Air quality guidance note

Spray painting operations

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

1 Description of operations

Applying protective and decorative coatings to items other than fixed architectural surfaces is generally achieved by spray painting, especially for repetitive painting jobs.

Spray painting is mostly undertaken in paint spray booths (PSBs) in a variety of small and large businesses and manufacturing operations. Booths can either be dedicated to a sole activity where spray painting of items (furniture, cars, production run items, etc.) is continuous, or they can handle piecework such as in motor vehicle smash repairing or refinishing.

Emissions from spray painting have significant implications for both local and regional air quality.

Odours, fallout and toxic impacts are local, but as precursors to photochemical air pollution, solvents and other VOCs have potential regional impacts.

Local council officers have an important role in managing these operations and achieving positive environmental outcomes.

1.1 Scope of activities

Smaller-scale operations that use spray painting are not usually scheduled under the POEO Act and so do not require an Environment Protection Licence. They are regulated by local councils as non-scheduled premises.

Industries in which spray painting is encountered include:

- smash repairers or auto-refinishers
- auto mechanics
- furniture makers
- boat builders and repairers
- kitchen manufacturers
- carpentry businesses (e.g. staircases, partition shutters)
- metal fabricators such as welding and general engineering workshops.

Electrostatic spray painting of furnishing parts

1.2 Surface coating systems

Conventional surface coatings or paints applied in spray painting are usually a mixture of:

- resins or polymers which 'cure' or 'harden' to produce a durable coating on the application surface
- coloured pigments and fillers, and
- solvents or water acting as carriers for the resins that evaporate during application and drying.

Solvent-based coatings were the first to be developed and are generally the preferred type for smash repairs.

Water-borne coatings also contain small amounts of solvents. Water-borne coatings are used by vehicle manufacturers for undercoats and primers, but are mostly unsuitable for refinishing because of relatively long drying times. Top coats or finish coats have tended to be solvent-based for automobile coatings.

Coatings are:

– solvent-based or

– water-borne.

Solvent-based coatings tend to predominate in non-production line operations, such as smash repairers.

Categories of solvent-based coatings are:

– lacquers

– enamels

– urethanes

Solvent-based coatings

Solvent-based coatings can be further categorised into the order in which they were developed or 'evolved' in the industry as

- lacquers
- enamels, and
- urethanes (two-pack systems).

The quality and durability of the final finish, from lacquers through enamels to urethanes, depends to an increasing degree on cross-linking and polymerisation of the resins after application. The amount of solvent in the formulation tends to decrease as the polymerisation increases.

From an air-quality perspective (i.e. in relation to VOC emissions) **the more recently developed urethanes are the most preferable, but they can pose an occupational problem for applicators** because they contain isocyanates, to which asthma sufferers are particularly sensitive.

Smash repairers or auto-refinishers

Smash repair or auto-refinishing operations involve:

- vehicle preparation
- vehicle priming
- top coat application, and
- equipment clean-up.

Blending repair coatings to match the surrounding vehicle finish calls for the application of successively thinner coats and more solvents.

> Smash repairers commonly have to use paint systems which are different from those used by vehicle manufacturers.
>
> **The systems used by smash repairers typically have more solvent emissions.**

Vehicle manufacturers apply coatings using production line machinery in an enclosed process. Here the metallic vehicle bodies or body parts can be baked whole in an oven to cure the coating. These systems also collect and control VOC emissions from the baking ovens.

Smash repairers cannot use heat curing to the same extent or at the same temperature as manufacturers, because of the jobbing-style of their operations and the need to work on vehicles already fitted with internal trim. The coatings, formulations and techniques used in the manufacturers' production lines, including some water-based formulations, are therefore generally not suitable for repairs and refinishing.

1.3 Operation of spray painting

Spray painting refers to the process of atomising a paint-solvent mix—forming a mist of fine liquid aerosol paint droplets 10–50 μm (micrometres) in diameter—in a 'gun' under pressure, and applying the aerosol spray onto the object or surface to be painted.

The sprayed surfaces are then allowed to 'tack off' when the volatile solvents evaporate leaving a uniform coating.

A dry-off period follows, giving the coating time to harden or cure.

Most paint solvents and thinners are flammable, many are odorous and some are potentially toxic. The application of sprayed paint must be conducted in a situation where the air pollutants emitted are controlled for both operators and neighbours. This is accomplished with spray booths and extraction ventilation and dispersion systems, considered further below.

The dominant method of spray application has been a compressed air gun (40–70 psi) with either gravity, suction or pressure feeding of the paint-solvent mix. More recently, high-volume low-pressure (HVLP) suction-feed guns have been developed using lower pressure (5–10 psi). HVLP application reduces 'bounce back' from the work piece, and overspray is also reduced. Electrostatic spray systems also offer a higher efficiency of application.

2 Potential emissions to air

The potential emissions to atmosphere from spray painting operations are:

- **evaporated solvents** (as VOCs) from drying of coating formulations, thinners and cleaners
- **odours**, caused by odorous solvents and VOCs
- **toxic compounds**, to the extent that solvents, thinners and cleaners are toxic
- coating **overspray** or 'carryover', and
- **sanding and blasting dust** arising from surface preparation in some activities, such as smash repairing or timber painting.

Evaporated solvents, odours and dust are the most common problems encountered at local government level in dealing with small to medium-scale spray painting activities.

2.1 Local impacts

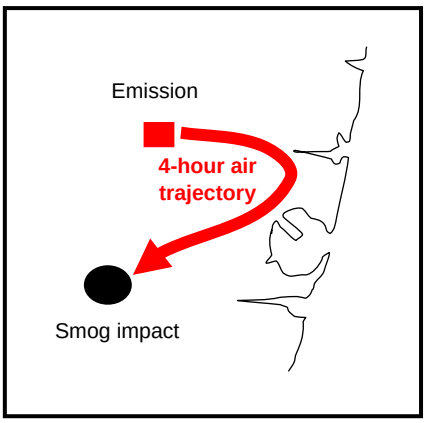
Efficient capture in a spray booth at the point of evaporation does not **in itself** prevent emission of solvents, odours and toxic compounds.

Overspray and **sanding dust** can cause local soiling and fallout problems. Most paint overspray will dry in the air during transport from the emission point to the 'target' so 'wet' paint fallout is rarely a problem. Fallout problems are usually recognised due to a complaint.

Many solvents and thinners are **odorous**. Some solvents and thinners are also **toxic**. Once evaporated, solvents will be emitted from the spray painting establishment unless they are contained in a capture or ventilation system and either removed from the air stream or destroyed. **Capture alone does not eliminate the emissions.**

Local impacts from small to medium-sized establishments are typically ameliorated by dispersion of solvent emissions to acceptable levels in the environment. Alternatively, coating formulations can sometimes be changed to reduce solvent emissions or substitute less odorous or toxic solvents.

2.2 Regional impacts



Solvents evaporated in spray painting are precursors to photochemical air pollution ('smog'). In the presence of strong sunlight they react with nitrogen oxides in the atmosphere to form ozone and other undesirable photochemical air pollutants.

This is a regional impact. The time taken for the solvents emitted from spray painting to react photochemically is typically from three to four hours. (See diagram above.) By that time the air parcel containing the emissions will have moved to another locality in the air basin. (Refer to Module 1 of this Toolkit.)

While not a dominant component, it is significant given the broad Government approach that each emission source should bear a proportionate responsibility for control of total emissions.

End-of-pipe controls, such as carbon adsorbers and thermal oxidisers, are not generally cost effective for small establishments such as smash repairers. They are, however, feasible in larger manufacturing establishments.

In California, where smog and toxics control has had a very high priority, the allowable solvent content in surface coating formulations used by spray painters has been progressively reduced by legislative pressure over the past 30 years. The development of lower-VOC emission formulations in this jurisdiction has resulted in spin off benefits for other places, such as Australia, where solvent content is not (yet) legislated for air quality.

Each year over 4,000 tonnes of VOCs are discharged to the air from smash repairers in Sydney. These contribute about 3% to overall VOC smog precursors.

Californian air quality regulators have forced major developments in low-VOC emission formulations for spray painting. Some of these formulations are available in Australia.

In general, local council officers will not be in a position to require significant reductions in VOC emissions from spray painting. But they should be aware that, in situations where local circumstances require such a reduction, as distinct from dispersion, there are wider regional benefits in addition to local air quality.

3 Solutions

There are essentially two practical solutions to local air pollution problems from small to medium-scale spray painting operations:

- filtration or scrubbing to remove particles and droplets of resin, and
- dispersion of evaporated solvents to control odours and exposure to toxic materials.

Both techniques assume that capturing and containing emissions at source in the spray painting establishment is efficient and effective. In other words, work should be done in properly designed and well-maintained spray booths to the maximum extent possible.

Dispersion can reduce odour impacts from spray painting

A properly designed and well-maintained spray booth ensures efficient capture of spray painting emissions

A few other measures are important in mitigating impacts:

- good housekeeping
- efficient application of coatings in the spraying operation
- proper disposal of solvents and thinners.

These can result in small but significant reductions of emissions, especially of solvents and thinners.

In some situations a change to a new coating or paint formulation might remove particularly odorous or toxic materials from the emissions and contribute to the solution of a local problem.

Low emission and zero emission paints are available and, though expensive and sometimes resulting in a 'lower quality' (less glossy) finish, they may appeal to customers who want an environmentally friendly paint.

For larger installations and production line coating applications, air pollution control equipment to reduce emissions may be warranted, such as carbon adsorbers or thermal or catalytic oxidisers. (See Module 3 Part 1, 'Air pollution control techniques'.)

3.1 Identifying specific problems

Before going on site for an inspection or assessment the following should be checked:

– the consent conditions for the premises or the activity, and

– any previous reports on file including diagrams, photographs, maps, etc.

Common sources of emissions

Emissions to air occur from the following points:

- the booth exhaust vent or stack, where the aerosols not caught by the filter and the solvent vapour are released to atmosphere
- the dry-off area, either as fugitive or captured emissions
- the exhaust vent of any baking oven where residual solvent vapours are released
- the paint preparation and spray gun cleaning areas, where paint and cleaning solvent vapours are released, and
- the surface preparation area, if it is not enclosed and hooded to capture dust (e.g. from sanding and sand blasting).

General guidance for an investigation into complaints of odour and fallout are outlined in Module 3 Part 2, 'Practical regulation of air pollution sources'.

A 'sniff survey' around the installation will often reveal a problem. Observations should be made both upwind and downwind and the wind strength and direction noted. However, if it is warm and sunny or windy when the 'sniff survey' is done, odours which would be detectable in relatively still, cooler conditions may not be detected. Several surveys are desirable. Refer to the meteorology information in Module 1 section 2 for a description of the best meteorological conditions for a survey, e.g. when dispersion is poor.

Identifying specific sources of emissions

An inspection of a spray painting operation should cover **all phases of the process**. (See also the attached checklists). Make sure that an inspection covers the following aspects of the operation:

All phases of a spray painting operation should be inspected

Where are sprayed items dried off?

Mix preparation

- Where is the paint-solvent mix prepared?
  - Preparation is often carried out in a separate paint-mixing room to protect workplace health standards, but this will not reduce solvent emissions unless the exhaust gas is treated. Separate paint-mixing rooms with proper exhaust systems can improve dispersion.
  - Mixing should not be carried out in workshop doorways where immediate neighbours can be exposed to solvent evaporation.
- Is solvent evaporation occurring in ventilated booths? Check solvent evaporation from spray application and drying off.
  - If not, then fugitive solvent emissions will be at a lower vertical height than the stack and therefore dispersion will be less effective.

Sanding and surface preparation

- Is this carried out in booths with filtered or scrubbed exhausts?

Clean-up of spray guns and equipment

- Is this done in a controlled space?

Extraction booth filter and ducting

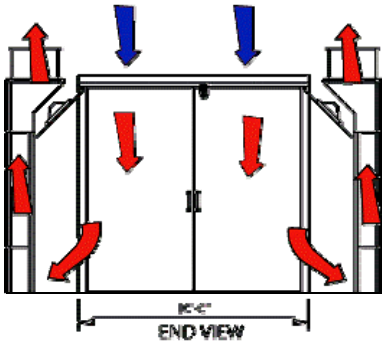
- Is the extraction system designed and operated according to Australian Standard AS 4114.1 and 4114.2?
- Is the filter cleaned or replaced regularly?
- Are there any gaps around the filter medium?
- Do the doors close tightly during operation?
- Is there adequate draft through any openings in the booth, e.g. 0.5 m/s minimum across any open face?
- Is the booth a down flow or cross flow arrangement? (See diagrams at right.)
- Is the booth under negative pressure?
  - Is there a pressure gauge?
  - Is the pressure drop across the booth and filter greater than 60 Pa (0.25 inches water gauge)?
  - If pressure drop becomes too high, flow through the booth is reduced and fugitive emissions increase, causing possible odour complaints.

Spray gun types

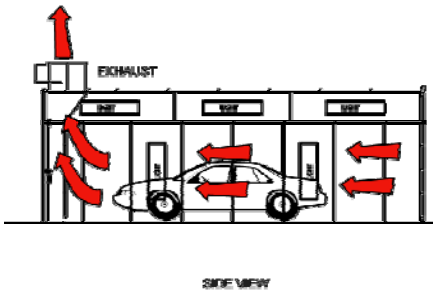
- Are the spray guns:
  - standard pressure
  - HVLP or
  - electrostatic?

More efficient paint application (i.e. using HVLP or electrostatic guns) reduces the amount of solvent evaporation.

Doors securely closed during operation?



Down flow spray booth



Cross flow spray booth

Booth manometer, useful for detecting blocked filters or poor ventilation flows.

Waste disposal

- Are spent solvents disposed of by licensed waste contractors?
- Are spent solvents held in closed systems for disposal and not exposed for evaporation?

Discharge stacks

- Discharge stacks should be designed according to Australian Standard AS 4114.1 and 4114.2, with a stack height at least 3 m above the highest point of the roof line.
- The design discharge velocity should be between 12 and 15 m/s.
- Stacks should have a vertical discharge not impeded by an old-style rain protector.

Stacks should be high enough so that dispersion is not impeded by downwash from buildings or by other tall objects such as trees acting as wind barriers (see Module 1 section 2 and Module 3 Part 1,'Air pollution control techniques' section 3).

Carefully designed equipment for clean-up and disposal of thinners and cleaning solvents can reduce solvent emissions

Dispersion impeded by trees

Dispersion impeded by adjacent buildings

3.2 Industry good practice

In addition to generating air emissions, spray painting operations also work with a high risk of creating other environmental problems, such as water contamination, incorrect waste handling and treatment or threats to health and safety in the workplace. Work practices which address these issues often also constitute good practice for air pollution control. Good housekeeping and orderly, well-documented operations contribute to minimising emissions to air (e.g. due to fewer spills or accidents).

The hazard, safety and occupational health issues associated with spray painting are considerable. Many materials handled are not only toxic (e.g. solvents, isocyanates) but also flammable. WorkCover NSW administers the relevant occupational health and safety legislation for spray painting. The WorkCover NSW Health and Safety Guide, *Spray Painting, Guide 2001* should be consulted for industry requirements and good practice (available at www.workcover.nsw.gov.au). It covers many aspects including ventilation requirements, storage of dangerous and flammable materials and storage and handling of the many materials involved.

Compliance with occupational health and safety requirements can also improve environmental performance, but is no guarantee that environmental requirements will be met.

Good practice tips

The following list of good practice tips for spray painting operations has been developed by Marrickville Council and DECC.

Solvent and paint handling

The solvents emitted from spray painting are VOCs and contribute to photochemical smog, so using more efficient spray guns to minimise paint and solvent emissions is worthwhile. As some solvents are also toxic minimising their emissions is worthwhile from this perspective too.

- Don't place solvents in garbage bins.
- Solvents should be recycled or collected by a licensed contractor.
- Spray guns should be cleaned in gun wash bays or using purpose-designed equipment.
- Airless or HVLP spray guns are the preferred type of gun.
- Spray paint should be directed towards exhaust systems.
- Solvent containers should be sealed when not in use.
- Don't spray paint outside booths.
- Mix paint in a ventilated room.
- Solvent recovery units should be in well ventilated areas with adequate exhaust to ensure dispersion.
- If possible switch to less toxic materials.

If switching formulations to avoid toxic materials is not feasible, dispersion is the main option for toxic emissions. Consult the DEC publication *Approved methods for the modelling and assessment of air pollutants in NSW* (2005) to make sure dispersion (stack height or separation distance) is adequate.

Filters, scrubbers and adsorbers

Make sure the following requirements are complied with:

- equipment always maintained in good working condition
- routine maintenance program in place
- filter medium fully covering the support frame
- spare filters kept on site
- booths not operated when filters, scrubbers or adsorbers are not in place
- if scrubbers are installed, there is a routine clean out of accumulated solids and scrubbing liquor is disposed of in an approved manner
- if adsorbers are installed for odour control (as a last resort), the adsorbent is replaced when 'breakthrough' occurs.

Remember that scrubbers are not generally effective for removing solvents and odours.

Australian Standards

The relevant Australian Standards for paint spray booths are:

- AS/NZS 4114.1: 2003 *Spray painting booths, designated spray painting areas and paint mixing rooms, Part 1: Design, construction and testing*
- AS/NZS 4114.2:2003 *Spray painting booths, designated spray painting areas and paint mixing rooms, Part 2: Installation and maintenance.*

In general these standards focus on occupational health and safety issues for spray painting booths.

3.3 Reducing odour impacts

When an existing spray painting operation presents a continuing problem (e.g. odours, fallout) and housekeeping and work practices have been brought up to an adequate level, further control equipment and process changes should be considered.

The two types of equipment to be considered are higher stacks to improve dispersion and control equipment to reduce the rate of emission.

Options for reducing odour impact, in priority order are:

1 better dispersion—higher stack

2 changed paint formulation

3 changed procedures

4 emission control—adsorbers, thermal oxidisers, catalytic oxidisers.

Improving dispersion

For spray painting operations, the main option for odour control at the local council level is better dispersion—if formulation switching is not feasible. Better dispersion is achieved by raising the height of discharge, i.e. installing a higher stack for the release of air streams containing solvents and other odours.

Study by a reputable consultant will often be required, in accordance with DEC publications:

- *Approved Methods for Modelling and Assessment of Air Pollutants in NSW* (2005) and
- draft policy *Assessment and Management of Odours from Stationary Sources in NSW* (2001).

Such a study will always involve dispersion modelling at the appropriate level of intensity and will often involve measuring the odour concentrations of the emissions.

There are a few important aspects for local government to consider when overseeing these studies, to make sure the best outcome is achieved:

Raising a stack next to a nearby high building can solve an odour problem without the need for an expensive dispersion study.

- **Is the consultant competent and experienced in odour assessment and dispersion?**
- **Will the surroundings complicate the dispersion modelling?** Are high buildings or clumps of high trees in close proximity, or is steeply rising land nearby? These will tend to increase the uncertainty of modelling predictions.
- **Were the odour strength measurements made under representative operating conditions?** Are these representative conditions likely to vary over time? Changes in paint formulations can make a big difference to the rate of odour emitted as various solvents have widely differing odour thresholds.
- Given the high cost of such a measurement and modelling study, **would a simple elevation of the stack to well above the height of nearby buildings overcome the problem** for the same expense as the dispersion study?
- Be aware that **predicting the odorous strength of mixtures of odorous compounds is not a reliable science.**

Installing control equipment

For most 'jobbing'-type spray painting operations encountered by local councils, fitting odour control equipment will generally not be feasible.
Forget scrubbers—they do not work for odour!

Installing equipment to remove solvent from an air stream will generally be a last resort for small to medium-sized spray painting operations. The large volumes of air that must be exhausted to ensure adequate health and safety conditions for workers make control equipment very expensive and usually well beyond the operator's financial capability.

If there is no other solution than fitting control equipment, then options for consideration are:

- adsorbers installed after efficient filters
- thermal oxidisers, or
- catalytic oxidisers.

Refer to Module 3 Part 1, 'Air pollution control techniques' for detailed information about their requirements.

If it proves necessary to install control equipment, the parties involved may take comfort in knowing that controlling VOC emissions will contribute to an improvement in regional air quality.

Substituting materials

Changing paint formulations can remove particularly odorous solvents from the operations. But remember, formulations are changing all the time. **Vigilance is needed!**

Changing the paint mix formulation to avoid particularly odorous solvents may be able to significantly reduce the odour emission rate while maintaining the quality of finished spray painting.

This option is best explored by the operator in conjunction with surface coating suppliers. However, to be effective, the changes must be conducted as trials accompanied by reliable and independent assessment of odour levels in the vicinity.

Changing work procedures

A change to procedures can reduce odour impacts in some situations.

Operating procedures

Avoiding spray painting operations during late evening or night will help to avoid dispersion conditions in which odour is likely to have greatest impact. However, most smash repairers already limit their hours of operation from early morning to early evening, often reinforced by consent conditions.

If a problem persists with these limitations already in place, it will not usually be possible to limit certain types of formulations to times of the day when odour dispersion is likely to be more effective. The variation in the daytime dispersive capacity of the atmosphere is not usually sufficient to address odour problems effectively.

Operations outside designated hooded areas and booths should be prohibited.

Careful handling of solvents, avoiding spills and keeping solvent and paint containers closed when not in use are all important measures.

Maintenance procedures

> If a business has gone to the expense of installing equipment to overcome environmental problems, it pays to spend the little extra required to keep it in good working order …**and** to put in the extra effort of training employees to use it properly.

Sound maintenance of control equipment that has already been installed plays an important role in continued mitigation of odour impacts.

- **Filters should be changed regularly.** If they become blocked, back pressure on the booth builds up so that solvents are not collected in the booth and are discharged at ground level rather than through stacks. Also, overspray will be discharged from the stacks. If filters are not replaced regularly the discharge velocity will be reduced and this can affect dispersion.
- **If filters do not cover the whole suction area** of the ventilation air, bypassing and discharge of overspray will occur.
- **If scrubbers are installed** to remove particulates and overspray, the water treatment, circulation and make up system should be checked regularly to make sure it is operating correctly.
- **If adsorbers are installed** to remove odours, the adsorbent material (usually activated carbon) should be changed at ‘breakthrough’.
- **If thermal or catalytic oxidisers are installed,** the control systems should be checked regularly to make sure operating temperatures are maintained, burners are serviced regularly and catalysts changed when their recommended life has expired.

Commitment by management

The firm's management needs to lead the way in complying with sound procedures, and encourage all employees to be aware of factors leading to increased emissions.

4 Local council management

Local council officers can do much to prevent problems arising from spray painting operations.

- Effective planning can avoid new problems.
- Ensuring sound operation and good maintenance of standard equipment can solve fallout problems.
- Requiring better dispersion and changed operations can address odour problems.

4.1 Planning and development

A thorough examination of potential odour and toxicity problems at the approval stage should be a key consideration in granting development consent and imposing conditions on the development.

- A dispersion study using worst-case odour emission rates should be included in the development application (Statement of Environmental Effects) for any significant spray painting operation.
- All spraying and paint mixing operations should be conducted in well-designed, ventilated and filtered booths and enclosures.
- Surface preparation should be carried out in enclosed, ventilated and filtered spaces.
- Hours of operation should be limited to daylight hours unless control equipment is installed specifically to control odours.
- WorkCover NSW and Australian Standard requirements for spray painting should be followed.

The quality and experience of the consultants used for the investigative work is critically important.

4.2 Regulatory and enforcement activities

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

- compliance with consent conditions under the EP&A Act, and
- using the notice provisions of the POEO Act (see Module 2 and Module 3 Part 2, 'Practical regulation of air pollution sources') to issue:
  - a Prevention Notice or series of notices, or
  - a Clean-up Notice, when appropriate,

  or both.

Under the POEO notice provisions, local councils are clearly empowered to call for studies to be carried out by the operation's management. However, time spent making sure the brief for any investigation is thorough, and covers all the aspects raised in this guideline, is time well spent—for the management, for council and for the neighbours and wider community.

4.3 Education

Educating the management and the operators about the environmental risks associated with spray painting operations will handsomely repay any effort expended. For all parties involved, education can be far more effective than extensive and formal regulatory action.

A number of educational resources are available to help with managing the environmental impacts of spray painting:

- *Spray Painting, Guide 2001,* WorkCover NSW Health and Safety Guide
- *National Guidance Material for Spray Painting*, 1999, National Occupational Health and Safety Commission
- Occupational Health and Safety Regulation 2001 (Part 7.1 Spray painting)
- *An environmental checklist for smash repairers*, and *Environmental review of smash repairers: a tool for councils*, 2001, DEC

5 Considerations for consent conditions

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

5.1 Standards to be met

In cases where odour modelling and testing is to be undertaken, odours from the premises to comply with the requirements of DEC draft policy *Assessment and management of odour from stationary sources in NSW* (2001).

- 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 Aug 1997 (not for a new development consent)
  - 250 mg/m^3 for plant installed between 1 Aug 1997 and 1 Sept 2005 (not for a new development consent)
  - 100 mg/m^3 for plant installed after 1 Sept 2005.
- Smoke to comply with Ringelmann 1 or 20% opacity.
- Need for compliance testing to be considered in each situation, balancing expense to the operator against likely sensitivity and the extent of likely impact.
- 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.

- Construction, installation and maintenance of spray booths, spray painting areas and paint mixing rooms to comply with AS/NZS 4114. 1 and 4114.2 2003.

5.2 Operational and control requirements

- Odours from the premises not to be detectable at the nearest sensitive land use.
- Odorous exhaust gases from spray painting booths, baking ovens and paint mixing areas to be either:
  - vented at a height which is demonstrated to comply with the requirements of DEC *Approved methods for the modelling and assessment of air pollutants in NSW 2005,* or
  - treated using activated carbon adsorbers, direct thermal oxidisers or catalytic oxidisers before the exhaust gases are discharged to atmosphere; the ventilation system to be equipped with efficient filtration equipment to remove particles and aerosols from the exhaust before it enters activated carbon adsorbers.
- Activated carbon adsorbers to be checked regularly for odour 'breakthrough' (and the filter changed once breakthrough has been reached).
- Spent activated carbon to be disposed of to landfills which are licensed and approved to accept this type of waste material.
- Direct thermal oxidisers to be designed to maintain a temperature of 750^0C for 0.5 seconds residence time and equipped with temperature monitoring and control.
- Exhaust stacks to be vented at a height clear of downwash effects from the building in which the activity is located and adjacent buildings and a minimum of 3 m above the highest point of the building roof ridge line or above that of any higher, adjacent building within 50 m.
- Exhaust stack gases to be vented with a design exit velocity of at least 10 m/s without any impediment to vertical discharge.
- Spray booths, filters and other control devices to be operated and maintained in accordance with the manufacturer's requirements.
- Filters to be replaced or cleaned when the paint spray booths negative pressure requirement of 50 Pa is compromised by more than 10 Pa (i.e. <40 Pa or >60 Pa).
- Monitoring of control equipment to be assessed based on:
  - extent of emissions
  - toxicity or odorous potential of emissions, and
  - sensitivity of the activity.
- Appropriate monitoring devices to be used, as specified in accordance with Table 6 of the Module 3 Summary tables.
- All activities, including housekeeping, to be carried out according to industry best practice.
- Where appropriate, hours of operation to be restricted to ensure there are no impacts on sensitive receptors.

Spray painting operations: 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.
- 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?

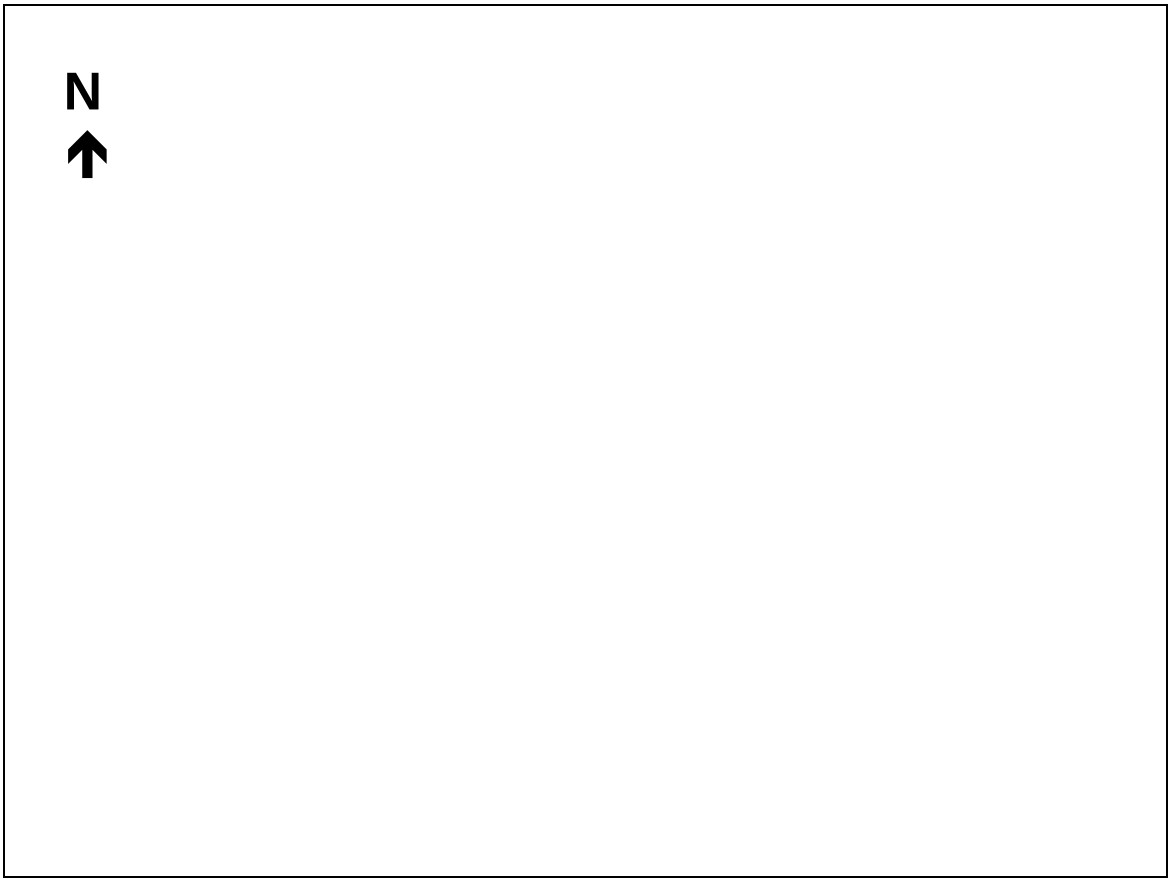
	Land use	Distance	Comments
North			
South			
East			
West			

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.



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 Core business and equipment

Tick if yes and add comments as appropriate.

Types of items sprayed

Item	Yes	Comments
Car bodies		
Furniture		
Production		
Other		

Types and numbers of spray booths

Type	Size	No.	Comments

Types and numbers of air filters

Type	Size	No.	Comments

Types and numbers of stacks

Type	Size	No.	Comments

E Installation and maintenance of equipment

Indicate as satisfactory (s) or unsatisfactory (u) and add comments as appropriate.

Assessment of cabinets and spray booths

Chamber purpose		Installation		Operation
Surface preparation[1]		Enclosure Exhaust Australian Standard		Condition Records Neg. pressure
Spray painting		Enclosure Exhaust Australian Standard		Condition Records Neg. pressure
Paint mixing		Enclosure Exhaust Australian Standard		Condition Records Neg. pressure
Baking		Enclosure Exhaust Australian Standard		Condition Records Neg. pressure
Dry-off		Enclosure Exhaust Australian Standard		Condition Records Neg. pressure
Equipment clean-up		Enclosure Exhaust Australian Standard		Condition Records Neg. pressure

[1] Identify as appropriate

Comments and recommendations on spray booths

Indicate as satisfactory (s) or unsatisfactory (u) and add comments as appropriate.

Air filters

Type		**Installation**		**Operation**
		Location Gaps or defects		Condition Replacement
		Location Gaps or defects		Condition Replacement
		Location Gaps or defects		Condition Replacement

Attach photographs here:

Comments and recommendations on filters

Indicate as satisfactory (s) or unsatisfactory (u) and add comments as appropriate.

Other control equipment

Type		**Installation**		**Operation**
Scrubbers		Location Pressure		Condition Treatment
Adsorbers		Location Pressure		Condition Treatment
Oxidisers		Location Pressure		Condition Treatment

Attach photographs here:

Comments and recommendations on control equipment

Exhaust stacks

	Unit served			
Is discharge impeded by rain cap?				
Height above roof line (m) (should be at least 3m)				
Is dispersion impeded by nearby buildings or trees				

Attach photographs here:

Comments and recommendations on exhaust stacks

F Management of paints, pigments, new and used solvents

How are unused paints, pigments and solvents stored?[2]

	Open storage	**Enclosed room *without* venting**	**Enclosed room *with* venting**	**Comments**
Paints				
Pigments				
Unused solvents				

[2] The storage of paints, pigments and solvents is predominantly an occupational health and safety issue (under the aegis of WorkCover NSW) but it still has an impact on emissions from the premises to the outside air.

How are used solvents managed?[3]

Disposal	**Check**	**Comment**
Open container allowing evaporation		
Closed container		
Closed container and provision for removal or recycling		

[3] The management of used solvents is also predominantly an occupational health and safety issue. However, evaporation from an open container within a work area will also contribute to the fugitive discharge of VOCs to the outside air.

Comments on the general standard of housekeeping:

G Complaints from nearby premises

Odours

Date	Complainant	Distance and direction from spray painting operation	Time of day	Comments

Overspray and spotting

Date	Complainant	Distance and direction from spray painting operation	Time of day	Comments

General comments on complaints:

List any attachments here: