# AIR QUALITY

CHAPTER TWENTY-TWO

# 22 Air quality

**This chapter provides an assessment of the potential impact on air quality as a result of the project and identifies mitigation measures to address these impacts.**

## 22.1 Secretary's environmental assessment requirements

There are no Secretary's environmental assessment requirements that relate specifically to this chapter.

## 22.2 Assessment methodology

A qualitative air quality impact assessment was carried out and involved:

- A desktop review of the background air quality environment based on 2013 and 2014 data sourced from NSW Office of Environment and Heritage air quality monitoring stations at Lindfield, Rozelle, Randwick and Earlwood (the closest stations to the project)
- A desktop review of long term meteorological conditions (including prevailing wind and temperature trends) based on data sourced from Bureau of Meteorology monitoring stations at Sydney Observatory Hill, Sydney Harbour Wedding Cake West, Riverview Observatory and Sydney Airport
- A desktop review of Commonwealth Department of the Environment's National Pollutant Inventory data to identify any projects or facilities that may be contributing to local air quality conditions
- The identification of air quality sensitive receivers with the potential to be adversely affected by the project
- A review of construction and operational aspects of the project with the potential to generate air pollutant emissions (including dust and exhaust emissions)
- A qualitative assessment of potential air quality impacts at surrounding sensitive receivers. This assessment was undertaken by comparing the locations of construction and operational air pollutant emission sources and nearby receivers with prevailing weather and ambient air quality conditions
- The identification of mitigation measures to address potential air quality impacts.

## 22.3 Existing environment

Ambient air quality throughout the Sydney Basin is influenced by a number of factors, including topography, prevailing meteorological conditions (such as wind and temperature, which vary seasonally) and local and regional air pollution sources (such as motor vehicles, industrial facilities and bushfires). Consequently, regional air quality can be highly variable and impacted by events occurring a significant distance away. Local emission sources, the existing air quality environment, and sensitive receivers are described below.

### 22.3.1 Local emission sources

A search of the Commonwealth Department of the Environment's National Pollutant Inventory (2015) and a desktop review of land uses surrounding the project area identified a number of air pollution sources close to the project which are likely to influence local air quality. These sources include:

- Industrial facilities at Lane Cove, Artarmon, St Leonards, North Sydney, Greenwich, Alexandria, Camperdown, Sydenham, Marrickville and Mascot that reported air emissions (under the National Pollutant Inventory reporting program) during the 2013–2014 reporting period. These facilities include:
  - basic ferrous and other fabricated metal product manufacturing (at Artarmon and Alexandria)
  - waste treatment, disposal and remediation services (at Artarmon and North Sydney)
  - hospitals (at St Leonards)
  - mineral, metal and chemical wholesaling (at Greenwich and Mascot)
  - airport operations and other air transport support services (at Mascot)
- Vehicle exhaust emissions from the road and rail networks and shipping activities in Sydney Harbour
- Commercial businesses, such as service stations and smash repairs
- Domestic activities, such as wood-fired home heaters and lawn mowing
- Other construction projects.

### 22.3.2 Background air quality

Air quality data sourced from monitoring stations at Lindfield, Rozelle, Randwick and Earlwood are summarised in Table 22-1. The data shows that the concentrations of air pollutants were generally below the applicable air quality criteria during the 2012, 2013 and 2014 reporting periods, with the exception of occasional days when the maximum 24-hour average concentration levels of particulate matter with an aerodynamic diameter less than 10 microns ($PM_{10}$) exceeded the applicable criterion of 50 micrograms per cubic metre. These occurrences are generally the result of natural events including dust storms, bushfires and sea spray arising from on-shore winds.

The NSW Office of Environment and Heritage uses a standardised measurement known as the air quality index to characterise air quality at a location and compare it in relative terms with other locations throughout NSW. The average daily air quality index values for Central and Eastern Sydney in 2012, 2013 and 2014 were 53, 60 and 52 respectively. These values correspond with an air quality index outcome of 'good', indicating that air quality around Central and Eastern Sydney is generally of an acceptable quality.

**Table 22-1 Background air quality data**

| Pollutant | Averaging period | Criteria[1] | Lindfield | | | Rozelle | | | Randwick | | | Earlwood | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 2012 | 2013 | 2014 | 2012 | 2013 | 2014 | 2012 | 2013 | 2014 | 2012 | 2013 | 2014 |
| PM10 (µg/m³) | Maximum 24-hour | 50 | 35 | 63 | 38 | 41 | 59 | 44 | 44 | 55 | 46 | 44 | 63 | 45 |
| | 95th percentile 24-hour | 50 | 24 | 26 | 25 | 29 | 34 | 30 | 31 | 34 | 32 | 34 | 35 | 30 |
| | Annual | 30 | 14 | 14 | 14 | 17 | 18 | 18 | 18 | 19 | 18 | 20 | 20 | 18 |
| CO (µg/m³) | Maximum 1-hour | 30 | – | – | – | 0.3 (average) 1.6 (100th %-ile) | | | – | – | – | – | – | – |
| $NO_2$ (µg/m³) | Maximum 1-hour | 246 | 43.1 (100th %-ile) | | | 57.5 (100th %-ile) | | | 45.2 (100th %-ile) | | | 49.3 (100th %-ile) | | |
| | Annual | 62 | 16.4 | 15.2 | 15.0 | 22.0 | 21.4 | 20.1 | 11.9 | 12.3 | 11.1 | 16.4 | 18.4 | 15.7 |
| $SO_2$ (µg/m³) | Maximum 1-hour | 570 | 11.4 (100th %-ile) | | | – | – | – | 14.3 (100th %-ile) | | | – | – | – |
| | Annual | 60 | 1.5 | 1.4 | 1.1 | – | – | – | 3.4 | 2.4 | 2.5 | – | – | – |

1 *Criteria sourced from the Approved Methods for Modelling and Assessment of Air Pollutants in NSW (Department of Environment and Conservation, 2005b).*

### 22.3.3 Sensitive receivers

The project would traverse a well-established urban environment that contains a wide range of sensitive receivers including residential properties, community facilities (such as schools, childcare centres, places of worship and medical facilities), recreational areas and commercial and retail premises. A number of these receivers are located immediately adjacent to the construction site boundaries of the proposed metro stations.

A detailed description of the existing land use patterns and sensitive receivers surrounding the project is provided in Chapter 12 (Land use and property) and Chapter 19 (Social impacts and community infrastructure) and summarised in Table 22-2.

Table 22-2 Summary of sensitive receivers

| Location | Surrounding land use and sensitive receivers |
|---|---|
| **Chatswood dive site (northern)** | Set adjacent to the T1 North Shore Line in Chatswood, medium density residential dwellings are located to the north and south of the site, with low density housing located to the east. Commercial and industrial premises are located immediately to the south and west of the site.<br>The nearest sensitive receivers are the residential receivers set immediately to the north along Nelson Street and the residents east of the work area, on the opposite side of the rail corridor along Orchard Road. |
| **Artarmon substation** | The site is surrounded on the northern and eastern sides by residential land uses. The Gore Hill Freeway runs along the south-west boundary of the site. |
| **Crows Nest Station** | The Crows Nest station site is to be located adjacent to the Pacific Highway within the commercial district at Crows Nest. This location is bordered to the north by a commercial district and mixed use commercial and residential premises. |
| **Victoria Cross Station** | The Victoria Cross station construction sites are located along Miller Street around the intersections with McLaren Street, and between Berry and Mounts streets. These areas are surrounded by commercial and retail land uses with some interspersed residential uses. The Monte Sant' Angelo Mercy College is located between the two construction sites, along Miller Street. The nearest single dwelling residential receivers are set along McLaren Street, immediately west of the Victoria Cross station north construction site. |
| **Blues Point temporary site** | The Blues Point temporary site would be located within the Blues Point Reserve at the end of Blues Point Road. The multi-storey residential building Blues Point Tower is set just to the west of the site with other residential premises around 50 to 150 metres away along Warung Street. One residential receiver is also present adjacent to the site to the east. |
| **Barangaroo Station** | The site would be located within the road reserve of Hickson Road and the adjacent Barangaroo development area. The nearest residential premises are located immediately to the east along High Street and High Lane, and to the north along Argyle Place. |
| **Martin Place Station** | Both sites are currently occupied by commercial and residential mixed use buildings. Both areas are surrounded by mixed use commercial and retail users, including residential. The Sydney Eye Hospital is also located around 150 metres to the east of the site. |
| **Pitt Street Station** | The Pitt Street Station construction sites would be located on the corner of Pitt, Park and Castlereagh streets; and around the corner of Pitt and Bathurst streets. Both areas are surrounded by a mixture of commercial, residential, retail and educational land uses. Several hotels and short-term accommodation premises are also located nearby. |
| **Central Station** | The Central Station construction site would be located primarily within the operational area of the station. The site is located in close proximity to commercial and residential mixed use areas. Several educational institutes are located to the east, with the University of Technology Sydney also located around 500 metres to the west. Many multi-story hotels and apartment buildings are located to the east of the site along George, Little Regent and Quay Streets. |
| **Waterloo Station** | Set at a block bounded by Raglan Street, Cope Street, Wellington Street and Botany Road, the site is surrounded in all directions by lands zoned for 'Mixed Use' and 'General Residential' uses. The nearest residential premises are located to the south along Wellington Street and the east along Cope Street. |
| **Marrickville dive site (southern)** | Located adjacent to the T3 Bankstown Line in the Marrickville industrial area, the site is mostly surrounded by industrial uses. Camdenville Park is located to the east, with the nearest residential receivers located around 150 metres away to the south east along Unwins Bridge Road and to the north on Lord and Darley streets. |

## 22.4 Potential impacts – construction

During construction, local air quality may be temporarily affected by particulate (dust) and exhaust emissions. These impacts are described in the following sections.

### 22.4.1 Dust (including asbestos fibres and other hazardous materials)

The main potential air quality impacts during construction would be associated with the generation of dust, which would include pollutants such as total suspended particulates (TSP) and particulate matter with an aerodynamic diameter less than 10 microns ($PM_{10}$) and less than 2.5 microns ($PM_{2.5}$).

Owing to the urban setting, there is also potential for dust emissions to contain:

- Contaminants mobilised through the disturbance of contaminated soils
- Other hazardous materials, such as asbestos fibres and hazardous biological material (for example bird droppings) mobilised through the demolition of buildings and other structures. These issues are discussed in Chapter 18 (Soils, contamination and water quality).

Construction activities with the greatest potential to generate dust would include:

- Excavation, handling, stockpiling, loading and unloading, and transport of spoil
- Demolition of buildings and other structures, and the handling, stockpiling and transport of demolition material
- Transport, loading and unloading, stockpiling and handling of imported construction materials such as imported fill
- Creation of exposed surfaces through the clearing of vegetation, stripping of topsoil and other overlying structures (such as road and footpath pavements), which would increase the potential generation of dust emissions by wind erosion
- Concrete batching and pre-cast concreting activities.

Without the implementation of adequate mitigation measures, dust emissions from the above activities could result in reduced local air quality and dust deposition at the nearest potentially affected receivers due to the small distance between these receivers and the construction sites.

The volume of dust generated during a typical work day would vary depending on the types of activities occurring at each construction site and prevailing weather conditions (for example, dry windy conditions increase the potential for wind erosion) and the controls that are implemented to reduce these emissions.

Sensitive receivers with the greatest potential to be adversely affected by dust at each construction site (due to the location of sensitive receivers, magnitude of dust-generating activities and prevailing meteorological conditions) are outlined in Table 22-3.

Table 22-3 Potential construction dust impacts on nearby sensitive receivers

| Site | Potential dust impacts on nearby sensitive receivers |
|---|---|
| **Chatswood dive site (northern)** | Nearby residential receivers located east of the site would be most susceptible to dust emissions during mornings when winds typically blow from the west. During afternoons, commercial and industrial receivers to the south of the site would have the most potential to be impacted by dust emissions. Occasional southerlies present dust emission risks for the nearest residential receivers immediately north of the site along Nelson Street. |
| **Artarmon substation** | Winds predominantly shift clockwise from the southeast to the southwest and present the greatest dust emission risks to the residential receivers immediately adjacent to the site. |
| **Crows Nest Station** | This site is surrounded in all directions by residential or mixed use residential land users. Dust emission risks would be greatest at residential receivers east of the Pacific Highway during mornings and residential receivers west of the Pacific Highway during afternoons. |
| **Victoria Cross Station** | Potential dust impacts may arise if wind-dispersible material is handled at the site when strong winds are blowing from the east and southeast, which are common during afternoons. |
| **Blues Point temporary site** | Residential receivers are located to the west, north and east of the site. The most common winds are from the east in the afternoons (which could result in dust impact to Blues Point Tower located to the west) and the west in the mornings (which could result in dust impact to the single residential receiver located to the east). |
| **Barangaroo Station** | Residential receivers located to the east of the site along High Street and High Lane are most likely to be affected during mornings when westerlies are prevalent, but also occasionally during afternoons when strong westerlies can occur (greater than 40 kilometres per hour). Receivers to the north of the site off Argyle Place may be affected during occasional southerlies.<br>In addition, there is some potential that contaminated materials may be encountered during excavations, which would lead to potential odour impacts and require specific mitigation measures. |
| **Martin Place Station** | This site is closely bordered by commercial and retail premises. Morning winds blowing from the west present the greatest risk, considering the location of the Sydney Eye Hospital located around 150 metres to the east of the site. |
| **Pitt Street Station** | During handling and management of spoil, dust impacts could arise under any wind conditions owing to the proximity of receivers around the construction site. |
| **Central Station** | This site is surrounded by a variety of different receivers and may be sensitive to all wind conditions. Morning winds from the west may blow dust towards receivers along Chalmers Street and Elizabeth Street. The multi-story accommodation at Railway Square has the greatest risk of being affected during afternoons. |
| **Waterloo Station** | This site is surrounded by residential dwellings. As such, winds from any direction would present a risk during construction. Owing to the prevalence of westerlies in the morning and easterlies in the afternoon, the nearest receivers along Cope Street and Botany Road are expected to be most susceptible during construction. |
| **Marrickville dive site (southern)** | A range of works with a high potential to generate dust would be carried out at this site including tunnel boring machine launch and support, spoil handling, storage and removal activities, and concrete batching and pre-cast manufacture. At this site, light winds from the northwest during the morning pose the highest risk to impact on the residential receivers located to the southeast of the site along Unwins Bridge Road. |

Overall, dust emissions would be comparable to other similar infrastructure projects and the risk of dust impacting on receivers would be readily manageable through standard mitigation measures, such as wetting stockpiles and exposed surfaces and minimising dust-generating works during adverse weather conditions.

The risk of mobilising hazardous materials (including contaminants, asbestos fibres and biological material) would be adequately managed through standard air quality management planning as detailed in Table 22-4.

### 22.4.2 Exhaust emissions

Exhaust emissions during construction would generally be restricted to minor localised emissions of carbon monoxide, oxides of nitrogen, sulfur dioxide and volatile organic compounds. These pollutants would be generated during the combustion of fuel in construction plant, machinery and equipment, as well as from the handling and / or on-site storage of fuel and other chemicals.

The tunnel boring machines used to excavate the tunnels would use electric power and therefore would not create local exhaust emissions. However, at some of the station construction sites, roadheaders may be powered by generators instead of providing a mains power connection, or for a period of time prior to the mains power supply becoming available. This would result in local exhaust emissions.

Minor emissions of carbon monoxide, oxides of nitrogen, sulfur dioxide and volatile organic compounds would not significantly affect local air quality at the nearest sensitive receivers and would be adequately managed with standard mitigation measures.

## 22.5 Potential impacts – operation

### 22.5.1 Local impacts

As the project would be powered by electricity, local emissions generated during operation are expected to be minimal and highly dispersed.

The project would include a ventilation system to circulate fresh air through the tunnels and underground stations and prevent the build-up of heat. Fresh air would be drawn into the tunnels and air would be extracted from the tunnels through the portals by the piston effect of the trains, and by mechanical ventilation at the stations. Air would be discharged from the tunnel portals and through ventilation outlets integrated into each station.

The stations would also provide separate fresh air ventilation systems to draw fresh air in and extract air from the station environment. Air discharged from the tunnels and stations would be well diluted and dispersed into the outdoor air.

Minor quantities of particulate matter ($PM_{10}$) emissions would be generated in the tunnels, mainly due to wear of the train brake pads, vaporisation of metals due to sparking, wear of steel due to friction between wheels and rail, and recirculation of particulates from tunnel walls. Most of these emissions would be vented through the fresh air ventilation system in very low concentrations.

Vented air is also likely to comprise minor concentrations of carbon dioxide, volatile organic compounds and oxides of nitrogen as well as ash and soot particulates generated during maintenance. The ventilation outlet air would contain small quantities of particulates at low concentrations due to the large volumes of exhaust air. Given the low concentrations of particulates, it is very unlikely that the project would have air quality impacts on the surrounding environment, including sensitive receivers.

The fresh air ventilation system would also respond to emergency conditions such as fire incidents where smoke-laden air would be discharged through the emergency ventilation system to prevent smoke entering stations or recirculating through ventilation shafts or tunnel portals. The design and location of the fresh air ventilation shafts at stations would ensure sensitive receivers were not unnecessarily affected; suitable emergency plans would be in place for these circumstances.

Although air quality may be impacted at the source of power generation, the overall impact from increased power generation to run the trains is expected to be minor. An assessment of greenhouse gas emissions anticipated to be generated during the operation of the project (due to power generation) is provided in Chapter 25 (Sustainability).

### 22.5.2 Regional impacts

The project is expected to benefit regional air quality by delivering an attractive alternative mode of public transport, which could result in a mode shift from road to rail. This has the potential to reduce air pollution emissions from road transport and congestion within the Global Economic Corridor (when compared to the emissions that would otherwise occur if the project were not delivered).

## 22.6 Mitigation measures

The mitigation measures that would be implemented to address potential air quality impacts are listed in Table 22-4.

**Table 22-4 Mitigation measures – air quality**

| Ref | Mitigation measure | Applicable location(s)[1] |
|---|---|---|
| AQ1 | The engines of all on-site vehicles and plant would be switched off when not in use for an extended period. | All |
| AQ2 | Plant would be well maintained and serviced to minimise emissions. Emissions from plant would be considered as part of pre-acceptance checks. | All |
| AQ3 | Construction site layout and placement of plant would consider air quality impacts to nearby receivers. | All except metro rail tunnels |
| AQ4 | Hard surfaces would be installed on long term haul routes and regularly cleaned. | All except metro rail tunnels |
| AQ5 | Unsurfaced haul routes and work area would be regularly damped down in dry and windy conditions. | All except metro rail tunnels |
| AQ6 | All vehicles carrying loose or potentially dusty material to or from the site would be fully covered. | All except metro rail tunnels |
| AQ7 | Stockpiles would be managed to minimise dust generation. | All except metro rail tunnels |
| AQ8 | Demolition would be managed to minimise dust generation. | All except metro rail tunnels |

1 *STW: Surface track works; CDS: Chatswood dive site; AS: Artarmon substation; CN: Crows Nest Station; VC: Victoria Cross Station; BP: Blues Point temporary site; GI: Ground improvement works; BN: Barangaroo Station; MP: Martin Place Station; PS: Pitt Street Station; CS: Central Station; WS: Waterloo Station; MDS: Marrickville dive site; Metro rail tunnels: Metro rail tunnels not related to other sites (eg TBM works).*