to the proposed activities at the RDC have been presented as isopleth diagrams showing the following:

- Predicted maximum 24-hour average PM_{10} concentration;
- Predicted annual average PM_{10} concentration;
- Predicted annual average TSP concentration; and
- Predicted annual average dust deposition.

The maximum 24-hour average contour plots do not represent the dispersion pattern for any particular day, but show the highest predicted 24-hour average concentration that occurred at each location. The maxima are used to show concentrations which can possibly be reached under the modelled conditions.

Operational Impacts

Figure 7.7 shows the predicted maximum 24-hour average PM_{10} concentrations due to proposed operations. At the residential areas to the west, south and east of the site the predicted concentrations are less than 10 $\mu g/m^3$. The prediction at each location on the plot represents the worst day due to emissions from the RDC. The nearest residential areas are approximately 500 m from the proposed development site. Predicted concentrations are below the DEC 50 $\mu g/m^3$ goal at the nearest residential areas and the impact of the RDC is therefore considered to be acceptable.

Figure 7.8 shows the predicted annual average PM_{10} concentrations due to the RDC operations. Assuming a background concentration of 18 $\mu g/m^3$ it can be seen that the dust emissions from the RDC would not cause exceedances of the air quality goal (30 $\mu g/m^3$) at any neighbouring residential areas. The predicted highest PM_{10} contribution from the RDC to existing levels is less than 2 $\mu g/m^3$ at the nearest residential area. As discussed the emission estimates have assumed that up to 10% of all material delivered to the RDC would be diverted to the radial stacker and rehandled. This is a conservative approach which increases the emissions from transferring material to the main storage bins. Therefore annual average predictions would be over estimated.

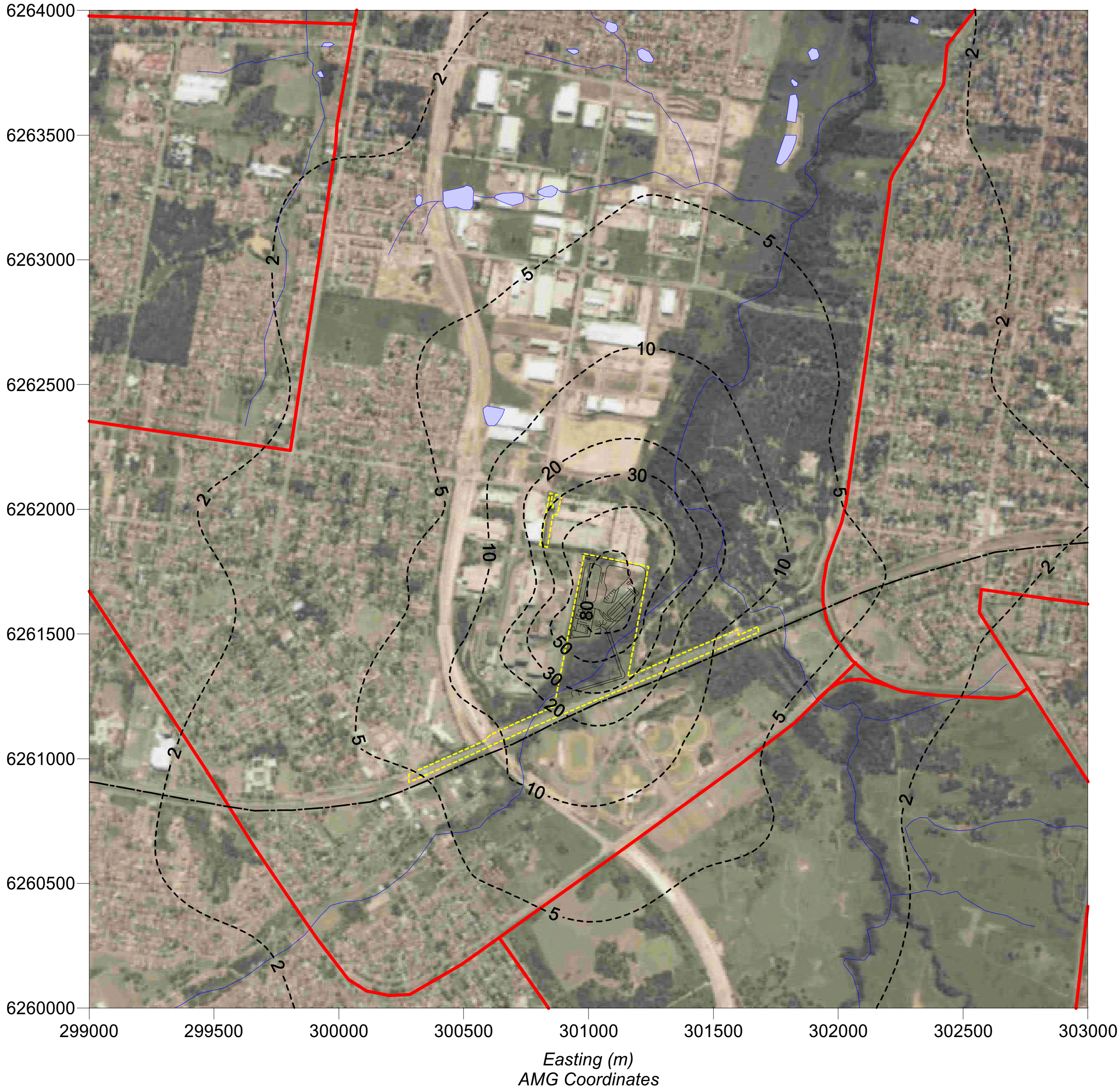
Predicted annual average TSP concentrations are shown in Figure 7.9. The model predictions show that the nearest residential area would experience annual average TSP concentrations less than 2 $\mu g/m^3$ due to the operations of the RDC. Compliance with the annual average 90 $\mu g/m^3$ TSP would be anticipated even when considering typical background levels of around 45 $\mu g/m^3$.

Figure 7.10 shows the predicted annual average dust deposition. The contribution of dust emissions to existing dust deposition levels is predicted to be low being less than 0.1 g/m^2/month at the nearest residential area. It is unlikely that the operation of the RDC would be the cause of exceedances of the 4 g/m^2/month air quality goal.

Air quality impacts at the adjacent Nurragingy Reserve and Blacktown Olympic Centre have also been considered. Both sites may receive up to 2,000 visitors in one day and the critical assessment criteria would be short-term (24-hour) dust concentrations. Predicted maximum 24-hour average PM_{10} concentrations due to the RDC are shown in Figure 7.7. It can be seen from this figure that the 50 $\mu g/m^3$ contour level encroaches into some areas of the Nurragingy Reserve. These areas are on the western side of the reserve adjacent to the industrial area. The model has been configured to predict a 24-hour average, consistent with the DEC air quality goal. An assessment of the likely frequency of the highest 24-hour average PM_{10} concentrations at the Nurragingy Reserve has also been conducted. There were two days in the modelled year when the predicted 24-hour average PM_{10} concentrations were above 50 $\mu g/m^3$ at this location.

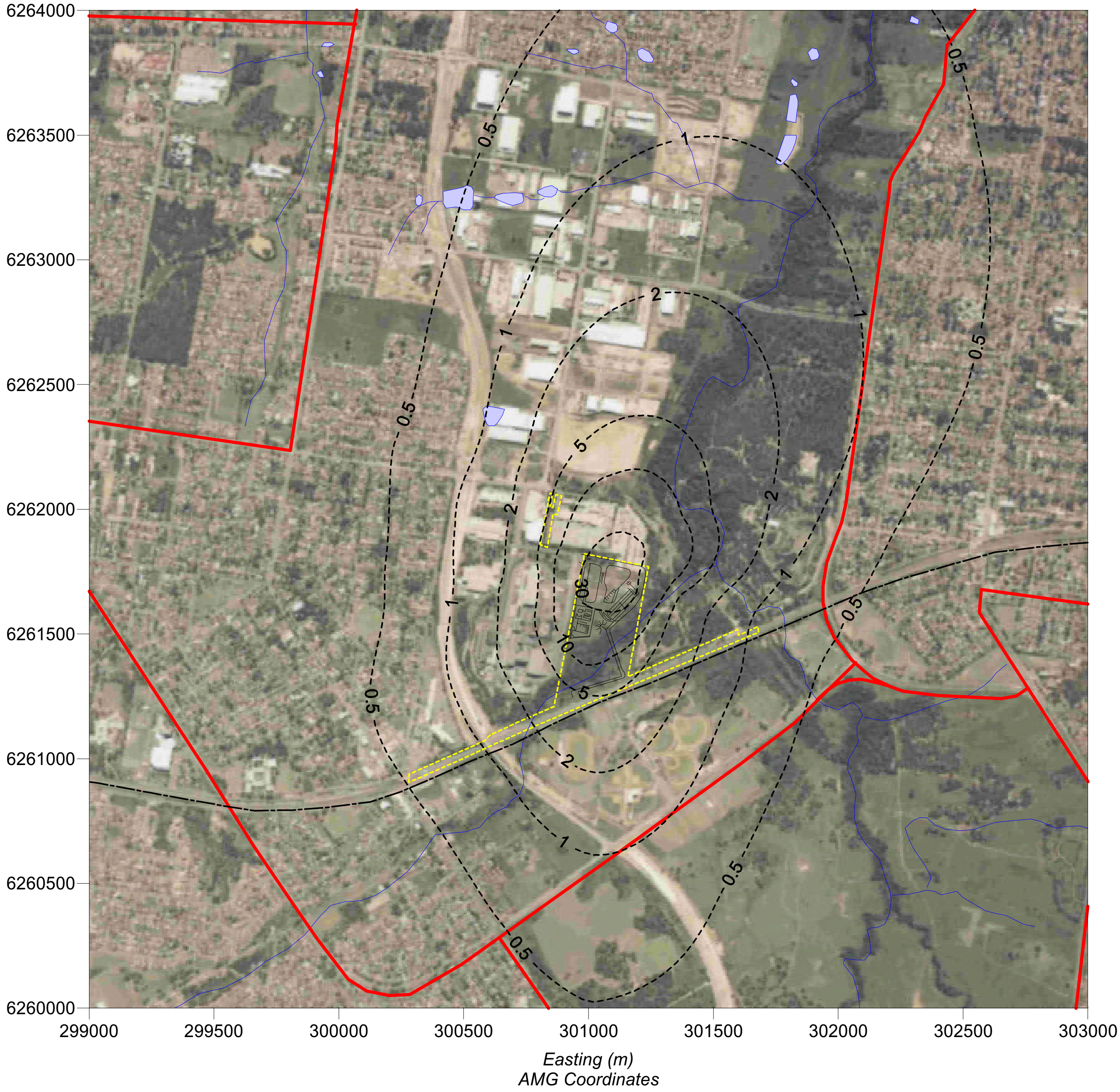
Visitors to the sites could spend up to about 12 hours in the area however there is no air quality goal for PM_{10} in NSW for averaging times less than 24-hours. The dispersion model has been re-run to predict maximum 12-hour average PM_{10} concentrations and the results are shown in Figure 7.11. The purpose of these results is to show the likely concentrations during daytime hours when there would be visitors at the reserves. Although there is no 12-hour average PM_{10} goal the results from Figure 7.11 show that concentrations are below 50 $\mu g/m^3$ during daytime hours. This level of impact is considered to be acceptable.

A cumulative impact assessment of the 24 hour average PM_{10} impact of the proposed RDC on local receptors is provided in Technical Report No 5.



ROOTY HILL RDC
Predicted maximum 24-hour average PM10 concentrations due to Rooty Hill RDC - $\mu g/m^3$

FIG. 7.7



ROOTY HILL RDC
Predicted annual average PM10 concentrations due to Rooty Hill RDC - µg/m³

FIG. 7.8

ROOTY HILL RDC

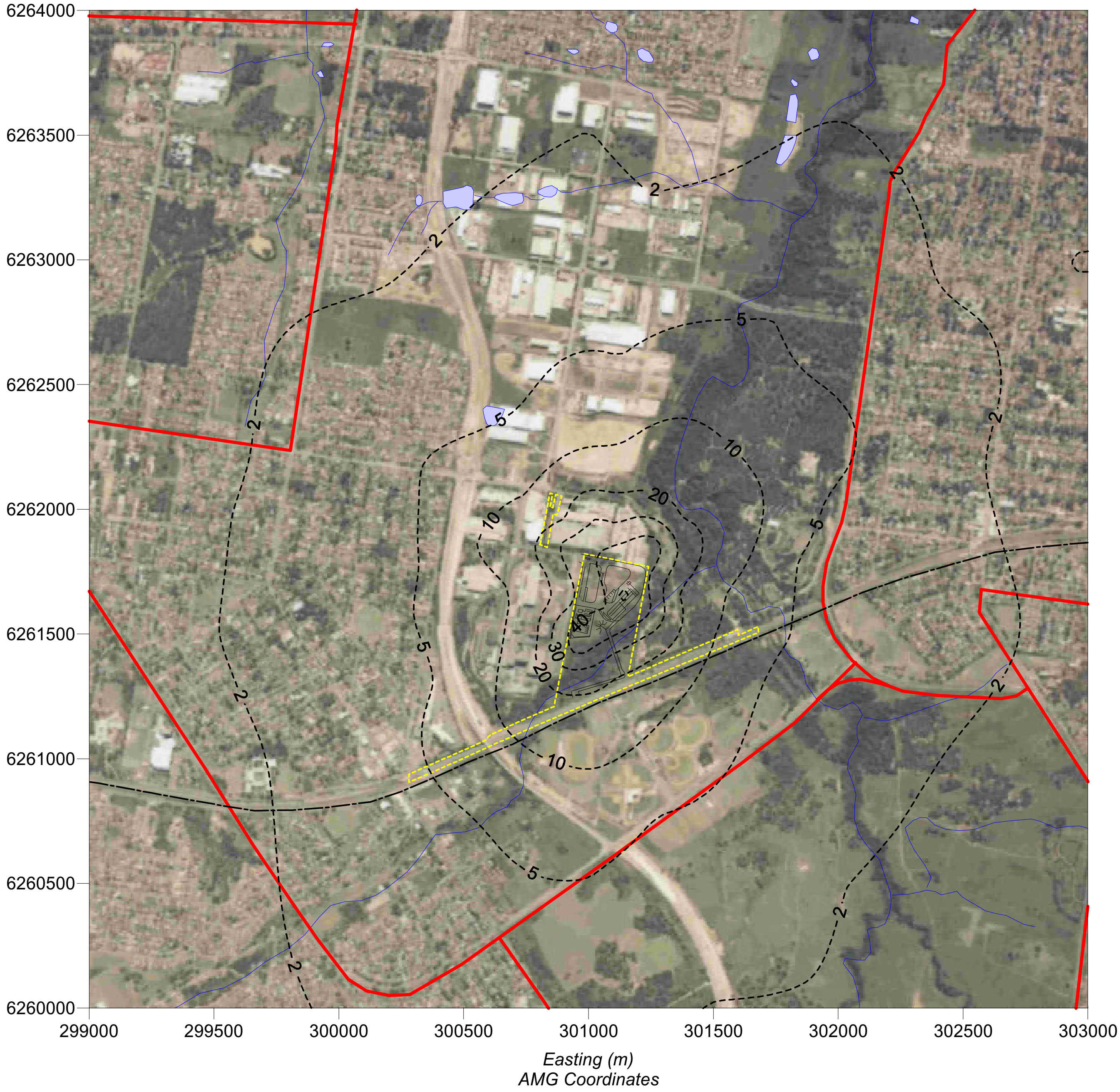
Predicted annual average TSP concentrations due to Rooty Hill RDC - µg/m³

FIG. 7.9

ROOTY HILL RDC

Predicted annual average dust deposition due to Rooty Hill RDC - g/m²/month

FIG. 7.10



ROOTY HILL RDC
Predicted maximum 12-hour average PM10 concentrations during daytime hours due to Rooty Hill RDC - μg/m^3
FIG. 7.11

Construction Impacts

Air quality impacts during construction would largely result from dust generated during earthworks and other engineering activities associated with the facilities construction. The total amount of dust generated would depend on the silt and moisture content of the soil, the types of operations being carried out, exposed area, frequency of water spraying and speed of machinery. As construction is likely to continue for up to two years, it is important that exposed areas be stabilised as quickly as possible and that appropriate dust suppression methods be used to keep dust impacts to a minimum. It is proposed that monitoring be carried out during the construction phase of the project to assess compliance with DEC goals. A minimum of three deposition monitors would be required, ideally at the closest residences or other sensitive receptors.

Health Impacts

Associate Professor David McKenzie of the Chest and Sleep Centre prepared a report based on his professional experience in the diagnosis and management of respiratory disorders with a particular interest in Occupational Health problems. The report was also based on an assessment of the medical literature related to exposure to dusts of various kinds and urban pollution. Technical Report No 5 includes a copy of the report prepared by Associate Professor McKenzie.

The report discusses the likely composition and concentrations of dust that would be emitted by the proposed RDC and considers the possible health consequences of such exposures. It also discusses the medical evidence concerning exposure to small particles of respirable dust. These observations have been related to the predicted concentrations of dust particles contained in the air quality impact assessment prepared by Holmes Air Sciences (refer Technical Report No 5). The following section presents the findings of the report.

The bulk of dust likely to be liberated from such materials at the RDC is considered to be relatively non-toxic and labelled as “nuisance dust”. It is possible that there would be some very small concentrations of respirable silica released during the handling of the sand and some of the aggregates. However, these emissions would be suppressed with water sprays and other dust suppression measures. Silica is capable of producing damage to lungs and the allowable limits for the concentration of airborne silica of respirable size is substantially lower than that for the nuisance dust.

The air quality assessment indicates that the RDC would increase airborne levels of particulates by a relatively small amount compared with the current background levels. As mentioned, the bulk of this dust would be “nuisance dust” rather than the toxic particles mentioned above. The contribution of particulates from the trucks involved in this operation would be trivial compared with the existing number of vehicles on the roads of Sydney.

The current standard of 50 $\mu g/m^3$ can be compared with the occupational health standards for workers in dusty industries. The allowable peak level for safe exposure of a worker to nuisance dust is in the range of 5,000 to 10,000 $\mu g/m^3$. In other words the environmental standard for residents is over 100 times more stringent than the maximum safety standards for employees.

Technical Report No 5 includes diagrams which show the likely concentrations of dust surrounding the proposed RDC and the rate of dilution of that dust with distance. It shows that relatively small sections of the nearest residential areas would be exposed to levels up to 5 $\mu g/m^3$ depending upon atmospheric conditions. These values are the predicted maximum 24 hour average values but the anticipated annual values are lower. All these values are well within the standards set by the DEC and would not be expected to produce adverse health effects in the short or long term.

Examination of the diagrams indicating the predicted maximum 24 hour average PM_{10} concentrations shows that there is likely to be a gradual decrease in airborne dust concentration moving from the western end of Nurragingy Reserve to the eastern end of the reserve. The standard is set for residents who are likely to be exposed to levels up to that concentration 24 hours a day 7 days a week. Thus, there is no potential for visitors to the reserve to suffer any adverse consequences from inhalation of dust related to the RDC. There is no reason to expect any respiratory problems in casual visitors even if they spent all their time in the corner of the reserve with the highest predicted concentrations.

The Blacktown Olympic Centre is situated to the south of the Main Western Railway Line which is at the southern end of the proposed development site. The Air Quality Assessment indicates that the bulk of this site is within regions predicted to have PM_{10} concentrations in the range of 10 to 20 $\mu g/m^3$. These values are well within the current standards and are therefore safe even for residents with continual exposure. Most of the people using Blacktown Olympic Centre would not be present for more than a few hours daily and many would visit the site no more than once or twice a week. The site would be used by athletes and during events their ventilation rate would be much higher than average resting levels for the duration of the event. Thus, a greater amount of airborne dust would be inhaled per unit time during those events. However, the environmental standard is set in the knowledge that some people would be exposed to that level during maximal or near maximal exertion for at least part of the time. Thus, there is no need for concern about exposure to levels of 10 to 20 $\mu g/m^3$ during exercise for relatively short periods of time. Employees at the site might be exposed to levels of 10 to 20 $\mu g/m^3$ for up to 40 hours per week. This is still well within the environmental standard and is not a cause for concern.

Associate Professor McKenzie's report concluded that there is no reason for concern about adverse health effects from the proposed RDC. The anticipated levels of respirable dust in the adjacent residential areas would be well below the criteria set by the DEC. In Associate Professor McKenzie's view, there is no reason for concern about the safety of even the most susceptible individuals living in the vicinity of the proposed RDC. There is also no reason for concern about the safety of people using or working in the adjacent recreational areas.

Greenhouse Gas Emissions

Without the project Readymix would deliver all materials direct to customer by road from outside the metropolitan area. This would see an increase in truck kilometres travelled both within and outside the metropolitan area. In contrast the project would see the bulk of raw materials brought to the RDC by rail from outside the Sydney Basin. This would require fewer trucks travelling within the metropolitan area and a reduction in longer distance haul. Greenhouse emission statistics and CO_2-equivalent emissions for trucks and trains associated with distribution to Sydney customers are provided in Table 7.9. This table presents calculations for the with and without project scenarios.

Table 7.9
Greenhouse Emission Statistics

	Without project	**With project**	
Mode of transport	**By Road**	**By Road**	**Additional By Rail**
Fuel consumption (l/km)	0.521[1]	0.521[1]	12[2]
VKT (millions of km)	38.8	7.3	0.422
Total fuel consumed (millions of l/y)	20.2	3.80	5.06
CO_2-e emission factor for transport fuel (t/l)[3]	0.0027	0.0027	0.0027
Total CO_2-e emissions (t/y)	54,540	10,269 + 13,673 = 23,942	

[1] Australian Greenhouse Office, 2002
[2] Estimate from personal communication between Pacific National and Readymix (4 L/loco/km and 3 locos per train)
[3] Full fuel cycle analysis, Australian Greenhouse Office, 2003

It is also estimated that there would be an additional 422,180 km per year of travel by rail with the project. From these calculations, the estimated CO_2-equivalent emissions with the project are 30,598 tonnes per year lower than without the project.

Greenhouse gases would also be released indirectly from the use of electricity. To estimate these emissions the annual electrical requirement has been estimated by the proponent. In summary the electrical requirement would be 7,575,600 kWh/y.

In converting the information to estimates of CO_2-e emissions it has been assumed that each kWh of electrical energy used results in the release of 0.968 kg of CO_2–e (Australian Greenhouse Office, 2003 – figure for NSW generators). Therefore, the estimated annual CO_2-e emissions due to electricity consumption is 7,333 t/y.

7.6.8 Conclusion

Dispersion modelling has been used to assess the impact that dust emissions from the operation of the RDC would have on the local air quality. It is concluded that air quality impacts would be at acceptable levels and that air quality goals would not be exceeded at sensitive locations due to the operation of the RDC at full capacity of 4 Mtpa.

The implementation of proposed dust control measures should ensure that air quality impacts are lower than those predicted in this study.

Air quality monitoring data have indicated that existing short-term dust concentrations are above air quality goals on occasions. Particulate matter concentrations arising from non-Project related sources, such as bushfires and dust storms, may continue to result in elevated levels on occasions.

An assessment of the Air Quality Impact Statement by Associate Professor David McKenzie concluded that there is no reason for concern about adverse health effects from the proposed RDC. The anticipated levels of respirable dust in the adjacent residential areas would be well below the criteria set by the DEC. There is no reason for concern about the safety of even the most susceptible individuals living in the vicinity of the proposed RDC. There is also no reason for concern about the safety of people using or working in the adjacent recreational areas.