Air quality guidance note

Small-scale sawmills

This guideline deals with air pollution issues. It does not deal with water pollution or noise.

1 Industry description

Small scale sawmills (also referred to as timber mills) are not scheduled under the POEO Act unless they have an intended annual processing capacity of more than 50,000 cubic metres of timber or timber products, or have an intended processing capacity of 6,000 cubic metres of timber or timber products per year and burn waste (other than as a source of fuel).

Operations below these thresholds are non-scheduled premises and do not require an Environment Protection Licence. They are regulated by local government.

There are approximately 160 sawmills listed in the NSW Yellow Pages, predominantly located in regional areas. Only about 10% of these premises are licensed (and therefore regulated by DECC). Local councils are the regulating authority for the remaining 90%.

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.

1.1 Industry structure

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

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

- structural timber for building purposes, including laminated beams
- specialised timber products for cabinet and furniture making, and architectural uses (skirting boards, picture rails, architraves, etc.)
- veneers and plywood
- chipboard and fibreboard composite products
- 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.

If a **specialised product** is required then, after kiln drying, further sawing and planing, or shaping (milling) may be required.

Specialised equipment is required for the production of 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. These processes will usually not be encountered in the smaller, non-scheduled sawmills.

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

2 Potential emissions to air

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

Emissions can be discharged from three types of sources in a typical saw mill:

- a **point source** venting a process or piece of equipment, for example, the smoke opening from a tepee burner or the chimney stack from a wood waste boiler
- a **fugitive source**, for example, sawdust escaping through open doors, windows or roof ridge ventilation from a building
- an **area source**, for example, dust blown from storage areas and waste stockpiles or smoke from open burning of waste.

The sources of these emissions and some of the control and management options for each of them are summarised in Table 1.

Table 1: Typical air emissions, their sources and management options for a small-scale sawmill

Emission	Nature of source	Control and management options
Smoke	• Wood-fired boilers • Tepee burners • Stepped-grate burners • Trench burning • Open burning[1]	• Improved combustion efficiency for wood • Afterburners for solvents and fumes • Alternate recovery and reuse or recycling options for wood waste.
Particulates	All of the above plus: • Sawing, planing, milling, sanding, etc. • Log reception yards • On-site traffic movements	• Collection and extraction of particulates by cyclones or fabric filter dust collectors • Use of water sprays • Use of concrete or bitumen to seal storage areas and trafficable surfaces

Emission	Nature of source	Control and management options
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

[1] Open burning of wood waste is not permitted in council areas listed in Parts 1 and 3 of Schedule 8 of the Protection of the Environment Operations (Clean Air) Regulation 2002.

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

- burning bark, sawdust and offcuts in tepee burners or open-pit fires as a means of waste disposal
- using wood waste as boiler fuel (for boilers which generate steam to heat drying kilns)
- windblown soil dust and sawdust from open storage of logs and wastes.

2.1 Woodsmoke

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.

Information about woodsmoke in the context of domestic burning can be found on the website: www.deh.gov.au/atmosphere/airquality/publications/handbook/. Woodsmoke from small sawmills is different but much of the chemistry is the same.

Observation of woodsmoke darkness

Observable shades of grey and black reflect the efficiency of combustion of woodsmoke. These shades are standardised using a ‘Ringelmann chart’ that grades such observations from white (0) to black (5). The Ringelmann method is described in Module 1 section 1.7.

The Ringelmann chart cannot be used to determine the level of particulate emissions.

Composition of woodsmoke

Woodsmoke contains carbon monoxide, carbon dioxide, water vapour and particulates including entrained ash and carbonaceous particulates or soot.

Woodsmoke also contains a range of volatile organic compounds (VOCs) and more complex tar-like organic compounds. The tars usually contain polyaromatic hydrocarbons or PAHs. The VOCs and tars impart the characteristic odour associated with the smoke.

Woodsmoke is troublesome mainly because of:

- acrid odours which affect eyes, nose, throat and lungs, and
- toxic components which affect health.

Health impacts of woodsmoke

- Some of the chemicals in woodsmoke are potentially carcinogenic and mutagenic.
- Woodsmoke can be irritating to the mucus membranes of the eyes, nose and throat.
- The finer particulates of soot can carry a range of noxious materials deep into the lungs.

2.2 Particulates

Particulates arise from the same sources as smoke (see Table 1) as well as a range of other operations in sawmills:

- combustion of wastes
- traffic and materials handling, and
- the processing of sawlogs and other timber products.

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.

Traffic and materials handling

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

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

Processing sawlogs and other timber products

Inside the mill, the processing of timber and timber products through sawing, planing, sanding, milling or turning (depending on what is being produced) generates wood shavings, sawdust, sanding dust, etc.

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 are known to be worse than others in this respect although there is considerable individual variation in the response to some timber dusts.

Such particulate matter can be carried by the wind or by traffic movements and move downwind where it may cause nuisance to adjacent or nearby landholders.

2.3 Odour

Smoke

The odour associated with smoke has been discussed above.

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 three main types of resin in current use are:

- **urea-formaldehyde (UF) resin**: these are the cheapest and easiest types of resin to use, and they cure to a clear film; they are used for standard boards that are not exposed to moisture
- **melamine-formaldehyde (MF) resin**: these resins are moisture resistant and superior to UF but are much more expensive; they are used to fortify UF resins to provide improved moisture resistance; moisture-resistant particleboard and MDF uses mixed MF/UF (or MUF) co-condensed resins
- **phenol-formaldehyde (PF) resin**: these resins are dark in colour and of the highest durability but are 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 or 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 from such operations.

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 products' desired properties.
- **Fire-retardants, insecticides and fungicides** may also be added in small quantities for specific products requiring protection.

Natural wood odours

It should be noted that **freshly sawn (or planed, sanded or milled) timber** can also produce odours associated with the natural oils and resins contained within the timber. Under hot, still weather conditions this odour can be quite strong. Although many find this smell inoffensive in the short term, this may not be the case if residents are exposed on an ongoing basis.

3 Managing air pollution

3.1 Combustion sources

Old tepee in poor condition

Tepee burners

Burning of wood waste has long been a problem with small sawmills. A traditional means of disposal has been the use of tepee burners or beehive ceramic kilns (there are few of these in NSW).

A tepee burner in its crudest form is little more than a burning heap of sawdust and offcuts within a conical covering of sheet steel having an opening at the top of the cone, often with a coarse mesh screen covering. As it is generated, wood waste from the mill is conveyed into the kiln on a continuous belt and dropped onto the apex of a burning pile. The tepee burner is described in Module 3 Part 1, ‘Air pollution control techniques’ section 4.17.

The name derives from the burner’s typical appearance being like that of a traditional North American Indian tent (commonly spelled ‘teepee’ in the US).

Combustion air is nominally admitted at the base of the cone, sometimes with notional ‘control’ dampers. But the only ‘control’ is due to the manual setting of the dampers and the natural draft generated by the combustion of the waste, which proceeds at varying rates. In practice, due to the light construction of the shell and uneven burning, it is not uncommon for the tepee structure to become warped, with most combustion air entering between holes and gaps in the conical shell.

In the ‘standard’ tepee the level of combustion control is only a marginal improvement on open burning. The flame is commonly ‘lazy’ and smoky. Swirling air resulting from wind gusts can carry burning sawdust out of the shell.

The essential conditions for good combustion, the ‘three T’s’, are **not** present in a simple tepee burner:

- There is no control over the admission of fuel and air to ensure they are in balance, allowing adequate time for combustion.
- There is no control over the temperature of the gases in the immediate post-flame zone.
- Turbulence is erratic due to the shape of the chamber and the lack of control of air flow in the tepee structure.

The three T's essential for good combustion are:

Time

Temperature, and

Turbulence.

(See Module 3 Part 1, 'Air pollution control techniques' section 4.14.)

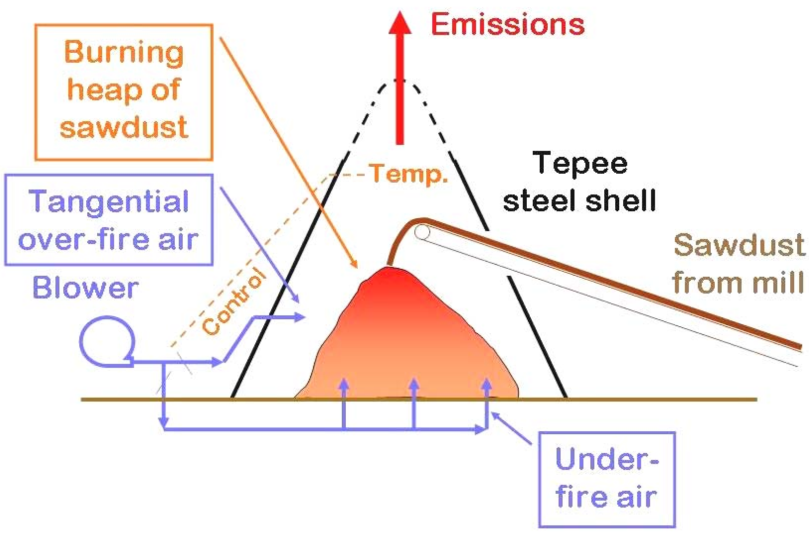
This results in a typically low combustion temperature, indicated by flue gas emission temperatures of 100 to 250°C. There is also a far greater amount of air than needed for combustion as indicated by a typical carbon dioxide (CO_2) concentration in flue gases of 1–3%. The combustion is diluted with too much excess air, and partly burned sawdust, soot and fumes are released.

'Improved' tepee burners

An 'improved' tepee burner was developed about 30 years ago in the US and Australia, in a practical attempt to improve combustion from this type of source. A substantial measure of control is achieved by fitting the typical burner with:

- controlled, under-fire combustion air provided by a mechanical blower, entering the burning pile through openings in the floor of the combustion chamber
- controlled over-fire combustion air, also provided by blower, directed above the burning zone with a configuration that ensures a measure of controlled turbulence, and
- temperature control which adjusts the under-fire and over-fire air flow to match the rate of combustion.

With the application of these measures the temperature of the flue gases from improved tepees increases to 400 to 500°C and the CO_2 concentration increases to 6–10% volume, indicating more favourable conditions for complete combustion of the waste. Visually, the smoke from 'improved' tepees is greatly reduced in density and amount.



'Improved' tepee burner

Control and the completeness of combustion can be further significantly enhanced by controlling and evening out the variability in the feed rate from the mill. But this involves collecting the waste in a hopper and feeding it at a steady rate to the burner. This in turn introduces some difficult materials handing problems. Wood waste, typically containing uneven sizes and having varying moisture contents, can be very difficult to handle so as to ensure a steady rate of feed to the burner. In smaller mills it will not generally be practical to try to control the feed rate.

Emission measurements made in the early 1970s indicate a particulate loading in flue gases of 0.2–0.4 g/m^3 (at STP corrected to 12% CO_2) for improved tepees, compared to 0.5–1.0 g/m^3 for typical tepees (J D Court, J R Harry and J H Scheltema 1974 ‘Woodwaste disposal in urban and country areas—the future for incineration’ in *Proceedings of the 1974 Australia Waste and Control Management Conference*, UNSW, pp147–152). That emission testing would not have complied strictly with current procedures, but the results can be taken to be reasonably indicative of actual emissions.

For practical reasons it is not possible to test emissions strictly according to the DEC publication *Approved methods and guidance for the modelling and assessment of air pollutants in NSW* (2005) (Module 1, section 1.7) because of the conical flow of the flue gases at the point of discharge from a tepee burner.

Outside the Greater Metropolitan Area it is possible to upgrade existing combustion equipment without needing to meet the higher standard of 100 mg/m^3 in the POEO (Clean Air) Regulation 2002.

The Greater Metropolitan Area is defined in the Regulation as:

– the Central Coast Metropolitan Area
– the Newcastle Metropolitan Area
– the Sydney Metropolitan Area
– the Wollongong Metropolitan Area, and
– the local government areas of Blue Mountains, Cessnock, Kiama, Lithgow, Maitland, Mid-Western Region, Muswellbrook, Port Stephens, Shoalhaven, Singleton, Wingecarribee and Wollondilly.

In some regional areas this may open up opportunities to upgrade existing old tepees (installed before 1997) with controlled-air firing and temperature control to meet the 400 mg/m^3 at 12% CO_2 limit, since the earlier testing indicates that they are likely to comply. However, this would not be possible in the Greater Metropolitan Area, where a limit of 100 mg/m^3 at 12% CO_2 would apply for any upgrade or replacement (Clause 32 (2) of the Regulation).

Boilers and furnaces

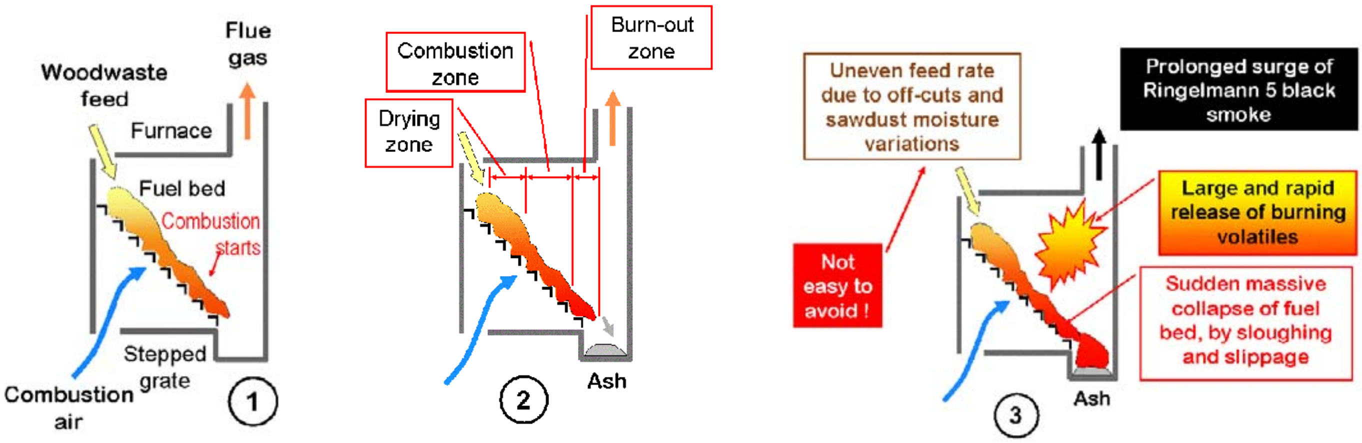
Offcuts and sawdust from sawmills are potential fuels, but opportunities to sell them have generally only emerged where the potential consumers are close to the mill. Their most immediate application within the timber industry is as a fuel for generating steam which is used as a heat source in kiln drying of sawn timber. However, air drying of timber is more common at small sawmills. Occasionally there are opportunities for wood residue firing at nearby ceramic kilns or steam raising plants, such as in hospitals.

Wood residues can be pelletised for use as a supplementary fuel, but this market has proven to be limited, with gas firing of industrial equipment now tending to be the norm. Furnaces designed for gaseous fuels are usually not suitable for handling solid fuels.

A controlled feed rate for wood is preferable for burning (i.e. using a screw feeder or moving grate). However, this can require that the offcuts are reduced in size (hogging), and there are materials handling problems associated with this: hogged wood residues tend to 'bridge' and 'hold up' in hoppers, interfering with the steady feed rate.

Stepped grate burner

An old technique commonly used for burning wood waste is the stepped grate. Gravity makes the wood waste slowly descend the stepped grate as combustion proceeds, as shown in the diagrams below.



1: Combustion initiated 2: Combustion established 3: Fuel bed collapses

However, this method needs very careful attention to evenness of quality (moisture and size) and rate of feeding. Variations in the feed rate to the stepped grate can result in sudden slumping and sloughing of the burning bed with periodic large releases of volatiles and bursts of very black smoke (Ringelmann 5) and soot.

Open burning

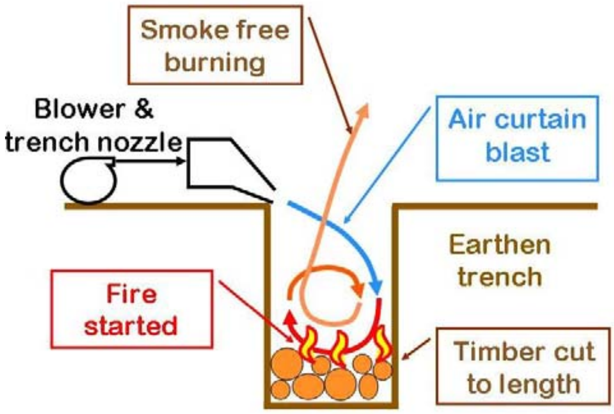
Open burning is prohibited in some council areas. It tends to be practised mostly in country areas, well away from residential areas. Some older sawmills have fenced compounds in which wood wastes are allowed to slowly smoulder and burn. This practice results in uncontrolled emissions of smoke, odour, soot and ash, exacerbated in windy weather.

Trench burners

The trench burner has been advanced as a possible means of dealing with burning problems. The trench burning technique is briefly described in Module 3 Part 1, 'Air pollution control techniques' section 4.17.

Trench burning is a significant improvement on open-pit combustion, but in some circumstances it may not be enough of an improvement for a satisfactory environmental outcome. Special care is needed for 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.

> Proposals for trench burning need careful assessment, since permanent trench burners are unlikely to comply with the particulate emission limits for new non-scheduled plant.
>
> Whether such plant can be construed as 'replacement' and therefore be allowable in non-metropolitan areas needs careful consideration on a case-by-case basis.



3.2 Managing odours other than woodsmoke odours

Odours can be dispersed to acceptable concentration levels if they are collected and vented from a suitably configured stack (i.e. emissions are released at a suitable height, location and discharge velocity).

If the required height is too great for this to be a realistic option then control technologies such as **burning** or **activated carbon adsorption** can be used to reduce odorous emissions before discharge.

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. (Module 3 Part 1, 'Air pollution control techniques' section 4.11.)

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

4 Assessment process

The assessment of premises and particular activities in relation to air quality management takes place in several contexts:

- in connection with the **development approval process**, either for the initial establishment or for refurbishment of equipment or increased level of operation
- as part of a **council audit** of all businesses in the area (e.g. as part of a regular audit program)
- in response to a specific **complaint about emissions** from the premises.

Whatever the context it is helpful to have a simple and systematic process for assessing potential and actual air pollution sources from the site. This section describes such a process and relates to the assessment checklist for small-scale sawmills at the end of this document.

4.1 Visual inspection

A visual inspection of the sawmill site and operation can ascertain:

- the location and surroundings of the premises (nearby land use, topography)
- the nature of the activities taking place
- the types and standards of emissions management and control.

4.2 Housekeeping

Housekeeping, both inside and outside the mill, is generally important because accumulated debris such as shavings and sawdust can be readily mobilised and dispersed by the wind, resulting in fugitive low-level emissions that can be a significant nuisance for nearby land uses (although the level of nuisance will depend on the nature of the land use).

- What is the housekeeping program for the mill? A written procedure should be available, supported by on-site staff training.

4.3 Management of storage areas and trafficable areas

The movement of sawlogs and traffic in the yard can generate dusts.

- Are fugitive emissions minimised by using water sprays or sealing trafficable areas?
- Are there wheel wash facilities for the logging trucks?

Standing downwind at the property boundary, or at the nearest premises from which complaints may be, or have been generated, on a dry and windy day, is the simplest way of determining whether a potential problem exists with respect to fugitive dust emissions.

4.4 Management of sawmill processes

Sawmill processes are major sources of airborne wood shavings and sawdust. Some questions to ask are:

- Are wood shavings and sawdust being extracted and collected via cyclones or fabric filter dust collectors, or both?
- Are visible particulate emissions being discharged from the stacks venting these processes or from the collection devices?

Spontaneous ignition of wood shavings and sawdust

It is important that **PVC plastic piping is NOT used** as ducting for the collection of wood particulates as static charges will accumulate and result in the potential for a dust explosion. **Metal ducting should be used**.

Similarly, **fans should be dust ignition proof (DIP)** in order to avoid explosions and fires and their associated air quality impacts. AS 61241.2 – *Electrical apparatus for use in the presence of combustible dust* describes flammable dust equipment requirements.

This is a specialised area and if the status of electrical equipment, switches, fans and lighting are unknown or considered to be in poor condition, WorkCover NSW can be contacted to follow-up on these compliance aspects [1].

Particulate fallout

Standing downwind at the property boundary, or at the nearest premises from which complaints may be, or have been generated, on a dry and still day, is the simplest way of determining whether a potential problem exists with respect to particulate emissions from point sources. Particulates will tend to fall out in the immediate area.

[1] AS 2430 – *Identification of hazard zones* (i.e. equipment suitable for flammable dusts must comply with Class 1, Zone 21/22 requirements), and AS2381 – *Selection of electrical equipment and wiring methods*, are also relevant.

4.5 Management of additional wood product processes

The further manufacturing of wood-based products can involve additional sawing, planing, sanding, milling, turning or the production of veneers, plywood, laminated beams, and fibre-based products such as chipboard.

The usage and consumption rate of **resins, adhesives and other additives** must be understood in order to estimate emissions from these types of activities.

The operator should be able to provide Material Safety Data Sheets (MSDS) on the chemicals in use—these are available from the chemical suppliers. Many of these materials are odorous and potentially toxic, and workplace exposures may need to be appropriately managed as well as emissions beyond the boundary of the premises.

Where the odours associated with these chemicals can be clearly discerned downwind at the boundary, it is likely that operations at the premises could potentially cause nuisance impacts, and either odour control at source or improved dispersion of odours is required, or both.

Burning of **timber treated** with copper-chrome-arsenate (CCA) or pentachlorophenol (PCP) is prohibited by the Protection of the Environment Operations (Clean Air) Regulation 2002 (clause 6D).

> Burning treated timber releases highly toxic compounds into the atmosphere.
> This is the reason why it is prohibited and the prohibition must be enforced.

4.6 Management of wood wastes and residues

> In regional areas the management of wood waste presents a real problem for local councils and small operators. For practical and economic reasons small operators may just burn their waste, causing significant smoke emissions. Recycling or reuse options should be investigated by the operator, in preference to tepee burning, open burning or dumping of wood wastes.

Wood residues can constitute up to 50% of the original timber entering a mill. Traditionally this has been burnt in boilers to provide steam for heating drying kilns. Larger mills have also generated electricity from wood wastes.

Tepee or beehive-type burning arrangements and open burning of wood waste should not be allowed if this creates amenity impacts (smoke and odour) for nearby land uses, because it is not possible to control emissions from these types of sources.

- Has the operator investigated all reuse and recycling options for their wood wastes?

> Depending on available markets, most wood residues can be recycled for composting, vermiculture, animal bedding, wood fibre products, and so on.

5 Improving emission performance

Most impacts from small-scale sawmills will be limited to the immediate and local area. Depending on the topography (e.g. if the mill is in a small valley) and meteorology (e.g. still atmospheric conditions or an atmospheric inversion layer), the open burning of wood wastes can result in limited dispersion and therefore have a broader subregional impact.

A broad range of options is available to smaller saw mills to improve their emission performance. They can be categorised as being either **management options** or **control technology options**. In most cases a combination of these techniques will be the most effective.

5.1 Management options

Management options include waste minimisation and cleaner production initiatives (see the case study at the end of this document), and the manner in which plant is operated and maintained. For example, whether training programs are in place.

Housekeeping is also very important, such as keeping the mill and yard tidy and free of excessive quantities of sawdust, wood waste and other debris.

Good management includes dealing with the issues associated with combustion of wood waste at small sawmills, as outlined above in section 3.1. Wood-fired boilers should only be fed with dry non-contaminated fuel, and not overloaded. Overloading can lead to insufficient air being available for efficient combustion to occur, creating excessive smoke (especially in natural draught configurations). Depending on the boiler design, the hearth may need to be raked occasionally to help air flow.

Land use planning

An important management option which may only be available once or twice during the mill's lifespan is the selection and management of the location where it is established. The location should make sure there is sufficient **separation distance to the nearest receptor** to effectively disperse residual emissions after the control technology has been applied.

An unsuitable location, or allowing unsympathetic development close to a sensitive receptor, such as housing, will create problems that may be difficult to manage and control in the future. The extent of the separation distance required will depend on the size of the mill and the control technology employed.

5.2 Control technology options

> The efficiency of any particulate control device is a function of particle size. Therefore it is important to understand the size distribution of the particles that are to be controlled in order to design or select the most effective air pollution control device for the application.

To achieve environmental standards for particulate emissions being discharged to the environment it is often necessary to use an air pollution control device. Control technologies applicable to small-scale sawmills include:

- simple inertial separators
- multi-cyclones

- fabric filters (often used in combination with inertial devices)
- carbon adsorbers (for solvent odours)
- combustion based on sound principles:
  – adequate time
  – adequate temperature
  – adequate turbulence
  – control of waste feed rate
  – control of combustion air.

These techniques are described in Module 3 Part 1, ‘Air pollution control techniques’.

6 Considerations for consent conditions

Other conditions may be necessary to control environmental impacts other than air pollution.

6.1 Acceptable standards

- The premises to be maintained in a condition which minimises or prevents the emission of dust.
- Total dust deposition beyond the boundary of the premises not to exceed 4 g/m^2 per month.
- Roads and storage areas within the boundary of the premises to be watered or sealed (or both) to minimise the emission of dust.
- All loads of wood chips and sawdust being removed from the premises effectively covered to control spillage.
- Except with the permission of the consent authority, sawdust or sawmill waste not to be deposited on any land, whether by way of filling or otherwise, or burnt—except in fuel burning equipment of a type approved by the consent authority.
- Any boiler or furnace using wood residues to be operated and maintained so that efficient combustion occurs.
- Only dry and non-contaminated wood residues to be burnt.
- Solid particle emissions to comply with POEO (Clean Air) Regulation 2002 for any stack discharges on the site:
  – 400 mg/m^3 for plant installed before 1 August 1997 (not for a new development consent)
  – 250 mg/m^3 for plant installed between 1 August 1997 and 1 September 2005 (not for a new development consent)
  – 100 mg/m^3 for plant installed after 1 September 2005.

  NOTE: Upgrades outside the Greater Metropolitan Area can operate at the original standard of 400 mg/m^3.
- Smoke emission to comply with
  – Ringelmann 2 or 40% opacity for plant installed before 1 August 1997, with allowance for start-up

  - Ringelmann 1 or 20% opacity for plant installed after 1 August 1997, with allowance for start-up.
- Compliance testing to be considered in each situation, but it is generally not feasible for solid particles in relation to open burning, trench burning or tepee burners.
- Plant to be operated and maintained in a proper and efficient manner which does not cause air pollution, in accordance with s. 124 and 125 of the POEO Act.
- Materials to be handled in a proper and efficient manner which does not cause air pollution, in accordance with s. 126 of the POEO Act.
- Chemical odours from the premises not to be detectable at the nearest sensitive land use.

6.2 Controls

- Sawdust and other particulates generated during the processing of timber to be captured at source and transported to a hopper or other storage facility by means that prevent fugitive dust emissions. Such transfer to incorporate additional dust collection and control where required to minimise dust emissions.
- Cyclones to be used where appropriate to control and collect larger particulates.
- Baghouses or other devices to be used to control and collect fine particulates.
- Dust collectors to be individually fitted to tools or pieces of machinery, or a centralised dust collection unit to be installed with an appropriately designed ducting and collection interface.
- Collection points for wood residues to be configured so as not to give rise to fugitive dust emissions, and to be emptied on a regular basis.
- A level indicator to be placed in sawdust storage and receival bins or hopper discharge bays, to warn workers when the sawdust level reaches the outlet from the cyclone or baghouse discharge duct. The level indicator to be fitted with an audible or visual alarm to notify workers. This alarm to be regularly tested.
- The sawdust storage bin or hopper discharge bay to be enclosed on three sides, and a flexible plastic or canvas chute attached to the discharge outlet to prevent unnecessary free fall of the dust into the storage bay (or truck, if configured for truck loading).
- The floor of the sawdust storage discharge bay to be sealed.
- No visible particulate emissions to be discharged from a point source serving a baghouse.
- Cyclones, baghouses and other dust collectors to be maintained in efficient working condition at all times.
- Wood-fired boiler or furnace systems to be configured for a constant supply of wood residue and designed for the efficient combustion of this rate of supply in terms of the size of the combustion chamber and the combustion air requirements.
- The stack serving a wood-fired boiler or furnace to have free vertical discharge and be sufficiently high to clear the roof of the tallest building on site by at least 5 m.
- No open burning of wood wastes and residues is allowed.

- Timber processing areas where resins and other chemicals are used to be suitably ventilated and have odorous emissions captured and discharged at a suitable height so as not to cause odour nuisance. Alternatively, activated carbon filters may be used to adsorb odours before discharge to atmosphere.
- Where activated carbon is used, the emissions to be regularly checked to determine when ‘breakthrough’ has occurred. The carbon filter to be changed once this point has been reached. Used carbon filters disposed of to landfills licensed to accept such wastes.

Small-scale sawmills: air quality management checklist

This checklist has been designed for:

- assessment officers—to help identify potential air pollution issues early in the assessment process and devise consent conditions which will prevent or minimise air pollution problems
- compliance officers—to help with routine inspections, as part of an audit program or as part of a complaint investigation
- site managers and foremen—to help identify and manage potential air quality issues
- owners and operators—as part of a set of educational materials and to help identify and manage potential air quality issues.

Company
Address
Site location

Contact	Permit assessment
	Complaint response
Phone	Compliance inspection
Fax	Time & date of inspection
Email	Inspector’s name

A Site location and context

What are nearby sensitive land uses? (e.g. schools, hospitals, car detailers, etc.)

	Land use	Distance	Comments
North			
South			
East			
West			

What are the characteristics of the site that will affect the dispersion of air pollution?

Topography	
Prevailing winds	
Other	

B Sketch plan of the site

Draw a sketch plan of the site showing the surrounding land uses, nearby buildings and local topography.

N
↑

Note particularly:

- nearby sensitive land uses (schools, homes, other affected premises)
- locations of any complainants
- locations and heights of nearby buildings or trees
- locations and heights of stacks on premises
- wind directions during times of complaint (night and day)
- any other relevant features.

Comments:

C Results of odour survey

Date	**Time**	**Location** [1]	**Wind speed** [2] **(estimate)**	**Wind direction**	**Temperature** [3]	**Weather:** cloudy sunny	**Odour type**	**Odour strength:** weak medium strong	**Comment**

1 Make observations upwind and downwind of source premises.

2 Estimate in metres per second, or knots, or by the Beaufort scale, or failing that, descriptively, e.g. still, light breeze, moderate wind, strong wind and so on.

3 If the temperature is not known or can not be measured at the time of the survey, then find and record it later.

D Activities

Tick yes if the activity is carried out on the premises, and add comments as appropriate.

Core business

Activity	**Yes**	**Comments**
Structural timber		
Veneer		
Plywood		
Chipboard		
MDF		
Chips		
Timber treatment		
Other		

Waste disposal

Activity or equipment	**Yes**	**Comments**
Recycling or reuse		
Recovery for on-selling		
Wood waste boiler		
Tepee, beehive or trench burner		
Open burning		
Other		

Comments:

E Standard of housekeeping on the premises

Indicate: satisfactory (✓), unsatisfactory (x) or NA and any action required.

Activity	Standard	Comments
Sawlog reception		
Timber storage		
Waste storage		
Sawing area		
Fuels		
Chemicals		
Planing, sanding, milling, turning		
Other		

General comments on housekeeping:

F Emissions to air

Tick if yes and add comments as appropriate.

Smoke

Question	Yes	Comments
Is all combustion of wood wastes efficient?		
Are the essential elements of combustion control practised: • feed control? • combustion air control? • the three Ts?		
Smoke does not cause a nuisance to any neighbours. Describe any complaints.		
Can sources of smoke be controlled or prohibited?		

General comments and recommendations on smoke:

Odours

Question	Yes	Comments
Odours are collected and controlled?		
Odours cannot be detected off site? If they can, describe when and where.		
Odours do not cause offence to any neighbours? Describe any complaints.		
Are more controls needed?		

General comments and recommendations on odours:

Management of particulates

Question	Yes	Comments
Particulate fallout (deposition of dust) is not detectable off the premises.		
Particulate fallout is not present at any complainant's premises.		
Is there appropriate watering of yard and storage areas?		
Are there wheel wash facilities?		
Are trafficable areas in and around the premises hard-surfaced?		
Are conveyor belts enclosed?		
Are collected dusts recycled (R), burnt (B) or land-filled (L)?		
Are wood wastes transported off site in covered vehicles?		
Are cyclones used to collect particulates?		
Are baghouses used to collect particulates? **If so, check:**		
Maintenance log for the bags is up to date?		
Manometer is correctly calibrated?[2]		
Pressure drop indicated by the manometer is adequate?[3]		
Ducting is dust-tight?		
No particulates visible in baghouse exhaust?[4]		
Dust collection hoppers serviced regularly?		

General comments and recommendations on particulates:

[2] The manometer should read 'zero' before the equipment is switched on.
[3] Too high may indicate clogged bags and too low may indicate holes in the bags.
[4] Particulates should not be visible in the baghouse exhaust.

G General safety issues

Tick if yes and add comments as appropriate.

Operational aspect	Yes	Comments
Are fans and other electrical equipment handling wood dusts intrinsically safe?		
None of the dust-collecting duct work is made of plastic pipe?		
Are fire protection measures appropriate?		
Are chemicals appropriately stored and handled?		

General comments and recommendations on safety issues:

List any attachments here:

Case study:

A small-scale sawmill that has achieved significant environmental improvements and cost savings

The company and its business

Tasman Lumber Company Ltd is a timber processing enterprise with a staff of 110. The company operates a sawmill, a round wood operation, and timber processing facilities producing timber and 150 tons of timber residues per day. The company is located in New Zealand. This case study was part of the Ministry for the Environment's cleaner production demonstration project in the 1990's.

Cleaner production principles

- Good housekeeping
- Recovery, reuse and recycling of waste materials.

Cleaner production application

Previously discarded waste material now kept clean and sold on to make another useful product.

Sawdust generated from timber processing operations that was previously disposed of is now being sold to make medium-density fibreboard. The entrance to the sawdust bin and the loading ramp have been concreted to keep the sawdust free from grit and stones, etc. The concrete pads are cleaned twice a day and rubbish is no longer put on the sawdust belts. Sawdust samples are collected twice a day and tested for grit content.

Packaging material that was previously used only once is now reused and …

80% of the timber is reprocessed on site, and it is bundled for transporting around the site. Wire strapping used to bundle the timber was being discarded in the company's landfill after a single use. The wire has now been replaced with reusable and recyclable polypropylene plastic strapping, reducing costs by 50% per year, and extending the life of the landfill. The company aims to ultimately reduce wire usage by up to 80%. Wire is still used for strapping lumber despatched directly from the sawmill, as the plastic strapping is not yet certified for road transportation.

… then it is recycled.

A scrap chopper was installed to produce manageable batches of plastic strap for recycling. The remaining wire and metal strap is also being recycled. Plastic strapping is now being reused 1.7 times on average.
The success of these projects highlights the importance of maintaining the quality of material being sold for other uses.

Waste that cannot be further processed commercially is used for fuel or passed on to other users.

Fifty percent of the bark is being burned for fuel. The remaining bark is taken by various customers on demand. Bark is available free to anyone at the site.

Environmental and economic benefits

The life of the local landfill has been extended.

Products are now being made out of material previously wasted. Sawdust is no longer being dumped, extending the life of the landfill. The quality program put in place for the sawdust ensures that the standard of materials being sold is sufficiently high.

Packaging costs have been halved.

Implementing the cleaner production program has led to most waste being reused or recycled. Strapping costs have decreased by 50% with a payback period of 1.3 years. Savings on sawdust and bark are about $100,000 per year.

An initial cost of only $13,000 is now generating an income of $5,000 per month.

The capital cost of preparing the sawdust bin was $13,000. Sale of the sawdust brings in $5,000 per month—a payback period of only two and a half months. The following table sets out the economics of this project. No income is gained from the plastic strap. Recycling the wire and metal strap is generating $20 per tonne.

Costs of changing from wire to plastic strapping

Costs per annum for material	**Wire**	**Strapping**	**Difference**
Wire	$19,314		
Polypropylene strap		$4,665	
Polypropylene seals		$2,792	
Total	$19,314	$7,457	$11,857
Other costs per annum			
Magnetic truck	$2,500		
Recycling labour		$5,664	
Wirers	$1,425		
Total per annum	$23,239	$13,121	$10,118
One-off purchases			
Tensioner		$1,332	
Sealers		$880	
Dispenser		$660	
Chopper		$8,760	
Total one-off costs		$11,632	
Total one-off + per annum	**$23,239**	**$24,753**	**[$1514]**
Payback period	**1.15 years**		

Constraints

Bark is still produced in greater quantities than demanded. Transportation costs can make it prohibitive for bark to be sold outside the area.