CHAPTER 19 – AIR QUALITY AND GREENHOUSE GASES

GULF ALUMINA LTD – SKARDON RIVER BAUXITE PROJECT
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19. AIR QUALITY AND GREENHOUSE GASES

19.1 Introduction

This chapter describes summarises the aspects of the Project that may result in emissions to the atmosphere, air quality objectives for the Project, potential impacts to sensitive receptors and mitigation measures, if required. Legislation, policies and guidelines that are relevant to the assessment and management of air emissions in Queensland and Australia are described.

The assessment provides the following:

- definition of the air quality regulatory requirements relevant to the Project
- description of the existing environment in the region, including:
  - terrain features
  - dominant land-uses
  - climate and meteorology.
  - sensitive receptors
  - existing air quality
- an inventory of air pollutant emissions associated with the Project
- evaluation and comparison of the levels of air pollutants as a result of the Project with other similar projects in the region and comparison of the Project’s levels with the relevant air quality regulatory requirements
- consideration of the cumulative impact of the Project with other proposed projects in the region
- description of the mitigation and management procedures for the Project

This chapter also provides an estimate of greenhouse gas (GHG) emissions over the Project life and proposes measures to manage GHG emissions.

Air quality impacts for the Project have been inferred from an approved air quality assessment report for a mining activity that has a similar dust emissions inventory; the analogue project being the South of Embley Project located in western Cape York to the south of Weipa.

The South of Embley Project EIS was approved in 2012 and included a dispersion modeling study of dust emissions from a proposed 50 Mtpa bauxite mine. This chapter is based on the comparative assessment findings of the technical report; Air Quality Assessment for the Skardon River Bauxite Mine (June 2015) provided in Appendix 9.

The Project location is provided in Chapter 4. A detailed description of Project construction and operational activities are provided in Chapter 5.

19.2 Environmental Objectives and Performance Outcomes

The environmental objectives and performance outcomes below are based on Schedule 5, Table 2 of the Environmental Protection Regulations 2008 (EP Regulation). The mitigation and management measures presented in this chapter are designed to achieve these environmental objectives and performance outcomes. The environmental management plan (EM Plan) presented in Appendix 13 provides a consolidated description of these mitigation and management measures.
19.2.1 Environmental Objectives

- The activity will be operated in a way that protects the environmental values of air.

19.2.2 Performance Outcomes

- Fugitive emissions of contaminants from storage, handling and processing of materials and transporting materials within the site are prevented or minimised.
- Contingency measures will prevent or minimise adverse effects on the environment from unplanned emissions and shut down and start up emissions of contaminants to air.
- Releases of contaminants to the atmosphere for dispersion will be managed to prevent or minimise adverse effects on environmental values.
- Critical design requirements will prevent emissions having an irreversible or widespread impact on adjacent areas.
- No complaints about dust or odour from the Project.

19.3 Legislative and Policy Context

The assessment of air quality impacts and GHG emissions has been prepared in line with the requirements contained in the documents listed below, (also see Chapter 2):

- Queensland Environmental Protection Act, 1994
- Queensland Environmental Protection (Air) Policy, 2008 (EPP(Air))
- National Environment Protection Measure (NEPM) for Ambient Air Quality, (NEPC, 2003)
- National Greenhouse and Energy Reporting Act 2007 (NGER Act)
- National Greenhouse Accounts (NGA) Factors.

The regulatory framework relating most directly to air quality and GHG is summarised below:

19.3.1 Environmental Protection Act 1994 (EP Act)

The Environmental Protection Act 1994 (EP Act) provides for the management of the air environment in Queensland. The EP Act gives the Department of Environment and Heritage Protection (EHP) the power to create Environmental Protection Policies that identify, and aim to protect, environmental values of the atmosphere that are conducive to the health and well-being of humans and biological integrity.

19.3.2 Queensland Environmental Protection (Air) Policy 2008

The Environmental Protection (Air) Policy (Air EPP) was made under the EP Act and gazetted in 1997; the Air EPP was revised and reissued in 2008.

The objective of the Air EPP is:

...to identify the environmental values of the air environment to be enhanced or protected and to achieve the objective of the Environmental Protection Act 1994, i.e. ecologically sustainable development.

The environmental values to be enhanced or protected under the Air EPP are the qualities of the environment that are conducive to:

- protecting health and biodiversity of ecosystems;
- human health and wellbeing;
- protecting the aesthetics of the environment, including the appearance of building structures and other property; and
- protecting agricultural use of the environment.

The administering authority must consider the requirements of the Air EPP when it decides an application for an environmental authority, amendment of a licence or approval of a draft environmental management plan. Schedule 1 of the Air EPP specifies air quality indicators and objectives for approximately 93 contaminants that may be present in the air environment.

19.3.3 Application Requirements for Activities with Impacts to Air

Also relevant is EHP Guideline: Application Requirements for Activities with Impacts to Air (EM960 version 2), (2014); which outlines the information to be provided to EHP as part of the application process for environmentally relevant activities and how the information is used. This outlines how the proposed activity will be assessed by comparison with the requirements stipulated in the EP Act. In particular, this requires an application to include, if applicable:

- description of the site and surrounding areas, including topography, prevailing winds and ambient air quality
- identification of any nearby sensitive places must be identified and assessed appropriately
- identification and evaluation of possible impacts on air quality
- proposed management.

19.3.4 National Environment Protection (Ambient Air Quality) Measure


The Queensland EPP (Air) 2008 adopts the Ambient Air Quality NEPM standards as air quality objectives for Queensland.

19.3.5 EHP Model Mining Conditions

EHP has developed model conditions to form general environmental protection commitments and EA conditions for mining activities and was released in November 2014 (EML944 - version 5). The conditions that relate to air pollutants that may be generated from the Project (particulate matter - air quality) are detailed in Schedule B (Air).

19.3.6 National Greenhouse and Energy Reporting Act 2007 (NGER Act)

The NGER Act introduced a consistent national framework for the reporting and dissemination of information related to GHG emissions, GHG projects and energy use and production of corporations. Corporations are required to register and report if they meet the relevant facility or corporate thresholds

Under Section 12 of the NGER Act, controlling corporations (e.g. at a facility level) that meet one or more of the reporting thresholds in a given financial year, must register by 31 August and report by 31 October the following financial year.

Reporting under the NGER Act is required for Scope 1 emissions and Scope 2 emissions, while reporting of Scope 3 emissions is voluntary. The calculation methods used in this assessment are based on those used for the National Greenhouse Accounts.

19.3.7 National Greenhouse Accounts (NGA) Factors

The Commonwealth Department of Industry, Innovation, Climate Change, Science, Research and Tertiary Education (DIICCSRTE) has prepared the National Greenhouse Accounts (NGA) Factors (DIICCSRTE, 2013a). The NGA Factors are used to estimate greenhouse gas emissions for reporting under various government programs, including the NGER Act. The methods described for calculating emissions listed in the NGA Factors are “Method 1” from the National Greenhouse and Energy Reporting (Measurement) Determination 2008 (DCCEE 2008) and the National Greenhouse and Energy Reporting (Measurement) Technical Guidelines 2008 v1.1 (DCCEE 2012), which have been designed to support reporting under the NGER Act.

The methods described in this chapter for deriving emissions in the NGA factors are consistent with the above guidelines.

19.4 Existing Conditions

19.4.1 Topography and Land Use

The Project is located approximately 90 km north of Weipa on the western Cape York Peninsula in Far North Queensland. The Project area (MLs 40082, 40069 and 6025) is located on land between the Ducie River to the south and the Skardon River to the north.

The terrain of the region is relatively flat and comprised of coastal plains and riverbeds typical of Cape York. Larger terrain features that can influence the meteorology are not prevalent in this area. The predominant land use in the Project region is tropical scrublands, the Gulf of Carpentaria (to the west) and a number of rivers and creek beds.

The location of the site and surrounding topographical features are presented in Chapter 10.

19.4.2 Local Meteorology

Twenty five years of meteorological monitoring data (1990 to 2015) measured at the Bureau of Meteorology (BoM) Weipa Airport station, 80 km south of the Project site, have been used to characterise the long term climate of the Skardon River region. The data at the BoM Weipa Airport station is expected to be representative of the Project site due to the relative proximity of locations, similarity in surrounding terrain and the coastal location. A summary of the measured meteorological parameters is provided in Appendix 9 and Chapter 9, for temperature, rainfall humidity and cyclones. Information is presented below on surface atmospheric pressure, wind speed and wind direction as these are key factors in assessing impacts to air quality.

19.4.3 Surface Atmospheric Pressure

The monthly average surface pressure at Weipa Airport is presented in Appendix 9. The annual pattern of peaks and troughs in the monthly average pressure field indicates that the month of January is generally dominated by low pressure features that are typically associated with wetter summer conditions, while the month of July is generally dominated by high pressure features that are typically associated with clear, drier conditions.
19.4.4 Wind Speed and Wind Direction

Wind speed and direction are important parameters for the transport and dispersion of air pollutants, with the proximity to the coastline and the local terrain features providing a number of complexities in the flow of winds across the region.

The annual, seasonal and diurnal wind roses for the 1-hour average measurements of wind speed and wind direction from the Weipa Airport monitoring site for the period 1 January 1995 to 31 December 2014 presented in Figure 19-1, Figure 19-2 and Figure 19-3 respectively.

The Weipa Airport site is dominated by winds from the east to southeast, with approximately 65% of the annual winds recorded from these sectors. Winds from other sectors do not occur for more than 10% of the time e.g. winds from the west occur for 6% of the time. The annual wind rose indicates that the air pollutant emissions released into the atmosphere would generally be transported to the west and northwest.

The seasonal pattern of winds at the Weipa airport show the dominance of the east to south-easterly winds, especially in autumn, winter and spring. Summer winds are more distributed between east to west winds with few winds occurring from the southwest.

The diurnal winds at Weipa Airport show light winds from the east to southeast between midnight and 6 am, increasing to stronger winds from the same direction between 6am and midday. Strong winds continue from the east to southeast during the afternoon (midday to 6pm) and then decrease in speed from 6pm to midnight. A relatively strong west wind also occurs during the afternoon (indicating a sea breeze).

![Annual Wind Rose of Wind Speed (m/s) and Wind Direction (°) Recorded at Weipa Airport Monitoring Station during January 1995 to December 2014](image-url)
Figure 19-2  Seasonal Wind Rose of Wind Speed (m/s) and Wind Direction (°) Recorded at Weipa Airport Monitoring Station during January 1995 to December 2014

Figure 19-3  Diurnal Wind Rose of Wind Speed (m/s) and Wind Direction (°) Recorded at Weipa Airport Monitoring Station during January 1995 to December 2014
19.5 Environmental Values

19.5.1 Locations of Sensitive Receptors

Publically available aerial imagery was used to search for potential sensitive receptor dwellings within a 20 km buffer of the study area. A 20 km buffer is generally adequate to provide sufficient separation distance between mine site activities and sensitive receptors for air quality.

Analysis was carried out from a visual inspection of frames at a scale of 1:5,000 (approximately 1 km x 1 km) separate aerial imagery sources were used for the aerial search of the Project area and a 20 km buffer of the Project). The Geoscience Australia Homestead layer, mapped roads and the Ergon Power Network were also used to assist in locating and verifying potential receptors.

The only sensitive (human) receptors identified within 20 km of the Project area were located at Mapoon approximately 16 km southwest of the southernmost mining lease boundary and 34 km southwest of the Port facilities on the Skardon River. A number of isolated homesteads are located along the coastline between Cullen Point and Mapoon. Cullen Point is approximately 10 km southwest of ML 6025 and the nearest sensitive receptor is 11 km southwest of the nearest active mine area and 30 km from the Port of Skardon River. A map of the potential sensitive receptor locations is presented in Figure 19-4.

Metro Mining’s proposed Bauxite Hills Project’s accommodation camp is the only other potential sensitive receptor. The exact location of this accommodation camp is unknown at the time of reporting however a published\(^1\) conceptual location for the camp positions it adjacent to the far north east corner of the proponents southern ML (ML6025) (see Figure 19-4).

---

Figure 19-4

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Study Area and Sensitive Receptors

Legend

- Mining Lease Boundaries
- Potential Sensitive Receptors
- Port of Skardon River
- Indicative Location of Metro Mining’s Proposed Bauxite Hills Camp
- 20km Buffer of Mining Lease Boundaries

Gulf of Carpentaria

Gullen Point

Mapoon

Proposed Bauxite Hills Accommodation Camp

Mineral Lease Boundaries

ML 6025

ML 40082

ML 40059

Port of Skardon River

Potential Sensitive Receptors

Indicative Location of Metro Mining’s Proposed Bauxite Hills Camp

20km Buffer of Mining Lease Boundaries

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19.5.2 Existing Air Quality

There are no air quality monitoring stations at the Project site or at the nearest town of Mapoon. The air quality at the Project area would be dominated by natural sources of wind-blown dust from exposed ground, particles generated from bushfires and salt spray particles from the Gulf. The former kaolin mine would have been a source of dust when it was operating but has been under care and maintenance for a number of years.

The largest source of anthropogenic dust in the region is the existing bauxite mine at Weipa, operated by Rio Tinto Alcan, and 80 km south of the Project area. The Weipa bauxite mine is a well-established operation. The Weipa mine includes two mine areas, directly to the east and north of the town, as well as two beneficiation plants and associated transport and ship loading facilities.

19.5.3 Fires in the Cape York Region

The North Australian Fire Information website provides information on bushfire frequency and period of occurrence between 2000 and 2014 across all of northern Australia including Cape York. Figure 19-5 shows the fire frequency (i.e. the number of years with a fire between 2000 and 2014) and Figure 19-6 shows number of years since a particular area was last burned.

These figures show that almost the entire area of Cape York Peninsula in the Project region west of the dividing range has been burned recently and has been burned multiple times. These bushfires are likely to be a combination of natural fires, deliberate burning or accidental burning. The majority of fires occur in the dry season when winds tend to be from the south east and particulate matter would be blown towards the Gulf of Carpentaria.

The area of Cape York shown on Figure 19-5 is approximately 6.25 million ha. In 2014 2.8 million ha (45 %) was burned. In 2012 3.15 million ha (50 %) was burned. These years are typical of the extent of burning on an annual basis.

---

Fire Frequency (2000 - 2014)

Legend

- Mining Lease Boundaries
- Major Watercourses

Number of Years Burnt 2000-2014
(Northern Australia Fire Information)

- 0 - 2
- 3 - 5
- 6 - 8
- 9 - 11
- 12 - 15

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Previous Bushfire
(2000 - 2014)

Legend

- Mining Lease Boundaries
- Major Watercourses

Years Since Last Burnt 2000-2014
(Northern Australia Fire Information)

- 0 - 2
- 3 - 5
- 6 - 8
- 9 - 11
- 12 - 15

Queensland

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Figure 19-6

Revision: R1
Date: 15/08/2015
Author: malcolm.nunn

Map Scale: 1:1,800,000
Coordinate System: GDA 1994 MGA Zone 54

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19.5.4 Air Quality Criteria Adopted for the Project

The adopted criteria for the Project are taken from the Air EPP air quality relevant to the key air pollutants that may be generated from the Project are presented in Table 19-1.

Table 19-1  Ambient Air Quality Objectives (Air EPP)

<table>
<thead>
<tr>
<th>Pollutant</th>
<th>Environmental value</th>
<th>Averaging period</th>
<th>Air quality objective (µg/m³)</th>
<th>Number of days of exceedance allowed per year</th>
</tr>
</thead>
<tbody>
<tr>
<td>TSP</td>
<td>Health and wellbeing</td>
<td>Annual</td>
<td>90</td>
<td>N/A</td>
</tr>
<tr>
<td>PM₁₀</td>
<td>Health and wellbeing</td>
<td>24-hour</td>
<td>50</td>
<td>5</td>
</tr>
<tr>
<td>PM₂.₅</td>
<td>Health and wellbeing</td>
<td>24-hour</td>
<td>25</td>
<td>N/A</td>
</tr>
<tr>
<td>Dust deposition*</td>
<td>Nuisance</td>
<td>Maximum monthly average</td>
<td>120 mg/m²/day</td>
<td>N/A</td>
</tr>
</tbody>
</table>

Note:  
* Dust deposition is not specified in the Air EPP. The objective used here has been reproduced from the EHP Guidelines for Model Mining Conditions (EML944 - version 5)

There is no statutory limit for protecting health and biodiversity of ecosystems for key air pollutants (dust) generated from the Project. EHP provides design guidance for dust deposition for the avoidance of dust nuisance, which is related to human perception.

The effect of dusts on vegetation is principally through interception of light by leaves and the consequential effects on the rates of photosynthesis and plant health and growth. However, there are no prescribed assessment criteria for dust loads on vegetation associated with reduced physiological activity.

For this assessment the dust deposition nuisance guideline has been conservatively adopted to determine impacts on vegetation.

19.6 Assessment Methodology

Due to separation distance to sensitive receptors there is a low risk of air quality impacts from the Project, and therefore no dispersion modelling was conducted.

The assessment considered the South of Embley EIS (Rio Tinto Alcan, 2012 and 2013) and draws conclusions about the necessary buffer required between mining activities and sensitive receptors in and near Mapoon that would result in a low air quality risk. This buffer was then applied to the Project and a determination of air quality risks was made.

19.6.1 Review of South of Embley Air Quality Assessment

The South of Embley Project EIS has been approved by the State and Commonwealth Governments and the air quality assessment has been used in this assessment to determine air quality risks. A comparison of the magnitudes of the projects shows that the production rate of the South of Embley Project is ten times larger (50 Mtpa) than the Project (5 Mtpa maximum).

19.6.1.1 South of Embley Emissions Inventory

Table 19-2 presents a summary of the emissions inventory detailed in the South of Embley Project EIS Air Quality Assessment.
Table 19-2  Summary of South of Embley Dust Emissions Inventory

<table>
<thead>
<tr>
<th>Activity</th>
<th>Estimated annual dust emission rate (tpa)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>TSP</td>
</tr>
<tr>
<td>Excavator on subsoil</td>
<td>76</td>
</tr>
<tr>
<td>Excavator on bauxite</td>
<td>76</td>
</tr>
<tr>
<td>OB haul truck move</td>
<td>588</td>
</tr>
<tr>
<td>OB haul truck dump</td>
<td>846</td>
</tr>
<tr>
<td>Dozer</td>
<td>1,192</td>
</tr>
<tr>
<td>Grader</td>
<td>391</td>
</tr>
<tr>
<td>Wind erosion</td>
<td>5,110</td>
</tr>
<tr>
<td>Dumping</td>
<td>706</td>
</tr>
<tr>
<td>Handling</td>
<td>0.40</td>
</tr>
<tr>
<td>All roads combined</td>
<td>9,385</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>18,370</strong></td>
</tr>
</tbody>
</table>

19.6.2 Project Emissions Sources

The most important air pollutant emitted from the Project will be particulate matter (dust). Elevated levels of dust have the potential to cause adverse impacts on the amenity and health of people living in the vicinity. Emissions of dust from the Project may occur during both the construction and operational phase. The Project activities that may contribute to emissions of dust include:

- land clearing
- topsoil stripping
- topsoil and subsoil handling (loading trucks and dumping at stockpile area)
- bauxite mining (excavation)
- bauxite material handling (loading trucks and dumping at stockpile area)
- haul truck movements of topsoil, subsoil and bauxite on unpaved roads
- stockpiling of topsoil, subsoil and bauxite (wind erosion)
- barge loading of bauxite at port
- ship loading of bauxite at sea.

Fleet vehicle exhaust emissions will also be a source of air pollutant emissions. The combustion of fuel (diesel) in vehicles will result in emissions of oxides of nitrogen (NO$_x$), carbon monoxide (CO), particulate matter, sulfur dioxide (SO$_2$) and carbon dioxide (CO$_2$). Trace amounts of hydrocarbons will also be present in the vehicle exhaust. The air emissions from the fleet vehicles would be transient and far smaller than emissions of particulate matter from mining activities and have not been considered further in this assessment.

A complete inventory of significant sources of air pollutant emissions for the Project is detailed below.

19.6.2.1 Project Emissions Inventory

Emissions to the atmosphere are likely to be produced during the construction and operation of the Project. Dust emissions will be generated through clearing of land and the handling and transportation of topsoil, subsoil and bauxite. Wind erosion of exposed areas, including cleared areas and stockpiles, will
also generate dust emissions. Dust emissions associated with construction activities will be lower than operational emissions and, consequently, construction emissions have not been explicitly quantified.

The Project is expected to operate for 10 years with a peak extraction rate of 5 Mtpa of bauxite. This assessment has estimated the dust emissions for a worst case year of the Project based on the following information and assumptions:

- 5 Mtpa bauxite throughput (maximum capacity)
- 0.9 Mtpa topsoil and 2.3 Mtpa subsoil (maximum combined throughput, planned to occur in 2023)
- 11 km average product haulage
- A maximum cleared area of 717 ha (planned to occur in 2017 and 2021)

The following possible options for bauxite haulage have been considered as part of the assessment:

- High speed dump trucks with 70 t payload
- Dump trucks with 200 t payload
- Road trains with 350 t payload

Dust emissions from the Project were calculated using emission factors from the National Pollutant Inventory (NPI) Emission Estimation Technique (EET) Manual for Mining (NPI, 2012) and the US EPA AP42 documents.

A detailed list of the emission factors, activity rates and assumptions is included in Appendix 9. The estimated annual emission rate for each set of activities is shown in Table 19-3 along with location of activities. The table shows that handling of bauxite represents the greatest proportion of emissions, followed by bauxite excavation. The choice of haul option changes the total emission rate by less than 10%.

Table 19-3  Summary of the Skardon River Bauxite Project Dust Emissions Inventory

<table>
<thead>
<tr>
<th>Activity</th>
<th>Location</th>
<th>Estimated annual dust emission rate (tpa)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>TSP</td>
</tr>
<tr>
<td>Topsoil/subsoil excavation &amp; handling</td>
<td>Active mining areas</td>
<td>102</td>
</tr>
<tr>
<td>Topsoil/subsoil stockpile wind erosion</td>
<td>Exposed areas</td>
<td>296</td>
</tr>
<tr>
<td>Topsoil/subsoil haul</td>
<td>Active mining areas</td>
<td>120</td>
</tr>
<tr>
<td>Bauxite excavation</td>
<td>Active mining areas</td>
<td>3,208</td>
</tr>
<tr>
<td>Bauxite stockpile wind erosion</td>
<td>Processing area</td>
<td>394</td>
</tr>
<tr>
<td>Bauxite haul (range based on three haulage options)</td>
<td>Haul roads</td>
<td>727 - 2,041</td>
</tr>
<tr>
<td>Bauxite handling - including processing area</td>
<td>Processing area</td>
<td>8,005</td>
</tr>
<tr>
<td>Wind erosion - exposed area</td>
<td>Exposed areas</td>
<td>366</td>
</tr>
<tr>
<td>Shiploading</td>
<td>Transhipper</td>
<td>1,800</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td><strong>15,017 - 16,330</strong></td>
</tr>
</tbody>
</table>
A comparison of the dust emissions inventories of the Project (Table 19-3) and the South of Embley Project (Table 19-2) indicate a similar total level of dust emissions even though the scale of the projects are different. This can be partially explained by the methods of mining between the two projects, with the South of Embley Project using conveyors to transport some of the bauxite from pit to port. Using conveyors results in lower dust emissions compared to using trucks on unpaved haul roads, as proposed for the Project.

It is not possible to directly compare the two dust emissions inventories due to a lack of detailed information that was used to estimate dust emissions in the South of Embley air quality assessment. Detailed information regarding the estimation of dust emissions for the Project are described in Appendix 9.

Notwithstanding this, as the magnitude of emissions are similar between the two projects the dispersion modelling results from the South of Embley air quality assessment can be used to infer impacts from the Project. The South of Embley Project air quality assessment detailed that air quality objectives were not predicted to be exceeded beyond 5 km from mining activities.

19.6.3 Vegetation Burning

Vegetation cleared during mining operations is proposed to be burned. Annual clearing will be approximately 120 ha per annum resulting in particulate emissions. This represents approximately 0.004% of the approximate annual area of burning in the northern Cape York Region (refer Section 19.5.3), which is considered to be insignificant in terms of particulate emissions attributable to the Project.

19.7 Impacts, Emissions and Releases

19.7.1 Inferred Project Emissions

Based on interpretation of the South of Embley Project air quality assessment dispersion modelling study, air quality impacts from the Project operating in isolation are not predicted to occur beyond 5 km from mining activities. Therefore, ground-level air quality concentrations at sensitive receptors in and around Mapoon are not expected to exceed the air quality objectives for the Project.

19.7.2 Potential Cumulative Impacts

There are a number proposed bauxite mining projects in the region that could contribute to air quality levels in the future. The Bauxite Hills Project is proposed to be located on MLs adjacent to the Project in the Skardon River region. There are also two projects proposed to the south of Weipa; the South of Embley Project and the Hey Point Bauxite Project. The following sections provide a brief summary of each of the proposed projects.

19.7.2.1 Bauxite Hills Project

Metro Mining Ltd (formerly Cape Alumina Ltd) is currently in the approvals phase for the Bauxite Hills Project, a 2 Mtpa bauxite mine located within tenements to the south of the Skardon River and adjacent to Gulf’s Project (see Figure 19-4). The Bauxite Hills Project lifetime is expected to be approximately 20 years. The mining methods and shiploading methods will be similar to Gulf’s Project.

The environmental assessment for the Bauxite Hills Project is currently being completed and is expected to be released by the end of 2015. Therefore, specific information on the air quality impact from the Bauxite Hills Project cannot be determined at this stage. However, it is likely that emissions will be of a similar nature to Gulf’s Project. If approved, the Bauxite Hills Project indicative accommodation camp location would be the nearest sensitive receptor to the Project (see Section 19.7.4).
Assuming the Bauxite Hills Project has similar activities to Gulf’s Project and is less than half the size (2 Mtpa), air quality impacts are assumed not to occur beyond 2.5 km from their mining activities. Conservatively, cumulative air impacts are therefore not predicted to occur beyond 7.5 km from both projects.

19.7.2.2 South of Embley Project
The South of Embley Project is an approved 50 Mtpa bauxite mine located to the south of Weipa. An EIS for the South of Embley Project (Rio Tinto Alcan, 2012 and 2013) was approved by the State Government in 2012 and by the Commonwealth in 2013. The South of Embley Project EIS stated that air quality impacts were not predicted to occur at distances greater than 5 km from mining areas and therefore there will be no cumulative impacts with the Bauxite Hills Project.

19.7.2.3 Hey Point Bauxite Project
The Hey Point Bauxite Project is a 1.6 Mtpa bauxite mine expected to operate for three to four years. The Hey Point Project is located approximately 10 km south of Weipa and 5 km south of the community of Napranum. A site specific application for an Environmental Authority for the Hey Point Bauxite Project was released in 2014 (MET Serve, 2014). The report application concluded that the risk of air quality impacts at the nearest receptors 5 km away was low and therefore there will be no cumulative impacts with the Bauxite Hills Project.

19.7.3 Impacts to Existing Sensitive Receptors
The nearest existing sensitive receptors to the Project in and near Mapoon are 11 km or more to the southwest of the closest active mining areas and approximately 30 km from the processing area where over 50% of emissions are estimated to occur. Based on the estimated cumulative impact buffer distance of 7.5 km and the fact that winds in the region predominantly occur from the east to southeast, the minimum buffer distance of 11 km is considered to be more than adequate to ensure that the nearest receptors are not impacted by any dust emissions from the two projects.

Ground-level concentrations at existing sensitive receptors are not expected to exceed the air quality objectives for the Project. Ground-level concentrations at existing sensitive receptors are not expected to exceed the air quality criteria as a result of cumulative impacts.

19.7.4 Bauxite Hills Project Accommodation Camp
The proposed Bauxite Hills Project’s accommodation camp is the only other potential sensitive receptor identified. The exact location of this accommodation camp is unknown at the time of reporting however a published conceptual location for the camp positions it adjacent to the far north east corner of the proponents southern ML (ML6025) (see Figure 19-4).

Based on the cumulative impact results, sensitive receptors are required to be located more than 7.5 km away from mining activities in order to comply with air quality criteria. However, it may not be feasible to locate accommodation camps greater than 7.5 km from mining activities.

As both projects are planning accommodation camps it is likely that both projects will generate dust at the adjacent accommodation camp without appropriate mitigation measures. It is assumed that a mutual agreement between Gulf and Metro Mining will be entered into later in the development of the Project to manage air quality impacts at the respective accommodation camps. In addition the Project will implement measures to achieve workplace health and safety air quality criteria.

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This agreement could involve operational controls to reduce dust, construction methods for the camp accommodation to limit dust within accommodation units, timing and location of mining activities, air quality monitoring at camps and plans to alter mining activities should air quality levels at the camps not achieve compliance.

19.7.5 Impacts on Vegetation

The deposition rate of dust decreases with distance from mining activity. The South of Embley EIS predicted that dust deposition rates would fall below nuisance guidelines at a distance of 1 km from a source. The vegetation in the immediate vicinity of the Project activities is primarily classed as ‘least concern’ regional ecosystem. However, it will be located within a few hundred metres of mining activities.

Whilst there are no statutory guidelines for dust impacts on vegetation, a study by Doley (2006) indicated that sensitive plants can tolerate dust deposition level up to twice the human nuisance guideline. The vegetation in the Project region is classed as ‘least concern’ and coupled with the dust management controls the mine will implement (Section 19.9), the impact to vegetation is considered to be low.

19.7.6 Vegetation Burning

Vegetation burning for the Project is insignificant in comparison to annual burning that occur in the Cape York region. In addition burning for the Project will occur in the late dry season when winds are predominantly from the east and south east resulting particulate being blown towards the Gulf of Carpentaria and not towards any sensitive receptors. Vegetation burning will only be undertaken when weather conditions are predicted to be favourable and all burning will be controlled to prevent spread of bushfires. Therefore vegetation burning for the Project is unlikely to result in a nuisance for sensitive receptors.

19.7.7 Odour

Due to the separation distance from sensitive receptors, and proposed measures to manage and dispose of waste, there are not expected to be any noxious or offensive odours resulting from the Project which may cause an environmental nuisance at any sensitive place.

19.8 Greenhouse Gas Assessment

19.8.1 The Greenhouse Gas Protocol

There are three scopes of emissions that are established for greenhouse gas accounting and reporting purposes, defined in the Greenhouse Gas Protocol as follows.

19.8.1.1 Scope 1 Emissions – Direct GHG Emissions

The GHG Protocol defines Scope 1 emissions as those which result from activities under the Proponent’s control or from sources which they own. The Scope 1 emissions that are applicable to the Project are:

- emissions from transportation of materials, products, waste, and employees resulting from the combustion of fuels in company owned/controlled mobile combustion sources
- onsite power generation using 2MW generators
- emissions from wastewater processing
- clearing of vegetation.
19.8.1.2 Scope 2 Emissions – Electricity Indirect GHG Emissions

Scope 2 emissions are those which relate to the generation of purchased electricity consumed in owned or controlled equipment or operations. There are no Scope 2 emission that are applicable to the Project.

19.8.1.3 Scope 3 Emissions – Other Indirect GHG Emissions

The GHG protocol states that Scope 3 reporting is optional and covers all other indirect GHG emissions. Scope 3 emissions are defined as those which do not result from the activities of a company although arise from sources not owned or controlled by the Proponent. Examples of Scope 3 emissions include the extraction and production of purchased materials, offshore transportation of product to foreign markets, transportation of purchased fuels and the use of sold products (e.g. refining of bauxite produced by the Project) and services.

Scope 3 emissions are outside of the scope of this assessment and have not been considered further.

19.8.2 Greenhouse Gas Calculations

Quantification of potential emissions from the Project has been undertaken in relation to both carbon dioxide (CO₂) and other non-CO₂ greenhouse gas emissions. For comparative purposes, non-CO₂ greenhouse gases are awarded a “CO₂-equivalence” (CO₂-e) based on their contribution to the enhancement of the greenhouse effect. The CO₂-e of a gas is calculated using an index called the Global Warming Potential (GWP). The GWPs for a variety of non-CO₂ greenhouse gases are contained within the Intergovernmental Panel on Climate Change (IPCC), (1996) document “Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories”.

The GWPs of relevance to this assessment are:

- methane (CH₄): GWP of 21 (21 times more effective as a greenhouse gas than CO₂); and
- nitrous oxide (N₂O): GWP of 310 (310 times more effective as a greenhouse gas than CO₂).

19.8.2.1 Scope 1: Direct Emissions

19.8.2.1.1 Fuel Combustion

Diesel will be the primary fuel source for the vehicles, plant, equipment, generators, aircraft flying workers to site and barges operating at the Project. The estimated diesel consumption rate for the Project at full production is 9.6 million litres per annum over 10 year operations. Construction period fuel consumption is expected to be approximately half that of operations, and since the first and second year of operations are at a reduced bauxite production rate, with lower annual average fuel requirements, the combined construction and ramp up phase has been considered as two year of fuel consumption.

As the majority of this fuel will be used in the trucks hauling bauxite and overburden, Scope 1 emissions of CO₂ and other GHGs from diesel combustion based on the above consumption figures have been estimated using transport-related emission factors as shown in Table 19-4 (DIICCSRTE, 2013a).

### Table 19-4 Scope 1 GHG Emissions – Diesel Combustion

<table>
<thead>
<tr>
<th>Period</th>
<th>Energy Content (GJ/kL)</th>
<th>Emission Factor (kg CO₂-e/GJ)</th>
<th>Consumption (kL)</th>
<th>GHG Emissions (t CO₂-e)</th>
<th>Total Emissions (t CO₂-e)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>CO₂</td>
<td>CH₄</td>
<td>N₂O</td>
<td>CO₂</td>
</tr>
<tr>
<td>Operation (annual)</td>
<td>38.6</td>
<td>69.2</td>
<td>0.20</td>
<td>0.50</td>
<td>9,600</td>
</tr>
</tbody>
</table>
19.8.2.1.2 Wastewater Treatment

Emissions of CH$_4$ and N$_2$O from the on-site wastewater treatment process have been estimated using default factors from the National Greenhouse and Energy Reporting (Measurement) Technical Guidelines (DCCEE 2012). The calculations followed Method 1 as per Section 5.25 (CH$_4$) and Section 5.31 (N$_2$O) of the Guidelines as illustrated below.

\[
E_{CH4} \text{ (tonnes CO}_2\text{-e/year) = ((P x DC}_W) - \text{COD}_{sl} - \text{COD}_{eff}) \times MCF_{ww} \times EF_{CH4}
\]

Where:

- \( P \) is the population served by the operation of the plant during the year and measured in numbers of persons = 150 people
- \( DC_W \) is the quantity in tonnes of COD (Chemical Oxygen Demand\(^4\)) per capita of wastewater for a year = 0.0585 t per person
- \( \text{COD}_{sl} \) is the quantity of COD removed as sludge from wastewater and treated in the plant = 0 tonnes
- \( \text{COD}_{eff} \) is the quantity of COD in effluent leaving the plant during the year = 0 tonnes
- \( MCF_{ww} \) is the Methane Correction Factor for wastewater treated at the plant during the year = 0 for managed aerobic treatment
- \( EF_{CH4} \) is the default CH$_4$ emission factor for wastewater = 5.3 tonnes of CH$_4$ measured in CO$_2$-e per tonne of COD.

\[
E_{N2O} \text{ (tonnes CO}_2\text{-e/year) = (Protein x Frac-Pr x P) x EF}_{N2O}
\]

Where:

- \( Protein \) is the annual per capita protein intake of the population being served by the plant, measured in tonnes per person = 0.036 tonnes per year
- \( Frac-Pr \) is the fraction of nitrogen in protein = 0.16 tonnes of nitrogen per tonne of protein
- \( P \) is the population serviced by the plant during the year = 150 people
- \( EF_{N20} \) is the default N$_2$O emission factor for wastewater = 4.9 tonnes of N$_2$O measured in CO$_2$-e per tonne of nitrogen.

The emission factors and activity data give 0 t CO$_2$-e for methane and 4.2 t CO$_2$-e for N$_2$O. This a highly conservative estimate as less than 150 workers will be living on site during operations. Thus actual emissions are likely to be less than half of the values shown in Table 19-5. On this basis they can be concluded to be an insignificant source of GHG emissions for the Project.

<table>
<thead>
<tr>
<th>Table 19-5</th>
<th>Scope 1 GHG Emissions – Wastewater Handling</th>
</tr>
</thead>
<tbody>
<tr>
<td>Period</td>
<td>Population</td>
</tr>
<tr>
<td>Operation (annual)</td>
<td>150</td>
</tr>
</tbody>
</table>

\(^4\) The COD is a measure of the amount of organic compounds present in a water sample.
19.8.2.1.3 Vegetation Clearance

Vegetation clearance for the Project would result in the release of greenhouse gas emissions. The total area of clearance of remnant vegetation over the life of the Project is approximately 1,260 ha.

The carbon biomass for eucalyptus open woodland in Cape York bioregion, that is expected to be cleared, was estimated at 93.8 tonnes/ha cleared using the Full Carbon Accounting Model, a tool within the National Carbon Accounting Toolbox (DoE, 2015).

Vegetation clearing will not occur evenly on a per annum basis and hence is only estimated for the life of Project. However, for the purpose of estimating annual emissions, an average annual value over the life of Project (10 years) has been estimated.

### Table 19-6 Vegetation Clearance Areas and Emission Factor Details

<table>
<thead>
<tr>
<th>Vegetation Type</th>
<th>Total Area Cleared(^*) (ha)</th>
<th>Carbon (t/ha)</th>
<th>Total Carbon (t)</th>
<th>Emission Factor (t CO(_2)-e/t carbon)</th>
<th>Total Emissions (t CO(_2)-e)</th>
</tr>
</thead>
<tbody>
<tr>
<td>eucalypt tall open forest</td>
<td>1,260</td>
<td>93.8</td>
<td>3</td>
<td>3.67</td>
<td>433,901</td>
</tr>
</tbody>
</table>

\(^*\) Over Life of Project

19.8.3 Greenhouse Gas Emissions Summary

Calculated annual GHG emissions resulting from the operational phase emission sources are summarised in Table 19-7 (annual emission estimated for operational years, including an annualised value for land clearing). The annual GHG emissions for the Project are estimated to be 69,296 t CO\(_2\)-e per year. The total life of Project emissions (including construction phase emissions and vegetation clearing) are estimated at 692,964 t CO\(_2\)-e, as shown in Table 19-8.

A comparison of the annual Scope 1 and Scope 2 GHG emissions from the Project against published total GHG emissions for Queensland and Australia (including land use, land use change and forestry) has also been conducted. Emissions of 152.4 Mt CO\(_2\)-e and 543.6 Mt CO\(_2\)-e were reported for Queensland and Australia respectively for the 2011/12 reporting year (DoE, 2014). The estimated annual Scope 1 emissions from the Project represent around 0.05 % of total Queensland 2011/2012 emissions and approximately 0.01 % of total Australian 2011/2012 emissions.

### Table 19-7 Total Annual GHG Emissions – Operational Phase (Excluding Land Clearing)

<table>
<thead>
<tr>
<th>Source</th>
<th>GHG Emissions by Scope (t CO(_2)-e/year)</th>
<th>Total Emissions (t CO(_2)-e(_e)/year)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Scope 1</td>
<td>Scope 2</td>
</tr>
<tr>
<td>Fossil Fuel Consumption</td>
<td>25,902</td>
<td></td>
</tr>
<tr>
<td>Wastewater Treatment</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Electricity Use</td>
<td></td>
<td>0</td>
</tr>
<tr>
<td>Land Clearing (Annualised)</td>
<td>43,390</td>
<td></td>
</tr>
<tr>
<td>Queensland (2010/11)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>National (2012)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table 19-8  Total Life of Project GHG Emissions (Including Land Clearing)

<table>
<thead>
<tr>
<th>Source</th>
<th>GHG Emissions by Scope (t CO₂-e)</th>
<th>Total Emissions (t CO₂-e)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Scope 1</td>
<td>Scope 2</td>
</tr>
<tr>
<td>Fossil Fuel Consumption</td>
<td>259,021</td>
<td></td>
</tr>
<tr>
<td>Wastewater Treatment</td>
<td>40</td>
<td></td>
</tr>
<tr>
<td>Land Clearing</td>
<td>433,901</td>
<td></td>
</tr>
<tr>
<td>Electricity Use</td>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>

19.9  Management Measures and Plans

19.9.1  Particulate Matter and Dust

While there is a low risk of potential impact from the Project, dust emissions will be minimised are far as practicable. It is likely the control of dust emissions will be primarily required to manage workplace health and safety risks and dust levels at the accommodation camps, rather than exposure to dust at the nearest receptors in and near Mapoon.

The Project will have, as a minimum, the following dust mitigation measures in place:

- watering of haul roads and stockpiles
- use of dust suppressants as required
- progressive rehabilitation of mined areas.

Dust emissions have the potential to occur during both the construction and operational phases of the Project. Mitigation measures will be implemented to minimise dust emissions – these include:

- minimising the use of topsoil and subsoil stockpiles
- watering haul roads and bauxite stockpile
- using dust suppressant on haul roads, as required
- fitting the barge loading conveyor with a telescopic chute required to accommodate the tidal movement and minimise spillage and dust
- implementing speed limits via posted speed limit signs on project unsealed roads
- ensuring vehicles keep to marked trafficable areas which would be maintained in a damp and compacted condition to enhance safety and minimise dust emissions.
- minimising cleared areas as far as practicable and retaining existing vegetation where possible.
- allowing regrowth of grasses and shrubs in areas cleared of tall vegetation.
- ensuring rehabilitation proceeds as soon as is practicable after works are completed to minimise the duration of exposure of disturbed areas.

A complaints management system will be implemented so that any identified incidents or complaints are dealt with through investigation and implementation of corrective treatments.

Proposed management measures for the Projects camp and Bauxite Hills project camp are described in Section 19.7.3.

Other mitigation measures recommended to minimise air emissions from the Project include:
- Maintaining all vehicles and machinery used for the construction and operation of the Project in accordance with the manufacturer’s specifications to minimise exhaust emissions.
- Minimising truck queuing, unnecessary idling of trucks and unnecessary trips through logistical planning of materials delivery and work practices.

### 19.9.2 Monitoring

Dust deposition and particulate matter monitoring will occur in response to complaints about dust from Project (if any) and as requested by the administering authority. If requested by the administering authority, dust and particulate monitoring will be undertaken within a reasonable and practicable timeframe nominated by the administering authority to investigate any non vexatious complaint of environmental nuisance at any sensitive place, and the results will be notified within 14 days to the administering authority following completion of the monitoring.

In addition to monitoring dust, local meteorological data will be collected from a monitoring station installed on the Project area. This station will collect temperature, relative humidity, rainfall and wind data over the life of the project.

If Gulf Alumina can provide evidence through monitoring that the limits identified in Table 19-1 are not being exceeded then no additional mitigation is required. If monitoring indicates exceedence of the relevant criteria then Gulf Alumina will:

- address the complaint including the use of appropriate dispute resolution if required or
- immediately implement dust abatement measures so that emissions of dust from the activity do not result in further environmental nuisance.

Odour monitoring will be undertaken in response to a complaint that is not frivolous or vexatious, as requested by the administering authority. Odour monitoring results will be notified within 14 days to the administering authority following completion of the monitoring. If monitoring indicates an odour nuisance is being caused then Gulf Alumina will:

- address the complaint including the use of appropriate dispute resolution if required or
- immediately implement odour abatement measures so that emissions of odour from the activity do not result in further environmental nuisance.

### 19.9.3 Greenhouse Gas Minimisation

The principal sources of GHG emissions from the Project are combustion of fuel for vehicles, equipment, generators and barges, and land clearing. However the total annual emissions are relatively small when compared to the Queensland and Australian annual emission inventories.

Land clearing is unavoidable, however rehabilitation using native vegetation will result in carbon sequestration for many years during and after the Project’s operations. This sequestration has not been included in the above greenhouse gas calculations and will significantly offset any GHG emissions during the Project life.

The following list details methods that may be implemented to assist in the reduction of GHG emissions from fuel use during Project operations, noting that it is the proponent’s interest to minimise fuel use as this is a significant operational cost for mining projects:

- selection of vehicles, vessels and equipment to minimise fuel use
- optimisation of haul routes to reduce transport distances from open pit
- optimisation of barge operating times
- minimise vehicle idling time and maintain optimum tyre pressure
The proponent is committed to monitor, audit and report on GHG emissions as per the requirements of the NGER Act.

**19.10 Risk Assessment**

The residual (post mitigation) risk assessment of impacts to the air quality and GHG environmental values identified in Section 19.5, is shown in Table 19-9.

Risks from air emissions to people, the community and the environment have been assessed as follows:

- low risk for known existing residential sensitive receptors at Mapoon, and
- medium risk for the Bauxite Hills accommodation camp.

Due to the nature of operations the risk of significant impacts to national and state GHG inventories is medium. The performance outcomes described in Section 19.2 are expected to be achieved.
### Table 19-9  Risk Assessment

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Mapoon Residential Receptors</td>
<td>Exceedance or air quality criteria for PM$<em>{2.5}$, PM$</em>{10}$ and TSP emissions, and dust deposition at sensitive receptors. Nuisance from burning.</td>
<td>Unlikely</td>
<td>Minor</td>
<td>Low</td>
<td>See Sections 19.7, 19.8 and 19.9</td>
<td></td>
</tr>
<tr>
<td>Bauxite Hills Project Accommodation Camp</td>
<td></td>
<td>Possible</td>
<td>Minor</td>
<td>Medium</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mapoon Residential Receptors</td>
<td>Exceedance of air quality criteria for NO$_2$, CO, SO$<em>2$ or PM$</em>{10}$ from use of a 2 MW diesel generator during construction. Nuisance from burning.</td>
<td>Unlikely</td>
<td>Minor</td>
<td>Low</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bauxite Hills Accommodation Camp</td>
<td></td>
<td>Unlikely</td>
<td>Minor</td>
<td>Low</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Environment</td>
<td>Significant impacts to national and state GHG inventories</td>
<td>Possible</td>
<td>Minor</td>
<td>Medium</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Community</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>People</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Environment</td>
<td>Vegetation Exceedance of air quality criteria for dust deposition at vegetation receptors.</td>
<td>Possible</td>
<td>Insignificant</td>
<td>Low</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
19.11 Conclusion

The air pollutant emitted from the Project with the greatest potential for impacts is particulate matter or dust. The Project activities that contribute to the dust emissions include bauxite mining (excavation), bauxite material handling, haul truck movements on unpaved roads and barge loading of bauxite at the Port.

The location of the Project is relatively remote. The nearest existing sensitive receptors are located approximately 11 km southwest of the nearest proposed mine area and 30 km south of the Port of Skardon River. Mapoon is approximately 16 km southwest of the nearest proposed mine area.

Air quality criteria for the Project were derived from the Environmental Protection (Air) Policy and the Model Mining Conditions.

The meteorological conditions in the region have been inferred from data measured at Weipa Airport and show a dominance of winds from an east to southeast direction. Therefore, the most likely areas to be impacted by emissions from the Project would be in a westerly to northwesterly direction (i.e. away from receptors in and near Mapoon).

A dust emissions inventory was calculated for the Project based on expected operational parameters and Project information (including haulage options), and modelling assumptions.

Air quality impacts for the Project have been inferred from an approved air quality assessment report for a mining activity that has a similar dust emissions inventory, the South of Embley Project located in western Cape York to the south of Weipa. The South of Embley Project EIS was approved in 2012 and included a dispersion modeling study of dust emissions from a proposed 50 Mtpa bauxite mine. The dispersion modelling study indicated that air quality impacts would not occur at distances greater than 5 km from mining areas.

Using the air quality results from the South of Embley EIS it can be inferred that the air quality impacts from the Project would have a low risk of exceeding air quality criteria at the nearest existing sensitive receptors (located at Mapoon). This is due to the large buffer distance of 11 km and the fact that the predominant prevailing wind direction is from the east to southeast.

The proposed Bauxite Hills Project is a 2 Mtpa bauxite mine that would be located in the area adjacent to Gulf’s Project. Assuming the Bauxite Hills Project has similar activities to Gulf’s Project and is less than half the size (2 Mtpa), air quality impacts are assumed not to occur beyond 2.5 km from their mining activities. Conservatively, cumulative air impacts are therefore not predicted to occur beyond 7.5 km from both projects. Therefore there would be a low risk of exceeding air quality criteria at the nearest existing sensitive receptors.

The Bauxite Hills Project’s accommodation camp is the only other potential sensitive receptor. The exact location of this accommodation camp is unknown at the time of reporting however a published conceptual location for the camp positions it adjacent to the far north east corner of the proponent’s southern ML (ML6025). It is expected that a mutual agreement between Gulf and Metro Mining will be entered into later in the development of the Project to manage air quality impacts at the respective accommodation camps. In addition the Project will implement measures to achieve workplace health and safety air quality criteria. This agreement could involve operational controls to reduce dust, construction methods for the camp accommodation to limit dust within accommodation units, timing and location of mining activities, air quality monitoring at camps and plans to alter mining activities should air quality levels at the camps not achieve compliance. There is a medium risk of exceedance of air quality criteria at each Project’s nearby accommodation camp.
Notwithstanding the low risk to air quality at existing sensitive receptors from the Project, operational management practices will be implemented to minimise dust emissions, including dust suppression of haul roads and stockpiles, and the progressive rehabilitation of mined areas.

Due to the insignificant extent of burning proposed for cleared vegetation in comparison to the extent of burning in Cape York, and the predominant south easterly wind carrying particulate matter offshore, there is low risk of nuisance impacts to sensitive receptors.

The greenhouse gas (GHG) assessment has been conducted with conservative operational data and annual Scope 1 and Scope 2 GHG emissions have been calculated. The total annual GHG emissions for the Project (including an annualised value land clearing) are estimated to be 69,296 t CO$_2$-e per year. The total life of Project emissions (including land clearing) are estimated at 692,964 t CO$_2$-e. A comparison of the estimated annual Scope 1 and Scope 2 GHG emissions from the Project against total GHG emissions for Queensland and Australia showed that Project GHGs represent approximately 0.05% of total Queensland 2010/11 emissions and around 0.01% of total Australian 2012 emissions. The majority of the Project’s GHG emissions are from land clearing, however this will be offset through carbon sequestration by native vegetation used in rehabilitation.

Following the implementation of the mitigation measures described in Section 19.9.3, the objectives and performance outcomes in relation to air quality and GHG described in Section 19.2 are expected to be achieved for the Project. All risks from air emissions to existing sensitive receptors and the environment have been assessed as low. The risk of significant GHG emissions is medium.