# *ENVIRONMENTAL CODE OF PRACTICE*

# *FOR*

# *AUTOMOTIVE SPRAY PAINTING*

***DEPARTMENT OF THE ENVIRONMENT***

***FOREWARD***

This environmental code of practice is intended to provide guidance to owners and operators of automotive spray painting premises as to the likely environmental impacts associated with the industry and the acceptable methods of control.

In some circumstances, alternative practices or equipment, other than those suggested in the code, may be equally effective in limiting environmental impact.

The code is not intended to be regulatory, but essentially advisory, and is definitely not intended to encroach on any other areas of legislative responsibility.

The Department of the Environment (DOE) believes that if the code is honestly maintained by the industry, their operations will cause little, if any, adverse environmental effects. The code can be applied in a relaxed manner if the automotive spray painting premises are a reasonable distance form housing or other sensitive land uses. If the industry is located in a sensitive area, where there is an air, noise or water impact, the code would need to be diligently adhered to.

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# ***AUTOMOTIVE SPRAY PAINTING***

## *1. Introduction*

The mass production of automobiles with the advent of the assembly line was the principal factor in the development of the spray method of painting, which allows the rapid application of a uniform smooth coat.

Over the past 50 years or so, the spray painting of automobiles has progressed from nitrocellulose lacquers, to very sophisticated plastic materials involving resins and catalysts. Today, the variety of automobile paints is applied by a selection of systems relying on a spray technique. Most paints used in spray painting are suspended in an organic solvent of some kind.

The most common method of application involves the paint being mixed with air and sprayed from a nozzle onto the painted surface, but alternative techniques involving electrostatic means enables the volume of air used to be reduced and so minimize the loss by overspray and solvents.

Environmentally unsound practices in the paint spraying industry are not uncommon. Some painters clean spray guns by spraying solvents through the equipment, and discharging the solvents into the atmosphere. Excess paints and contaminated solvents are often poured onto the ground at the rear of the premises, with the potential to pollute groundwater, wetlands, rivers and streams. Complaints are common from neighbours of spray-painting premises who find the odour of the paint solvents irritating and, where spray painting is carried outside of a booth, from spray drift entering their premises.

Organic compounds used as solvents and thinners cause land and water pollution during disposal and add to environmental pollution by their evaporation into the atmosphere. The major objective of this code is to promote the collection and recycling of solvents wherever possible.

## *2. A Brief Description of the Processes*

## *2.1 Spray Painting*

The principle of spray painting is to atomize the liquid paint into a fine spray and direct it onto the surface being painted.

| Method | External Agent | Polymer System |
|---|---|---|
| Solvent evaporation | None (heat) | Lacquer systems |
| Environmental cure | Oxygen moisture | Oil modified alkyd urethane |
| Vapor phase curing | Amine | Hydroxy acrylic / isocyanate blend |
| 2 pack | None (heat) | Epoxy / amine |
| Radiation | IR or UV | Unsaturated polyester |
| Thermo-setting | Stoving oven | Alkyd/$N_2$ resin and Thermo-setting acrylics |

Usually, compressed air is the atomizing medium, but other techniques such as electrostatic spray are being used more and more because of improved transfer efficiency. The application, however, generates overspray and provisions should be made to carry off this overspray and to exhaust it safely to the atmosphere, or in some cases, collect it with a recovery system.

### *2.1.1 Acrylic lacquers*

| Method | Description | Advantages | Disadvantages |
|---|---|---|---|
| **Compressed air** | Thinned paint, pressure fed from a large container, or drawn from a small pot attached to the gun, is emitted through a needle valve and atomized by jets of compressed air. | The air spray gun is very versatile and allows fast painting and is extremely popular. | The coating efficiency is low, as about half of the paint is lost as overspray. |
| **Air-less** | The paint is pumped to the gun and ejected from the spray nozzle by high hydraulic pressure. | The air-less spraying system reduces the amount of overspray. | The industry does not consider this system as effective as other methods. |
| **Electrostatic** | Electrostatic paint spraying relies on a simple principle – if paint particles are atomized in an electric field, they become charged and drawn towards the article being painted. | The electrostatic gun is suitable for spraying even surfaces. The amount of overspray is reduced. | The method is unsuitable for painting recessed parts as the paint is attracted to the nearest surface. |

The acrylic lacquer is a solution of substituted polyacrylic and acrylate resins together with plasticising resins.

Acrylic lacquers are accepted as the present day automobile finish. The paint film dries by solvent evaporation. The solvent and thinners are a mixture of esters, ketones and cyclic alcohols.

Application by air spray is preferred by the industry, as an air-less spray tends to produce a coarser finish.

### *2.1.2 Paint spraying*

### *2.1.3 Solvents*

With the exception of water, all solvents, thinners and diluents used in paints are organic compounds of low molecular weight and most are a mixture of different organic compounds. Two main types of organic compounds are used:

- Hydrocarbons, both aliphatic (such as petroleum ether) and aromatic (for example, toluene) and;
- Oxygenated, such as ethers, ketones and esters.

### *2.1.4 Pigments*

Inorganic and organic pigments are used in paints and powders for colour. Some pigments may be hazardous to health if used irresponsibly, for example, yellow and red chrome pigments. Such pigments may cause ulcers of the skin and mucous membranes, eczematous dermatitis and may be carcinogenic to the lungs, nasal cavity, larynx and stomach.

## *2.2 Surface cleaning before painting*

Prior to the repainting of automobiles, the metal surface requires cleaning and removal of the old paint, rust, grease and the removal of dirt and dust. The method adopted for cleaning will depend on the type of contamination present, i.e. rust, old paint or grease.

### *2.2.1 Abrasive blasting*

The automobile or component should be cleaned with an abrasive in an enclosed chamber.

### *2.2.2 Paint strippers*

A strong solvent mixed in a gel is applied to the painted surface and, after a suitable period, washed off with water and the old paint scraped or wire-brushed off.

### *2.2.3 Sanding*

The old paint is removed with a high-speed disc sander in a dry state. The paint is reduced to a fine powder that is blown into the atmosphere.

### *2.2.4 Wet sanding*

A very smooth surface is achieved by the use of "wet and dry" emery rubbing paper which is used on a very wet surface. The fine particles of paint or filler are washed in the water to form a "mud".

# 3. Some of the environmental problems

When the fan of paint droplets leaves the air spray gun, part of the fan passes to the side of the surface when edges are being painted and a portion of the atomized paint "bounces" off the surface in the reflected compressed air stream. This effect is most pronounced with very fine droplets and a fast air current. It is reduced by using a coarse spray and low air pressure, but the quality of the finish will be poor. The actual efficiency of an air spray gun under normal conditions is low. Between 40% and 65% of the paint reaches the surface. It is estimated that of the paint lost to the atmosphere, one third is due to "bounce-back" and two thirds to overspray.

The loss from electrostatic spray guns is significantly less.

Spray painting if carried out outdoors may drift towards a nearby neighbour's property.

Almost the entire volume of organic solvents finishes up in the atmosphere and contributes to potential photochemical smog. The organic vapours used in spray painting (as listed in Appendix A) are all considered to be very photochemically reactive. Concern about environmental pollution and energy conservation is having an impact on application techniques, with water-based coatings becoming more accessible.

The disposal of wastewater contaminated with paint remover, or pigments from plastic fillers, undercoat and finishing paints can pose a problem if allowed to enter the ground water through soak wells or by discharging it onto the ground; or contaminate surface waters if allowed to enter storm water drains.

# 4. General management principles

## 4.1 Site selection

Automotive spray-painting premises should be located in commercial and light industrial areas. However, it is unwise to site such premises near factories undertaking activities that produce dust. Also, it is ill-advised to locate spray painting premises near places where food is prepared or near shops or other commercial premises as the odour of the solvents may cause offence.
New automotive spray-painting premises should not be located closer than 150 meters to any residential area.

## 4.2 Occupational health and safety

There is a general requirement that an employer shall, as far as practicable, provide and maintain a working environment in which employees are not exposed to hazards.

This includes maintenance of work places, plant and work systems; provision of information, instruction and training enabling employees to work without hazards; consulting with employee-elected health and safety representatives and/or employees about occupational health, safety and welfare; providing adequate protective clothing and equipment; and ensuring all work procedures are carried out without exposing workers to hazards.

The air inhaled at work should not contain chemical agents at concentrations which produce effects on health, safety and well-being. Therefore, exposure standards have been established which, according to current knowledge, should neither impair the health of nor cause undue discomfort to nearly all the workers. The exposure standard is applied as a time weighted average, or a peak.

Material Safety Data Sheets (MSDS) are used internally to provide the information required to allow the safe handling of substances used at work. Therefore MSDSs should be acquired and the safe handling instructions adhered to.

## *4.3 Flammable solvents and fire risk*

The storage of flammable solvents shall only be undertaken in accordance with the requirements of the Dangerous Goods Act.

Paint solvents are highly inflammable and present a fire risk to adjacent property and personnel. It is essential that paint-spraying premises take all practical precautions when storing and using solvents, to ban smoking or any naked flames, prevent static discharge and to ensure that all electrical equipment used within the premises is flame proof.

Such flammable solvents and paints should be stored in accordance with the requirements of the Dangerous Goods Act. Drums of flammable solvents not in use must be stored in an appropriate, well-ventilated flammable liquid store. It is also necessary to ensure that volatile thinners are stored in a temperature-controlled area within that store.

It is also prudent for the occupier of any spray painting premises, when storing flammable solvents, to advise local Fire Department(s) of the quantity and nature of flammable solvents stored on the premises. Hazard warning signs should be erected in prominent positions on the outside walls of the premises with the applicable Hazchem Code.
Empty solvent containers should be stored outside of the premises away from any possible source of ignition.

## *4.4 Environmental commitment*

All personnel, both management and operators, should be encouraged to develop a commitment to being good neighbours and prevent nuisance to others nearby. Operators should make every effort to ensure that fume and dust control equipment is maintained in efficient working order at all times, and good housekeeping practices are observed.

## *5. Basic control requirements for spray painting*

Many of the solvents in common use represent a health hazard and have potential to contribute to atmospheric pollution. Wherever possible, water-based paints should be used in preference to solvent-based paints. Solvent emissions on a large scale can be controlled by the use of after-burners or by recycling. For small-scale operations, such as automotive painting repair shops, such in-house technology is not practicable, but adequate dilution is necessary to prevent nuisance to people working or situated near to the premises, and waste solvents can be drummed and transported to other premises for recycling.

Ventilation rates and exhaust duct designs in spray booths should be required, and great care should be taken to ensure that a nuisance is not created to any other premises.

Baffles placed in the ductwork will remove some overspray, but will require regular cleaning. Where the spray booth is used more or less continuously, the extraction air should be passed through an efficient water scrubber to remove the bulk of the entrained paint particles.

Where the spray painting is undertaken only a few times each week, an air extraction system is adequate to dilute the solvent fumes.

Another option is to install an activated carbon adsorber in the exhaust duct. Such a cartridge will adsorb solvents until it is "full" and then must be desorbed by steam or heat. The solvent can be collected and recycled and the cartridge used again.

*A*. Automobiles and components should only be painted in a spray booth.

*B*. Painting equipment should not be cleaned by discharging solvents through the system and releasing the solvent and paint residues to the atmosphere. (This cleaning practice is allowable when the solvent sprayed through the equipment is directed into a solvent recovery system and can be collected for recycling.)

*C*. Spray-painting equipment should be cleaned by immersing the components in a suitable solvent and pouring the solvent through pipes or tubes, where necessary.

*D*. All contaminated solvents and spent solvents used for cleaning equipment should be sealed in drums and removed to a reputable solvent recycling enterprise.

*E*. The exhaust duct from the spray booth should project at least 2 meters above the highest point of the roof. (If toxic or very odorous solvents are in use, this height may need to be increased).

*F*. The exit velocity of the air from the flue should not be less than 10 meters per second.

(Rain caps, which restrict the upward flow of the exit air, should not be used; instead a suitable vertical discharge cap should be used).

*G.* Where a wet scrubber is used to remove paint particles and solvent vapour, the spray nozzles should be checked regularly and the water maintained at the correct level at all times.

*H.* Automobiles should not be sanded in the open with power sanders as the dust may blow into neighbouring premises.

*I.* Automobiles should not be wet sanded or rubbed down on the drive-way, road or access way so that the residues can dry out and be stirred up by passing traffic and cause a nuisance to neighbouring premises.

## *6. Water pollution*

Many organic solvents used in spray painting are either miscible with or partly soluble in water and can enter surface or ground waters and endanger aquatic life or taint drinking water.

*A.* Waste solvents should not be disposed of onto the ground or into soak wells or drains.

*B.* Waste solvents should not be disposed of at any landfill.

*C.* Waters contaminated with paint, paint remover or sanding dust from paint or fillers should be directed to a settling tank and stored until the particulate matter settles out and clear water is allowed to discharge to a sewer or soak well, or it should be removed from the premises on a regular basis.

(The disposal of contaminated wastewaters directly to a sewer or to an on-site wastewater disposal system can only be undertaken with the approval of the Department of the Environment (DOE).)

## *7. Solid waste disposal*

*A.* Sludge from the settling tank should only be disposed of at a landfill with the approval of the relevant local authority.

*B.* Empty paint tins should only be disposed of in suitable landfills.

## *8. Control of noise*

Spray booth fans may create unnecessary noise. When purchasing equipment, it is essential that the operation does not cause a nuisance to neighbouring industrial premises or nearby residences.

The manufacturer or supplier should be able to specify the noise emission of a spray booth fan. If possible, a guarantee should be obtained that the operation of the fan will not exceed the level of noise deemed appropriate as required under the *Pollution Regulations, 1996, S. I. No. 56 of 1996*. This is especially necessary if it is proposed to use the spray booth at night when traffic and other background noise have diminished in the area.

*A.* The premises should be operated in such a manner that during operation the noise level from the premises, excluding vehicle movements, does not exceed the level of noise deemed appropriate for the environment in which it is located.

*B.* Noise from machinery, plant and equipment should not emit any pronounced tonal components, frequency modulations or impulses which will increase the annoying effect of any noise generated. It is recommended that noise specifications be included in tenders for the purchase of new plant and equipment to keep noise levels down.

*C.* The use of extension telephone bells and public address systems should be avoided.

## *9. Control of lighting*

Lights used to illuminate any area of the site for security or any other reason should be angled or shaded in such a manner so that the light does not directly illuminate any nearby residential premises.

# *Appendix A*

Flash points and exposure standards for some common solvents. As a general guide, the flashpoint of a mixture of solvents can be assumed to be that of the solvent with the lowest flashpoint.

| **Solvent** | **Flash point (°C)** | **Exposure standard (ppm)** | |
|---|---|---|---|
| | | **TWA** | **STEL** |
| **KETONES** | | | |
| Acetone | -17 | 500 | 1000 |
| Methyl ethyl ketone | -4 | 150 | 300 |

| | | | |
|---|---|---|---|
| Methyl isobutyl ketone | 13 | 50 | 75 |
| Diacetone alcohol | 54 | 50 | - |
| Di isobutyl ketone | 47 | 25 | - |
| **ESTERS** | | | |
| Ethyl acetate | -3 | 400 | - |
| Isobutyl acetate | 16 | 150 | - |
| n-butyl acetate | 25 | 150 | 200 |
| 2 Ethoxyethyl acetate | 52 | 5 | - |
| 2 Butoxyethyl acetate | 115 | - | - |
| **ALCOHOLS** | | | |
| Methanol | 10 | 200 | 250 |
| Ethanol | 12 | 1000 | - |
| n-propanol | 22 | 200 | 250 |
| Isopropanol | 10 | 400 | 500 |
| n-butanol | 33 | 50 peak | limitation |
| Isobutanol | 27 | 50 | - |
| Sec butanol | 14 | 100 | - |
| **HYDROCARBONS** | | | |
| Toluene | 5 | 100 | 150 |
| Xylene | 24 | 50 | 150 |
| White spirit | 39 | 790mg/$m^3$ | |

**TWA** = time weighted average
**STEL** = short-term exposure limit