Local Government Air Quality Toolkit

Construction sites guidance note

Information on mitigation and management measures to reduce air emissions from construction

Acknowledgement of Country

Department of Climate Change, Energy, the Environment and Water acknowledges the Traditional Custodians of the lands where we work and live.

We pay our respects to Elders past, present and emerging.

This resource may contain images or names of deceased persons in photographs or historical content.

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Cover photo: Construction track out. Zephyr Environmental

Artist and designer Nikita Ridgeway from Aboriginal design agency – Boss Lady Creative Designs, created the People and Community symbol.

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1. Introduction

1.1 Industry overview

This guidance note provides general information on the type and nature of construction activities, emissions to air from these activities, and mitigation and management measures to reduce air emissions from construction. It does not cover water quality management, asbestos management, work health and safety, or greenhouse gas emissions.

The aim of construction activity is to renovate, refurbish or construct structures for residential, commercial or industrial purposes on a piece of land suitably zoned for that purpose. This may also include demolition of existing structures.

Except for major freeways and tollways, construction sites are not scheduled activities under the *Protection of the Environment Operations Act 1997* (POEO Act) and therefore do not require an environment protection licence. For non-scheduled construction sites, the local government is the appropriate regulatory authority (ARA) unless the NSW Environment Protection Authority (EPA) is declared the ARA under s 6 of the POEO Act.

Some construction sites may be scheduled development work, which would require an environment protection licence (POEO Act s 47). For example, the construction of a sewage treatment plant large enough to carry out the 'sewage treatment' scheduled activity (Schedule 1, cl 36), would require an environment protection licence.

Construction sites require an environment protection licence under the POEO Act for:

- road construction scheduled activity described in Schedule 1 cl 35
- railway infrastructure construction scheduled activity described in Schedule 1 cl 33
- scheduled development work as described in s 47.

The environmental management and resolution of any air pollution or off-site impacts caused by particulates or odour from construction sites is the responsibility of the site owner and operator.

1.2 Types of activity

The types of activities carried out on construction sites include:

- land clearing and earthworks related to excavation and compaction activities
- operation of heavy machinery and related equipment for earthmoving and construction purposes (excavators, bulldozers, front end loaders, cranes, etc.) and the internal combustion engines associated with such machines
- erecting structures using steel, concrete, brick, glass, timber and other materials
- mechanical activities including grinding, hammering, drilling, grit blasting and demolition
- transport of building materials and supplies onto the site, and transport of wastes off site
- movement of vehicles along roadways and paths, in and out of the site and within the site, together with any maintenance of the roadways (e.g. grading)
- metal joining and finishing, including welding, brazing, soldering and other techniques
- generation of solid wastes and debris, their stockpiling and transfer through chutes, and loading onto trucks or into skips
- application of surface coatings and finishes using paints and adhesives.

Construction sites vary in size and the nature of sources and dust emissions will generally be associated with the following 5 main sources:

- demolition – removing existing structures or material prior to construction
- earthworks – excavating material, haulage, tipping, stockpiling levelling and landscaping
- construction – construction of new buildings / infrastructure on prepared sites
- track out – the transport of dust and dirt from a construction site onto the public road network
- exposed areas that may be susceptible to wind erosion, including stockpiled material.

2. Potential emissions to air

2.1 Overview

The main air emissions from construction sites are particulates (dust), diesel engine exhaust and, to a lesser extent, odour. These air emissions can have adverse off-site impacts if they are not properly managed or controlled.

Particulate emissions can occur during the preparation of the land (e.g. demolition and earthworks) and during construction itself, and can vary substantially from day to day depending on the level of activity, the specific operations being completed, and the weather conditions. For example, wheel-generated dust can occur at regular intervals throughout the day, every day, whereas demolition, grit and sand blasting may only occur at certain stages of the construction process.

A significant portion of dust emissions result from site plant and vehicles moving over temporary roads and open ground. If mud and other material is allowed to get onto local public roads (track out), dust emissions can occur at some distance from the construction site as this material dries out (Figure 1).

Figure 1 **Tracked out material that has dried on the road surface becomes a dust source**

Source: Jane Barnett/Zephyr Environmental

Odour can occur, to a lesser extent, and is generally related to activities such as painting and finishing using organic solvents.

For construction sites, sources of air emissions can be categorised in 2 ways:

- a controlled source – point sources such as venting a process or piece of equipment via a stack or conduit
- an uncontrolled source – fugitive sources such as dust emissions being released through doors, windows or other building openings, or emissions from roads or waste stockpiles.

2.2 Dust

There are different types of dust (particulate matter) that can be caused by construction, depending on the activity and the material. These can include crystalline silica, timber / wood dust, particles from combustion, sand and clay. The activities that can result in dust from a construction site include:

- demolition
- earthmoving and excavation
- sanding, grinding and welding
- sand and grit blasting (crystalline silica)
- waste transfer and storage
- masonry activities (preparation of concrete, cement and mortar mixes; cutting stone, bricks or pavers)
- timber construction; sawing wood, wood dust
- concrete drilling, cutting or breaking (Figure 2)
- crushing or screening (e.g. sorting) aggregate materials
- surface finishing (e.g. spray painting)
- unpaved access roads and pathways, and the clearing of access roads
- on-site traffic movements
- diesel exhaust emissions
- wind erosion from stockpiled / stored material (Figure 3).

Figure 2 Dust produced from rock and cement breaking

Source: Jane Barnett/Zephyr Environmental

Figure 3 A stockpile potentially exposed to wind erosion

Source: Jane Barnett/Zephyr Environmental

2.3 Odour

The sources of odour from a construction site include:

- surface finishing and coating (e.g. spray painting)
- resins, adhesives, caulking compounds, sealants, silicones, etc.
- grinding, cutting and sanding operations
- engines and motors
- stormwater storage areas that become contaminated.

2.4 Diesel emissions

On-site non-road vehicles and machinery with diesel-fired engines can emit particulate matter and gaseous emissions such as carbon monoxide (CO), sulfur oxides (SOx), nitrogen oxides (NOx) and organic compounds including polycyclic aromatic hydrocarbons (PAHs) and volatile organic compounds (VOCs). The NSW Government Resource Efficiency Policy requires that from 1 January 2018, the minimum performance standard for newly manufactured mobile non-road diesel plant and equipment purchased by NSW Government agencies must be US EPA Tier 4 or EU Stage IV compliant (OEH 2019). Further information can be found on the EPA's *Non-road diesel and marine emissions* webpage (EPA 2021).

2.5 Hazardous materials

During demolition and refurbishment of existing structures, a range of hazardous materials may be encountered that can also influence the potential emissions associated with construction activities.

Hazardous materials found on sites being redeveloped may include asbestos materials, lead-based paints, polychlorinated biphenyls (PCBs; found in capacitors of old fluorescent light fittings and transformers in derelict electrical sub-stations), mercury switches, and halons and chlorofluorocarbons (CFCs) found in refrigeration equipment and fire safety systems.

Such hazardous materials need to be carefully managed. Ideally, they should be removed from the site before demolition or refurbishment activities begin using specialist contractors.

Work health and safety considerations such as a hazardous materials audit or risk assessment should be carried out before any demolition or refurbishment activity takes place on any commercial or industrial construction site.

Management protocols for such materials are specified in various regulations and guidelines available from SafeWork NSW (see SafeWork NSW 2020).

> Special precautions need to be taken where asbestos is present on site.
>
> Asbestos should be completely removed before demolition work begins using specialist contractors.

3. Managing emissions to air

3.1 Management hierarchy

Figure 4 shows the hierarchy of hazard control, which is a way of determining which actions will best control exposure (NIOSH 2022). The hierarchy has 5 levels of actions to reduce or remove hazards. The most effective solution is clearly to remove the hazard. If this cannot be done, there are other options including engineering and administrative controls, and last of all personal protection from the hazard (PPE).

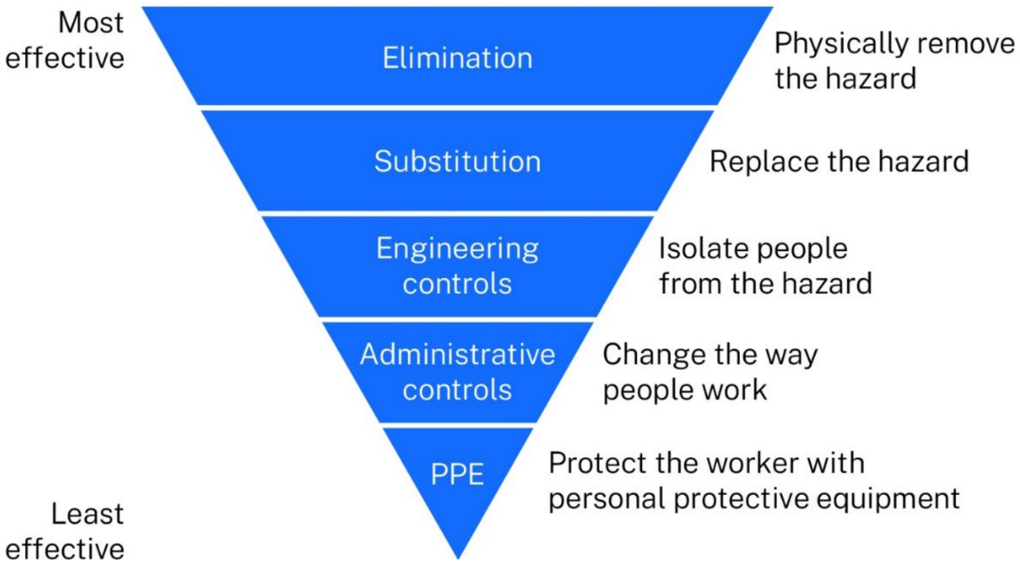

Figure 4 **Hierarchy of hazard control**
Source: based on NIOSH (2022)

3.2 Management options

If dust emissions from construction cannot be eliminated, the following management options should be considered by operators.

Environmental management plans

Larger construction activities should be coordinated through a construction environmental management plan (CEMP) for the site that covers all aspects of the construction phase. A local council will sometimes add a requirement for a CEMP to any development consent conditions. A CEMP should include issues such as management of stormwater run-off, wastes, noise impacts and emissions to air, as well as management of impacts on the ecological environment of the site. Where there is significant potential for emissions to air, a dedicated air quality management sub-plan may also form part of the broader CEMP.

Cleaner production

Management options also include waste minimisation and cleaner production initiatives, and the way the site is operated and maintained. This may be, for example, through training, supervision, defined operating procedures and the auditing of management plans. If such aspects are not included within a facility's CEMP and supporting procedures, this may be requested by council through any conditions of consent that are included in the determination of a development application (DA).

At construction sites close to off-site sensitive receptors, it may be appropriate to specify that equipment meets the latest international vehicle engine emissions standards, including preferencing the use of electrically powered plant and equipment over diesel-powered equipment.

Housekeeping

Keeping the site tidy and free of excessive quantities of refuse and debris (including overloaded waste bins) is important in minimising the impacts of windblown dust, litter and other debris that can arise from such sources (Figure 5). Good housekeeping can also help reduce accidents and incidents – a tidy site is usually a safe site.

Figure 5 **Waste skip becoming overloaded**
Source: Jane Barnett/Zephyr Environmental

Workforce training

Training the construction workforce to understand air emissions can be carried out at all levels (workers, foremen, managers) and can be included in site induction courses or toolbox talks. For example, workers can be trained to limit the surface area of an activity to reduce the scale of emissions, such as dust in a pit or fumes from painting. Training should also encourage workers to consider the timing of activities in relation to prevailing wind conditions, especially activities such as spray painting or sand blasting.

Traffic management

The designation of traffic routes and the setting and enforcing of speed limits can help control dust from vehicle movements. Decisions concerning site layout may also help reduce dust; for example, keeping distances travelled on unsealed routes to a minimum.

Relocation

Another management option is to consider whether it is possible to relocate certain operations away from sensitive land uses such as residences or emission-sensitive industries. For example, the storage of wastewater, which could potentially become odorous, should be located away from adjacent residential areas if possible. Stockpiles of excavated or raw materials can cause windblown dust emissions and should also be placed away from sensitive receptors where possible.

Stakeholder engagement

Nearby sensitive receptors such as residents and businesses must be notified of construction. This should include prior notification of works, limiting the timing and duration of certain activities and communicating this to those people or organisations who might be affected, and providing contact details in the event of any problems for when the site is both occupied and unattended.

Nearby receptors are typically more understanding of short-term impacts if they are notified in advance that they may occur.

Cease work

If there is a significant complaint from adjacent sensitive land uses, the site operator should identify the source of the complaint and potentially cease work until it is rectified or controlled. For example, works generating dust may have to cease under certain weather conditions when the wind is blowing emissions into adjacent premises. Such considerations should be covered in the site's CEMP and / or air quality management sub-plan.

All the above options may be included in standard operating procedures, log sheets or checklists.

3.3 Control options – particulate matter

The key control and management options for the sources of particulate matter mentioned in Section 2.2 are provided in Table 1.

Table 1 Control and management options for particulates

Nature of source	Control and management options
Demolition	• Water sprays and dust suppression surfactants • Timing with respect to wind direction • Location and proximity of sensitive land uses
Earthmoving and excavation	• Water sprays and dust suppression surfactants
Sanding, grinding, welding	• Suitable extraction or ventilation • Filtration and controlled discharge if this activity is generating complaints
Sanding and grit blasting	• Dust suppression curtain (hessian, shade cloth) • Suitable extraction and ventilation, filtration and controlled discharge if this activity is generating complaints
Waste transfer and storage	• Enclosed conveyors and chutes • Water sprays • Covers over wastes
Masonry activities (preparation of concrete, cement and mortar mixes; cutting stone, bricks or pavers)	• Avoiding cement dust emissions • Managing stockpiles (sand, gravel) by using water sprays (when emptying cement bags into mixer) • Wet cutting and drilling techniques
Concrete drilling or cutting	• ‘Wet’ systems preferable • Suitable extraction or ventilation • Filtration and discharge if this activity is generating complaints
Crushing or screening (i.e. sorting) aggregate materials	• Suitable extraction or ventilation • Cyclones or filtration equipment if this activity is generating complaints
Surface finishing (e.g. spray painting)	• Controlling overspray • Considering wind direction and potential impacts • Dust suppression curtain (hessian, shade cloth) to minimise overspray (aerosol) impact
Unpaved access roads and pathways, and the clearing of access roads	• Water sprays and dust suppression surfactants • Revegetation • Wind breaks (temporary cyclone fence with fine shade cloth attached)
On-site traffic movements	• Water sprays and dust suppression surfactants • Sealing of main trafficable areas

Nature of source	Control and management options
Diesel exhaust emissions	• Maintenance and tuning of engines • Correct fuel specification • Limiting idling time • Avoiding overloading • Appropriate height of discharge above ground level • Requiring plant and equipment that meets the latest international engine emission standards, including the use of electric equipment options • Locating diesel generators away from sensitive receptors or (preferably) using battery technologies
Wind erosion from stockpiled material	• Water sprays • Bunker storage • Limiting size of stockpiles • Vertical barriers (or covering the pile if it is small)

Relevant control options should be specified in standard operating procedures and the CEMP / air quality management sub-plan.

Some further detail is provided below for the management options and controls mentioned above.

On-site traffic movements

For controlling dust from traffic movements, road surfaces can be sprayed with water or a water-based surfactant (known as a chemical dust suppressant). The surfactant causes agglomeration of fine particles, making it more difficult for the resultant larger particles to become windblown when the water evaporates. Such materials are a good option when water is in short supply for dust management purposes.

Washing vehicles' wheels before they leave the premises can also help to remove track-out and thus control dust.

Waste transfers

All material to be transferred or transported should be covered or contained.

Dust from fugitive sources

This should be managed by the following:

- Stockpile heights and areas should be limited, and removal should take place from the downwind side.
- Physical barriers can be erected, depending on the size of the source. For smaller sources the barrier could be a temporary cyclone fence with fine shade cloth attached (Figure 6). Screening materials (e.g. shade cloth) on 3 sides could also be used (with no less than 50% porosity to the material being contained).
- Simple porous wind breaks can also be erected to minimise dust generation. Solid barriers can sometimes exacerbate wind erosion by increasing the turbulence of air flow around these obstacles and increasing wind speeds in some areas (Figure 7).

- Re-vegetation of a stockpile or exposed area is an option whenever soil is likely to be exposed for a long period of time (greater than 4 weeks), or whenever works are completed in an area.
- Mulched green wastes can be temporarily laid over the stockpile and removed when required and retained for later landscaping purposes.
- For high dust-generating activities, consideration of wind direction (and location of sensitive receptors relevant to the wind direction) should be given. Workers should consider wind direction before carrying out activities that could cause off-site impacts, as directed in the CEMP.

Figure 6 **Example of additional or temporary sheltering erected within a construction site for higher dust generating operations**

Source: Jane Barnett/Zephyr Environmental

Figure 7 **Example of porous shade cloth with additional openings for high wind events**
Source: Jane Barnett/Zephyr Environmental

Dust generated from other construction activities

Particulate matter generated from other more specialised construction activities, such as sand blasting, spraying of surface coatings, drilling, etc. can be controlled using equipment to collect or clean the dust.

Such technological control options often have limited application in a construction setting unless occupational health exposure standards are likely to be exceeded. For example, it may be impractical to have dust mitigation equipment on site due to the short-term nature of the dust episode and the space and cost requirements of the equipment. Even then, the favoured option is usually the provision of personal protective equipment (PPE) such as dust masks and eye protection. However, the control hierarchy dictates that an engineered solution to reducing exposures (i.e. emissions) is preferable.

Technological control options include:

- collection of dust using a hood type or flexible ‘elephant trunk’ type ducting or fan arrangement, by enclosing the activity, or using a dust suppression curtain (e.g. water sprays, hessian or shade cloth)
- dust cleaning using a cyclone or fabric filter dust collector (e.g. a baghouse) on drilling or brick cutting equipment.

A cyclone separates particulates (dust) from the gas stream using inertia within the cyclone unit. As a result of this separation action, larger particles are removed but finer particles may pass through the ‘clean’ side of the cyclone.

A fabric filter separates particulates from the gas stream by passing the gas stream through a filter medium (e.g. paper or fabric bags). The 'cleaned' air passes through the filter while the dust particles are retained on the dirty side of the filter.

Where the application requires finer particles to be removed as well (e.g. where fine particles are the source of a complaint) both units can be used together in the same gas stream. In this arrangement the fabric filter would be situated after the cyclone.

For more detailed information on specific equipment refer to the Local Government Air Quality Toolkit – Module 3, *Guidelines for managing air pollution*.

3.4 Control options – odour

The key control and management options for odour are provided in Table 2.

Odour from construction sites can be difficult to control, with odour-generating activities typically moving around the site.

Although mobile extraction or filtration may be feasible in some instances (e.g. lead-based paint removal) there will be instances where little can be done in terms of emission control. In these cases, a control option could be to direct that the activity be completed when wind speed and direction help with the dilution and dispersion of emissions away from nearby sensitive land uses.

Table 2 Control and management options for odour

<table>
<tr><th>Nature of source</th><th>Control and management options</th></tr>
<tr><td>Exhaust fumes from non-road engines and motors on site</td><td>• Efficient combustion and proper dispersion.
• Requiring that plant and equipment meet the latest international engine emission standards, including the use of electric equipment options
• Locating diesel generators away from sensitive receptors or (preferably) using battery technologies</td></tr>
<tr><td>Surface finishing (spray painting)</td><td rowspan="3">• Considering wind speed and direction when undertaking these activities
• Appropriate extraction of fumes, and ventilation, and suitable discharge to aid dispersion and dilution of odour, where this activity is generating complaints</td></tr>
<tr><td>Use of resins, adhesives, caulking compounds, sealants and silicones, etc.</td></tr>
<tr><td>Odour from grinding, cutting and sanding operations</td></tr>
</table>

Case study

> Note that this case study is for illustrative purposes only. It does not indicate a procedure that ARAs, authorised officers and enforcement officers should follow in all cases and does not constitute legal advice. Readers should seek their own legal advice in relation to their specific circumstances.

Issue: Dust arising from a construction site leading to a complaint from a neighbouring resident who was suffering respiratory irritation. The neighbour worked from home so was close to construction activities during work hours.

Background: It was alleged that workers at the construction site were cutting concrete without any dust mitigation (e.g. no dust screens or collection systems).

The complainant's property was directly adjacent to and within 30–34 m of the construction site.

Only one complaint was received by the council about this activity.

Response: The council's authorised officer reviewed the DA conditions and conducted an on-site inspection.

The site was on a corner block and easily visible from the street and public footpath. Powers of entry were therefore not required / used during the site inspection.

The officer identified that the dust screens on the steel fencing around the site were inadequate to sufficiently contain dust from construction activities.

The council officer notified the private certifier for the development of the absence of screens. Both parties instructed the site manager to re-install dust screening.

The council's authorised officer confirmed that this had been installed, 4 days later.

Outcome: The focus was on enforcing the DA conditions and the issue was resolved.

Figure 8 A fence without dust screens

Source: Liverpool Council

Figure 9 A fence with adequate dust screens

Source: Kim Boxsell/DCCEEW

4. Considerations for local councils

4.1 Scheduled or non-scheduled activity

As mentioned in Chapter 1, local government is generally the ARA for construction sites that do not require an environment protection licence or where the EPA is not declared the ARA under s 6 of the POEO Act.

Local government officers have an important role in managing air quality on and around construction sites. This can be achieved using conditions on the development consent at the planning stage and the compliance process during the construction stage. The POEO Act provides for enforcing positive environmental outcomes via the use of statutory notices, orders and directions.

Local councils can use s 125 of the *Local Government Act 1993* to require a construction site operator to mitigate dust or odour where it is causing a public nuisance; for example, if works are impacting a public roadway. To be a public nuisance, the dust or odour must be materially affecting the reasonable comfort and convenience of a sufficient class of people to constitute the public or a section of the public.

4.2 Assessment and dispersion modelling

An assessment of air emissions from the construction phase is typically included in an air quality assessment; however, this usually excludes atmospheric dispersion modelling. The amount of dust generated depends on the quantities of material handled, as well as the characteristics of the soil (silt and moisture content), the extent of any exposed areas, the frequency of dust suppression spraying and whether internal roads are sealed or unsealed. Developing an accurate emissions inventory for a site is therefore almost impossible. In addition, given the changing nature of a construction site on a daily basis, it is also not practical to accurately quantify impacts using quantitative methods such as dispersion modelling.

An assessment of the construction phase can be conducted semi-quantitatively following the steps outlined in the Institute of Air Quality Management (IAQM) *Guidance on the assessment of dust from demolition and construction* (IAQM 2024).

There are a few important aspects for local government to consider when reviewing external consultants' air quality assessments, to make sure the best outcome is achieved. These are included in Chapter 6 of the Local Government Air Quality Toolkit – *Resource pack*.

4.3 Operational and control recommendations

Consideration should be given to appropriate operational procedures to control and limit air emissions. Chapter 7 of the Local Government Air Quality Toolkit – *Resource pack* lists dust mitigation and management measures that are helpful in reducing emissions and impacts from construction sites.

Council may be required to complete a site inspection to investigate current air quality management practices. Chapter 2 of the Local Government Air Quality Toolkit – *Resource pack* provides helpful information for council officers prior to these inspections, including a checklist.

Before going on site for an inspection, council officers should be aware of the facility's status (scheduled or non-scheduled) and should review any previous reports (including diagrams, photographs and maps).

The Local Government Air Quality Toolkit – *Dust from construction sites visual guide* can assist.

5. References and further resources

All documents and webpages that are part of the Local Government Air Quality Toolkit are available from the EPA website.

EPA (Environment Protection Authority) (2021) *Non-road diesel and marine emissions*, NSW Environment Protection Authority, Parramatta NSW, www.epa.nsw.gov.au/your-environment/air/non-road-diesel-marine-emissions.

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Sutherland Shire Council (2018) *Controlling construction site air pollution fact sheet*, Sutherland Shire Council, Sutherland NSW, https://cms.ssc.nsw.gov.au/files/sharedassets/website/document-library/environmental-management/air-and-noise-pollution/2018-05-04-final-air-quality-fact-sheet.pdf [PDF 2.9 MB].