Module 3:
Guidelines for managing air pollution

Summary tables

Contents

Summary tables

This section contains tables which summarise and cross-reference air pollution control techniques, pollutant discharges, and activities and premises.

Activities and premises

This Module includes DECC guidance notes for eleven specific activities and business types that local councils have regulatory responsibility for:

- agricultural stubble burning
- beef cattle feedlots
- composite structural products (fibreglass etc.)
- construction sites
- dairies
- egg production
- food outlets
- meat chickens
- piggeries
- small-scale sawmills
- spray painting operations.

In addition, local government officers have identified several other premises and activities they deal with in relation to air quality issues. They are:

- car parks
- domestic combustion sources (coal/wood fired heaters and stoves, barbecues)
- irrigators
- medical facilities
- non-domestic combustion sources (boilers, furnaces, incinerators, crematoria)
- small and medium-scale manufacturing industries (metal products, white goods, furniture manufacturers), dry cleaners and print shops
- small waste disposal sites
- timber treatment
- truck terminals.

Some of these premises and activities are not present in some council areas. Some do not cause significant air quality issues, either because of appropriate control measures or because of their location. However, each of them presents issues for many local councils across NSW.

In a survey of local government officers the respondents identified the following five activities and premises as being of most importance for air quality management in their local areas. Their level of importance was comparable for councils in both regional and metropolitan areas:

1 construction sites
2 domestic combustion sources
3 vehicle repairs and spray painting
4 food outlets
5 manufacturing industries.

The following tables can also help council officers identify issues and find solutions for activities or premises which have not been addressed in a specific guidance note.

1 Air pollutant discharges from activities and premises

The air pollutant discharges that are commonly associated with a range of activities and premises are summarised in Table 1. Most pollutants can occasionally come from all activities.

Definitions

The pollution terms in Table 1 are defined as follows:

Odour	Offensive odour
Particulates	Suspended particulate matter from non-combustion sources (such as sand blasting) or windblown from land surfaces.
Fallout	Deposited air pollutants. Principally solid particulate matter, but including aerosols and liquid droplets.
Smoke	Visible emissions from combustion, usually black or grey.
Soot	Deposition stains from combustion processes, manifest as black stains and smears.
Fumes	Visible, non-combustion emissions of aerosols or droplets, which may also be odorous.
Toxic substances	Substances generally identified as toxic to humans, usually being those materials identified under the National Pollutant Inventory as toxic. They are frequently emitted as colourless vapours or gases, although toxic solid particles are also included.
VOCs	Volatile organic compounds (hydrocarbons), mainly from solvents and products of incomplete combustion. Cumulative precursors to photochemical air pollution (ozone).
NO_x	Nitrogen oxides, mainly in the form of nitric oxide which is converted photochemically to nitrogen dioxide. Cumulative precursors to photochemical air pollution (ozone).
CO	Carbon monoxide—a colourless, odourless gas resulting from incomplete combustion and capable of impeding the oxygen transferring capacity of the blood in persons inhaling it.

Table 1: Air pollutant discharges commonly associated with a range of activities and premises

	Air pollutant discharge									
Activity or premises	Odour	Particulates	Fall-out	Smoke	Soot	Fumes	Toxics [1]	VOCs	NO_x	CO
Agricultural stubble burning		✓	✓	✓	✓	✓	✓	✓	✓	
Beef or lamb feedlots	✓	✓	✓					✓	✓	
Car parks					✓			✓ [2]	✓	✓
Composite products	✓		✓			✓	✓	✓		
Construction sites		✓	✓	✓ [3]	✓	✓				
Dairies	✓	✓								
Domestic combustion sources	✓			✓	✓		✓	✓ [4]	✓	
Dry cleaners	✓						✓	✓		
Egg production	✓	✓	✓							
Food outlets	✓		✓			✓	✓	✓		
Food processing	✓	✓				✓		✓	✓	
Irrigators	✓	✓	✓				✓			
Manufacturing industries	✓	✓	✓	✓	✓	✓	✓	✓	✓	
Meat chickens	✓	✓	✓							
Medical facilities	✓			✓	✓	✓	✓ [5]	✓ [6]		
Non-domestic combustion			✓ [7]	✓	✓		✓		✓	
Piggeries/pork	✓	✓								
Print shops	✓						✓	✓		
Small waste disposal sites	✓	✓	✓				✓	✓		
Timber sawing or milling	✓	✓	✓	✓	✓	✓		✓	✓	✓
Timber treatment	✓					✓	✓			
Truck terminals	✓		✓	✓	✓	✓		✓	✓	✓
Vehicle repairs, spray painting	✓		✓ [8]			✓	✓	✓	✓	

[1] Toxic emissions from agricultural and related activities are from burning residues containing pesticides.

[2] VOC emissions from car parks can be large since most vehicles lose fuel vapour after parking ('hot soak').

[3] Smoke from any heavy diesel equipment operating on construction sites.

[4] Assuming heaters are wood fired; PAHs and dioxins can be formed in this type of heating.

[5] If medical waste is incinerated there is a high potential to emit dioxins.

[6] From solvent evaporation from pathology laboratories.

[7] Only likely with solid or liquid fuel combustion. Gas fuel should be free of fallout, smoke and soot.

[8] Fallout from spray painting operations will be solidified paint and enamel particles.

2 Characteristics of air pollution control techniques

Large and technically complex air pollution control systems like those used in scheduled premises are not usually encountered in the non-scheduled activities and premises managed by local councils.

The air pollution control techniques commonly used for the activities and premises managed by local councils are listed in Table 2. The table includes the characteristics of each technique and the applications for which they are and are not effective. (No tick indicates ‘not applicable’.)

More detailed description of the principles of operation and what to check for each of these techniques is contained in the following section of this Module.

Key to Table 2 characteristics

The characteristics of the air pollution control techniques listed in Table 2 are indicated as follows:

Characteristic	High	Medium	Low
Capital cost	$$$	$$	$
Energy usage	↯↯↯	↯↯	↯
Space requirements	❒❒❒	❒❒	❒
Maintenance	🧍🧍🧍	🧍🧍	🧍
Special features	Any special features are noted.		

Table 2: Air pollution control techniques—characteristics and effectiveness of their application

Air pollution control technique	Characteristics					Effectiveness of application									
	Capital cost	Energy usage	Space requirements	Maintenance	Special features	Odour	Particulates	Fall-out	Smoke	Soot	Fumes	Toxic substances	VOCs	NO_x	Carbon monoxide
Dispersion	$$	↯	❒ 1	🧍	'idiot proof' 2	✓✓✓	✓	✓	3	✓	✓	✓✓	✓ 4	✓	✓✓
Dust suppression	$	↯	❒	🧍			✓✓	✓✓				✓ 5			
Inertial separators	$	↯	❒	🧍	'idiot proof'		✓	✓							
High-efficiency cyclones	$$	↯↯	❒❒	🧍🧍	'idiot proof'		✓✓	✓✓		✓					
Fabric filters	$$$	↯↯	❒❒❒	🧍🧍🧍	maintenance		✓✓✓	✓✓✓	✓	✓✓	✓✓	✓✓ 6			
Low-energy particulate scrubbers	$	↯	❒❒	🧍🧍	waste water		✓	✓✓							
Medium-energy particulate scrubbers	$$	↯	❒❒	🧍🧍🧍	waste water		✓✓	✓✓✓		✓	✓	✓			
High-energy particulate scrubbers	$$$	↯↯↯	❒	🧍🧍🧍	waste water		✓✓✓	✓✓✓		✓✓	✓✓	✓✓ 7			

1 Assuming dispersion is achieved through elevation of the discharge from a stack. If it is achieved by a buffer zone, space requirement will be large.

2 It is impossible to operate a stack improperly or inefficiently, provided the ducting is not bypassed and there is not an incentive to do so.

3 Visible smoke is an offence whatever the height of discharge.

4 VOCs and NO_x can be diluted to alleviate any local impacts, but dispersion is not effective for the regional impacts which are cumulative.

5 If the dust is from remediation of a contaminated site and contains toxic materials.

6 If the toxic substances are in particulate form.

7 If toxics are soluble or contained entirely in the particulate matter.

Air pollution control technique	Characteristics					Effectiveness of application									
	Capital cost	Energy usage	Space requirements	Maintenance	Special features	Odour	Particulates	Fall-out	Smoke	Soot	Fumes	Toxic substances	VOCs	NO_x	Carbon monoxide
Gaseous scrubbers	$$$	↗↗	❐❐	🧍🧍🧍	liquor recovery	✓✓ 1	✓ 2	✓			✓	✓✓ 3	✓✓		
Electrostatic precipitators	$$$	↗↗	❐❐❐	🧍🧍🧍	rare for LG	✓ 4	✓✓✓	✓✓✓	5	✓	✓	✓ 6			
Adsorbers	$$	↗	❐	🧍	break though 7	✓✓✓	X 8					✓✓ 9	✓✓		
Biofiltration	$$	↗	❐❐❐	🧍🧍	food odours	✓✓✓	✓				✓	✓	✓		
Incineration	$$	↗↗↗	❐❐	🧍🧍🧍	yields full destruction	✓✓✓	✓ 10		✓	✓	✓	✓✓	✓✓✓		✓
Capture and fugitive emissions	$$	↗	❐❐	🧍	governs overall	✓✓	✓	✓	✓		✓	✓	✓✓		

1 If odorous materials are soluble.

2 Some particulates can be removed, but care is needed to make sure collected material does not result in blocking of the packing.

3 Provided the toxic materials are soluble.

4 Only if odorous aerosols are present.

5 Most precipitators will not effectively collect black smoke due to poor combustion.

6 If contained in particulate matter.

7 Monitoring of the breakthrough point and replacement or regeneration of the adsorbent is essential for effective operation.

8 Accumulated particulates, especially if sticky, can render the adsorption process ineffective.

9 If the toxic materials are gaseous and adsorbable.

10 If the particles are not ‘refractory’, such as carbon soot.

3 Air pollution control techniques for activities and premises

The air pollution control techniques that are commonly used in each of the activities and premises listed above are summarised in Table 3.

Some of the activities, agricultural stubble burning for example, obviously involve no special technology and are appropriately managed through suitable timing in the context of weather conditions and neighbouring land use.

Table 3: Air pollution control techniques commonly associated with activities and premises

	Air pollution control technique												
Activity or premises	Dispersion	Dust suppression	Inertial separators	Filters	Low-energy particulate scrubbers	Medium-energy particulate scrubbers	High-energy particulate scrubbers	Gaseous pollutant scrubbers	Electrostatic precipitators	Adsorbers	Biofiltration	Incineration	Capture and fugitive emissions
Agricultural stubble burning	✓	✓										✓	
Beef or lamb feedlots	✓✓	✓✓											✓
Car parks	✓✓												✓
Composite products	✓✓			✓						✓		✓	✓✓
Construction sites	✓	✓✓											✓
Dairies	✓	✓											
Domestic combustion sources	✓	✓								✓		✓	✓
Dry cleaners	✓							✓		✓		✓	✓✓
Egg production	✓✓	✓✓									✓		✓✓
Food outlets	✓✓			✓	✓				✓	✓		✓	✓
Food processing	✓	✓✓		✓✓	✓	✓	✓	✓	✓	✓✓	✓✓	✓✓	✓✓
Irrigators	✓	✓											
Manufacturing industries	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Meat chickens	✓✓			✓	✓					✓	✓		✓✓
Medical facilities	✓							✓		✓	✓	✓	✓✓
Non-domestic combustion	✓✓		✓✓	✓								✓✓	
Piggeries/pork	✓✓	✓✓									✓		✓
Print shops	✓							✓		✓		✓	✓✓
Small waste disposal sites	✓	✓✓						✓✓		✓✓	✓	✓✓	✓✓
Timber sawing or milling	✓	✓✓	✓	✓		✓						✓✓	✓
Timber treatment	✓	✓								✓		✓✓	✓✓
Truck terminals	✓												✓
Vehicle repairs, spray painting	✓✓			✓✓	✓	✓✓				✓✓		✓	✓✓

4 Air pollution control techniques for air pollutant discharges

The air pollution control techniques that are commonly used for the different air pollutant discharges listed in Table 1 are summarised here in Table 4. Reference should be made to Table 2 for a short description of each air pollution control technique and, in particular, the applications for which each technique is effective or ineffective.

More detailed description of the principles of operation and what to check for each of these techniques is contained in the following section of this Module.

Table 4: Air pollution control techniques commonly used to manage different air pollutant discharges

	Air pollutant discharge									
Air pollution control technique	Odour	Particulates	Particulate fall-out	Smoke	Soot	Fumes	Toxic substances	VOCs	NO_x	Carbon monoxide
Dispersion	✓	✓	✓		✓	✓	✓			✓
Dust suppression		✓✓	✓✓							
Inertial separators		✓	✓✓			✓				
Filters		✓✓✓	✓✓✓		✓✓	✓	✓✓			
Low-energy particulate scrubbers		✓	✓✓							
Medium-energy particulate scrubbers	✓ 1	✓✓	✓✓✓	✓	✓	✓				
High-energy particulate scrubbers		✓✓✓	✓✓✓	✓✓	✓✓	✓✓	✓✓ 2			
Gaseous pollutant scrubbers	✓✓ 1	✓	✓	✓	✓		✓✓	✓✓ 3		
Electrostatic precipitators		✓✓✓	✓✓✓		✓	✓	✓ 4			
Adsorbers	✓✓✓	X 5					✓✓✓			
Biofiltration	✓✓✓	✓✓	✓✓				✓✓	✓		✓
Incineration	✓✓✓	✓		✓	✓	✓✓✓	✓✓	✓		✓
Capture fugitive emissions	✓✓✓	✓	✓✓			✓✓✓	✓✓	✓✓✓		

1 If the odour causing substances are soluble.

2 If the toxic substances are soluble or in particulates.

3 If the VOCs are soluble in the scrubber liquor.

4 If the toxic substances are in particulates or aerosols.

5 Particulates **must** be removed before the adsorber.

5 Air pollutant discharges associated with products

The premises and activities listed in Tables 1, 3 and 5 cover the majority of products whose manufacture or growth potentially involves air quality management issues. However, there are some manufactured or grown products that might not be easily locatable in any of those premises or activities. Table 5 lists the discharged pollutants that are commonly associated with a range of manufactured or grown products.

Table 5: Air pollutant discharges commonly associated with a range of products

Products	Air pollutant discharge									
	Odour	Particulates	Particulate fall-out	Smoke	Soot	Fumes	Toxic chemicals	VOCs	NO_X	Carbon monoxide
Bricks and tiles		✓	✓	✓	✓			✓	✓	✓
Cement and concrete		✓	✓				✓ 1		✓	✓
Chemicals	✓			✓	✓	✓	✓	✓	✓	
Construction		✓	✓						✓	
Electricity		✓	✓	✓					✓	
Ferrous metals		✓	✓	✓		✓			✓	✓
Food products	✓	✓					✓	✓	✓	
Mining—surface		✓	✓		✓				✓	
Mining—underground									✓	✓
Non-ferrous metals		✓	✓			✓	✓ 2	✓	✓	
Paints	✓			✓	✓		✓	✓	✓	
Paper and cardboard	✓	✓		✓		✓	✓	✓	✓	
Petroleum products	✓	✓		✓	✓	✓	✓	✓	✓	✓
Plastics and rubber	✓			✓	✓	✓	✓	✓		
Printed products	✓						✓	✓	✓	
Railways				✓	✓	✓			✓	
Roadways				✓	✓	✓	✓ 3	✓	✓	✓
Sewage	✓							✓		
Solvents	✓			✓	✓		✓	✓		
Stock feeds	✓	✓						✓		
Timber		✓		✓	✓	✓				
Waste disposal	✓	✓	✓	✓	✓		✓	✓	✓	
Waste treatment	✓	✓		✓	✓	✓	✓	✓	✓	

1 If the kiln is being used for destroying hazardous wastes.

2 Dioxin emissions are high for zinc, not for other metals.

3 Benzene emissions from traffic are high.

6 Monitoring devices for air pollution control techniques

Monitoring devices and their effectiveness for the different air pollution control techniques are summarised in Table 6. Reference should be made to Table 2 for a short description of each air pollution control technique and, in particular, the applications for which each technique is effective or ineffective. **The commonly preferred method is shown underlined** (x). It's important to use judgement here—many situations do not warrant expensive monitoring!

Table 6: Monitoring devices for air pollution control techniques

	Monitoring device									
	Pressure gauge	Smoke meter	Opacity meter	Tribo-electric sensor	Temperature	VOC detector (FID)	Ambient PM_{10}	Deposit gauge	Field odour survey	
Air pollution control technique	In stack						Beyond boundaries			**Comments**
Dispersion (in-stack monitoring)	x						x		x	Pressure gauge on control device can indicate extent of ground-level fugitive emission.
Dust suppression							x	x		Only usually warranted for larger earth-moving or material-moving operations.
Inertial separators	x			x						Monitoring is not usually warranted for coarse dust. Complaints will indicate a problem.
Fabric filters	x		x	x						Pressure drop only indicates reduced capture efficiency (fugitive), not emissions from holes in bags.
Low-energy particulate scrubbers	x									Pressure drop is the key performance parameter. Emission monitoring not usually warranted.
Medium-energy particulate scrubbers	x									Pressure drop is the key performance parameter. Emission monitoring not usually warranted.
High-energy particulate scrubbers	x		x							Opacity monitoring requires removal or evaporation of 'vapour' droplets before measurement.
Gaseous pollutant scrubbers	x				x	x			x	Pressure drop and temperature indicate problems with liquor circulation.

	Monitoring device									
	Pressure gauge	Smoke meter	Opacity meter	Tribo-electric sensor	Temperature	VOC detector (FID)	Ambient PM_{10}	Deposit gauge	Field odour survey	
Air pollution control technique	In stack						Beyond boundaries			**Comments**
Electrostatic precipitators			x	x			x	x		In-stack measurement will directly indicate reduced precipitator removal efficiency.
Adsorbers	x					x			x	Pressure drop indicates blockages of adsorbent bed. VOC monitoring shows ‘breakthrough’ point.
Biofiltration	x				x				x	Stack discharge unusual, so VOC monitoring not possible. High temperature destroys microbes in bed.
Incineration		x			x	x				Time, temperature and turbulence are key parameters. Temperature is operationally dependent.
Capture fugitive emissions	x						x	x	x	No preferred method. Usually not warranted if primary capture and control is efficient.