Local Government Air Quality Toolkit

Small-scale sawmills guidance note

Information on good management practices to reduce air emissions from small sawmill operations

NSW GOVERNMENT

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This resource may contain images or names of deceased persons in photographs or historical content.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: Sorting logs by diameter. ArtEvent ET/iStock

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

Published by:
Environment Protection Authority and
Department of Climate Change,
Energy, the Environment and Water
Locked Bag 5022, Parramatta NSW 2124
Phone: +61 2 9995 5000 (switchboard)
Phone: 1300 361 967 (Environment and Heritage enquiries)
TTY users: phone 133 677, then ask for 1300 361 967
Speak and listen users: phone 1300 555 727, then ask for 1300 361 967
Email info@environment.nsw.gov.au
Website www.environment.nsw.gov.au

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1. Introduction

1.1 Industry overview

This guidance note provides general information on the types of products and processing and good management practices to reduce air emissions from small sawmill operations. It does not cover noise emissions and work health and safety.

Sawmills, also referred to as timber mills, that carry on the activity of wood or timber milling or processing are a scheduled activity under the *Protection of the Environment Operations Act 1997* (POEO Act) if either:

- in the case of an activity that burns waste (other than as a source of fuel), the sawmill has a capacity to process more than 6,000 m^3 of timber (or timber products) per year
- the sawmill in any other case has an annual processing capacity of more than 50,000 m^3 of timber (or timber products).

For this level of activity, an environment protection licence (EPL) is required and the NSW Environment Protection Authority (EPA) is the appropriate regulatory authority (ARA) for the purposes of the POEO Act.

Local government is responsible for regulating environment protection for small-scale sawmills with a capacity below the thresholds in Schedule 1 of the POEO Act, mentioned above. The environmental management and resolution of any air pollution-based nuisance or off-site impacts caused by smoke, particulates or odour from these premises is the primary responsibility of the operator.

The NSW wood processing industry is diverse, with mills of all types and sizes spread across the state producing a wide range of wood products.

New South Wales produces one third of Australia's softwood timber, most of it via plantations using exotic species such as radiata pine. Cypress pine is a common native softwood species that is harvested from dry native forests generally located west of the Dividing Range.

The timber and forest products industry in New South Wales is an important component of other industry sectors in Australia. In particular, the timber industry underpins vitally important supply and demand relationships with the Australian design, manufacturing, construction and property sectors.

Councils have an important role in ensuring sawmill operations achieve positive outcomes for the local community and the environment.

1.2 Products and processing

Sawmills receive logs harvested from forests for processing into timber products.

Depending on the type of timber received and the processing equipment at the mill, a variety of timber products can be produced, including:

- structural timber for building purposes (typically hardwoods)
- specialised timber products for cabinet and furniture making, as well as architectural uses (typically softwoods)

- veneers, plywood, chipboard and fibreboard composite products (typically softwoods)
- woodchips (from waste timber).

Some pre-processing may occur during harvesting but generally the sawmill will receive logs that will then be debarked, rough sawn, sorted, kiln-dried, planed (milled) on site, then sorted, graded and sold.

Specialised products may require further sawing, sanding or shaping (milling).

Specialised equipment is required to produce veneers used in furniture and architectural linings. Plywood is manufactured from layers of veneer glued together.

Chipboard and fibreboard products are made from prepared wood fibre, chips and other wood waste materials bonded together with adhesive resin. Specialised equipment is also required to manufacture these products, but these processes do not usually occur in smaller, non-scheduled sawmills.

The industry produces a significant amount of wood waste, which can be as much as 50% of the total amount of timber received. Much of this can be used or recycled in a variety of ways.

2. Potential emissions to air

2.1 Overview

Emissions to air from sawmills include smoke, particulates and odour that can have adverse off-site impacts if not properly managed or controlled.

For a typical sawmill, emission sources can generally be categorised in 2 ways:

- a controlled source – these are point sources such as venting a process or piece of equipment; for example, the stack from a wood waste boiler
- an uncontrolled source – these are fugitive sources such as sawdust emissions through open doors, dust blown from storage areas and waste stockpiles, or smoke from open burning.

The sources of these emissions and some of the control and management options for each of them are summarised in Table 1. Each of the air pollutants is also described in more detail in the following sections.

Table 1 Typical air emissions, their sources and management options

Emission	Nature of source	Control and management options
Smoke	• Wood fired boilers	• Improved combustion efficiency for wood • Alternative fuel sources • Alternative recovery and reuse or recycling options for wood waste
Particulate matter (PM)	• Sawing, planing, milling, sanding • Log reception yards • On-site traffic movements	• Collection and extraction of particulates by cyclones or fabric filters • Use of water sprays • Use of concrete or bitumen to seal storage areas and traffic surfaces
Odour	• Smoke	• Efficient combustion • Adequate dispersion
	• Use of resins and adhesives • Kiln drying	• Effective extraction, dispersion and dilution via a stack • Use of activated carbon • Careful control of kiln heat cycle afterburners

Some of the sources of air pollution associated with small sawmills are particularly difficult to manage or control, including:

- burning bark, sawdust and offcuts as a means of waste disposal[1]
- using wood waste as boiler fuel (for boilers that generate steam to heat drying kilns)
- windblown soil dust and sawdust from open storage.

[1] Open burning of wood waste is not permitted in council areas listed in Parts 1 and 3 of Schedule 1 of the Protection of the Environment Operations (Clean Air) Regulation 2022, unless approved by the EPA.

2.2 Smoke

Smoke is generated by the incomplete combustion of organic materials and fuels such as wood when there is insufficient temperature or air for all the organic material to be oxidised to carbon dioxide, water and ash.

Where there is not enough air for complete combustion, soot and carbon monoxide will be produced.

While woodsmoke from small sawmills is different to domestic burning, much of the chemistry is the same. Information about woodsmoke in the context of domestic burning is provided in the Local Government Air Quality Toolkit – *Neighbourhood smoke guidance note*.

2.3 Particulates

Particulates arise from the same sources as smoke as well as other operations in sawmills, including:

- combustion of waste material
- traffic on unsealed roads (wheel generated dust) and materials handling
- processing of sawlogs and other timber products.

In terms of air quality, these are generally categorised in 3 particle size groups:

- $PM_{2.5}$ – particulate matter with an aerodynamic diameter of less than 2.5 microns (μ). These particles are included in PM_{10} and total suspended particulates (TSP)
- PM_{10} – particulate matter with an aerodynamic diameter of less than 10 μ. These particles are included in TSP
- TSP – all airborne particles up to approximately 30 μ in diameter.

Combustion processes

Combustion is rarely taken to a high level of completion in small sawmills, so unburnt (organic) timber particles are contained in almost all emissions. There are also fine inorganic emissions from the trace amounts of minerals in most timbers. Sodium, potassium, silicate and aluminate compounds are the common sources of inorganic materials.

Processing sawlogs and other timber products

Inside the mill, the processing of timber and timber products through sawing, planing, sanding, milling or turning generates wood shavings, sawdust and sanding dust (Figure 1).

The size of these wood-based particles varies significantly. Some dusts are very fine and can cause respiratory irritation.

In addition, some wood types can generate dusts that create allergic responses ranging from skin and eye irritation to dermatitis and asthma. Some types of wood can be worse than others in this respect although there is considerable individual variation in the response to some timber dusts.

Particulate matter can be blown off site during periods of high winds or become airborne due to traffic movements, and move downwind where it may cause nuisance to adjacent or nearby landholders.

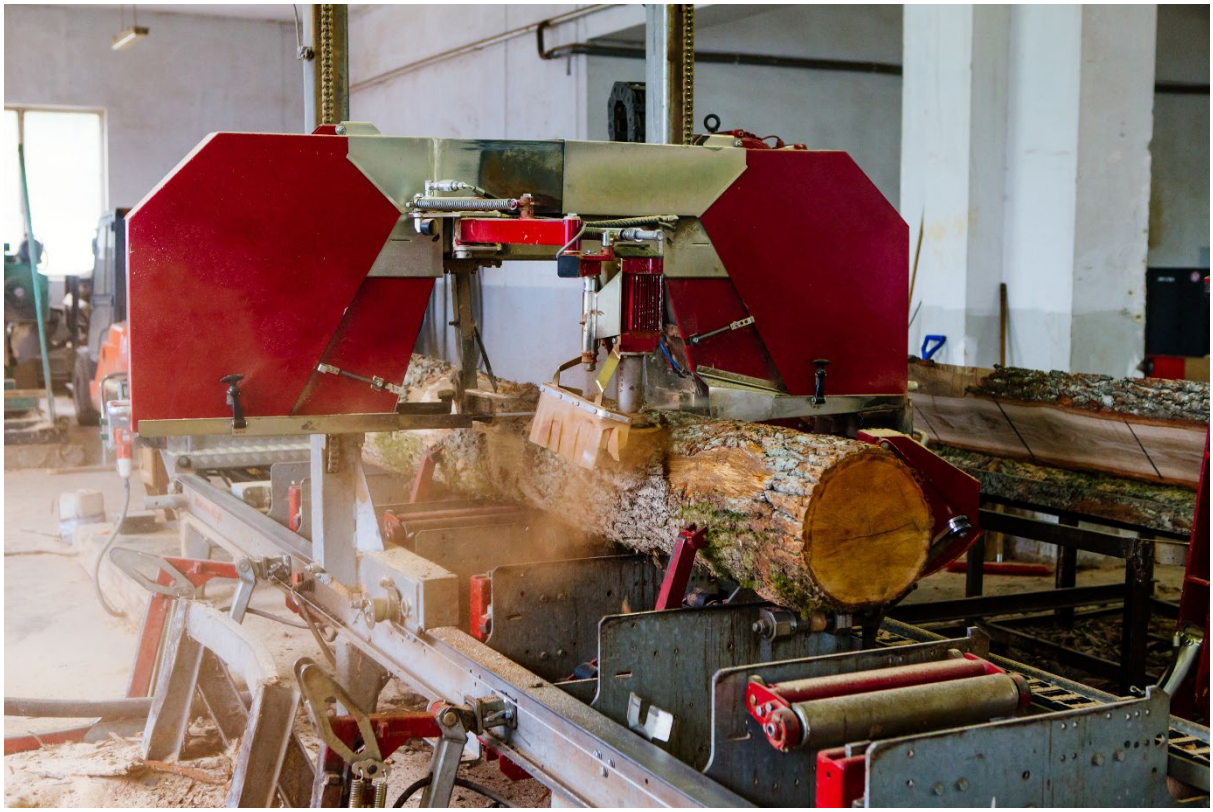

Figure 1 **Dust from sawing raw logs**
Source: Dzmitry Ryshchuk/iStock

Traffic and materials handling

Particulates, consisting of dirt and debris from logs and unsealed surfaces, can arise from:

- the reception yard where logs are delivered
- movements of sawn timber into the kilns
- other materials handling in the yard.

2.4 Odour

Resins and adhesives

Mills engaged in further processing of timber, such as those using adhesives and resins for manufacturing plywood, chipboard or laminated beams, can produce odours due to the volatile materials contained in the adhesives and resins. The 3 main types of resin in current use are:

- urea-formaldehyde (UF) resin – the cheapest and easiest types of resin to use, which cure to a clear film, used for standard boards that are not exposed to moisture
- melamine-formaldehyde (MF) resin – moisture resistant and superior to UF but much more expensive; they are used to fortify UF resins to provide improved moisture resistance; moisture-resistant particleboard and medium density fibreboard (MDF) uses mixed MF/UF (or MUF) co-condensed resins
- phenol-formaldehyde (PF) resin – dark in colour and of the highest durability but expensive; PF resin and tannin-formaldehyde (which is based on natural poly-phenolic materials) may be used in the manufacture of particleboard flooring.

Resin and lacquer formulations frequently contain volatile solvents, which are largely evaporated during application or curing, and escape to the atmosphere if no control is provided. Many of these solvents are odorous, toxic or both.

Additives

A range of additives can be added to the resins or sprayed on to the wood particles or product to improve particular properties of the finished product. If a sawmill is engaged in these types of activities there is the potential for odours to arise. Some examples of additives are:

- paraffin wax can be added in small quantities, either as an emulsion or sprayed in a molten state, to provide water resistance and to control swelling caused by temporary wetting. It does not protect against high humidity or continual dampness
- hardeners and catalysts control the rate at which resin cures during pressing, optimising production of the product's desired properties
- fire-retardants, insecticides and fungicides may also be added in small quantities for specific products requiring protection.

Natural wood odours

Freshly sawn (or planed, sanded or milled) timber can also produce odours associated with the natural oils and resins contained within the timber itself. Under hot, still weather conditions this odour can be quite strong. Many people find this smell inoffensive in the short term; however, this may not be the case if residents are exposed on an ongoing basis.

3. Managing air pollution

The following sections describe several measures that can be adopted for different types of air emission sources at small sawmills. Further information on technological controls can be found in the Local Government Air Quality Toolkit – Module 3, *Air pollution control techniques*.

3.1 Combustion sources

Burning waste

Open burning is prohibited in some local government areas (LGAs) but even where permitted, it should be discouraged as it does not represent good practice. All reasonable and practical measures should be taken to avoid open burning, even in LGAs where this is allowed.

Some older sawmills have fenced compounds in which wood wastes are allowed to slowly smoulder and burn. This practice results in uncontrolled emissions of smoke, odour, soot and ash, exacerbated in windy weather.

Trench burning is an improvement on open burning but is also unlikely to provide a satisfactory environmental outcome. Special care is needed when burning sawdust, since the blast of air used in a trench burner has the potential to carry significant amounts of partly burned sawdust out of the burner as emissions.

The environmental and human health risks should be considered on a case-by-case basis to ensure there are no impacts at the nearest receptors.

Combustion as a fuel source

Wood residues have been used as a supplementary fuel, but gas firing of industrial equipment is now generally the standard.

Offcuts and sawdust from sawmills have historically been potential fuels within the timber industry for generating steam that is used as a heat source in kiln drying of sawn timber. However, at small sawmills, air drying of timber is more common.

3.2 Processing

For processing activities such as sawing, sanding, milling and shaping, the best form of control is containment at the source. These types of processes are generally carried out indoors and so collecting particulate pollution can be done by enclosing process areas and introducing ducting systems to capture and filter emissions prior to release into the atmosphere.

Effective containment minimises fugitive emissions that may otherwise escape through openings inside the buildings. The filtered emissions are then released into the atmosphere as a point source, which allows more efficient dispersion resulting in lower ground level concentrations.

There should be no visible particulate emissions discharged from these non-combustion outlets / stacks.

The most common types of equipment used to contain particulates in the timber industry are:

- fabric filters (used in a bag house) (Figure 2)
- cyclones (Figure 3).

As moisture content increases, fabric filters may begin to clog and may need additional maintenance, or more regular replacement. The schematics below show how a fabric filter inside a baghouse operates, and a cyclone, both filtering polluted intake air prior to discharge.

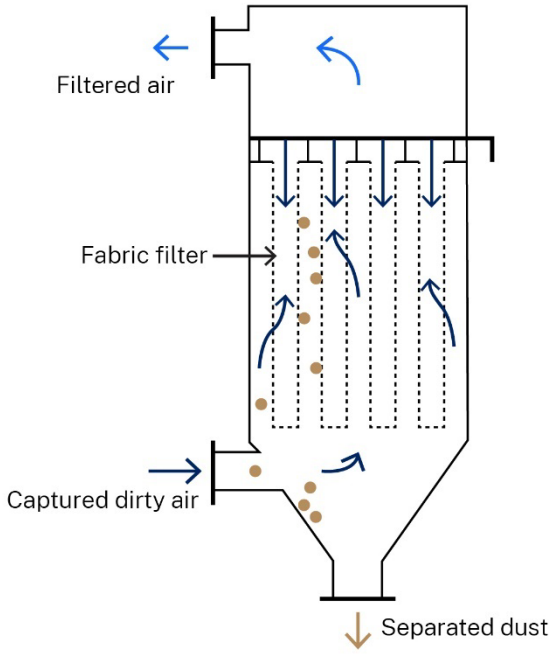

Figure 2 **Schematic of airflow through a baghouse**

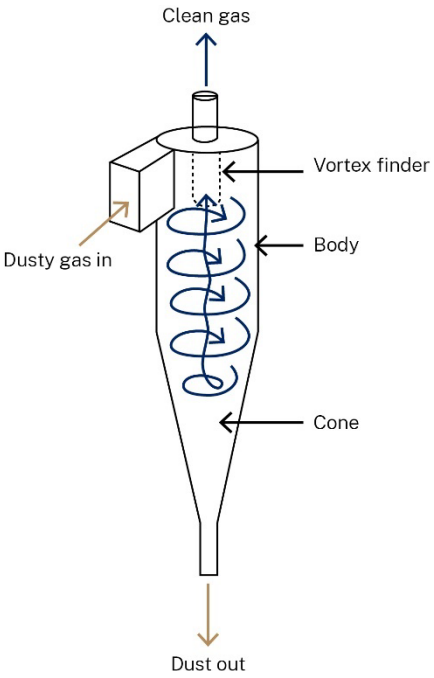

Figure 3 **Schematic of airflow through a cyclone**

Adding extraction systems can risk introducing noise issues. Council officers should be aware that there is sometimes a balance required between reducing air emissions and increasing noise.

Some additional measures include:

- having designated collection points for wood residues so as not to give rise to fugitive dust emissions. These should be emptied on a regular basis (Figure 4)
- placing a level indicator in sawdust storage and receival bins or hopper discharge bays, to warn operators when sawdust levels reach the outlet from the cyclone or baghouse discharge duct. The level indicator should be fitted with an audible or visual alarm to notify operators, and the alarm should be tested regularly
- ensuring the floors within processing areas are sealed so they can be cleaned more easily and regularly
- ensuring no open burning of wood waste
- using natural gas for boilers.

Figure 4 **Example of a dust collection system at a sawmill**
Source: Nalidsa Sukprasert/iStock

3.3 Traffic and material handling

Fugitive emissions can result from:

- traffic movements within the site on unsealed roads – wheel generated dust and uncovered loads
- material handling – loading and dumping of material
- storage – windblown dust from storage piles.

Again, minimising emissions at the source is best practice and all measures should be taken to follow these as far as reasonably practicable. Such measures may include:

- keeping highly trafficked routes moist if possible
- reducing vehicle speed limits on site
- ensuring dusty loads are covered as vehicles leave the site
- using a wheel wash for logging trucks
- keeping storage piles to a minimum size
- using water sprays under windy conditions
- ensuring enclosed storage or processing areas are maintained to avoid the enclosure becoming ineffective and open to wind erosion (fugitive emissions)
- keeping exposed areas clean and clear to avoid accumulation of material that could become windblown
- clearing all spillages as soon as possible by vacuum cleaning, wet methods, or other appropriate techniques. Dry sweeping of dusty spillages should not be permitted.

3.4 Managing odour

As with particulates, odours can be dispersed to acceptable concentrations if they are collected and vented from a suitably configured stack. Emissions should be released at a suitable height, location and discharge velocity.

If the required height is too great for this to be a realistic option, control technologies such as the use of an activated carbon filter (for solvent odours) should be considered to reduce odorous emissions before discharge. As this reduces the pollution at the source, this would be considered best practice.

Where activated carbon is used, the emissions should be regularly checked to determine when the medium needs to be replaced.

Activated carbon filters are readily available and used in a wide range of commercial applications; however, solid and aerosol particles must be removed before the adsorption process.

Wet scrubbers are generally ineffective for removing these types of odours since the odorous chemicals are rarely soluble in water.

Filters and scrubbers lose efficiency over time and so require ongoing maintenance to ensure odour breakthrough does not occur. This breakthrough happens when the activated carbon has reached saturation and cannot absorb any further volatile organic compounds. Monitoring is required to ensure the filter medium is replaced before this occurs.

4. Considerations for local councils

4.1 Scheduled or non-scheduled activity

As discussed in Section 1.1, a sawmill is either a scheduled or non-scheduled activity under the POEO Act. This depends on whether the activity satisfies the POEO Act definition of wood or timber milling or processing, and whether the capacity of the facility for processes being undertaken at the site is above or below the threshold for a scheduled activity, as set out in Schedule 1 of the POEO Act.

If the sawmill activity is a non-scheduled activity, the council is the ARA for the purposes of the POEO Act, and can direct the operators to ensure the activity is carried on in an environmentally satisfactory manner. If the sawmill activity is a scheduled activity the EPA is the ARA and an EPL is required.

Existing problems can be addressed using 2 sets of regulatory tools:

- orders requiring compliance with consent conditions under the *Environmental Planning and Assessment Act 1979* (EP&A Act)
- environment protection notices under Chapter 4 of the POEO Act (see the Local Government Air Quality Toolkit – Module 2 and Module 4), including:
  - a prevention notice or series of notices, where the ARA suspects the activity is being carried out in an environmentally unsatisfactory manner
  - a clean-up notice, where there is a pollution incident within the meaning of the POEO Act
  - both a prevention notice and clean-up notice.

If issues are identified, the following tools are available in the Local Government Air Quality Toolkit – *Resource pack*:

- Chapter 3 – checklists for investigating odour, fallout (dust deposition) or other complaints
- Chapter 6 – checklists for reviewing air quality assessments and dispersion modelling.

Under the POEO Act notice provisions, local councils are empowered to direct a recipient to take clean-up action or preventative action; for example, requiring studies to be carried out by the operation's management. Time spent making sure the brief for any investigation is thorough and covers all the relevant aspects raised in this guideline, is time well spent – for the sawmill management, for the local council and for the neighbours and wider community.

4.2 Planning and development

Local council officers can do much to prevent problems arising from sawmill operations including:

- effective planning to avoid new problems, such as encroachment on residential or other sensitive receiver areas
- ensuring sound operation and good maintenance of standard equipment to solve dust fallout problems from particulate emissions. The case study below shows an example of poor maintenance of a containment structure for sawdust, allowing wind erosion to take fine particles off site.

More information can be found in the Local Government Air Quality Toolkit – *Land-use planning* guidance note.

Potential air quality issues should be a key consideration in granting development consent and imposing conditions on the development, and ought to be thoroughly examined at the approval stage The following aspects should be considered when assessing a development application:

- For a sawmilling operation proposed to be carried out in the immediate vicinity of residential receivers or that is approaching (but not exceeding) the thresholds for the scheduled activity of 'wood or timber milling or processing' under the POEO Act, a dispersion modelling study using worst-case emission rates (or site-specific if available) should be included in the development application (as part of the Statement of Environmental Effects). See Section 4.3 of this guidance note for further information.
- For sawmilling operations further removed from residential areas, it would be appropriate to require an Air Quality Management Plan (AQMP) as a condition of the consent, to ensure all relevant dust and odour generating sources have been identified and management practices are incorporated.
- All odour and particulate generating operations should be conducted in enclosed areas with appropriate capture, filtering and ventilation.

4.3 Assessment and dispersion modelling

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

4.4 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 several operational measures that are helpful in reducing emissions and impacts from small-scale sawmills.

The local council may be required to conduct a site inspection to investigate current 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 whether scheduled or non-scheduled activities are being carried out at the premises and should review any previous reports (including diagrams, photographs and maps).

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: A complaint was made by a resident living approximately 130 m from the dust storage shed of a sawmill. The storage shed was built by the sawmill operator. Past complaints had also been made by residents at further distances (~230 m) from the storage shed, where the dust was also reaching their property.

Background: The storage shed was made of large concrete blocks that were stacked to about 3 m, making a 3-walled shed. This structure had no building approval from the local council. The roof was made of inadequately fitted metal bars that ran across each wall and a tarpaulin across the top. When the complaint was made, the tarp had been ripped apart by a storm and left in the same condition for months (Figure 5).

Figure 5 **Inadequate construction and maintenance resulting in failure of a dust storage facility at a wood processing premise**

Source: Clarence Valley Council

Response: The council officers responded with several steps:

1. A letter was sent to the business explaining the allegations and advising that an investigation was underway to check compliance with the POEO Act.
2. The complainant was emailed a diary template to be completed with evidence to support their claim.
3. The diary was returned with photographs, videos and notes attached showing an excessive amount of dust leaving the property in windy conditions due to the roof (tarp) being ripped apart.

4. A site inspection occurred under the POEO Act Chapter 7 investigation provisions.
5. A warning letter was issued to the sawmill operator requesting that the operator fix the shed and implement dust management actions to stop emitting dust outside the premises.
6. The sawmill operator did not comply within the specified timeframe and did not provide reasonable explanations as to why.
7. Further site inspections were conducted to verify the current state of the shed.
8. As evidence suggested the activity was being carried on in an environmentally unsatisfactory manner a prevention notice under the POEO Act was issued.

Mitigation: Educational materials, including this guidance note, were provided to the owner but no effective measures were taken to manage the dust nuisance.

Outcome: The prevention notice was appealed in Court, resulting in a conciliation conference that was held on site to try to resolve the matter. The sawmill operator had repaired the dust storage shed prior to the conference, including sealing the shed and installing roof water sprinklers to minimise dust emissions. The matter was resolved by the sawmill operator agreeing to follow a written dust management plan that was to be approved by the local council.

5. References and other resources

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

DEC (2006a) *Technical Framework: Assessment and management of odour from stationary sources in NSW*, NSW Department of Environment and Conservation, Sydney South NSW, www.epa.nsw.gov.au/-/media/epa/corporate-site/resources/air/20060440framework.pdf [PDF 259 KB].

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