# 17. Air quality

**Overview**

Construction of the Project (particularly the large scale earthworks and concrete batching) has the potential to generate dust which could have an adverse effect on air quality. This potential effect can be mitigated to an acceptable level through dust management measures.

Overall, the operation of the Project will have a positive effect on air quality. The results of the dispersion modelling indicate that cumulative $PM_{10}$,$NO_X$, CO and benzene concentrations from the operation of the Project are unlikely to exceed the relevant NES AQ and AAQG thresholds. There will be no material adverse effects on air quality arising from the Project's operation and hence, no mitigation is considered necessary.

## 17.1 Introduction

This chapter discusses the air quality effects arising from the construction and operation of the Project. Construction effects mainly relate to dust, whereas operational effects arise from vehicle emissions from road users. The information presented in this chapter is based on the assessment of air quality effects (**Technical Report 13**).

## 17.2 Existing air quality

In order to assess the air quality effects of the Project, information was gathered about the existing air quality in the Project area and about the location of potentially sensitive receptors.

Air quality is influenced by the prevailing meteorological conditions of an area, particularly wind speed and direction. There are no weather stations in the immediate Project area but nearby measurement stations in Tawa and Paraparaumu are considered to be generally indicative of wind conditions experienced within the Project area. Both sites show a prevalence of north to north-easterly winds. However, given the length of the Main Alignment and the variable terrain that it traverses, local winds flows are expected to vary throughout the route.

The Project area is within the Porirua and Kapiti Coast airsheds, as defined by GWRC. In terms of air quality within the Project area, vehicle emissions and domestic solid heating from residential areas are the biggest contributors to air contaminants, namely $PM_{10}$, $NO_2$, CO and benzene. Vehicle emissions in this area predominantly arise from SH1, SH58, Kenepuru Drive and suburban streets and contribute to background levels of $PM_{10}$, $NO_2$, CO and benzene. Contaminants arising from solid fuel heating at Paekakariki, Cannons Creek and other residential areas are also expected to be contributors of background levels of $PM_{10}$ and CO within the environment. Long term monitoring data is available for all the listed contaminants, except benzene. Benzene is not measured in the Wellington region. However, it is measured by the NZTA in Auckland adjacent to roads with much higher traffic count than SH1 in the Wellington region. As such, using data from Auckland will provide a conservative estimate for the Project area. Estimated worst-case contaminant levels for urban areas within the Project area are shown in Table 17.1.

**Table 17.1: Estimated worst- case background contaminant levels for air quality in urban settings in the Project area**

| Contaminant | Averaging period | Background concentration | NES AQ / AAQG threshold |
|---|---|---|---|
| $PM_{10}$ | 24-hour | 39 µg/m$^3$ | 50 µg/m$^3$ |
| | Annual | 16 µg/m$^3$ | 20 µg/m$^3$ |
| $NO_2$ | 1-hour | 45 µg/m$^3$ | 200 µg/m$^3$ |
| | 24-hour | 29 µg/m$^3$ | 100 µg/m$^3$ |
| $NO_x$ | 1-hour | 425 µg/m$^3$ | - |
| | 24-hour | 213 µg/m$^3$ | - |
| CO | 1-hour | 3.4 mg/m$^3$ | 30 mg/m$^3$ |
| | 8-hour | 3.1 mg/m$^3$ | 10 mg/m$^3$ |
| Benzene | Annual | 1.0 µg/m$^3$ | 3.6 µg/m$^3$ |

Background contaminant concentration levels in urban areas are all below the relevant NES AQ thresholds, indicating a high level of existing air quality. Air quality in rural settings (i.e. throughout most of the Project area) is likely to be considerably better than the worst-case levels estimated for the urban settings, as shown by the estimated levels for rural settings indicated in Table 17.2.

**Table 17.2: Estimated background contaminant levels for air quality in rural settings in the Project area**

| Contaminant | Averaging period | Background concentration | NES AQ threshold |
|---|---|---|---|
| $PM_{10}$ | 24-hour | 15 µg/m$^3$ | 50 µg/m$^3$ |
| $NO_2$ | 1-hour | 15 µg/m$^3$ | 200 µg/m$^3$ |
| CO | 8-hour | 0 mg/m$^3$ | 10 mg/m$^3$ |

The estimated background concentration levels in rural areas are also well below the NES AQ thresholds.

### 17.2.1 Sensitivity of the receiving environment

The sensitivity of the air quality receiving environment relates to the sensitivity of certain activities, and / or individuals, to reductions in air quality. Some activities are considered to be more sensitive to air quality effects. These are typically land uses which involve a cluster of sensitive individuals such as children, elderly persons and the infirm. Typical sensitive receptors include: residential areas, childcare and early learning facilities, schools and hospitals and residential care homes.

In general, the sensitivity of the receiving environment is considered to be low across most of the Project area, with most of the area being in pasture or forestry and being sparsely populated.

For assessment purposes, five key areas of potential increased sensitivity were identified and modelled:

- the proposed Kenepuru Drive intersection;
- existing SH1 at Linden;
- the proposed Warspite Avenue intersection;
- the proposed SH58 Interchange; and
- MacKays Crossing.

Details of individual receptors within these five areas are contained in **Appendix 13.C** of **Technical Report 13**.

## 17.3 Assessment of effects on air quality

Potential air quality effects can arise from both the construction and the operation of the Project. The potential effects from each phase are quite different and hence have been considered separately.

### 17.3.1 Construction of the Project

The following aspects of construction of the Project have the potential to cause adverse air quality effects:

- dust generated from earthworks and from rock crushing
- emissions from construction vehicles;
- odour generated during construction; and
- discharges to air from concrete batching.

Each of these potential effects is now discussed.

#### 17.3.1.1 Dust from earthworks

Exposed earthworks can be a significant source of dust, particularly when undertaken on such a large scale as needed for this Project. Dust can be a nuisance to the public but does not normally cause adverse health effects as the larger particle size means that particles have limited penetration into the respiratory tract.

Dust is generated naturally, typically from dry undisturbed surfaces when wind speeds reach above 5 – 10m/s. Where surfaces are disturbed (e.g. by large scale earthworks), the generation of dust typically increases, unless avoidance measures are put in place. The key construction activities that have the potential to generate dust include:

- the use of roads and access tracks by trucks and machinery during dry and windy conditions;

- the excavation and disturbance of dry material;
- the loading and unloading of material to and from trucks; and
- the stockpiling of material (particularly cut material).

The generation of dust is influenced by a number of factors; including particle size, wind speed, rainfall and evaporation rates. In accordance with sound industry practice, the air quality assessment considered potentially sensitive receptors within 100m of significant dust sources. This assessment found that dust is likely to be an issue at the following locations:

- Existing SH1 at Linden; and
- Proposed Warspite Avenue intersection (where the Porirua Link Roads will connect to the existing road network).

Without the proposed management measures put in place it is likely that the adverse effects of dust at these locations could be more than minor.

#### 17.3.1.2 Dust from rock crushing

Although most dust will be of larger particle size, it is possible that a small proportion of particles will be less than $PM_{10}$ (particle size less than 10µm). These smaller particles have the potential to cause adverse health effects on the human respiratory system – as discussed in **Technical Report 13**.

The likely effect of dust from rock crushing is dependent on the proximity of the dust sources to sensitive receptors. There is no New Zealand standard for recommended separation distances but Australian guidelines[92] recommend a minimum distance of 500m for rock crushing plants. These distances are intended to minimise the health, nuisance and amenity effects from dust. These separation distances will be able to be achieved for the Project, thereby reducing the potential adverse effects arising from dust.

Although adequate separation distances will be achieved for rock crushing activities, the Construction Air Quality Management Plan (CAQMP) will also contain protocols aimed at reducing the amount of dust emitted. This will ensure that potential adverse effects on air quality are suitably managed.

#### 17.3.1.3 Emissions from construction vehicles

Construction vehicles have the potential to cause adverse air quality effects, which can cause adverse air quality effects that can create a nuisance at neighbouring sensitive locations, under adverse meteorological conditions. Excessive smoke and odour from diesel-fuelled heavy vehicles, generators and other machinery is primarily caused by poor engine maintenance.

92. EPA Victoria, 1990. Recommended buffer distances for industrial residual air emissions AQ2-86; and EPA South Australia, 2007. Guidelines for Separation Distances.

The CAQMP describes measures to be undertaken to control and monitor vehicle emissions, including requirements to maintain vehicles and equipment in accordance with manufacturer specifications and immediately service units discharging excessive exhaust smoke.

Adherence to the CAQMP practices for construction vehicles will ensure that all potential adverse effects associated with emissions will be adequately managed.

#### 17.3.1.4 Odour

Road construction does not typically involve activities that generate offensive odours. It is possible that during earthworks activities, excavations may disturb a former landfill or offal pit which could result in the temporary discharge of offensive odour. However, the likelihood of this occurring is considered to be very low, as the contaminated land assessment (described in Chapter 18) did not result in the identification of any former landfill sites. In the unlikely event that such a site was uncovered, the Contaminated Land Mangement Plan (CLMP) contains measures to manage odour.

The other source of odour is from bitumen used for the pavement sealing and surfacing. This activity is a common part of road maintenance activities across the region. In addition, there is significant distance from where this activity will occur to any sensitive receptors in most areas. Accordingly, it is not expected that there will be any adverse odour effects of concern, arising from construction of the Project.

#### 17.3.1.5 Concrete batching

Construction of the Project will require significant amounts of concrete, mainly for the key structures such as bridges, culverts and some retaining walls. A concrete batching plant will be established at the main site compound near SH58 Interchange at Pauatahanui to manufacture this concrete. The concrete manufacturing process is described in Chapter 8 of this report and in **Technical Report 13**. An indicative plant layout is also provided in Figure 8.1.

Potential effects associated with concrete manufacturing can arise from the discharge of dust from aggregates and cement powder to air. This type of dust is typically larger (30 - 50µm) than the earthworks dust discussed earlier and has the potential to cause nuisance, rather than respiratory health effects. However, cement dust is also highly alkaline when dissolved in water and can be corrosive to skin. It is also known to be ecotoxic and can cause damage to aquatic animal and plant life if it is discharge in suitable quantities.

The likely effect of dust from concrete batching is also dependant on the proximity of the dust sources to sensitive receptors. As stated above (for rock crushing), there is no New Zealand standard for recommended separation distances but Australian guidelines[93] recommend a minimum distance of 100m from sensitive receptors for concrete batching plants. These distances are intended to minimise the health, nuisance and amenity effects from dust. A separation distance of at least 100m will be able to be achieved for the Project, thereby reducing the potential adverse effects arising from dust.

93. EPA Victoria, 1990. Recommended buffer distances for industrial residual air emissions AQ2-86; and EPA South Australia, 2007. Guidelines for Separation Distances.

Although separation distances of greater than 100m will be achieved for the concrete batching plant, it is recommended that a Concrete Batching Plant Management Plan (CBMP) is prepared, along with consent conditions to manage the potential for effects on the environment. The CBMP will control both discharges to air and water. Additional consent conditions will include the following:

- limit conditions:
    - a buffer zone around the physical boundary of the plant;
    - a requirement that there are no discharges to air, including visible discharges, that are noxious, dangerous, offensive or objectionable in the opinion of an enforcement officer; and
    - controls on hazardous air pollutants beyond the boundary of the site.
- operation and process conditions:
    - vehicle speed controls to limit dust;
    - specific dust management equipment to manage operation of the cement silos, including badfilters and alarms;
    - controls on the deliveries and storage of aggregate and other raw materials to avoid dust generation;
    - use of water sprays; and
    - as a minimum, enclosure of the aggregate conveyors.
- Monitoring and site management conditions:
    - regular maintenance including weekly visual inspections, including inspections of valves and alarms on dust management systems;
    - recording deliveries of aggregate and raw materials;
    - close management of contract drivers to ensure they stay within the driveway areas of the site; and
    - logging and reporting conditions

Along with the greater than 100m separation distance, these measures will allow potential adverse effects on air quality from concrete batching to be suitably managed.

### 17.3.2 Operation of the Project

The effect on air quality from the operation of the Project will be influenced by a number of different factors, including:

- existing air quality;
- predicted traffic volumes;
- meteorological factors influencing dispersions;
- the location of sensitive receptors; and

- improvements in the performance of the country's vehicle fleet emission rates.

The potential effects on air quality were predicted by modelling of $PM_{10}$, $NO_X$, CO and benzene concentrations from vehicle emissions[94]. For the four contaminants, the following scenarios were modelled:

- **Current base year (2006)** – Used to provide a 'baseline' against which to compare future effects, both with and without the Project.
- **2026 With Project (2026 WP)** – Traffic flows and fleet composition predicted for the year 2026, assuming the Project has been completed.
- **2026 Do Minimum (2026 DM)** – For comparison with the 2026 WP scenario. Traffic flows and fleet composition predicted for the year 2026, assuming the Project has not been completed.
- **2031 With Project (2031 WP)** – Traffic flows and fleet composition predicted for the year 2031, assuming the Project has been completed. Higher traffic volumes are predicted for the 2031 scenario, as compared to 2026 scenario. The fleet profile and emission rate also varies from 2026.
- **2031 Do Minimum (2031 DM)** – For comparison with the 2031 WP scenario. This scenario assumes the Project has not been completed.

Further information about the modelling, including the assumptions and limitations associated with the model, is contained in **Technical Report 13**. This report also sets out the relevant thresholds for each of the modelled contaminants.

The results of the emissions modelling are as follows.

#### 17.3.2.1 Predicted particulate concentrations

Maximum concentrations for particulate matter ($PM_{10}$) at sensitive receptors are predicted to be similar but lower for the 2031 'with Project' and 'do minimum' emission scenarios compared to the 2006 base year. Particulate levels for both 2031 scenarios are predicted to be similar and are predicted to be lower than the NES AQ limits. At the most impacted receptor (the residential property located near the Main Alignment and SH1 interchange) the maximum 24-hour concentration predicted for the 2006, 2031 'do minimum', and 2031 'with Project' emissions scenarios are 5.6µg/m$^3$, 3.8µg/m$^3$, and 4.1µg/m$^3$ respectively. As such, there is not predicted to be any material adverse effect arising from PM10 emissions.

94. $NO_2$ was not directly modelled. $NO_X$ is a combination of $NO_2$ and NO. Most emissions of $NO_X$ are in the form of NO but, once emitted into the atmosphere, NO reacts with ozone to form $NO_2$. Ground level $NO_X$ concentrations were predicted using the dispersion model and then, based on ambient monitoring data, the proportion of $NO_X$ which was likely to be $NO_2$ was estimated.

#### 17.3.2.2 Predicted nitrogen oxide concentrations

The predicted $NO_2$ concentrations for all the modelled scenarios are well below the NES AQ limit of 200µg/m³. At the most affected receptor the maximum 99.9 percentile 1-hour average concentration for the 2031 'with Project' scenario is predicted to be 57µg/m³, or approximately 29% of the 1-hour $NO_2$ NES AQ limit. A comparable maximum 99.9 percentile 1-hour average $NO_2$ concentration of 56µg/m³ is predicted for the 2031 'do-minimum' emission scenario. Cumulative $NO_2$ concentrations are also predicted to be less than 60% of GWRC's[95] 'maximum desirable level' of 95µg/m³. The maximum 24-hour average (for the 2031 'with Project' emission scenario) $NO_2$ concentration is predicted to 33µg/m³, or 33% of the MfE 24-hour average AAQG. As such, there is not predicted to be any material adverse effect arising from $NO_2$ emissions.

#### 17.3.2.3 Predicted carbon monoxide concentrations

The predicted CO concentrations for all the modelled scenarios are well below the NES AQ limit of 10mg/m³. At the most affected receptor the annual average incremental concentrations are predicted to be less than 0.09mg/m³, or less than 1% of the NES AQ threshold (for the 2031 'with Project' emissions scenario). As such, there is not predicted to be any material adverse effect arising from CO emissions.

#### 17.3.2.4 Predicted benzene concentrations

The predicted benzene concentrations for all the modelled scenarios are well below the AAQG limit of 3.6µg/m³. At the most affected receptor the annual average incremental concentrations associated with emissions from the modelled road sources are predicted to be less than 0.3µg/m³, or less than 8% of the AAQG. A maximum annual average cumulative concentration of 1.3 is 36% of the AAQG. As such, there is not predicted to be any material adverse effect arising from benzene emissions.

#### 17.3.2.5 Summary of dispersion modelling results

The results of the dispersion modelling indicate that cumulative $PM_{10}$, $NO_X$, CO and benzene concentrations from the operation of the Project are unlikely to exceed the relevant NES AQ and AAQG thresholds. As such, contaminant levels at sensitive receptors are unlikely to be materially affected regardless of whether the Project is constructed or not.

In summary, there will be no material adverse effects on air quality arising from the Project's operation and hence, no mitigation is considered necessary.

95. Regional Ambient Air Quality Guidelines, contained in Appendix 2 of the Wellington Regional Air Quality Management Plan 2000.

#### 17.3.2.6 Vehicle emissions from the operation of the Project

Although vehicles using the new roads will generate emissions, these emissions will be transferred from the existing SH1. Net vehicle emissions will decrease as a result of smoother traffic flows as compared to traffic currently using existing SH1, which is frequently congested. The movement of traffic away from communities along existing SH1 to a largely rural area also means that public exposure to vehicular emissions will be significantly reduced.

## 17.4 Measures to avoid, remedy or mitigate potential adverse effects on air quality

From the air quality assessment, the following potential key adverse effects were identified:

- dust from construction activities;
- emissions to air associated with rock crushing activities; and
- emissions to air associated with the concrete batching plant.

Dust from construction activities and rock crushing will be managed through the CAQMP and from the concrete batching plant through the CBMP. The primary management approach will be the suppression of dust at its source, allowing potential adverse effects on air quality to be appropriately managed. For the management of dust at the concrete batching plant, the CAQMP will also set out protocols for covering materials and regular inspections of equipment to check that it is functioning properly and is not leaking. The only monitoring of air contaminants recommended during construction is the continuous real-time monitoring of dust (or total suspended particulates) around the proposed southern tie-in at Linden. This monitoring will be undertaken as part of the implementation of the CAQMP and the information will form part of the adaptive management regime for the management of dust from construction activities.

As the Project will have positive effects on air quality in the long term, no on-going further mitigation or monitoring is considered necessary.