Chapter 6

Air Quality

6.0 Air Quality

6.1 Relevant Air Quality Legislation and Criteria

Relevant Legislation and Policy instruments considered in the assessment of air quality are:

- *Environmental Protection Act 1994* (Queensland) (EP Act)
- *Environmental Protection (Air) Policy 2008* (Queensland) (EPP Air)
- National Environment Protection (Ambient Air Quality) Measure (Commonwealth) (Air Quality NEPM).

Environmental Protection Act 1994

The *Environmental Protection Act 1994* (EP Act) is intended to protect Queensland's environment while allowing for development that improves total quality of life, now and in the future, by encouraging ecologically sustainable development. The EP Act regulates environmentally relevant activities (ERA) under the Environment Protection Regulation 2008 (EP Regulation) and some of these activities will require a permit. There are several policies published under the Act that govern the requirement for management of some environmental issues such as noise, air and water.

These policies determine objectives to be achieved in various environments with reference to sensitive receptors. One of these, the Environmental Protection (Air) Policy 2008 (EPP Air) must be considered for the assessment of impacts on air quality.

Environmental Protection (Air) Policy 2008

The EPP Air was prepared by the Queensland Government to enhance or protect the atmospheric environment in Queensland by providing air quality objectives. It does not apply to workplaces, and the air quality objectives set out in the EPP Air are intended to be progressively achieved over the long term. A summary of the air quality objectives set by the EPP Air relevant to the Project is provided in Table 6-1.

The EPP Air recommends different strategies to control emissions for different types of activities, including:

- identifying environmental values to be enhanced or protected
- stating indicators and air quality objectives for enhancing or protecting the environmental values
- providing a framework for making consistent, equitable and informed decisions about the air environment.

National Environment Protection Measures (NEPM)

NEPM are broad framework-setting statutory instruments that outline agreed national objectives for protecting or managing particular aspects of the environment. The air quality of an environment is protected in by the Ambient Air Quality NEPM as amended (2015). The Ambient Air Quality NEPM provides guidance relating to air in the external environment and does not include air inside buildings or structures.

The Ambient Air Quality NEPM outlines monitoring, assessment and reporting procedures for the following pollutants:

- PM_{10}
- $PM_{2.5}$
- nitrogen dioxide (NO_2)
- carbon monoxide
- ozone
- sulphur dioxide (SO_2).

The Ambient Air Quality NEPM standards are intended to be applied to air quality experienced by the general population in a region and not to air quality in areas in the region affected by localised air emissions, such as individual industrial sources. The standards were set at a level intended to adequately protect human health and wellbeing. The standards in the Ambient Air Quality NEPM relevant to the Project correspond to the EPP Air objectives protecting the health and wellbeing environmental values. The Ambient Air Quality NEPM standards relevant to the Project are consequently addressed in the air quality objectives in the EPP Air.

6.1.1 Adopted air quality criteria

Table 6-1 EPP air ambient air quality objectives

Indicator	Air Quality Objective	Averaging Period	Environmental Value	Source
NO_2	0.12 ppm 0.03 ppm	1-hour [1] Annual	Health and well being	EPP Air
	0.016 ppm	Annual	Health and biodiversity of ecosystems	EPP Air
SO_2	0.20 ppm 0.08 ppm 0.02 ppm	1-hour [1] 24-hour [1] Annual	Health and well being	EPP Air
	0.0075 ppm	Annual	Health and biodiversity of ecosystems (for forests and natural vegetation)	EPP Air
PM_{10}	50.0 µg/m³	24-hour [2]	Health and well being	EPP Air

ppm parts per million
µg/m³ micrograms per cubic metre
[1] Not to be exceeded more than one day per year
[2] Not to be exceeded more than five days per year
[3] Not legislative, recommended Project goal to reduce likelihood of complaints

6.2 Existing Environment

In order to characterise the existing air quality values in the Project area a review of available air quality monitoring data was conducted. The Department of Environment and Science (DES) has an ambient monitoring network across Queensland that monitors for controlled pollutants in areas with large population bases or heavy industry adjacent to residential areas. The nearest available DES air quality monitoring data is from Townsville, located approximately 100 km south-east of the Draft Alignment.

Queensland's compliance with the standards and goals of the Ambient Air Quality NEPM is assessed and reported annually. For the Townsville region all NEPM reporting is based on data collected at the Pimlico station. Although decommissioned in 2016, the Pimlico station provides long-term data from 2004 and was located in a residential area. Pollutants monitored at this station include NO_2, SO_2 and PM_{10}. Below, a summary of the annual results from the latest Queensland NEPM report (2016) for the aforementioned pollutants is discussed.

Annual average and 90th percentile average of one-hour NO_2 concentrations detailed in Table 6-2 have been taken directly from the 2016 Queensland NEPM report (Table 30). The maximum 90th percentile one-hour NO_2 concentration of 0.027 ppm was most recently recorded in 2011. This is well below the AQ EPP goal of 0.12 ppm for a one-hour average. No exceedances of the one-hour NO_2 concentration have been recorded historically.

Table 6-2 Annual average and 90th percentile one-hour NO_2 concentrations from Table 30 of the Queensland air monitoring 2016 NEPM report.

Year	Data Availability (% of days)	No. of Exceedances (days)	Annual Average (ppm)	90th Percentile (ppm)
2004	59.0	0	-	0.027
2005	100.0	0	0.005	0.024
2006	98.6	0	0.006	0.022
2007	99.2	0	0.004	0.020
2008	100.0	0	0.006	0.023
2009	97.0	0	0.005	0.023
2010	99.5	0	0.005	0.020
2011	98.9	0	0.006	0.027
2012	99.5	0	0.005	0.022
2013	98.9	0	0.004	0.018
2014	99.7	0	0.004	0.020
2015	97.8	0	0.004	0.021
2016	8.5	0	-	0.015

Note: '-' indicates insufficient data to calculate value.
Years listed in italics have less than 75% data coverage

Table 6-3 details annual average and 90th percentiles of one-hour SO_2 concentrations. This information has been taken directly from the 2016 Queensland NEPM report (Table 51). The maximum 90th percentile SO_2 concentration measured between 2005 and 2016 of 0.004 ppm was recorded in 2016, which was well below the EPP objective of 0.20 ppm for a one-hour average. No exceedances of the one-hour SO_2 concentration have been recorded at this location historically.

Table 6-3 Annual average and 90th percentile one-hour SO_2 concentrations from Table 51 of the Queensland air monitoring 2016 NEPM report

Year	Data Availability (% of days)	No. of Exceedances (days)	Annual Average (ppm)	90th Percentile (ppm)
2005	18.6	0	-	0.002
2006	98.6	0	<0.001	0.002
2007	98.1	0	0.001	0.003
2008	100.0	0	<0.001	0.002
2009	97.0	0	<0.001	0.002
2010	90.1	0	<0.001	0.002
2011	94.2	0	0.001	0.005
2012	99.5	0	0.001	0.003

Year	Data Availability (% of days)	No. of Exceedances (days)	Annual Average (ppm)	90th Percentile (ppm)
2013	94.8	0	<0.001	0.002
2014	99.7	0	0.001	0.002
2015	99.5	0	0.001	0.003
2016	16.1	0	-	0.004

Note: '-' indicates insufficient data to calculate value.

Years listed in italics have less than 75% data coverage

Annual average and 90th percentiles of 24-hour PM_{10} concentrations are detailed in Table 6-4 (Queensland NEPM 2016, Table 64). The maximum 90th percentile PM_{10} concentration measured between 2005 and 2016 of 24.1 µg/m^3 (discounting 2016 average due to insufficient data coverage) was recorded in 2015. Although this concentration is below the goal of 50.0 µg/m^3 for a 24-hour period it does suggest particulate matter levels in the area can be somewhat elevated. Multiple exceedances of the 24-hour PM_{10} 24-hour goal have been recorded historically (2005, 2006, 2008, 2009 and 2011).

Table 6-4 Annual average and 90th percentile 24-hour PM_{10}concentrations from Table 64 of the Queensland air monitoring 2016 NEPM report

Year	Data Availability (% of days)	No. of Exceedances (days)	Annual Average (µg/m^3)	90th Percentile (µg/m^3)
2004	52.2	0	-	21.4
2005	91.8	5	16.1	20.5
2006	89.6	2	14.6	20.1
2007	94.0	0	12.9	18.3
2008	97.0	1	16.4	23.9
2009	93.4	9	21.2	23.6
2010	80.3	0	13.9	19.4
2011	93.7	1	15.4	22.3
2012	92.1	0	12.9	18.8
2013	95.1	0	15.1	22.5
2014	98.4	0	15.1	20.6
2015	91.2	0	17.6	24.1
2016	11.7	0	-	24.5

Note: '-' indicates insufficient data to calculate value.

Years listed in italics have less than 75% data coverage

Historical data presented indicates that the general air quality in the Townsville area is consistent and of relatively good quality. Townsville is a developed city, and is the largest population centre in the central North Queensland region. As discussed in Chapter 13 Land Use, land-use within the Project area is primarily characterised as rural pastoral, with only three small population centres in the vicinity. As the Project area lacks large populations and special industry, Townsville should be considered to be a very conservative estimation of the existing Project area air environment.

6.2.1 Local emission sources

The National Pollutant Inventory (NPI), regulated by the Australian Government is tracking pollution across Australia, and ensuring that the community has access to information about the emission and transfer of toxic substances which may affect them locally. All major polluters are required by the Australian Government to submit annual reports of their emissions to air. The NPI has emission estimates for 93 toxic substances and the source and location of these emissions. These substances have been identified as important due to their possible effect on human health and the environment. The data comes from facilities like mines, power stations and factories, as well as other sources.

An NPI search conducted for the Project area and surrounding North Queensland region shows the only facilities listed are located in the immediate Ingham and Townsville areas. The facility closest to the Draft Alignment is the Victoria Wilmar Sugar Mill located approximately 45 km north east. At this distance it is unlikely emissions from the facility will influence the Project area.

Information provided by Powerlink Queensland indicates that some third party construction activities are currently occurring in the township of Kidston. Construction activities are likely to generate dust-related emissions, and these may impact the air quality locally. It is likely that mitigation practices are in place and therefore emissions from this source are considered negligible.

In summary, no significant emission sources are present in the Project area.

6.2.2 Sensitive receptors

A sensitive receptor is defined as a location that may be sensitive to impacts from the Project, such as residences, commercial or industrial facilities where people are present for an extended period of time. At *air quality* sensitive receptors, designated air quality goals must be met.

The location of the sensitive receptors in relation to the Project area has been mapped (Figure 3-2, Chapter 3 Project Description).

6.3 Potential Impacts

6.3.1 Potential to impact local air quality

6.3.1.1 Construction phase

The construction phase of the Project is likely to include activities that have the potential to impact the local air quality, and are listed below.

- Site preparation including vegetation clearing, topsoil stripping, chipping/mulching and ground surface levelling.
- Transmission structure and substation foundation excavation and installation.
- Stockpiling of excavated soil.
- Wind erosion from stockpiles.
- Vehicle and equipment movements over access tracks and work sites where ground is exposed.
- Exhaust emissions from vehicle and machinery operations.

Vegetation clearing will occur to establish substation locations, the 60 m wide transmission line easement and new access tracks. Construction will be conducted in a staged approach with the minimum area of disturbed ground exposed at any one time. In pastoral areas where no vegetation restricts the construction activities, localised air impacts are anticipated to be negligible. Where the alignment approaches sensitive receptors, possible air quality impacts especially from dust should be assessed to ensure mitigation of nuisance or human health impacts.

Combustion based pollutants (SO_2, NOx, etc.) have not been considered further in this assessment due to their small quantities in the existing air shed (Section 6.2), the lack of potential sources, and the overall characteristics of the area (generally low traffic volume and density, low population density, low density of industry sources and rural location).

6.3.1.1.1 Dust impact assessment

A semi-quantitative risk assessment of potential dust impacts on surrounding sensitive receptors was undertaken for the construction phase of the Project. The assessment was based on the methodology described in the UK Institute of Air Quality Management (IAQM) document, *Guidance on the assessment of dust from demolition and construction* (IAQM, 2014). The risk of dust soiling and human health impacts due to particulate matter (PM_{10}) on surrounding areas were determined based on the scale of activities and proximity to sensitive receptors. The IAQM method uses a four-step process to assess dust impacts:

- Step 1: Screening based on distance to nearest sensitive receptors
- Step 2: Assess risk of dust impacts from activities based on:
  - Scale and nature of the works, which determines the potential dust emission magnitude
  - Sensitivity of the area
- Step 3: Determine site-specific mitigation for dust-emitting activities
- Step 4: Reassess risk of dust impacts after mitigation has been considered.

6.3.1.1.2 Step 1 – screening assessment

The IAQM method recommends further assessment of dust impacts for construction activities where sensitive receptors are located closer than:

- 350 m from the boundary of the site
- 50 m from the route used by construction vehicles on public roads more than 500 m from the site entrance.

The number of sensitive receptors within the broader region is 231. Their respective distances from the Draft alignment are in Table 6-5 below.

Table 6-5 Number of receptors at specified distances from the Draft alignment.

Distance from Draft Alignment (m)	Number of Sensitive receptors
<20	0
21 – 50	0
51 – 100	1
101 – 350	0
350+	230

6.3.1.1.3 Step 2A – dust emission magnitude

Dust emission magnitudes are estimated according to the scale of works being undertaken and other considerations such as meteorology, types of material being used, or general construction and demolition methodology. The IAQM guidance provides examples to aid classification, as presented in the following excerpt from IAQM:

> *The dust emission magnitude is based on the scale of the anticipated works and should be classified as Small, Medium, or Large. The following are examples of how the potential dust emission magnitude for different activities can be defined. Note that, in each case, not all the criteria need to be met, and that other criteria may be used if justified in the assessment:*

Earthworks: Earthworks will primarily involve excavating material, haulage, tipping and stockpiling. This may also involve levelling the site and landscaping. Example definitions for earthworks are:

- Large: Total site area >10,000 m^2, potentially dusty soil type (e.g. clay, which will be prone to suspension when dry due to small particle size), >10 heavy earth moving vehicles active at any one time, formation of bunds >8 m in height, total material moved >100,000 tonnes.
- Medium: Total site area 2,500 m^2 – 10,000 m^2, moderately dusty soil type (e.g. silt), 5-10 heavy earth moving vehicles active at any one time, formation of bunds 4 m - 8 m in height, total material moved 20,000 tonnes – 100,000 tonnes.
- Small: Total site area <2,000 m^2 – soil type with large grain size, e.g. sand, <5 heavy earth moving vehicles at one time, formation of bunds <4 m in height, total material moved <20,000 tonnes, earthworks during wetter months.

Construction: The key issues when determining the potential dust emission magnitude during the construction phase include the size of the building(s)/infrastructure, method of construction, construction materials, and duration of build. Example definitions for construction are:

- Large: Total building volume >100, 000 m^3, on site concrete batching, sandblasting.
- Medium: Total building volume 25,000 m^3 – 100,000 m^3, potentially dusty construction material (e.g. concrete), on site concrete batching.
- Small: Total building volume <25,000 m^3, construction material with low potential for dust release (e.g. metal cladding or timber).

Trackout: Factors which determine the dust emission magnitude are vehicle size, vehicle speed, vehicle numbers, geology and duration. As with all other potential sources, professional judgement must be applied when classifying trackout into one of the dust emission magnitude categories. Example definitions for trackout are:

- Large: >50 truck (>3.5 t) outward movements in any one day, potentially dusty surface material (e.g. high clay content), unpaved road length 50 m – 100 m.
- Medium: 10-50 truck (>3.5 t) outward movements in any one day, moderately dusty surface material (e.g. high clay content), unpaved road length 50 m – 100 m.
- Small: <10 truck (>3.5 t) outward movements in any one day, surface material with low potential for dust release, unpaved road length <50 m.

Potential dust emission magnitudes for the Project were estimated based on the IAQM examples listed above. Justification and the factors used in determining the magnitudes are presented in Table 6-6 . All construction work associated with the Project will occur in a work day generally no longer than 12-hours. As with vegetation clearing, construction is expected to be conducted in a staged approach to limit area of exposed disturbed ground. However, depending on project time constraints multiple work fronts may be present at any one time along the Draft Alignment.

Table 6-6 Dust emission magnitudes in accordance with IAQM guidance

Activity	Potential Dust Emission Magnitude	Justification
Demolition	Nil	• No known buildings to be demolished.
Earthworks	Medium	• Vegetation clearing for transmission line easement and access tracks will occur where necessary to maintain safe electrical clearances – quantities yet to be established however will be limited to the 60 m wide easement and track locations. • Vegetation clearing for both substation buffers (50 m). • Excavation of up to 33,000 t[1] for transmission structure footings and foundation. Excavation is assumed to also be staged. • Earthworks and installation of earthing mat across substation sites. Surface area for both substations (excluding buffer of 50 m) is 63,000 m^2 equalling potential disturbance of up to 56,700 t[1] of soil. • Multiple work sites at any one time along the Draft Alignment. • Earthworks material likely to be dusty especially during dry season. • Soil types along corridor/substation locations to be confirmed.
Construction	Medium	• Construction of approximately 351 transmission structures and up to two substations. • Construction of five temporary construction camps and site office. • Multiple work sites at any one time along the Draft Alignment. • Onsite concrete batching for transmission structure foundations likely to occur due to isolated rural site locations (concrete high dust risk material). • Structural steel material presents a low dust risk. • Multiple materials for substation construction (metal frames, electrical equipment) but overall low potential for dust. • Local concrete batching locations also likely due to rural site locations (concrete high dust risk material).
Trackout	High	• Traffic throughout construction estimated to be up to 216 light vehicle and 116 heavy vehicle movements' daily[2]. • After construction, access tracks are expected to only be used for maintenance activities a few times per year. • Length of unpaved road unknown until design finalised but will be >100 m due to the size of the Project.

[1]: Excavation volumes are conservative estimations calculated using preliminary construction details. Cut and fill volumes are site-dependent and likely to change during the detailed design phase of the Project.

[2]: See Chapter 18 –Transport and Traffic.

6.3.1.1.4 Step 2B – sensitivity of surrounding area

The IAQM methodology allows the sensitivity of an area to dust soiling, human health impacts due to PM_{10}, and ecological effects to be classified as high, medium, or low. The classifications are determined according to matrix tables provided in the IAQM guidance document. Individual matrix tables for dust soiling and human health impacts are provided. Factors used in the matrix tables to determine the sensitivity of the surrounding area are described as follows.

- Receptor sensitivity (for individual receptors in the area):
  - high sensitivity – locations where members of the public are likely to be exposed for eight hours or more in a day. For example private residences, hospitals, schools, or aged care homes
  - medium sensitivity - places of work where exposure is likely to be eight hours or more in a day
  - low sensitivity – locations where exposure is transient – i.e. one or two hours maximum. For example parks, footpaths, shopping streets, playing fields.
- Ambient annual mean PM_{10} concentrations (only applicable to the human health impact matrix).
- Number of receptors in the area.
- Proximity of receptors to dust sources.

According to the IAQM guidance listed above, the overall sensitivity of the Project area to both dust soiling and human health impacts is classified as low. The justification for this classification is provided in Table 6-7.

Table 6-7 Sensitivity of the area in accordance with IAQM guidance

Potential Impact	Sensitivity of the Area	Justification
Dust Soiling	Low	A single receptor identified within 350 m of the Draft Alignment (see Section 6.2.2).
Human Health (PM_{10})	Low	A single receptor identified within 350 m of the Draft Alignment (see Section 6.2.2). Background PM_{10} concentration of 21.1 µg/m^3 for the area below criteria value indicated in IAQM (see Section 6.2).

6.3.1.1.5 Step 2C – unmitigated risks of impacts

The dust emission magnitudes for each activity (demolition, earthworks, construction, trackout) were combined with the sensitivity of the area in Table 6-7 to determine the risk of construction dust air quality impacts, with no mitigation applied. The risk of impacts for each activity is assessed according to the IAQM risk matrix methodology. An example of the IAQM earthworks risk matrix is provided in Table 6-8. The 'without-mitigation' dust risk impacts for each activity are summarised in Table 6-9.

Table 6-8 Dust emission risk matrix from IAQM

Sensitivity of Area	Dust Emission Magnitude		
	Large	Medium	Small
High	High Risk	Medium Risk	Low Risk
Medium	Medium Risk	Medium Risk	Low Risk
Low	Low Risk	Low Risk	Negligible

Table 6-9 Risk of dust impacts on sensitive receptors without mitigation

Potential Impact	Risk of Dust Impacts on Sensitive Receptors – Without Mitigation			
	Demolition	Earthworks	Construction	Trackout
Dust Soiling	Negligible	Low	Low	Low
Human Health (PM_{10})	Negligible	Low	Low	Low

The result of the qualitative air quality risk assessment shows that the unmitigated air emissions from the construction phase of the Project pose a low risk of dust soiling and human health impacts. On a ”per work site” basis, emissions associated with construction activities are expected to be localised to the immediate area and only present for a short period of time. Historical average annual PM_{10} concentrations for the region vary from 12.9 to 21.2 µg/m^3 (Section 6.2), indicating that the regional air shed should have capacity to accept and dissipate Project particulate matter emissions.

Nonetheless, active management of dust emissions during the construction phase is recommended to ensure project goals are met. Mitigation measures for potential emissions are detailed in Section 6.4.

6.3.1.2 Operation and maintenance phase

Potential air quality impacts associated with the operation and maintenance of the Project are also anticipated to be low to negligible. The activities associated with the operational phase that have potential to create emissions are mostly related to the maintenance of transmission lines, and are as follows.

- Vegetation management and control of regrowth in easements to maintain safe electrical clearances.
- Access track maintenance by earth moving machinery.
- Movement of maintenance vehicles and machinery over access tracks.
- Exhaust emissions associated with the operation of maintenance vehicles and machinery.

Inspections and maintenance should require only a small workforce with a set number of vehicles and pieces of equipment. Events are likely to occur at a pre-determined frequency (1-2 events per year), and on a strict as-needed basis (for example, after extreme weather events) to inspect or rectify damage. Potential air quality impacts associated with these activities (as per construction) are likely to be localised to the work area and only present for a short period of time.

Dust mitigation methods (Section 6.4.1) should be utilised whenever possible to minimise local impacts, especially during dry periods. To minimise potential exhaust emissions, all equipment used should be well maintained and fit for purpose.

6.3.1.3 Decommissioning phase

Transmission line infrastructure generally has a design life of approximately 50 years. After this period it is possible that the infrastructure may be decommissioned. The following decommissioning activities have the potential to impact the local air quality.

- Vegetation clearing where required for access to structures.
- Vehicle and plant movement over the easement and access tracks.
- Exhaust emissions associated with vehicle and machinery operation during works.
- Ground disturbance for the facilitation of rehabilitation of easement and transmission structure locations.

As with the construction phase of the Project, decommissioning works are expected to occur in a staged approach to minimise amount of disturbed ground at any one time. If this occurs, potential impacts to air quality are expected to be localised to work-sites and short-term. The magnitude of

potential impacts should not exceed those associated with the construction phase, assuming the size of the workforce and decommissioning fleet is not larger.

The recommended mitigation measures described below in Section 6.4 should be implemented during decommissioning to minimise any potential air quality impacts.

6.4 Mitigation and Management Measures

The following proposed mitigation measures align with Powerlink's Standard Environmental Controls Specification (Appendix I Environmental Management Plans).

6.4.1 Dust and particulate matter

Recommended mitigation measures include the following.

- Orientating material stockpiles in a direction that reduces exposed surfaces to prevailing winds.
- Watering of stockpiles to maintain a moisture content that minimises dust generation or alternatively temporarily cover stockpiles.
- Adequately store all bulk materials, and cover vehicles transporting materials to and from site.
- Restrict vehicle movements to within designated access tracks, and enforce speed limits (<40 km/h) where track is unsealed.
- Limit dust-producing work on windy days when possible or water down of dusty work sites to minimise dust generation.
- Limit work on days with high levels of bushfire smoke in the air and if wind is blowing towards receptors.
- Watering unsealed haul roads.
- Ensure chipping/mulching equipment has dust collection devices attached.
- Avoid burning cleared vegetation whenever possible. If burning obtain relevant approvals prior.
- Disturbed areas and bare earth should be stabilised or revegetated as soon as practical to minimise wind-blown dust.

6.4.2 Vehicle and machinery emissions

Recommended mitigation measures include the following.

- Ensure stationary plant, construction vehicles and equipment (especially those powered by diesel motors) is working correctly and maintained as per manufacturers recommendations (this will also aid in the mitigation of potential odour emissions).
- Shut down plant and equipment idling for excessive periods (i.e. longer than 5 minutes) where possible.
- Avoiding or minimising queuing in roadways approaching the worksites or adjacent to other sensitive activities.
- Minimise queuing of construction vehicles and idling for excessive periods (e.g. more than 5 minutes).