

**A Study into the Implementation of  
S.I. No 543 of 2002  
Emissions of Volatile Organic Compounds from Organic  
Solvents Regulations 2002  
At Local Authority Level**

**By  
Sonya Maguire**

**Submitted in part fulfilment of the HETAC requirements of  
the award of Master of Science  
in Environmental Protection  
at  
Institute of Technology, Sligo**

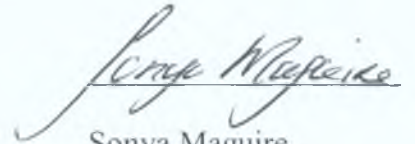
**August, 2004**

**Project Supervisor:**

**Margaret Savage**

## DECLARATION

I hereby declare that the work included in this dissertation is my own (unless otherwise stated) and has not been submitted previously to any other university or college.

A handwritten signature in cursive script that reads "Sonya Maguire".

Sonya Maguire

August, 2004

## ABSTRACT

The vehicle coating and refinishing sector are facing increased regulatory and environmental pressures. This is a relatively novel experience for proprietors of workshops, who because of their subdued existence and diminutive workforce have been overlooked in the past. However, the introduction of the Council Directive 1999/13/EC on the Limitation of Emissions of Volatile Organic Compounds due to the use of Organic Solvents in Certain Activities and Installations which was transposed into Irish legislation under the Emissions of Volatile Organic Compounds from Organic Solvents Regulations 2002 (S.I. No.543 2002), implied the requirement for significant change in the vehicle coating and refinishing sector. The introduction of this Regulation meant that for the first time, small sized workshops would be regulated and would have to reduce their VOC emissions to a specified limit.

For proprietors of small sized spray paint facilities, this is the foremost experience they have had to interpret and comply with a major item of legislation in Ireland. Therefore the manner in which this Regulation is approached, delivered and enforced by regulatory bodies, is essential to the success of its implementation.

The purpose of this thesis was to examine the current information available, which is relevant to the introduction of this Regulation and will determine if it is appropriate to the target audience who comprise of proprietors of workshops and local authority employees who will be partially responsible for the compliance with this Regulation. This dissertation established that there was a significant lack of understanding of the main requirements of this Regulation within the target audience and there was a great need for the provision of a more comprehensive training document, which would inform the target audience of these requirements. These training documents would be compiled as a result of the findings of this thesis.

## DEDICATION

This thesis is dedicated to my family.

## ACKNOWLEDGEMENTS

I wish to express my sincere gratitude and appreciation to the following:

My supervisor Margaret Savage for her continued guidance and advice.

To the Engineering and Environmental departments, Cavan County Council, in particular Mr. Peadar Lafferty, Mr. Frank Gibbons and Mr. Ger Finn.

To Justin Savage for his patience, support and encouragement throughout the course of this thesis.

To Kenny Maguire for his endless knowledge and willingness to share it!

# CONTENTS

	<b>Page</b>
Title Page	i
Declaration	ii
Abstract	iii
Dedication	iv
Acknowledgements	v
Contents	vi
<b>1.0 INTRODUCTION</b>	<b>1</b>
1.1 Aims and Objectives	4
<b>2.0 LITERATURE REVIEW</b>	<b>6</b>
2.1 The Vehicle Coating and Refinishing Sector in Ireland	6
2.2 Classification of paints available in the vehicle refinishing sector	8
2.2.1 Composition of paint	8
2.2.2 Classes of paint	9
2.3 Sources of Volatile Organic Compounds in vehicle coatings and refinishing sector	11
2.4 VOC content of currently supplied products	14
2.5 Analysis of substitute coatings and comparison with typically used coatings	17
2.5.1 High solids materials	18
2.5.2 Waterborne materials	18
2.5.3 Application issues associated with substitute coatings	20
2.5.4 Advantages of using substitute coatings	21
2.6 Equipment used during the application of a vehicle coating	23
2.6.1 Gunwash machine	23
2.6.2 Spray gun	24
2.6.3 Spray booth	25
2.6.4 Paint mixers	26

2.7	Environmental impact of VOC emissions from the vehicle coatings and refinishing industry	27
2.8	Health and safety aspects of paint spraying	32
2.8.1	Indirect effects	32
2.8.2	Direct effects	33
2.9	Proposals to reduce VOC emissions in the vehicle coating and refinishing sector	38
2.9.1	Best available low VOC content materials currently available	38
2.9.2	Best available low VOC content materials and reference coatings	40
2.9.3	Materials management	43
2.9.4	VOC emission abatement	44
2.10	Economic impact of implementing S.I. No. 543 of 2002	46
2.10.1	Existing trends	46
2.10.2	Additional annual costs per spray booth modification	46
2.10.3	Operating costs	47
2.10.4	Economic impact on small body-shops	47
2.11	Role of the local authorities in the implementation of S.I. No. 543 of 2002	51
2.12	Environmental legislation from the United States	54
2.13	International Agreements	57
2.13.1	Convention on Long Range Transboundary Air Pollution	57
2.14	European Directives	59
2.14.1	National Emissions Ceilings Directive	59
2.14.2	Solvents Emission Directive	60
2.14.3	Classification, Packaging and Labelling of Dangerous Preparations Directive	61
2.14.4	Integrated Pollution Prevention Control Directive	62
2.14.5	Packaging Waste Directive	63
2.15	Irish Legislation	65
2.15.1	Protection of the Environment Act, 2003	65
2.15.2	Emissions of Volatile Organic Compounds from Organic Solvents Regulations, 2002	66

2.15.3	Waste Management Act, 1996	68
2.15.4	Environmental Protection Agency Act, 1992	69
2.15.5	Air Pollution Act, 1987	70
2.15.6	EPA Best Practice Guidelines, 2003	71
2.15.7	Circular Letter issued to the Local Authorities from the Department of Environment, Heritage and Local Government	72
<b>3.0</b>	<b>METHODOLOGY</b>	<b>75</b>
3.1	Methodology key dates	76
3.2	Summary of EPA Best Practice Guidelines for Vehicle Coating and Refinishing Sector for the implementation of S.I. No. 543 of 2002	77
3.3	Analysis of questionnaires designed for proprietors of vehicle coating and refinishing installations	78
3.4	Analysis of questionnaires designed for environmental personnel at a Representative number of local authorities	81
3.5	Analysis of face-to-face interviews with proprietors of vehicle refinishing installations and local authority employees who will be directly involved in enforcing S.I. No. 543	84
<b>4.0</b>	<b>RESULTS &amp; DISCUSSION</b>	<b>85</b>
4.1	Results obtained from the questionnaires completed by proprietors of vehicle refinishing installations.	85
4.2	Results obtained from face-to-face interviews with proprietors of vehicle refinishing installations	108
4.3	Results obtained from the questionnaires completed by local authority employees	111
4.4	Results obtained from face-to-face interviews with local authority employees	129
<b>5.0</b>	<b>CONCLUSION</b>	<b>130</b>
<b>6.0</b>	<b>REFERENCES</b>	<b>134</b>



## APPENDICES

- I Circular Letter AC 1/03
- II Training Package designated for proprietors of Vehicle Refinishing Installations
- III Training Package designed for Local Authority employees who will be directly involved in the enforcement of S.I. No. 543 of 2002

## 1.0 Introduction

The term Volatile Organic Compounds (VOCs), covers a broad range of organic substances, which include hydrocarbons, halocarbons and oxygenates. A VOC, as defined under Council Directive 1999/13/EC on the limitation of emissions of volatile organic compounds due to the use of organic solvents in certain activities (OJ L85/42, 29/03/99) is “any organic compound having at 293.15K (20°C) a vapour pressure 0.01kPa or more or having a corresponding volatility under the particular conditions of use”. An organic compound is somewhat less specified and is defined, again under Council Directive 1999/13/EC, as “any compound containing at least the elements carbon and hydrogen or in which the hydrogen is partially or completely replaced by halogens, oxygen, sulphur, phosphorous, silicon or nitrogen with the exception of carbon oxides and inorganic carbonates and bicarbonates.” An organic solvent is defined as “any VOC which is used alone or in combination with other agents and without undergoing chemical change to dissolve raw materials, products or waste materials or is used as a cleaning agent to dissolve contaminants, or as a dissolver, or as a dispersion medium, or as a viscosity adjuster, or as a surface tension adjuster or as a plasticiser or as a preservative.” As VOCs have a high vapour pressure at normal temperature they can be present in high concentrations in the atmosphere. VOCs can be divided largely into two groups, Methane and Non-Methane VOCs (NMVOC). Since methane is present in the atmosphere in much higher concentrations than other VOCs and the majority of methane present is generated naturally, it is usually thought of separately from other VOCs.

In recent years, there has been an increased interest in the concentration of VOCs in the atmosphere due to their environmental impacts. The most significant environmental issue associated with VOC emission is photochemical oxidant formation or, as it is more commonly referred to, the formation of ground level ozone. The formation of ground level ozone has become an increasing problem in Europe today. The Photochemical oxidant formation is the result of an imbalance in the natural cycle of the formation and destruction of tropospheric ozone. In contrast to the depletion of the ozone layer in the stratosphere there are excessive concentrations of ozone present in the lower layers of the atmosphere. Reactions between VOC's, nitrogen oxides and sunlight result in the

formation of photochemical oxidants, which are compounds such as hydrogen peroxide, peroxyacetyl nitrate (PAN) and ozone. Other organic pollutants of concern are polycyclic aromatic hydrocarbons (PAH's), which are present in both volatile and particulate forms. It is the proportional relationship between nitrogen oxides and volatile organic compounds together with certain meteorological conditions that determine the amounts being formed. This ozone formation occurs both locally and over large areas. The increased interest in VOCs in the atmosphere has been compounded by the adverse health issues associated with VOC emissions. VOCs can have a detrimental effect on human health. They can contribute to respiratory illness, some VOCs are mutagenic and some VOCs are even carcinogenic. As VOCs can evaporate readily, they can quickly contaminate the work environment and if present in significant concentrations, may be toxic to the employee, if inhaled.

VOCs are a necessary component of all organic surface coatings in the vehicle coating and refinishing sector, irrespective of the type. The concentration and type of VOC used in the process is dictated by the functional requirements of the coating itself. The Californian Environmental Protection Agency (CEPA) was the first institute to acknowledge and address the issue of the adverse effect of VOC emissions from the vehicle-refinishing sector. They subsequently regulated VOC emissions under The Clean Air Act, 1990, as amended. The European Union embraced the notion and introduced the Council Directive 1999/13/EC on the limitation of emissions of volatile organic compounds due to the use of organic solvents in certain activities and installations. The sole objective of the implementation of this Directive was to prevent or minimise, as far as is reasonable practicable, the effects of VOC emissions from specific activities into the environment and the subsequent potential risks to human health. This Directive was transposed into Irish Legislation by means of 'The Emissions of Volatile Organic Compounds from Organic Solvents Regulations, 2002' (S.I. No. 543 of 2002).

According to Entec (2000), it is estimated that the Vehicle Coating and Refinishing sector in the EU comprises of approximately 75,000 body shops with paint spray facilities. Because of the nature of their emissions, which were having a detrimental effect on both

the environment and human health, a copper fastened monitoring and licensing system was deemed essential to minimise emissions.

In Ireland, if a Vehicle Coating and Refinishing installation utilises less than 500Kg of solvents per annum then it is exempt from licensing by both the local authority\* and the EPA. However, should a Vehicle Coating and Refinishing premises process a solvent consumption of 10,000Kgs (10 tonnes) or greater per year, it requires an IPC License from the EPA. This thesis will focus on the Vehicle Coating and Refinishing industries, which consume between 500Kgs and 10,000Kgs of solvent per annum. This study examines the Registration of such industries with a local authority and the role of the local authority in implementing these Regulations. Two training packages were developed and delivered by the author. One of these training packages was compiled with the Local Authority Environmental Section in mind. This training package was designed to equip the appropriate personnel with the necessary skills to deal with enquiries, maintain a register, awarding of licenses, the rejection of applications, attaching of conditions to an application and monitoring of emissions. The second training package was developed in a comprehensive and concise manner and was directed at the actual vehicle refinishing installations, which will be licensed by the Local Authority. This training package was compiled with a knowledge of the understanding of the existing knowledge of its target audience. The existing knowledge of persons involved in this industry was established by means of a questionnaire and face – to – face interviews. These training packages will enable Local Authority personnel to successfully enforce S.I. No. 543, and will assist persons in the vehicle-refinishing sector to meet their legal requirements.

\* May require waste permit licence of discharging 'trade effluent'

## 1.1 Aims and Objectives

The aim of this dissertation was to review all current available information relevant to the implement S.I. No. 543 and establish if it is sufficient and comprehensive to the persons involved in the successful implementation of S.I. No. 543. These include both proprietors of spray paint facilities and local authority personnel, who will be involved in the enforcement of S.I No. 543. The following were the main sources of information:

- USEPA who have already successfully implemented a similar item of legislation
- Paint Research Association
- Existing and proposed European and Irish Legislation
- Industry Guidelines
- Proprietors and operators of spray paint facilities

The aims of this study are listed below.

- To assess the level of awareness of the Regulation within the vehicle refinishing sector in County Cavan
- To establish the level of knowledge of the key issues in relation to volatile organic compounds (VOCs) in the vehicle refinishing sector in Co. Cavan
- To indicate how the EPA Best Practice Guidelines increase the knowledge of roles and responsibilities in the vehicle-refinishing sector.
- To assess the level of awareness of the Regulations within some local authorities.
- To establish the level of knowledge of the main provisions of the Regulations within these local authorities.
- To assess how the EPA Best Practice Guidelines increase the knowledge of roles within these local authorities.

The Objectives were to:

- Perform face-to-face interviews and questionnaires to obtain the information from both vehicle refinishing sector and the local authorities.
- Establish if there was a need to develop training packages for Local Authorities and proprietors of spray paint facilities in order to facilitate the better implementation of these Regulations.

- If so, to develop and pilot a training package for each of the target audiences.
- Establish how the training packages improve the awareness and knowledge of the Regulations within the participating vehicle refinishing installations and local authorities.

## 2.0 Literature Review

### 2.1 The Vehicle Refinishing Sector in Ireland.

According to the Paint Research Association (PRA) (2000), there are approximately 500 major body shops in Ireland and many smaller concerns operating at the weekends and in the evenings. Body shops in Ireland are generally small in size employing one to two employees. The majority of body shops in this country are not solely spray paint facilities, many offer mechanical repairs in addition to paint shop activities.

In recent years the numbers of body shops in Ireland has declined, this is primarily due to increased regulatory and environmental pressures, however, the competition to accommodate repairs financed by insurance companies has become fierce.

The table below depicts the estimated number of body shops, which will be operational by 2007 (according to the Society of the Irish Motor Industry (SIMI), Ireland and the European Council of Paint, Printing Inks and Artists' Colours Industry (CEPE)

**Table 1 - Summary of Trends of Operation Workshops in Ireland  
SIMI & CEPE 1999**

<b>Size Band (number of employees)</b>	<b>Number of body shops in 1999</b>	<b>Estimated number of body shops in 2007</b>
Small (1-5)	500	424
Medium (6-10)	0	26
Large (>10)	0	0
<b>Total</b>	<b>500</b>	<b>450</b>

Although Ireland is not considered as one of the primary contributors to VOC emissions, the Irish Government are signatories to the Gothenburg Protocol and as members of the European Union, we are obliged to adopt all European Directives. During a study conducted by the European Community (2002) in order to amend Directive 1999/13/EC,

Member States submitted data to the Commission, indicating that during summer months the threshold level for the protection of human health ( $110\mu\text{g}^{-3}$ , expressed as an average value over eight hours) is exceeded in all Member States and that in urban environments, more than 40 million people are estimated to be exposed to potentially harmful concentrations of tropospheric ozone.

The Irish Government has embraced Council Directive 1999/13/EC on the Limitation of Emissions of Volatile Organic Compounds due to the Use of Organic Solvents in Certain Activities and Installations by transposing it into Irish Legislation under the S.I. No 543 of 2002 Emissions of Volatile Organic Compounds from Organic Solvents Regulations 2002. The main requirements of this Regulation will be discussed in detail later in this study.



## **2.2 Classification of Paints available in the Vehicle Refinishing Sector**

### **2.2.1. Composition of Paint**

There have been substantial changes in paint technology over the past decade, however there are still the same four groups of materials that go into the manufacturing of paint. These four groups are solvents, binders, pigments and additives.

#### **(i) Solvents**

Solvents used in paints are liquid substances, which hold the solid components together. Solvents allow the paint to be viscous enough to be applied easily to the surface of the vehicle. Once the paint has been applied to the surface the solvent evaporates into the atmosphere. Solvents can be water-based or organic based.

#### **(ii) Binders**

Binders are polymers or film forming resins of a coating. The binder binds together the pigments and remains on the surface once the solvent has dried. Various types of binders are being used in the production of water-based and solvent-based paints. The type of binder used determines the chemical composition, service properties of a coating and, importantly, the solvent content of a coating. Conventional (low to medium solids content coatings with a high organic solvent content – Entec and the Paint Research Association (2000)) and low VOC content coatings are usually based on the same type of binder. Binders most commonly found in the Vehicle Coating and Refinishing Sector are acrylics, alkyds, nitro cellulose (NC), epoxides, unsaturated polyesters and urethane.

#### **(iii) Pigments**

Pigments added to the paint are responsible for the resultant colour. There are many naturally occurring pigments, however conventional paints generally use synthetic pigments.

#### **(iv) Additives**

There are many different additives used in the vehicle-refinishing sector, the type of additive used depends on the functional requirement. For instance, in water-based

coatings, additives such as surfactants are used to improve the wetting properties of the applied coating.

### **2.2.2. Classes of Paints**

There are various types of paints available in the vehicle-refinishing sector. This section looks at the types of paints most commonly used.

#### **(a) Solvent-based paint**

According to Andresen (1999), solvent-based paints can contain up-to 100% organic solvents. These paints were the most commonly used paints until the introduction of the Emissions of Volatile Organic Compounds from Organics Solvents Regulations 2002. Paint manufacturing companies have been forced to produce paints with a substantially lower organic solvent content.

#### **(b) High-solid paints**

High-solid paints contain less organic solvents than conventional solvent based paints. These paints can contain up to 90% solids weight and only 10% organic solvents. High-solid paints can present viscosity problems during the spraying process, therefore binders must be carefully selected for these paints. High-solid paints contain substances, which are very sensitive to variations in temperature and generally, possess a shorter shelf life than solvent based paints. These paints are often two-component systems and require specific application equipment. Equipment used for applying high-solid paints require intensive cleaning with an organic solvent.

#### **(c) Water-based paints**

Water-based paints contain small quantities of organic solvents as a co-solvent in addition to water. Water-based paints carry fewer odours than organic solvent based paints and they require less drying time than conventional paints. The majority of water-based paints contain between 5 and 10% organic solvents. They do not require turpentine or solvent-based cleaners, most equipment used during the application of water-based paints can be cleaned using water. The disadvantages of water-based coatings are quite numerous, they are substantially more expensive than solvent-based paints to purchase

and produce. They also have a lower initial gloss and therefore require more coats, which subsequently requires more time and costs. Water-based paints are still unsuited for use as high performance maintenance paints, traffic paints and automotive finishers. Vehicle refinishing installations, which possess a high solvent consumption, are the likely to use water-based coating in the hope of reducing their overall emissions.

**(d) Powder Coatings**

Powder coatings do not contain any organic solvents. These coating are applied by means of an electrostatic process, they are then melted and hardened by a heat treatment. This process can be effective in the vehicle-refinishing sector, however, it is expensive to purchase and operate. As a result, it is only considered for large workshops.

## **2.3 Sources of Volatile Organic Compounds in the Vehicle Coatings and Refinishing Sector**

According to the Final Report on Reducing VOC emissions from the Vehicle Refinishing Sector by Entec UK Ltd and The Paint Research Association (2000), Volatile Organic Compounds are currently used at most operational steps in the vehicle-refinishing sector.

### **I. Cleaning /Degreasing**

This is usually mechanical and involves removing previous coatings, debris or rust by means of blasting. Chemical cleaning can be used to remove old coatings. All surfaces are degreased to remove oils and greases. Spirit wipes and degreasers currently available vary in VOC content from 20 – 975g/l VOC.

### **II. Body Repair**

Body repair involves using body filler/putty/stopper to fill large holes, this is then sanded to smooth and restore the body or panel. The solids content of materials used in body repair has greatly improved in recent years to 70 – 86% solids weight according to Entec (2000). The VOC content, however, varies greatly from 30 – 558g/l VOC.

### **III. Masking**

Masking involves covering and sealing areas, which do not require attention. Generally, this is just a physical step in the refinishing step and little or no chemical is used.

### **IV. Priming**

Primers are applied to the surface to allow adhesion of paint and prevent corrosion. There are various primers available and the type of primer used depends on the substrate being repaired. Aluminium and steel substrate require etch primers, mordant solutions are used for zinc and activating flexible primers are applied to plastics. Isolating or barrier coats can be applied to surfaces, which have already been painted. Primers are typically very low in solids content and can vary in VOC content from 50 – 976g/l, depending on the type of substrate being repaired. If a sealer is used, it has an increased solids content of 30 – 60% and again, quite a high VOC content of 357 – 870g/l VOC.

## **V. Surfacing**

Primers are covered by surfacers or fillers to remove small flaws on the surface and give a flat, smooth surface for topcoats. Their surfaces can be sanded to smooth further. Surfacer currently available on the market have a high solids content of 50 – 90% solids weight, their VOC content also remains quite high at 124 – 576g/l VOC. The lower the solids content the higher the VOC content.

## **VI. Top Coating (Finish)**

The application of a topcoat allows for a decorative finish and increased resistance to UV radiation, weathering physical and chemical damage. There are a number of topcoat finishing systems and these are discussed below.

### **(i) Single Layer Top Coat**

Topcoat finish can be achieved through the application of a single paint formulation, which is referred to as a single layer system. Single layer systems available vary greatly in their solids content from 20 – 76% solids weight, comparably, so too does it's VOC content of 130 – 760g/l VOC, again the lower the solids content the higher the VOC content.

### **(ii) Single/Multi Layer Top Coat with Lacquer**

Another method used, which can also achieve the colour and effect is the single or multiple layer pigmented base coat which is covered with a clear lacquer, this provides a gloss and gives the finish protection. A multiple layer basecoat has quite a low solids content of 10 – 40% and the multiple layer basecoats VOC content vary greatly depending of their manufacturer, multiple layer basecoats currently available range from a VOC content of 25 – 840g/l. A multiple layer clear coat system is also available, it possesses a much higher solids content of 38 – 70% and a VOC content of 2 – 740g/l. This is referred to as a “multi-layer topcoat”.

### **(iii) Metallic/Pearl Finish**

To obtain a pearl or metallic finish, paints are usually applied as a base layer in two topcoat systems. Pearl finishes may also be applied as a three-layer system – ground coat, pearl coat and clear coat, this is referred to a “3-stage pearl”.

Single pack coatings normally comprise of thinners and additional additives, which will allow adjustment of certain properties such as drying times, gloss, texture or flexibility. Two pack, chemically curing, product components additionally include hardener, an activator and a catalyst. The combination of primer, surfacer and topcoat represent the coating system.

‘Basic’ colour and effect components, which match the original vehicle finish, make up colour coats, single or multiple layer basecoats. In recent years, there has been an increased demand for specific vehicle colours and effect finishes such as pearl, rainbow and metallic. The Paint Research Association (2000) estimated that of approximately 2000 vehicle manufacturer colour variants, 60% of their production is special effect finishes. The paint mixing system uses approximately 30 - 40 pigment tinters and varying grades of aluminium flake or metallic finishes. They are mixed by weight or volume according to the paint manufacturers instructions. The mixing system blends the components and is comprised of a stirrer bank, a microfiche reader/computer and a weighing scale.

## **VII. Gunwashing**

A gun is used to apply the paint from the paint pot to the section of the vehicle under repair. Once the paint has been applied to the vehicle, it should be cleaned immediately to prevent the paint from drying out. Solvent is used to remove the paint from the spray gun and spray pot.

## 2.4 VOC content of currently supplied products

There are various materials available on the market today with reduced VOC content, however, not all of the products available possess a low enough VOC content to meet with the VOC emission limits recommended by the USEPA. It is important to note that the VOC content of vehicle refinishing products is directly proportional to the quantity of VOC emitted from a premises, therefore it is essential to use products with the lowest possible VOC content.

The Final Report prepared by Entec UK and The Paint Research Association, (2000) for Reducing VOC emissions from the Vehicle Refinishing Sector compiled the following table:

**Table 2 – VOC content of current as supplied products  
Entec UK and The Paint Research Association (2000)**

Category	VR Material Solids wt%	VR Material VOCg/l
<b>Preparation &amp; Cleaning</b>		
Gunwash		31 to 790
Flattening Compounds (to prepare the surface)		0 to 320
Spirit Wipe / Degreaser		20 to 230
Others (e.g. deruster, stripper)		10 to 230
<b>Bodyfillers/Stoppers</b>	<b>70 to 86</b>	<b>30 to 558</b>
<b>Primers/Sealers</b>	<b>40 to 75</b>	<b>50 to 860</b>
Water Based		50 to 100
High Solids		200 to 470
Low Solids to Medium Solids		480 to 840
Plastic Primers		416 to 879
Etch Primers		468 to 690
Weld Primers		707
Sealer/adhesion	30 to 60	357 to 860
<b>Surfacers/Fillers</b>	<b>50 to 90</b>	<b>124 to 576</b>
Water Based		225
Very High Solids & High Solids		300 to 500
<b>Topcoats/Finishes</b>		
<b>Single Layer</b>	20 to 76	130 to 760
Water Based	NA	NA
Very High Solids & High Solids		130 to 420
Medium Solids to High Solids		420 to 550
Low Solids		550 to 760

Category	VR Material Solids wt%	VR Material VOCg/l
<b>Topcoats/Finishes</b>		
<b>Multiple Layer</b>		
Basecoat	10 to 40	25 to 840
Water Based & High Solids		25 to 430
Low Solids to Medium Solids		430 to 840
<i>Clearcoat (inc. tinting)</i>	<i>38 to 70</i>	<i>2 to 740</i>
Water Based	38	2
Very High Solids	60 to 70	
High Solids	50 to 60	450 to 500
Medium Solids	40 to 50	500 to 580
Low Solids to Medium Solids	20 to 40	600 to 740
<b>Property Additives/Modifiers</b>		
Hardeners/Activators		0 to 950
High Solids /Water Based		0 to 270
Medium Solids		275 to 600
Low Solids		600 to 950
Thinners		25 to 930
Water Based		20 to 100
Solvent		585 to 930
Other modifiers & additives		250 to 970
<b>Special Finishes</b>		<b>31 to 596</b>
Ancillary Products		0 to 400

It is clear from table 2, that the low to medium solid version of each material carries with it a higher VOC content than its high solids or water-based counterparts. An example of this is high solids primers/sealers, which have a VOC content of 200 – 470g/l, the low to medium solids primers/sealers possess a VOC content of up to 840g/l, this is a significant difference. It is also apparent from the table that the water based version of the same product, primer/sealer, currently available can contain 50 -100g/l VOC, and again, this is significantly lower than the organic solvent based primer/sealer currently available.

Table 2 outlines materials, which are currently available and it is apparent that most materials are available in low solids, medium solids, high solids and water based options. It can therefore be said, that in order to reduce solvent consumption, a proprietor of a spray paint facility should use either high solids or water based materials where possible. Where the various options are not available such as plastic primers, the proprietor should



examine the contents on the container. Different manufacturers supply materials with varying VOC contents, therefore, if the proprietor takes the time to examine the contents, the over all quantity of VOC emissions can be greatly reduced.

In 2002, the Commission of the European Communities proposed an amendment to Directive 1999/13/EC. Annex II of the proposed amendment indicates the VOC contents of various materials, which must be met by 1/1/2007. The VOC content of most materials will be reduced, however, the most significant changes will occur in top coats, currently top coats are available with a VOC content of up to 840g/l, this must be reduced to 420g/l VOC by 1/1/2007.

**Table 3 - Maximum VOC Content Limit Values for Vehicle Refinishing Products  
Annex II Proposed amendment to Directive 1999/13/EC (2002)**

	<b>Product Subcategory</b>	<b>Coatings</b>	<b>VOC g/l* (1/1/2007)</b>
<i>a</i>	<i>Preparation and Cleaning</i>	Gun wash Pre-cleaner	850 200
<i>b</i>	<i>Bodyfillers/Stoppers</i>	All types	250
<i>c</i>	<i>Primers / Sealers / Surfacer / Fillers</i>	General (metal) primers Wash primers	540 780
<i>d</i>	<i>Topcoat</i>	All types	420
<i>e</i>	<i>Special finishes</i>	All types	840

## 2.5 Analysis of Substitute Coatings and Comparison with typically used Coatings

As previously mentioned, VOCs are a necessary component of all organic surface coatings. The concentration and type of VOC present is dictated by the functional requirements of the coating. Although, the complete elimination of VOC from organic surface coatings is preferable, it is not considered practicable. However, there are methods of reducing the concentration of VOCs and thereby reducing VOC emissions. Extensive research into reduced organic solvent content has resulted in the following:

- 1) Powder coatings
- 2) Radiation curing or 100% polymerisable systems
- 3) High solids organic solvent material
- 4) Waterborne material

Powder coatings require curing temperatures of up to 180°C to obtain the desired film. Additionally, colour matching from the blending of powders is not practical. For these reasons, powder coatings are not suitable for refinish applications.

Radiation curing is carried out using a UV or electron beam. Radiation curing liquid coatings are currently widely available for the printing or wood finishing industries and are used during manufacture of certain car parts, such as lamp lens and glass components. Regardless of the improvements apparent in some physical properties and the reduction in energy consumption and processing time, when compared to two component coatings, the technology is not currently available for vehicle refinishing. This is probably due to the cost of curing equipment and restricted application of clear coat.

Therefore, of the low VOC content paint technologies currently available, only waterborne formulations or high solids are practical considerations for vehicle refinishing. These are discussed in more detail in the next section.

### **2.5.1 High Solids Materials**

There are reduced quantities of organic solvents present in high solids paints. As a result, the quantity of solid or film forming material present in the paint is increased in proportion to that of the solvents. By reducing the quantity of solvent in a paint, the viscosity is increased and this alters the coating drying times, thereby leading to possible application problems. Because of the drying times, the binder properties must be altered in the production of high solids paints. By using reduced molecular weight acrylic, epoxy and polyester binder, spraying high solids paints with a suitable viscosity can be achieved, alternatively, incorporating reactive diluents which will aid in the formation of a dry film is another option.

High solids primers and topcoats (air drying alkyds/modified alkyds) are available with a VOC content of 340-420g/l. However, in comparison to conventional alkyd formulations, air drying alkyds and modified alkyds result in poor thickness control, long re-coat intervals and longer air drying times of 6-8 hours.

Two pack high solids epoxy primers, suitable for refinishing are currently available with a VOC content of 168-420g/l. Two pack high solids polyester/polyurethane and acrylic/polyurethane formulations are available for the vehicle refinishing topcoats with a VOC content of less than 340g/l and 420g/l respectively. High solid formulations are available, however there is a limit to how far the solids weight can be reduced as the more the molecular weight is reduced the more volatile the formulation will become. In addition, lower molecular weight formulations lead to increased drying times and poor operational performance in spray painting.

Manufacturers are also beginning to substitute aromatic hydrocarbons with paraffinic solvents to address associated health and environmental hazards, which will be discussed later in this dissertation.

### **2.5.2 Waterborne Materials**

Where water is used as the primary solvent or diluent for a binder these formulations are referred to as waterborne or water based (WB) coatings. These coatings are water-

soluble or emulsions of liquid binder resins in water. Waterborne coatings typically contain a small quantity of organic solvent in order to render the binder soluble in the aqueous phase and to aid pigment wetting. Binder properties in waterborne systems are almost identical to those used in organic solvent-based paints, but resins are altered to render them water-soluble. Water thinable resin systems include epoxies, epoxide ester, alkyd, acrylic, phelonic and polyesters. Waterborne systems have solid contents similar to that of conventional coatings, which are typically low to medium.

Single component waterborne coat topcoats are used in the car-manufacturing sector, however, due to performance problems in the panel beating process, they are not normally used in the vehicle-refinishing sector.

Waterborne two-component polyurethane – acrylic or polyester topcoat paints can be created by treating the solvent used. Clear coats, which are created in this way claim to provide solvent reductions of up to 85% and similar performance to their solvent based counterparts.

Acrylic epoxy finishes are available, however, the chemical resistance they offer are not comparable to solvent-borne two pack systems and therefore are rarely used.

Epoxy primers are available with considerably lower VOCs than their solvent based counter parts. Drying time for these primers are acceptable in forced ventilation environments, such as drying ovens, however they are unsuitable for spraying with airless or air assisted guns. In addition, if spraying equipment is not cleaned immediately after use with these formulations, they can damage the equipment.

The equipment used for applying paints and assisting drying will be addressed in the next section.

### 2.5.3 Application issues associated with Substitute Coatings

The use of high solid and water based paints can create application issues, this section will look at the various problems that can arise:

#### (i) High Solids Coating

- Once high solids coatings have been prepared for spraying purposes, the integrity of the paint begins to deteriorate almost immediately, this implies that high solids coatings have a short pot-life. They have a much shorter pot-life than conventional paints and should be used immediately after mixing. Therefore, persons applying spray paints should pay careful attention to the quantities of paints mixed and ensure that they only mix the quantity required to complete the job. Shorter pot-life is more of an issue in the car manufacturing industry, as application times are generally longer than the vehicle coating and refinishing sector, due to the larger area which paint is applied to.
- The correct film thickness can be achieved in just a few coats of high solids paint. This causes two main problems, firstly it can cause runs or sags in the paint if the person applying the paint does not exercise due care. Secondly, it may require alterations to the spray gun to achieve the appropriate application conditions. The obvious advantage with a faster film build, however, is that application times are substantially reduced.
- Very high solids coatings usually contain reactive diluents and therefore they require longer drying times. They also contain resins with a low molecular weight, because of this cure times may need to be extended unless an accelerator is added to the mixture.
- Equipment used for applying high solids coatings, such as pumps and airless spray fluid lines, require increased maintenance and cleaning.

## **(ii) Water based coatings**

- Achieving the correct viscosity with water-based coatings can be difficult.
- Equipment, which will come into contact with water-based paint, must be corrosion resistant, therefore replacement of pump and spray gun may be required, if changing from solvent based to water based.
- If a spray paint facility is using both solvent based and water based paints, then different application equipment and cleaning systems are required for both, because waterborne materials can denature solvent based materials and vice versa. Waste water streams which arise from gun cleaning should also be segregated as the benefits from using a water based coating indicates that the gun can be washed with water, therefore it should be collected separately from gun wash water containing solvents.
- Achieving the exact desired colour from a water based coating can prove difficult as the colour develops with increased drying times, this is not the case with solvent based paints.
- Air flow and humidity in a spray booth must be carefully controlled because water based paints require increased air flow rate than conventional paints in order to achieve the same drying times as conventional paints, this results in increased costs.

### **2.5.4 Advantages of using Substitute Coatings**

A proprietor of a spray paint facility can benefit significantly by using substitute coatings, these advantages are outlined below.

#### **(i) High Solids Coating**

- A spray paint facility with a high turnover would benefit from using high solids coatings by significantly reducing total VOC emissions. Because of the high turnover, the short pot-life of the high solids coatings would not be an issue. According to Entec (2000), the difference between the VOC content of conventional coating materials and high solids coating can be as much 410g/l VOC, which will significantly reduce the overall VOC emission from that premises.

- Because the desired film thickness can be achieved in just a few coats of high solids coating, this can reduce application times, which in turn will reduce application costs.

**(ii) Water based coatings**

- By using water based coatings, the actual VOC content in the coating material can be reduced by up to 680g/l VOC according to Entec (2000), this is a huge reduction and when examining the overall solvent consumption is very significant. This reduction will, in turn, allow the proprietor to repair more vehicles without falling into the category that requires an IPC licence.
- The use of water-based coatings can also indirectly reduce the total VOC emissions. Equipment used for preparing and applying water-based coatings can be cleaned with water, which again will significantly reduce to overall solvent consumption.

## 2.6 Equipment used during the application of a vehicle coating

This section will explain briefly the various types of equipment used in paint application in the spray painting process for the vehicle coating and refinishing sector, it will not include ancillary equipment such as compressors and pumps are not discussed here as they are not relevant to this study.

### 2.6.1. Gunwash Machine

A gunwash system is used after each application of paint to remove any residual paint from the application gun and paint pot. It is essential to remove residual paint as it may dry and harden and lead to further application problems, such as nozzle blockage. The gunwash is connected to the spray gun after use and a cleaning solvent is circulated around the gun. The type of coating used dictates the type of cleaning solvent used in the gun washing machine, if a coating material with a high organic solvent content was used, then a cleaning agent with a high concentration of organic solvent must be used to remove any residual coating material, this can generate large quantities of waste water with a high organic loading which will require on site treatment before being released into the public waste water treatment system. However, if water based coating is used, then water can be used in the gun wash machine to clean the spray gun, this wastewater is low in organic loading and can be released into the public waste water mains.

The gun wash system can be an open or an enclosed system, the preferred option is the enclosed system. The enclosed automatic gun washer is of a similar design to a dishwasher except that the thinners and solvents in the automatic washer are not heated during the process. According to the USEPA (2000), these washers can be used to clean conventional air spray guns, HVLP (High Volume Low Pressure) guns, airless guns or air assisted guns. Solvents that are used in the washer are recycled and reused during the cleaning process. The paint gun is attached to a nozzle in the washer and the washer is then sealed. The outside of the gun is cleaned with atomised thinners and the interior of the gun, is cleaned by circulating solvent through the nozzle attachment. Spent solvent is collected in a reservoir and any impurities are filtered from the solution, the filtered solution is then ready for reuse. The collected impurities form a sludge, which are



collected and disposed of appropriately. The solvent capacity of a typical gun wash system is approximately 3 gallons. The advantages of using an enclosed gun wash system are:

- Reduction of VOC emission by up to 90%.
- Cleaning times are reduced by up to 20 minutes.
- Less solvent is utilised because less solvent is lost through evaporation.
- Cleaning of spray guns with an enclosed system is more efficient.
- Exposure to toxic vapours is significantly reduced.

### **2.6.2. Spray gun**

A spray gun is used to apply the primer and paint directly onto the substrate. The spray gun is, by far, the most essential piece of equipment in the spray-painting procedure, therefore it will be discussed in greater detail than the other items of equipment.

Spray guns vary in design, however, they all possess the same operational principles. Spray guns are fitted with a trigger, which controls the air valve. This valve allows the compressed air to pass to the spray head or cap, via the handle of the gun. The coating material to be applied may be held in a container fixed to the top of the gun and fed to the ejector point by means of gravity. Alternatively, the container may be attached to the underside of the gun, in which case, the coating material is drawn up by suction to the ejection point. When the trigger is pulled the air valve is opened and compressed air passes out of the nozzle. As the pressure is increased, the needle, which runs through the length of the gun, is drawn back, thereby allowing the paint to flow. The more pressure exerted on the trigger, the greater the flow of paint. Once the paint begins to flow, it is caught up in the stream of compressed air where it is atomised into minute particles.

There are many spray guns available, however, the most common spray guns in use in small to medium sized spray paint facilities are the conventional air-operated spray gun and the High Volume Low Pressure (HVLP) spray gun. These will be discussed in greater detail overleaf.

**(i) Conventional Air-Operated Spray Gun**

Conventional air-operated spray guns are the most commonly used spray gun in small sized spray paint facilities. This spray gun operates at very high pressure (50-70psi), which atomises coatings to give a very fine finish to the substrate. The conventional air-operated spray gun is used in conjunction with an air compressor. The USEPA estimate that only 50% of the coating sprayed from a conventional air-operated gun reaches the target substrate, which indicates that the other 50% remains in suspension in the air, this is referred to as overspray. This can have a detrimental effect on the operator's health, particularly in an unventilated area, it is also a significant contributor to VOC emissions.

**(ii) HVLP Spray Gun**

The HVLP spray gun operates at a much lower pressure level than conventional air-operated spray gun. In addition, the low-pressure gun has a canister, which holds the coating. A motor drives air into the canister to pressurise the paint, as the trigger is pulled on the spray gun, the coating is then released and atomised. The result is a gentle, controlled flow of paint with as little as 15% over-spray, this greatly reduces the risk of exposure of the operator to the inhalation of hazardous material. This statistic also suggests that by simply switching from a conventional air assisted gun to a HVLP gun reduces emissions by 35%, which would significantly reduce the annual emission limits from a workshop.

According to the USEPA (2000) the HVLP spray gun is capable of greatly increasing paint transfer efficiency, decreasing costs, and creating a healthier workplace, the HVLP spray gun seems to be the obvious choice of spray gun.

**2.6.3. Spray booth**

A spray booth is a physically segregated area of the workshop, which is used solely for spray painting. Spray booths are ventilated by means of an extraction system. Air flow can be down draft where the air is extracted at the base of the booth, semi-down draft where the air is drawn from the top of the booth but extracted at the side of the booth or cross draft, this involves drawing in air at the side of the booth and extracting it from the

opposite side of the booth. The total airflow in a standard spray booth is normally in excess of 10,000cfm (cubic feet per minute), according to OSHA (2001).

Because of the flammable nature of the atmosphere in a spray booth, equipment must be intrinsically safe and all personnel should be made aware of this.

Spray booths can also be provided with an oven, which will increase the curing of the paint and as a result will decrease the through put time of a job. With a system such as this, the temperature can be adjusted, allowing the car to be sprayed at the optimal temperature, which is room temperature, and then increase the temperature to accommodate efficient curing times.

Although, the majority of the overspray is extracted away from the operator, some of it remains in suspension in the air, therefore, respiratory equipment must be worn at all times when carrying out spray painting.

#### **2.6.4. Paint Mixers**

This device provides for the mixing of paints to achieve the desired colour. It is not a common feature of smaller workshops, as most of the paints purchased are ready to use. This piece of equipment uses rotating paddles to mix in pigments or other additives, it should always be used in conjunction with accurate scales. Paint mixers require extensive cleaning after paint has been mixed for two reasons, firstly residual pigments remaining from paint could inhibit achieving a desired colour in the future and secondly, residual paints will harden and as a result, damage the moving parts of the mixer. Cleaning of a paint mixer, particularly after mixing paints containing organic solvents, utilises a significant quantity of cleaning agents which are high in organic solvents, this in turn increases the overall solvent consumption.

There are very little fugitive emissions released during the paint mixing process, however, what are released are an occupational hazard and appropriate personal protective equipment must be worn by the operator. Because the coating is not atomised during the paint mixing process, its environmental impact is negligible.

## 2.7 Environmental Impact of VOC emissions from the Vehicle Coating and Refinishing Industry

There has been a deterioration of the environment in the last few decades as a result of the over use of natural resources and economic growth. The continued use of natural resources without continuous replenishment has left a void, and the manufacturing and use of synthesised products has also taken its toll on the environment, causing localised, national and international pollution to air and water. The state of our environment continued to deteriorate with such phenomena's as ozone depletion and significant climate changes arising as a result of a negligent attitude towards the protection of the environment. Consequently, environmental activists and the introduction of international standards exerted pressure on the heads of states to take the appropriate measures to address this increasing problem. As a result, legal measures were introduced to protect the environment, one of these measures set a target to reduce emissions and regulations were set to legalise these targets.

Ireland has introduced many Acts in order to protect the environment and meet international standards. One of the more recent items of environmental legislation to be introduced in this country was the Emissions of Volatile Organic Compounds from Organic Solvents Regulations, 2002, which was introduced to reduce VOC emissions to an acceptable level (see section 2.15.2 for more detail).

VOCs are significant contributors to air pollution and are commonly found in the atmosphere at ground level as a result of human activities such as transportation, solvent usage, industrial activities, petrol storage and distribution, oil refining, landfilled wastes food manufacture and agriculture. According to Bates. T. S. *et al* (1993), natural biogenic processes also give rise to substantial ambient concentrations of organic compounds and include the emissions from plants, trees, wild animals, natural forest fires and anaerobic processes in bogs and marshes.

In a study, Hester and Harrison (1995) indicated that the most significant environmental impacts caused by VOC emissions are:

- stratospheric ozone depletion,
- ground level photochemical ozone formation,
- toxic or carcinogenic human health effects, (This will be dealt with in section 2.8)
- enhancing the global green house effect, and
- accumulation and persistence in the environment.

These are discussed in more detail below.

### **Stratospheric Ozone Depletion**

Many organic compounds are stable when emitted into the atmosphere and are capable of withstanding the tropospheric removal process and subsequently, reach the stratosphere. If the organic compound contains chlorine or bromine substituents, they can undergo a series of reactions and lead to the release of “chain carriers”, which actively destroy the ozone layer. Many of the responsible compounds containing chlorine and bromine are now carefully controlled under the Montreal Protocol.

### **Ground Level Ozone Formation**

Volatile Organic Compounds are a major contributor to ground level photochemical oxidant formation as they control the rate of the production of oxidant where NO<sub>x</sub> levels are sufficient to support the production of ozone. The equation for ozone formation can be expressed as outlined below.

#### **Photochemical Ozone Formation**



It is now widely accepted that many organic compounds cause the environmental criteria for ground level ozone to be exceeded across Europe. In the Geneva Protocol to the UNECE International Convention on Long Range Transboundary Air Pollution it was

accepted that organic compounds produce photochemical ozone in the troposphere. The Protocol sets limits for all signatory countries, which must be met by 2010. Achievement of these targets will mean a 30% reduction of VOC emissions compared to 1998 levels. It is hoped that if introduction of S.I. No 543 is successful, that a 30% reduction in VOC emissions will be achieved. Therefore, it is critical to the successful implementation of this Regulation that it is fully understood by all involved.

Ground level ozone can lead to severe respiratory problems, particularly to the vulnerable sector of the population. This sector comprise of the elderly, the very young and those with existing medical conditions. The health effects of VOCs and ground level ozone will be addressed in more detail in section 2.8. Crops, plants and trees also suffer as a result of the presence of ground level ozone. Their growth is stunted and the production of fruits, vegetables and flowers is limited because of restricted sunlight, which is a result of the presence of ground level ozone. Hester and Harrison (1995), also indicated that the persistence of natural ecosystems is also threatened because of ground level ozone.

According to the European Community (2002), pollution by tropospheric ozone is a widespread and chronic problem within the Community. During a study conducted by the European Community in order to amend Directive 1999/13/EC, Member States submitted data to the Commission, indicating that during summer months the threshold level for the protection of human health ( $110\mu\text{g}^{-3}$ , expressed as an average value over eight hours) is exceeded at many monitoring locations in all Member States and that in urban environments, more than 40 million people are estimated to be exposed to potentially harmful concentrations of tropospheric ozone.

Irish statistics, obtained from Compass (2000), indicate that continuous ground-level ozone data are available from Mace Head since 1988 and from Dublin since 1991. Maximum-recorded hourly concentrations very rarely exceed the 'population information threshold' of  $180\mu\text{g}/\text{m}^3$ . Ground-level ozone levels are lower in Dublin. A new national ozone monitoring network has been installed recently, bringing the total number of stations to six, this will allow more accurate readings of ozone levels in this country. Although estimates of VOCs are uncertain in absolute terms, it is clear that emissions of

VOC have been increasing steadily, mainly from road transport and industries, which use organic solvents. Different organisations have given an approximate estimation of VOC emissions from the vehicle-refinishing sector in this country, however, there is no substantiated evidence to back this up.

### **Global Greenhouse Effect**

Many organic compounds are readily oxidised in the atmospheric boundary layer, which is the shallow region of the troposphere next to the earth's surface whose depth varies from a few hundred metres to almost 2km, depending on the season. Some organic compounds survive the atmospheric boundary layer and can be transported into the free troposphere during meteorological events such as convection, passage of fronts and in the passage of air masses over mountains. Some of these organic compounds have accumulated in the troposphere over the years. If these accumulated organic compounds absorb solar or terrestrial radiation, they may enhance the greenhouse effect. Some organic compounds are not reactive gases themselves in the troposphere, however they do have the potential to disturb the global distribution of other reactive gases. These gases are known as secondary greenhouse gases.

Hester and Harrison (1995) state that organic compounds can behave as secondary greenhouse gases by reacting to produce ozone in the troposphere and increasing or decreasing the tropospheric OH distribution and hence perturbing the distribution of methane. Once in the free troposphere, accumulated organic compounds can stimulate ozone production there.

### **Accumulation and Persistence**

Organic compounds with a higher molecular mass have a greater potential of surviving oxidation and subsequent removal in the boundary layer of the troposphere and may travel significantly before being removed by rain. Semi-volatile VOCs with a low molecular mass, due to their complexity often become absorbed onto the surface of suspended matter and are transported over large distances where they are deposited during precipitation in a different location. However, they can be reabsorbed back into the atmosphere and begin the cycle again. This may happen several times before they are

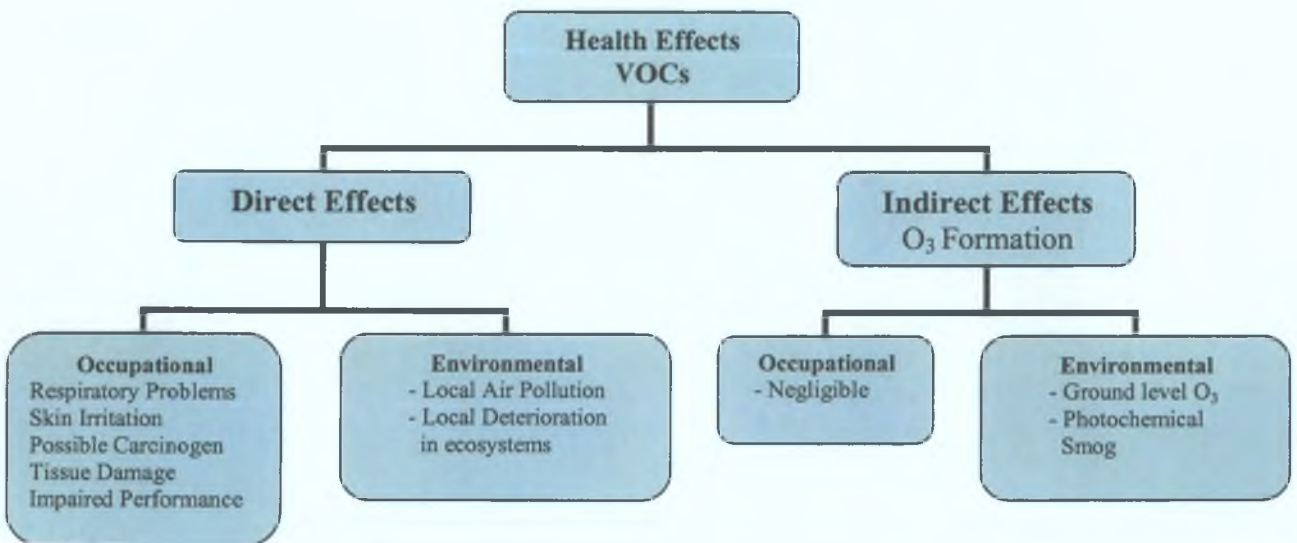
eventually deposited permanently in the colder aquatic polar-regions. Bioaccumulation in this environment can result in the presence of toxic levels in human foodstuffs in areas far removed from the original emission point.



## 2.8 Health and Safety aspects of Paint Spraying

As previously mentioned, VOC emissions contribute to the formation of ground level ozone. Organic compounds can have a detrimental effect on health either indirectly, through photochemical ozone formation, or directly through processes such as vehicle refinishing. The flowchart below gives a brief overview of the direct and indirect health effects from VOC, which will be dealt with in greater detail.

Figure 1 – Health Effects of VOCs



### 2.8.1. Indirect Effects

Repeated exposure to ozone pollution may cause permanent damage to the lungs, according to Pennsylvania Department of Environmental Protection (2004). They indicate that even when ozone is present in low levels, inhaling it triggers a variety of health problems including chest pains, coughing, nausea, throat irritation and congestion. Ground level ozone can also worsen bronchitis, heart disease, asthma, emphysema and significantly reduce lung capacity. Ground level ozone can also affect the healthy, making it more difficult to breathe comfortably.

### **2.8.2 Direct Effects**

The number of organic solvents in use in the workplace today has increased to several hundred. The World Health Organisation (2000), stated that some organic compounds affect the human senses through their odour, some exert a narcotic effect and some organic compounds are toxic. There are certain organic compounds, which are suspected as carcinogens these are the human genotoxic carcinogens and are often referred to as 'air toxics'.

The most significant toxicological properties of organic solvents are their ability to dissolve fats when volatile. By dissolving fats en-situ, organic solvents can damage haematopoietic tissue, the reproductive system, the nervous system, skin and all parenchymatous organs, which are rich in fats. As VOCs have the ability to evaporate, they can quickly contaminate the work environment and, if present in significant concentrations, they may be toxic to the employee, if inhaled. According to Baker (1986), if a person is exposed to high levels of solvent vapours it may result in acute narcosis. Being exposed to lower concentrations may lead to transient intoxication syndrome. The mildest form of the chronic effect may manifest itself as Organic Solvent Syndrome, its symptoms include irritability, tiredness and temporary impaired concentration. Epidemiological studies have continuously indicated a decrease in response time, dexterity, speed and memory and abnormalities in peripheral nervous system function in employees with prolonged solvent exposure.

#### **Hazards associated with Vehicle Refinishing**

The hazards associated with the different operational steps of vehicle refinishing are vast. Potentially, all employees engaged in spray painting, or if their duties situate them in the general vicinity of the spray-painting operation, can be exposed to the hazardous effects of spray painting.

Inhalation, ingestion or absorption of hazardous substances contained within the spray painting materials, such as acetone, toluene, methylene chloride, xylene and methyl ethyl ketone pose the most significant hazard in spray painting. However, there are other

hazards associated with spray painting, which can pose a serious risk to exposed persons.

These hazards are listed below.

- Operating plant and equipment.
- Electrical shock.
- Explosion and fire.
- Increased noise levels.
- Manual handling of loads.
- Confined spaces.
- Exposure to heat.

These hazards are the generic hazards present in all spray paint facilities, however, a detailed risk assessment must be carried out on each individual workshop in order to determine which hazards are specific to that workshop.

Hazardous substances are contained in materials, which are used at the majority of operational steps in the vehicle refinishing. These are outlined below.

**Table 4 – Materials used during Vehicle Refinishing Operations**

**(Source: Entec and the Paint Research Association (2000))**

<b>Operation/Substance</b>	<b>Materials Used</b>
Preparation & Cleaning	Gun wash, paint stripper, degreaser body wipe, silicon removers, polishers
Bodyfillers / stoppers	All types
Primers / Sealers / Surfacers / Fillers	General primer (metal), adhesion promoter, sealer, surfacer primers, undercoats, plastic primer, wet on wet, non – sand filler, spray fillers, wash/etch primer, weldable primers
Topcoats / Finishes	Single layer – Solid colour Multiple layer base – Solid colour and metallic / pearl effect Clear coat (inc. tinted)
Special Finishes	Single layer metallic / pearl effect, high performance solid colour and clear coats (e.g. anti scratch and fluorinated clear coat), reflective base coat, textured finishes (e.g. hammer), anti-slip, underbody sealers, anti- chip coatings, interior finishes.

From Table 4 and Table 2 in section 2.4, it is clear that the materials, which contain the highest quantities of hazardous substances, are low solids hardeners, which can contain up to 950g/l VOC, primers and sealers, which can contain up to 860g/l VOC and low solids multiple layer basecoat, which contain up to 840g/l VOC. Therefore their use and the use of other hazardous materials must be carefully controlled. If exposure is not adequately controlled, these materials can have serious health effects attached to their applications, such as:

- allergic contact dermatitis,
- occupational asthma,
- 'Painter's Syndrome' – long term exposure to organic solvents affects brain stimulation,
- kidney or liver damage, and
- damage to the reproductive system

Shorter-term effects can include:

- irritant contact dermatitis,
- burns to the skin or eyes,
- vomiting and diarrhoea,
- headaches, nausea, dizziness and fatigue, and
- irritation to the nose, throat and lungs.

It is essential that proprietors maintain a file containing all Material Safety Data sheets (MSD), and ensure they are accessible by all employees. MSD sheets should be updated regularly, particularly if materials have been changed.

During the spray-painting procedure, not all of the paint contained in the spray gun results on the car surface, some of it remains in suspension in air and contains fine paint particles, this is referred to as paint aerosol mists or overspray. This mist can occupy the volume of the spray area and can remain suspended in air for a significant period of time. The Health and Safety Executive (2000), stated that during air spraying approximately 50% of the liquid sprayed actually reaches the target and as a result several applications may be required to obtain the desired finish. The air flow carries fine droplets towards

the target, as the air comes in contact with the target, droplets of  $>12\ \mu\text{m}$  diameter can be deflected by the airstream as they have insufficient mass to be deposited. This is referred to as 'bounce-back'. It is estimated that approximately 20% of droplets formed by air spraying are smaller than  $12\ \mu\text{m}$  in diameter. The overspray poses many risks to the operator, the primary risk being inhalation of toxic vapours. Because organic solvents are largely flammable or explosive, this presents additional risks, as the overspray, which contains organic solvents, remains in suspension for a significant length of time there is increased risk of fire or an explosion.

Appropriate ventilation is the key to minimising exposure to the employee. The correct form of ventilation will draw the over-spray away from the operator's breathing zone. It will also control exposure to hazardous vapours. In addition, all equipment used within the spray area should be intrinsically safe, to avoid the ignition of the flammable vapours. A good ventilation system will collect vapours, solid particles and droplets and filter the air prior to discharge. Mechanical ventilation must be functioning at all times during and immediately after the spraying procedure.

### **Safe Work Practices in Vehicle Refinishing**

Safe work practices should always be adhered to during paint spraying. Because the direction, duration and volume of spray are directly under the operator's control, this can give rise to complacency or human error. It is essential that all persons involved in spray painting receive adequate training from a competent body. The following mitigating precautions should be adhered to at all times.

- Only trained personnel should be permitted access to the spraying area.
- All equipment should be intrinsically safe.
- No smoking or other naked flames in or immediately outside the workshop.
- Before commencing spraying, ensure that the extraction and ventilation systems are functioning correctly.
- Appropriate warning signs must be displayed in a conspicuous location, this will deter unauthorised persons from straying into the spraying area.

- All materials must be labelled and stored correctly, MSD sheets should be referred to for optimal storage conditions. All containers used to store materials, must be closed immediately after use.
- The correct Personal Protective Equipment must be worn at all times, this includes appropriate face mask, eye protection, disposable over-alls, gloves, safety footwear and hearing protection (if a compressor is in use).
- No eating in the workshop.
- Hands must be washed thoroughly before eating or using the sanitary facilities.
- Stand upstream of the section of the vehicle being sprayed.
- Where laminar airflow is in place, it is important for the operator not to spray above their head.
- Spray pressures must be reduced when spraying cavities within vehicles, to minimise bounce-back.
- If there is more than one person involved in spray painting a vehicle, then they must spray in the same direction.
- The spray gun should be held perpendicular to the vehicle.
- Where possible allow for a safe pass of 1m around the perimeter of the vehicle.
- Contaminated cloths used for cleaning or oiling must not be placed in pockets and should be disposed of appropriately.

Insurance companies now request that all spray paint facilities produce a Safety Statement, which will include detailed risk assessments carried out on all plant, equipment and operations. If the Safety Statement is deemed adequate by the insurance companies, they will normally offer the proprietor of the spray paint facility a reduction in insurance premium. Because of this, many proprietors have employed the services of a qualified safety consultant to complete the Safety Statement. The safety consultant will advise the proprietor to permit all employees' access to the Safety Statement so that they are made aware of the hazards they are exposed to.

If the appropriate control measures are introduced and adhered to, the level of risk associated with spray painting can be easily minimised and the impact of working in this environment can be significantly reduced.

## **2.9 Proposals to Reduce VOC Emissions in the Vehicle Coating and Refinishing Sector**

### **2.9.1. Best Available Low VOC Content Materials Currently Available**

Coating manufacturers have invested significantly into the research and development of lower VOC refinishing systems. Because products such as primers and topcoat systems contribute to the majority of sales, more research has gone into reducing VOCs in this area.

#### **(i) Cleaning and degreasing agents**

Waterborne cleaning products containing quantities of detergents and alcohol with a VOC content of less than 200g/l are available for surface preparation, which is a much more acceptable content than that of conventional cleaning products which can contain 790g/l VOC. However, careful consideration must be given to surface preparation before spraying commences, as the presence of contaminants, such as grease, may render the process unsuccessful and subsequently, it may have to be repeated from scratch. Because of this, aliphatic solvent degreasers are still use in the surface preparation stage of the process in most workshops. These degreasers possess a VOC content of 500 – 850g/l, thereby increasing the total VOC emissions in the process, VOC emission reduction from the degreasing process, however, can be achieved through waste minimisation and good housekeeping.

Currently, no satisfactory low VOC gun wash exists for the successful cleaning of organic solvent from guns. In fact, there has been a significant increase in the purchasing of high solvency gun wash to successfully remove dried paints from waterborne coatings. An enclosed gun wash system and solvent recovery will aid waste minimisation and thereby reduce VOC emissions.

#### **(ii) Fillers and Stoppers**

The majority of fillers and stoppers in use are high solids products with a low VOC content. Polyester fillers are available with a VOC content of less than 60g/l and epoxy fillers possess a VOC content of less than 200g/l, both of these fillers can be used in place

of nitrocellulose, acrylic and alkyd fillers which have a higher VOC content of 300 – 600g/l. The use of high solids fillers significantly reduces the potential VOC emission at this step of the process from 600g/l VOC to 60g/l VOC.

### **(iii) Primers**

Waterborne primers are available for both ready to use single pack coating and ready to use two-component coating. Waterborne single component coatings are available with a VOC content of 50g/l and for ready-to-use two component high solids materials at a VOC content of approximately 300g/l. There is currently no suitable replacement for existing weld primers and primers for plastics.

### **(iv) Primer Surfacer**

Waterborne primer surfacer formulations offer the lowest VOC content of 150g/l and a high solid content. Although primer surfacers with a lower solvent content exist, manufacturers indicate that as the solvent concentration decreases below 150g/l so to does performance. Currently, there is no low VOC technology available for wet-on-wet surfacers for coating with solvent-based materials.

### **(v) Topcoats**

The main method of reducing the VOC content of single layer topcoats is by increasing the solids content of solvent based coatings. A study carried out by the Paint Research Association in 2000 suggests that the solids content of the state of the art solid colour single layer finishes lies in the range of 55 to 70 wt% with a VOC content in the range of 350 to 420g/l. For pearl effect and metallic finishes, the solvent content will be higher as additional solvent is required to achieve a balance of metallic or mica plates and subsequently, the solids content will be reduced. Basecoat and clear systems are increasingly replacing single coat topcoat in the vehicle-refinishing sector. According to Bodyshop (1998), 65% of repairs carried out currently in the UK are clear over base systems. These systems will be discussed in greater detail overleaf.



For basecoat materials, the solids content of organic solvent based metallic and pearl effect is significantly lower at approximately 15 – 20 wt%. However, low VOC content base coats are achieved through waterborne technology. Waterborne basecoats are available as single and multiple component acrylic polyurethane coatings. Ready to use solid coatings contain between 16 and 30 wt% solids and 80 – 150g/l VOC, this is a significant improvement on the VOC content of prototype solid coatings of 150 – 500g/l. Clear coats are available in both waterborne and solvent based, but due to the increased processing time required for waterborne clear coats, the market place has witnessed a greater demand for the solvent based materials.

#### **(vi) Other products**

The VOC content for organic solvent based materials, such as hardeners, additives and thinners have remained unchanged for the past ten years, and this is primarily due to the compatibility of the binders. The VOC content for these materials is in the region of 550 – 950g/l. In the past hardeners for two pack coatings possessed a VOC content of 600 – 930g/l with a low to medium solids content, this has been dramatically improved to reduced VOC values of 0 – 600g/l for high solid and waterborne materials.

#### **2.9.2. Best Available Low VOC Content Material and Reference Coatings**

Water-based coatings are available for the main functional categories of coating, which are primer, single layer topcoats and clear or base topcoats. However, there is little confidence in spray-paint operators of their suitability, because of this products with a reduced VOC content or higher solids content may be used according to Entec (2000), as long as emission limit values are not breached.

The state of the art technology for clear and base coats is based on two component acrylic polyurethane binders. Solid colour and effect base-coats are available as a water-based coating. The availability of clear topcoats is quite restricted, however they are available from larger suppliers. Operators of spray-paint facilities favour the application of high and very high solids coatings, such coatings have a highly reduced VOC content which are in turn more acceptable to the environment also.

Single layer, solid colour and effect coatings are generally available as water-based or medium solids solvent based coatings. High solids coatings are available for solid colours but not for effect coatings.

Low VOC substitutes are not yet available for etch primers, plastic primers and wet on wet surfacers, however, general purpose primers and surfacers are available as water based materials. No water-based substitute exists for body stoppers and fillers, they are available with a high solids content.

The majority of additives and cleaning materials used in the vehicle-refinishing sector are generally organic solvent-based product and there is little sign of substitute materials becoming available. Some manufacturers have produced a hardener additive, which contains a substantial reduction in VOC content.

A solvent management plan can include details of where a combination of low VOC materials can be used with higher VOC materials, this in turn can reduce the overall VOC emissions.

The categorisation and VOC content of ready for use coatings is presented in the table overleaf, compiled by Entec and the Paint Research Association (2000):

**Table 5 - Proposal for Reference Coatings for Vehicle Refinishing Applications**

**Entec and the Paint Research Association (2000)**

<b>Category</b>	<b>Coatings</b>	<b>VOC g/l</b>
Preparation & Cleaning	Category 1: Gun wash, Paint stripper, Degreaser (inc anti-static types for plastic)	850
	Category 2: Body wipe, silicon removers, temporary coating removers – de-waxing fluids, flattening compounds/polishers	100
Bodyfillers / stoppers	All types	250
Primers / Sealers / Surfacer / Fillers	Category 1: General (Metal) Primer, Adhesion promoter, Sealer	150
	Category 2: Primer – surfacers, Undercoats, Plastic primer, Wet on wet, Non – sand filler, Spray fillers	500
	Category 3: Wash/etch primer, Weldable primers, Mordant solution – galvanised and zinc	650
Topcoats / Finishes	Single layer – Solid colour	420
	Multiple layer base – Solid colour and metallic / pearl effect	150
	Clear Coat (inc. tinted)	420
Special Finishes	Single layer metallic / pearl effect, high Performance solid colour and clear coats (e.g. anti scratch and fluorinated clear coat), Reflective base coat, textured finishes (e.g. hammer), anti-slip, Underbody sealers, anti-chip coatings, Interior finishes.	650

In 2002, The Commission of the European Communities proposed to amend Directive 1999/13/EC, by specifying the maximum VOC content limit values for vehicle refinishing products to be achieved by 1/1/2007 in all Member States of the EU. These are outlined overleaf:

**Table 6 - Maximum VOC Content Limit Values for Vehicle Refinishing Products**  
**Annex II Proposed amendment to Directive 1999/13/EC (2002)**

	<b>Product Subcategory</b>	<b>Coatings</b>	<b>VOC g/l* (1/1/2007)</b>
<i>a</i>	<i>Preparation and Cleaning</i>	Gun wash Pre-cleaner	850 200
<i>b</i>	<i>Bodyfillers/Stoppers</i>	All types	250
<i>c</i>	<i>Primers / Sealers / Surfacer / Fillers</i>	General (metal) primers Wash primers	540 780
<i>d</i>	<i>Topcoat</i>	All types	420
<i>e</i>	<i>Special finishes</i>	All types	840

\* g/l of ready to use paint, discounting any water content of the coating

### 2.9.3 Materials Management

Good management of materials compliments the reduction of VOCs. This is a simple and cost effective management system to implement and the results of good management of materials can be significant, primarily due to the reduction in waste and the potential reduction of emissions, are similar to those achieved efficient spray application techniques.

Batch preparation results in waste minimisation, electronic balances can be used to achieve accurate measurements. These balances allow the painter to consistently prepare the correct quantity of coating required to repair the vehicle. The quantity of coating required to repair the vehicle must be known prior to preparation. Many of the larger bodyshops have a computerised system, which can estimate the quantity required for job pricing.

A 20% reduction in materials and solvent use, have been achieved in certain bodyshops in the UK, through the purchase and operation of a specific materials management computer programme covering paint and solvent usage. These systems calculate the quantity of materials required from the area of repair using paint manufacturers technical data. A system like this costs approximately €2,500 per annum to lease.

#### 2.9.4 VOC Emission Abatement

The application of an abatement system to a spraybooth exhaust is an alternative to regulating the VOC content of coating materials. Application of low to medium solid content coatings possess a typical peak concentration, this is illustrated in the table below

**Table 7 - Peak emissions during the spraying of low solid coatings**  
Wall, C. (1992)

Coating	VOC emission mg/m <sup>3</sup> air sampled
Primer	200
Basecoat	380
Clear coat	220
Solid colour	100

If abatement equipment is used correctly, it has the potential of reducing emissions by over 90%. VOC abatement commonly in use today, includes carbon adsorption, condensation and thermal oxidation. Any of these technologies can be applied to a spraybooth to reduce emissions. However, some of these technologies are very expensive and impractical, particularly for small size spray paint facilities.

The Paint Research Association carried out a study in 2000, investigating the purchase and operational costs of abatement equipment, these approximate costs are outlined below.

Incineration and carbon adsorption have been used for emissions from spray booths in many countries. Larger bodyshops with a high turnover should consider utilising small modular incinerators, this can be purchased at a cost of up to €150,000, with operational costs of approximately €100,000 to €150,000 per annum. These incinerators can significantly reduce VOC emissions, however, the actual operation of a modular incinerator can generate a substantial amount of NO<sub>x</sub> emissions.

Carbon adsorption systems are in use in spray paint facilities around the EU, however they are generally too small for their use and their maintenance is typically sub-standard and, consequently do not achieve sufficient reduction in emissions. Their operational costs are quite significant with three tonnes of carbon required to treat one tonne of solvent per annum, according to The Paint Research Association (2000) this results in an annual operational cost of €9,000. To purchase a carbon adsorption unit for a small bodyshop with a typical booth airflow of 20,000m<sup>3</sup>/h is normally in the region of €16,000. These costs are quite substantial for a small sized body shop, particularly in sub-urban and rural areas.

## **2.10 Economic Impact of Implementing S.I. No. 543 of 2002**

The introduction of any new item of legislation brings with it additional costs. Many proprietors are more concerned with the additional cost than compliance, therefore it is important for an enforcement body to 'sell' the benefits to the proprietor. This section will look at the additional costs for the various options, which will be encountered as a direct result of the introduction of S.I. No. 543.

### **2.10.1 Existing Trends**

According to "The Cost-effectiveness Analysis" compiled by The International Institute for Applied Systems Analysis for the European Commission in 1999, the vehicle-refinishing sector is a highly competitive market, as a result profit margins are tight, there is an increased pressure exerted on this sector by insurance companies seeking for bodyshops to reduce costs. Bodyshops in turn look to paint suppliers to reduce their costs.

Paint manufacturer PPG were also involved in 'The Cost-effectiveness Analysis' study and they estimated in 1999 that 10% of vehicle refinishing sector are currently using water-based coatings in Europe, and 20% are using high solids coatings and the remaining 70% are using conventional low solids, high VOC coatings.

### **2.10.2 Additional Costs per Spray Booth Modification**

Existing spray booths may have to be upgraded or modified to possess the appropriate application and drying conditions for low VOC coatings. According to Entec (2000), this may cost up to €10,000 to adapt the spray booth accordingly. Spray application equipment such as spray guns and replacement pumps used within the spray booth, may be required to ensure successful application of the low VOC coatings, this is estimated to cost up to €2,100. The worst-case scenario, would be the requirement of a new compressor, the cost of this equipment as new can spiral up to €15,000.

The provision of training by paint companies costs an average of €2,240 for 2-3 sprayers over 2 to 5 days. This training would equip the operator with the necessary skills to

apply water based or high solids coatings, as the application of such coatings require different conditions and skills from conventional coatings.

The conversion from conventional coatings with a high VOC content to high solids, low VOC coating materials, requires a segregated heated storage area. Water-based paints freeze easily, therefore paint storage areas must be heated to prevent freezing. For a small bodyshop, heating can cost €3,100 per annum.

### **2.10.3 Operating Costs**

According to The Paint Research Association (2000), the cost of an average repair in the UK costs €1,570, labour accounts for 50% of this cost with parts and paint accounting for the other 50%. Potential operational expenses include:

- The generation of an additional aqueous waste stream can incur costs of €162 per annum for disposal for a small bodyshop.
- Additional electricity is required for booth heating, additional compressed air. This can amount to €280 per annum.
- The conversion from conventional coatings with a high VOC content to high solids, low VOC coating materials, requires a segregated heated storage area. Water-based paints freeze easily, therefore paint storage areas must be heated to prevent freezing. For a small body shop heating can cost €3,100 per annum.

### **2.10.4 Economic Impact on Small Bodyshops**

Entec and the Paint Research Association (2000) estimate that the total annual additional costs of all small body-shops in the EU upgrading to the best available low VOC coatings (or reference coating, as it is often referred to) is €52M, this figure does not include the once off training for the implementation of this Directive, which is expected to cost a total of €25M for all workshops in Europe. The cost to upgrade a typical small bodyshop is approximately €1,700 in the first year and approximately €800 per annum thereafter. This cost is expected to cover employment of the services of an Accredited Inspection Contractor (AIC), completion of an AIC report (which is required for registration with a Local Authority) and training for employees. This annual cost is estimated to be



approximately 0.4% of a turnover of €200,000 per annum, which is the average turnover for a small bodyshop in the EU.

The table below displays the estimated cost that will be incurred by medium sized bodyshops switching to waterborne paints as an individual bodyshop and across the EU:

**Table 8 – Costs incurred by medium sized bodyshops switching to waterborne paints as an individual bodyshop and across the EU – Entec UK (2001)**

Capex <sup>1</sup> Item (1)	Additional Capex per body-shop (Euro)	Additional annual cost per bodyshop (Euro) (3)	Additional annual cost across EU (Euro)	Comments (1)
Spraybooth IR Drying	9,400	940	5.8M	Estimated to be required by 20% of small body-shops
Spraybooth air Movement	3,900	390	2.4M	Estimated that it will be selected by 20% small body-shops
Paint store heating	3,100	310	9.6M	
Spray equipment	1,300	130	1.6M	Estimated that 40% of small body-shops will purchase
Aqueous waste separator	800	80	0	Assumed it will not be bought by small body-shops
Training	2,200	2,200 (once off cost)	27.4	Estimated 40% of small body-shops will invest
Total Capex	20,700	4,050	46.8M	
<b>Opex<sup>2</sup> Item (2)</b>				
Aqueous waste Disposal		160	3.5M	Assumed to apply to 70% of small work-shops
Electricity costs – Spraybooth		160	1.0M	Applicable to an estimated 20% small body-shops
Electricity costs – additional compressed air		110	0.7M	Estimated to apply to 20% of small body-shops
Total Opex (€)		430	5.2	
Total Capex plus Opex (€)		4,480	52M	

**Notes:**

- (1) Information provided by UK spraybooth suppliers, body-shops and European trade associations
- (2) Additional data supplied by Karlsruhe model on electricity costs and in-house data
- (3) Annual capital cost is based on a straight line 10 year depreciation
- (4) Capex<sup>1</sup> = Capital Expense
- (5) Opex<sup>2</sup> = Operational Expense

These figures have been calculated for medium sized body shops, because the large majority of body shops in operation in Ireland are small sized, these costs are expected to be significantly lower. There was no data available for small sized workshops at the time of completion of this study, therefore, we can use this table a guideline document for transferring from solvent based coatings to water based coatings.

Many of the costs listed in Table 8 can be eliminated or significantly reduced for small sized spray paint facilities. Spraybooth IR drying is quite rare in this country with only an estimated 20% of small body-shops expected to use it, therefore the capital expenditure of €9,400 and the operational expenditure of €940 for IR drying will not be encountered by most small sized work-shops. Additional spray booth air movement may be required to ensure that the coating dries in reduced time, however, this is only required where other jobs are being carried out, therefore it is not predicted to be required by most small sized body shops, giving an additional saving of €3,900 in capital expenditure and €390 in operational expenditure. It is estimated that paint store heating will cost an additional €3,100 in capital expenditure and €130 in operational expenditure, however there is a simple method of avoiding this cost for small sized body shops, particularly work shops which have easy access to suppliers, this is to only purchase water based paints as and when they are required, this will eliminate the additional cost.

Costs, which are likely to be incurred by small sized workshops, will be an annual expenditure of approximately €160 on aqueous waste disposal, which an estimated 70% of small sized body shop will require. The purchase of new spray equipment, such as the high volume low pressure (HVLP) spray gun, in order to reduce over all emissions is

expected by most small body shops. Capital expenditure for new equipment is expected to be in the region of €1,300 with an operational expenditure of €130. The majority of small body shops are expected to invest in training in order to comply with the requirements of this Regulation. This training will include environmental awareness (which will cover appropriate disposal of contaminated materials, segregation of wastes, etc.), training on new equipment, training on the use of new materials, etc. Once off training is expected to cost in the region of €2,200.

One cost which will be common to all workshops that move from organic solvent based coatings to water based coatings is additional electricity costs which will result from additional compressed air due to extended spraying coats required for water based coatings. Because it will take longer to apply water-based coating, therefore it will also incur additional electricity costs within the spray booth. These two additional electrical costs can amount to €270 per annum for a medium sized workshop, it will be significantly less for a smaller sized workshop.

The costs of Registration with a local authority will be €50 per annum and obtaining the services of an Accredited Inspection Contractors is expected to be in the region of €500 - €1,000, however this figure has yet to be confirmed.

When all of estimates are totalled, the maximum cost a small size work shop can expect to pay, is approximately €5000, however, the majority of this cost will be a once off expenditure for training and equipment, when this sum is deducted an estimated €1060 remains as the typical annual cost of complying with this Regulation.

## 2.11 Role of the Local Authorities in the implementation of S.I. No. 543 of 2002

In Ireland, the local authority has been designated as the ‘competent authority’ for regulating those members of the vehicle-refinishing sector who consume between 500kgs and 10,000kgs of solvent per annum. These installations must comply by either participating in a solvent reduction scheme or complying with Emission Limit Values. An Emission Limit Value (ELV) sets the maximum amount of VOCs allowed to be discharged from an installation. There are two ELVs set for the vehicle-refinishing sector, namely

- ELV for waste gases and
- ELV for fugitive emissions.

An ELV for waste gases sets the maximum quantity of VOCs that may be emitted per cubic metre of air released from stacks, such as air booth stacks. An ELV for fugitive emissions sets the maximum percentage of solvent that may be emitted from fugitive sources.

All installations will be required to register with the relevant local authority. All new installations, which became operational on or after 1<sup>st</sup> July 2003 and consume or predict to consume between 500kg and 10,000kg of solvent annually are required under the Regulations to register with their local authority before they commence operation. This installation must obtain a certificate of compliance from an Accredited Inspection Contractor (AIC) prior to registration with a local authority. An accredited inspection contractor must be accredited by the Irish National Accreditation Board (NAB) to ISO 17020 for the conduct of inspections to the Emissions of Volatile Organic Compounds from Organic Solvents Regulations 2002, the EPA expect AIC’s to be experienced in monitoring of air emissions. They will complete an assessment of the installation and determine if the emission limits from the installation or the solvent reduction scheme are compliant with the Directive. They will also advise the proprietor on where emission reductions can be made. Once the assessor is satisfied with their inspection, they will issue the proprietor with a certificate of compliance. This certificate may include recommendations or conditions. Once the proprietor of the installation possesses a certificate of compliance, they can register with their local authority for a fee of €50. The

AIC report must be re-submitted annually or if a substantial change in the process is proposed.

An existing installation complying with the requirements of a reduction scheme must be registered and must obtain a certificate of compliance no later than 31<sup>st</sup> October 2005. If an installation does not possess a certificate by this date, operation will be prohibited. An existing installation complying with emission limit values must be registered and must obtain a certificate of compliance no later than 31<sup>st</sup> October 2007. Again, continued operation beyond this date will not be permitted without a certificate of compliance. The local authority is required to maintain a register of certified installations and take appropriate action if a breach of conditions of a certificate occurs or should an installation fail to submit their certificate of compliance. In addition, the local authority will be expected to be knowledgeable in the provisions of this Regulation and subsequently, support its successful implementation through advising proprietors appropriately.

An enforcement officer should be appointed by each local authority to monitor the compliance of vehicle refinishing installations. If the enforcement officer deems that an installation is in breach of S.I. No. 543, they will be reprimanded accordingly, either by means of withdrawing their licence to operate or by issuing legal proceedings against the offending installation. In some rural local authorities, the level of industrial activity may not warrant the appointment of an enforcement officer, therefore they must employ the services of an AIC to monitor compliance within their jurisdiction.

The proprietor of a vehicle refinishing installation will be required to maintain records of solvent consumption and these records will be examined by the local authority enforcement officer. In addition, the enforcement officer will be required to monitor emissions from an installation, therefore the enforcement officer must be competent in collecting and analysing samples.

The EPA intend to organise a training seminar for local authorities in September 2004, it is hoped that this seminar will enable local authorities to successfully enforce S.I. No.

543, which in the opinion of the author is behind schedule because the Regulation is already in place.

## 2.12 Environmental Legislation from the United States

In the 1960's the State of Los Angeles acknowledged that there was a correlation between the manufacture of selected paint formulations and the worsening air pollution problem, and subsequently introduced the Los Angeles Air Control District Rule 66. This Rule attempted to address the issue by confining the manufacture and use of paint formulations, which contained photochemically active solvents. However, there was no apparent improvement in air quality, this was thought to be primarily due to uncontrolled use of other solvents such as chlorinates, which subsequently did not reduce the overall VOC emissions. The provisions of Rule 66 were reviewed by regulators who concluded that more attainable limits were set, based on the Best Available Technology for the various types of coatings. These Regulations brought with them significant changes, such as restricting the volumes of conventional solvent-based coatings produced and their subsequent sales. As a result, paint producers had to invest significantly into the research and development of new technologies, which would reduce the VOC content and their associated emissions. These evolved products included powder coatings, water-based coatings and high solids coatings.

The United States Environmental Protection Agency (USEPA) introduced the Federal Rule under the Clean Air Act Amendment (CAAA), 1990. The Federal Rule was enacted on September 11<sup>th</sup>, 1998 and revised the existing and federal air pollution Regulations. The provisions of the Federal Rule are applicable to the vehicle refinishing industry and coating components that are manufactured for sale or distribution on or after January 1999. This Act aimed to achieve and maintain clean air by reducing VOC's, ozone and nitrogen oxides along with other pollutants to a minimum and safe level. Section 112 of the Clean Air Act Amendment lists approximately 190 compounds and chemical categories, which are classified as Hazardous Air Pollutants. This list identifies many of the solvents used in the vehicle-refinishing sector as Hazardous Air Pollutants, such as methanol, xylene, ethyl glycol and hexane.

The EPA's regulation is based on Best Available Controls as defined under the Clean Air Act and defines VOC content limits on the following specific categories of refinishing coatings:

**Table 9 – USEPA VOC content limits**

<b>Coating Category</b>	<b>VOC Content (l) grams/litre</b>
Pre-treatment Wash Primer	780
Primer/Primer Surfacer	580
Primer Sealer	550
Single/2-Stage Topcoats	600
Topcoats of 3 or more stages	630
Multi-coloured topcoats	680
Speciality Coatings *	840

\* Speciality Coatings include adhesion promoters, low-gloss coatings, bright metal trim repair coatings, cut-in (jamming) clearcoats, elastmeric materials, impact-resistant coatings, underbody coatings, uniform finish blenders and weld-through primers.

The rule provides for a manufacturer to apply for a variation of the VOC content requirements on economical or technical grounds. There are no provisions for coatings available in non-refillable aerosol containers, lacquer topcoats or their components, or touch up coatings. Random spot checks on product samples within controlled categories are carried out by the USEPA, to ensure manufacturers comply with the limits.

There is little consideration from the USEPA for the environmental impacts at the point of application. A significant proportion of the VOC content is released during application and because of this, the USEPA suggested that the limits on the VOC content would be the most practical control measure to achieve the correct VOC emission reductions. Specific Best Available Controls were set by the USEPA for the different automotive refinish coatings to reflect the degree of emission reduction required. The VOC limits set by the USEPA were based upon local and State VOC emission standards, sales information, performance and cost considerations, market impacts, coating VOC content and stakeholder input.



The USEPA estimated in 1993, that the cost of implementing this rule for the importer/manufacture is approximately \$160 per tonne of VOC emissions reduction. The economic impact was estimated to be in the region of 0.2 – 0.02% increase per repair job, according to Californian Environmental Protection Agency (CEPA).

## 2.13 International Agreements

### 2.13.1 Convention on Long Range Transboundary Air Pollution

The Convention on Long Range Transboundary Air Pollution was signed by 34 countries along with the European Community in 1979 and was enforced in 1983. This convention was initiated as a result of the conclusion that scientists drew, indicating the transboundary nature of specific environmental problems such as acidification and tropospheric ozone creation. This Convention was the first legally binding document to address the increasing issue of air pollution on an international level. It was developed in the international regional forum of the United Nations in which, both Canada and the United States as well as all of the European Nations participated. The Convention introduced an institutional framework through research and policy and it implemented principles for international cooperation to abate air pollution. The convention has been implemented through the establishment of support structures, which provide a method for nations to gather scientific evidence of air pollutant flows and effects, to agree that abatement is essential and to negotiate agreements.

A protocol, from the Convention, ensuring the Control of Emissions of Volatile Organic Compounds or their transboundary fluxes was enforced in September 1997. The aim of this protocol for participating countries was to experience a 30% reduction of VOC emissions compared to 1998 levels.

This protocol identified different approaches that the participating countries may adhere to in order to comply with the following:

- Taxes on VOC containing products
- Eco-labels
- Labelling of VOC products

The Executive Body adopted the Gothenburg Protocol to Abate Acidification, Eutrophication and Ground Level Ozone in November 1999. This Protocol sets emission limits, which must be achieved by 2010 for the following pollutants NO<sub>x</sub>, VOCs, SO<sub>2</sub> and NH<sub>3</sub>. Selected scientists completed a range of complex assessments of existing pollution

limits, their effects and proposed the best abatement options. This Protocol is estimated to bring with it a 40% reduction in VOC levels from the 1990 levels.

All parties to the convention meet annually, these parties are known as the Executive Body. Upon meeting, priorities and plans are set and agreements are reached.

## 2.14 European Directives

In the past, it is the author's opinion that, the United States has always set the precedent in identifying issues, which carry an environmental impact and addressing the issue by implementing items of legislation. The introduction of legislation controlling VOC emissions was no different, however, in this instance, their rapid response and urgency was primarily due to the rate at which photochemical smog was developing in the United States. The European Union soon followed the example led by their US counterparts and introduced several directives which would have an impact on the manufacture and application of organic coatings. These Directives include the following:

- National Emission Ceiling Directive 2001/81/EC
- Solvent Emissions Directive 99/13/EC
- Classification, Packaging and Labelling of Dangerous Preparations Directive 99/45/EC
- Integrated Pollution Prevention Control Directive 96/61/EC
- Packaging Waste Directive 94/62/EC

### 2.14.1. National Emission Ceilings Directive 2001/81/EC

The National Emission Ceilings Directive focuses on the following major air pollutants NO<sub>x</sub>, VOC, sulphur dioxide (SO<sub>2</sub>) and ammonia (NH<sub>3</sub>) and setting a national emission ceiling for these pollutants. Because a national emission ceiling has been set for VOCs, it will involve complying with another standard, therefore this Directive is relevant to this study. This Directive requires all Member States to have drawn up programmes for the proposed reduction of emissions of these pollutants by the 1<sup>st</sup> of October, 2002. The National Emission Ceilings Directive will aid and reinforce the implementation of the Solvent Emissions Directive with regards to VOC emissions. The current VOC emission ceiling for Ireland is 55 kilo tonnes, however the Directive also focuses on further emission reductions by 2010.

#### 2.14.2. Solvent Emissions Directive 99/13/EC

Organic solvents are largely used in many industrial processes. Organic solvents are very volatile and are released either directly into the air or indirectly through a chain or physical or chemical reactions as VOC's. The Solvents Emission Directive (SED) was introduced on the 13<sup>th</sup> of March 1999 as a result of the increasing problem of tropospheric ozone formation. This Directive applies to more than 20 processes and industrial sectors, which use relatively large quantities of VOC's and which directly or indirectly release these into the atmosphere. The sectors to be covered by this Directive are outlined below.

- Coatings of Metals and Plastics, Coil Coating and Textile Coating.
- Dry Cleaning.
- Impregnation of Wood.
- Pharmaceuticals.
- Printing Process.
- Rubber Manufacture.
- Surface Cleaning.
- Vehicle Refinishing.

The SED limits the emissions of VOC's which arise out of organic solvent use in these industrial activities. Emission limit values that will come into force for a given facility depend on the industry sector and the quantity of solvents that are utilised. The Directive applies to industries, which use greater quantities of solvent than the threshold values prescribed. These limits were set, by considering the costs and technical options available to small, medium and large solvent using industries.

The SED aims to reduce VOC emissions from all Member States by 57% by 2007, based on 1990 levels. However, the implementation of the Directive is predicted to result in a 67% reduction in VOC emissions from certain industries within eight years.

According to Dobson (1998), the main features of the Directive are:

- Limits have been set for annual solvent consumption for smaller installations, however abatement is still expensive. Because of this, cost is an issue for the successful implementation of the solvents emission directive.

- Emission Limit Values for VOCs have been set for stack emissions and fugitive emissions.
- The methods by which emissions are reduced vary, abatement equipment can be used, substitution of material with a lower VOC content can be used, and appropriate management of materials or process changes can also be applied. These measures can be applied either individually or together.
- A Solvent Management Plan should be implemented to ensure that the limits set down in the Directive are adhered to.

### **2.14.3. Classification, Packaging and Labelling of Dangerous Preparations Directive 99/45/EC**

The aim of this Directive is to achieve a uniform approach to the classification and labelling of dangerous preparations, there are some exemptions such as medicinal and veterinary products. The introduction of this Directive implies that all dangerous materials used in industry generally and, therefore, in the vehicle refinishing industry must be labelled appropriately to reflect the hazards associated with them. These labels inform the user of potential adverse effects to both the environment and health and safety and subsequent precautions which should be taken. Under this Directive a product label must display the appropriate Risk Phrase and any product which carries any of the Risk Phrases R45, R46, R49, R60 or R61 (see Section 2.15.6 for definitions) must be replaced with a less hazardous material. In addition to Risk Phrases associated with adverse health effects, the label must display Risk Phrases to describe environmental hazards, such as R50, which implies that that product is very toxic to aquatic organisms. The implications of this Directive are quite significant in the car paint manufacturing sector, many materials previously used, must be replaced by less hazardous materials and all associated hazards both to the environment and health and safety will have to be clearly displayed in the appropriate manner.

#### **2.14.4. Integrated Pollution Prevention Control Directive 96/61/EC**

The aim of the introduction of this Directive was to collectively minimise pollution from the various industrial sources throughout the EU. This Directive establishes a list of common rules for the permitting of industrial installations.

Annex I of this Directive lists out all installations which are required to obtain authorisation to operate from the national competent authority. If an installation is listed in Annex I, it must possess a permit in order to operate. The competent authority will examine the installation to determine if they are complying with Best Available Techniques (BAT), as defined in Article II of the Directive, prior to awarding a permit.

The larger spray paint facilities within the Vehicle Refinishing Sector currently falls under Activity 6.7 from Annex I: 'Installations for the surface treatment of substances, objects or products using organic solvents, in particular for dressing, printing, coating, degreasing, waterproofing, sizing, painting, cleaning or impregnating, with a consumption capacity of more than 150 kg per hour or more than 200 tonnes per year'. However, the Solvents Emission Directive (99/13/EC) will amend this quantity in that any vehicle refinishing installation that consumes 10 tonnes or more per annum must possess an IPPC licence.

Article 3 of the IPPC Directive establishes the obligations of the operator, these include:

- Minimising pollution by instilling all preventative measures and in particular through the application of Best Available Techniques.
- Ensuring that no significant pollution is caused.
- Avoiding waste production, or where waste is produced that it is recovered appropriately, or where it is not economically or technical possible to avoid waste production the waste must be disposed of in manner that does not have an environmental impact.
- Ensuring that the necessary precautions are taken to prevent accidents and minimise their consequences.
- Ensuring an efficient use of energy.

- If there is a risk of pollution from a specific activity, it must be prohibited until it has been deemed acceptable to proceed.

The licensing authority will award a permit or licence if they are satisfied that BAT has been applied throughout the process, however, they require guidance to determine which techniques in the process are BAT. A number of factors should be considered when the Best Available Technology, these are outlined in Annex IV of the Directive. An example of these considerations are

- nature and volume of emissions,
- can technology be used which will produce minimum waste?
- if not, can the waste be recovered and recycled? and
- can hazardous substances be replaced with less hazardous substances?

A group of experts from the European Union member states, industry and environmental organisations has been commissioned to compile BREF (BAT Reference documents) notes by 2004. BREF notes will aid the licensing authorities in inspecting the installation, however the decision to award or refuse a licence lies with the licensing authority.

#### **2.14.5 Packaging Waste Directive 94/62/EC**

The objective of this Directive is to prevent the production of packaging waste by:

- Reduction.
- Reuse.
- Recycling and other methods of recovery.

Prior to the introduction of this Directive, the responsibility of handling waste generally lay with the consumer. However, this Directive placed the responsibility of the recovery and recycling of packaging waste on all who handle packaging at every stage of the supply chain.

This Directive will impact the vehicle refinishing sector significantly, as the majority of their commercial waste, such as used paint cans, aerosols and gun wash is difficult to recycle or recover. Therefore the responsibility lies with the proprietor to employ the



services of a certified waste disposal contractor to handle the waste correctly, this will involve increased expenses and will encourage the proprietor to reduce his waste where possible.

## **2.15 Irish Legislation**

### **2.15.1 Protection of the Environment Act, 2003**

The Protection of the Environment Act was passed on the 14<sup>th</sup> of July 2003 and transposes Directive 96/61/EC. This Act amends the method in which an IPC licence is sought and issued, under the Environmental Protection Agency Act, 1992. The introduction of this Act has replaced the IPC licensing system with the IPPC licensing system, which implies that the previous technical basis for issuing an IPC licence, Best Available Technology Not Entailing Excessive Costs, has now been replaced with BAT (Best Available Techniques).

The EPA must be satisfied that the proposed licence holder is a 'fit and proper' person; this means they must demonstrate that they are financially stable so that they can meet any liabilities arising from the operation and cessation of the activity.

Under this Act, the Minister has set a timetable for established activities (listed in Annex I), which now due to the reduced threshold will require to be licensed by 2007. A larger vehicle refinishing installation would fall under this category. The Act provides for the licensing of all existing installations, listed in the Directive, by 2007.

The EPA must place more emphasis on emission limits in IPPC licences. The installation must adhere to the emission limit values in the licence in order to be compliant. The EPA also has the authority to regulate greenhouse gas emissions in IPPC licenses, including CO<sub>2</sub>.

Transboundary environmental impacts are now provided for under this Act, this section is particularly applicable to the border counties, because Cavan is a border county, it is also very applicable to the completion of this dissertation. Under this Act all border counties, both North and South of the border must consult with each other where negative transboundary situations have occurred. Because of this, emissions from vehicle refinishing installations throughout Ireland and in particular in border counties, are expected to be carefully monitored so as to ensure that negative transboundary emissions

do not occur. Provision is also made for the impact of transboundary emissions when issuing an IPPC licence, again, this is more applicable to border counties.

### **2.15.2 Emissions of Volatile Organic Compounds from Organic Solvents Regulations, 2002**

The Solvent Emissions Directive 99/13/EC was transposed into Irish Legislation under the Emissions of Volatile Organic Compounds from Organic Solvents Regulations, 2002 and came into force on the 30<sup>th</sup> November 2002. This Regulation was introduced primarily to control emissions of solvent vapours from 20 specified activities, which are set out in Schedule 1 of the Regulations, when they exceed the relevant solvent consumption thresholds, which are set down in Schedule 2 of the Regulations. The thresholds for the vehicle-refinishing sector are broken into three groups, for regulatory purposes:

- Where the annual solvent consumption of a vehicle refinishing installation is less than 500kgs, which requires no formal regulating.
- Where the annual solvent consumption of a vehicle refinishing installation is between 500kgs and 10,000kgs, which will be regulated by the relevant local authority.
- Where the annual solvent consumption of a vehicle refinishing installation is more than 10,000kgs, which is regulated by the EPA and requires an IPC licence.

The majority of vehicle refinishing installations in Ireland possess an annual solvent consumption of between 500kgs and 10,000kgs and therefore will be regulated by the relevant local authority. Because of this, this section will examine the main requirements of S.I. No. 543 for vehicle refinishing installations, which fall into this category.

There are different requirements under the Regulations for existing and new installations, therefore it was essential to clearly define both, and these definitions are detailed below:

- An existing installation is an installation that was in operation on or before 30 June 2003.
- A new installation is an installation that was put into operation on or after 1 July 2003.

### **Risk Phrases**

Any substance or preparation, which because of its VOC content is classified as carcinogens, mutagens or toxic to reproduction under Directive 67/548/EEC must carry the risk phrases R45, R46, R49, R60 and R61 must be replaced by less harmful substances or preparations.

### **Registration Dates**

New installations must obtain a certificate of compliance and register with their local authority before they can commence operations. Existing installations that intend to comply with the requirements of a 'Reduction Scheme' must register with their local authority and obtain a certificate of compliance on or before 31<sup>st</sup> October, 2005. Existing installations that intend to comply with 'Emission Limit Values' must obtain a certificate of compliance and register with their local authority on or before 31<sup>st</sup> October, 2007.

### **Registration**

A vehicle refinishing installation with a solvent consumption of between 500kgs and 10,000kgs per annum must register with their local authority. The proprietor of an installation must submit a registration fee of €50 and an Accredited Inspection Contractors (AIC) report in order to commence or continue operations. An AIC report is compiled by an accredited inspection contractor and it demonstrates whether or not an installation complies with the requirements of the Regulations. Registration must be renewed annually, or if the installation has undergone a substantial change.

Proprietors of vehicle refinishing installations are given two options in order to comply with this Regulation, they must either comply with emission limits or comply with a reduction scheme, and these will be discussed in more detail below:

### **Emission Limit Values**

The emission limit values for vehicle coating and refinishing with an annual consumption of between 500kgs and 10,000kgs per annum are as follows:

<b>Emission Limit Values in Waste Gases</b>	<b>Fugitive Emission Value</b>
50 mg C/Nm <sup>3</sup>	25% of solvent input

Where incineration or alternative abatement systems have been in use in an existing installation, they are exempt from meeting these ELV's until 1 April 2013. Emissions must be monitored, to ensure they are compliant with ELV's.

Please refer to section 2.15.6 for more detail

### **Reduction Scheme**

The reduction scheme involves a target for reduced emissions and a plan setting out the measures that a proprietor will take to achieve this target. The reduction scheme is given as an option instead of meeting the emission limit values.

#### **2.15.3 Waste Management Act, 1996**

The Waste Management Act (WMA) was adopted in 1996. The Act improves environmental standards, promotes principals such as "polluter pays" and gives waste management hierarchy a legal standing in Irish law.

Under Part III of the Act, all producers of waste must take all reasonable steps to prevent or minimise the generation of waste. The Act encourages prevention and minimisation, through deposit-refund schemes, life cycle analysis (LCA) and having due regard to the effect that producers of waste has on the environment. The Act makes provisions for the Minister to make further regulations to introduce controls on packaging, introduce waste reduction schemes, carry out waste audits etc. This Part of the Act impacts spray paint facilities in that a small work shop can generate a significant amount of waste. The majority of their waste is paper which is used for preparing the vehicle for spraying, however, most of this paper becomes contaminated with organic solvents during the priming or spray painting process, because of this, their waste paper cannot be recycled in the conventional manner. The only realistic option a proprietor of a workshop has, is to substitute paper for a material which can be recycled or reused, therefore many workshops are now using heavy duty plastic to mask areas which do not require attention. This plastic can be reused many times and therefore reduce the quantity of waste generated.

Under section 35 of the Act, the local authority are authorised to make bye laws which can specify how waste should be presented, what type of waste receptacle is to be used and the approximate time of collection.

Under Part VI of the Waste Management Act, the local authorities are permitted to take all reasonable steps to prevent or minimise waste production, transportation or disposal in their functional area. The costs of which will be recouped by the Local Authority.

The EPA Act is amended in Part VII of the Waste Management Act to include a toxic emissions inventory to improve information to the general public. The penalties for breach of the Waste Management Act was a minimum of £1500 and/or 12 months imprisonment for a summary conviction and max fine of £10 million and/or 10 years imprisonment for an indictment offence. These fines have been increased under the Protection of the Environment Act, 2003 up to a maximum of €15 million.

#### **2.15.4 Environmental Protection Agency Act, 1992**

In 1992 The Environmental Protection Agency Act was enacted to improve the control of environmental pollution in Ireland and introduce integrated pollution control licensing for 61 types of activities. Approx 800 facilities in Ireland require an IPC Licence. Other activities may be licensed by the Local Authority under separate legislation. Some companies require more conditions to be attached to a licence and stringent Emission Limit Values to be set, these limits may be site specific as the area could be more sensitive environmentally.

Part V of the EPA Act, 1992 is replaced with the Protection of the Environment Act, 2003, introducing IPPC licensing.

This item of legislation in conjunction with the Protection of the Environment Act, 2003 will be applicable to the larger scale vehicle refinishing installations with a Solvent consumption of greater than 10,000kgs per annum, as these installations will require an IPC licence in order to operate.

### 2.15.5 Air Pollution Act, 1987

The Air Pollution Act, 1987 states that it is an offence for any person to operate an industrial plant, listed in the Third Schedule, other than an existing facility without a licence on or after 1/2/1989. Many of the licensing provisions of the Air Pollution Act, 1987 have become obsolete due to the introduction of the EPA Act 1992, as amended. The Air Pollution Act 1987 also includes provisions for a number of different approaches to Air Quality Control including; Air Quality Standards, Air Quality Management Plans, Emission Limit Values and Special Control Areas

Section 50 of the Act provides for the specification of Air Quality Standards (AQS) by the Minister. An Air Quality Standard can be defined as 'The concentration of polluting substances in the air during a specified time which is not to be exceeded'. An AQS specifies the maximum permissible concentration of a substance in ambient air. AQS may be set locally or nationally or for certain circumstances or certain time frames.

This country has National Air Quality Standards for five different substances, they are SO<sub>2</sub>, suspended particulates, Pb, NO<sub>2</sub> and O<sub>3</sub>. The AQS for these substances were introduced under the Air Pollution Act (Air Quality Standards) Regulations, 1987. Further Daughter Directives were introduced which repealed the National Air Quality Standards for SO<sub>2</sub>, suspended particulates, Pb, NO<sub>2</sub> and O<sub>3</sub>, these Directives were:

- 99/30/EC – Limit values for SO<sub>2</sub>, NO<sub>x</sub>, PM<sub>10</sub> and Pb in ambient air
- 2000/69/EC – Limit values for CO and Benzene in ambient air.

These Directives were transposed into Irish legislation under the Air Quality Standards Regulations, 2002. These Regulations provide for limits to be set for SO<sub>2</sub>, NO<sub>2</sub>, NO<sub>x</sub>, PM<sub>10</sub>, Pb, CO and Benzene in ambient air. These limit values will be effective from January 1<sup>st</sup> 2005, except for NO<sub>2</sub>, NO<sub>x</sub>, PM<sub>10</sub> and benzene.

Because Ireland has set a National Air Quality Standard for O<sub>3</sub>, and the VOC emissions from vehicle refinishing installations contribute to the formation of ground level ozone, this item of legislation is relevant to this study.

Local Air Quality Standards may be set as a condition of a licence (IPC, air or waste licence), this limit must not be exceeded within the plant.

#### **2.15.6 EPA Best Practice Guidelines, 2003**

The final draft of the EPA Best Practice Guidelines for Vehicle Coating and Refinishing were completed on 17<sup>th</sup> July 2003. The EPA Guidelines were designed for the vehicle-refinishing sector who consume between 500kgs and 10,000kgs of solvent annually. The Guidelines take account of all of the provisions of S.I. No. 543 of 2002 and outline what a vehicle refinishing installation must do, so as to comply with the Regulation. The Guidelines commence by defining the various terms, which are outlined in the Regulation such as, organic solvent, VOC, New installation and existing installation. The Guidelines then proceed to summarise the legal requirements of S.I. No. 543 of 2003, and refers the reader to the relevant section.

Under section 5 of the Guidelines, a new installation must possess a certificate of compliance and register with the appropriate local authority before they commence operations. A new installation is prohibited to commence operations until they have registered with their local authority. Section 5 also outlines the different options of compliance available to existing installations, which have been in operation since before the 30<sup>th</sup> of June, 2003. If an existing installation is to comply with the requirements of a reduction scheme, they must obtain a certificate of compliance and register with the appropriate local authority on or before 31<sup>st</sup> October, 2005. If an existing installation is to comply with emission limit values, they must obtain a certificate of compliance and register with their local authority on or before 31<sup>st</sup> October, 2007. An installation is prohibited from continuing operations beyond these dates, if they have not registered. Under section 5 of the Guidelines, an installation must employ the services of an accredited inspection contractor (AIC) to inspect the premises, after inspection the accredited inspection contractor will issue a report to the proprietor of an installation. If the AIC is satisfied that an installation is operating in compliance with S.I. No. 543 of 2002, they will issue the proprietor with a certificate of compliance. Once an installation possess a certificate of compliance and are registered with the appropriate local authority, they can proceed with their operations.



Section 6 of the Regulations deals with specific risk phrases. Under this section, if any materials in use at an installation contain any of the following risk phrases, they must be replaced with a material that does not possess one of these risk phrases:

- R45 – May cause cancer
- R46 – may cause heritable genetic damage
- R49 – may cause cancer by inhalation
- R60 – may impair fertility
- R61 – may cause harm to the unborn child
- R40 – limited evidence of a carcinogenic effect (if halogenated)

Section 7 of the Guidelines contains details on emission limit values (ELVs)

### **2.15.7 Circular Letter issued to local authorities by the Department of the Environment, Heritage and Local Government**

Local Authorities are informed of the introduction of an item of legislation by means of a circular letter which is issued by the Department of the Environment, Heritage and Local Government. The circular letter normally gives a brief overview of the main requirements of a Regulation, however, many of them can be presented in an equally confusing manner to the actual item of legislation.

Circular letter (AC 1/03) 'Emissions of Volatile Organic Compounds from Organic Solvents Regulations 2002 (S.I. No. 543 of 2002)' was issued to all Local Authorities to inform them of the introduction of S.I. No. 543, 2002. (See appendix II). This Circular letter gives a brief introduction to what a VOC is, various sources of VOCs and the general hazards associated with VOCs.

The competent authorities (EPA and local authorities) are clearly outlined in the Circular letter, however, only the responsibilities of the local authorities are referred to. This letter informs the local authority of the various options of compliance available to the proprietor, such as compliance with either emission limit values in waste gases and fugitive emission values, or total emission limit values as specified in Schedule 2 of the Emissions of Volatile Organic Compounds from Organic Solvents Regulations, 2002, or the requirements of a tailored reduction scheme where solvents are reduced or substituted

by less harmful products. An example of a substance, which can be substituted in the vehicle-refinishing sector, is replacing organic solvent-based coatings with water-based coatings.

New installations, which have commenced operation since 1 July 2003 are provided for in this circular, by stating that they must have registered with the appropriate local authority prior to commencement, they must have obtained a certificate of compliance from the local authority before they are authorised to operate. Existing installations must register with the appropriate local authority on or before 31 October 2005, if they are to comply with the reduction scheme, however if where an installation is to use abatement equipment to attain emission limit values, they have until 31 October 2007 to register with their local authority.

A regulatory system has been created so that uniformity and transparency of compliance with S.I. No. 543 is achieved. The circular letter states that this regulatory system will minimise the administrative and financial constraints on the local authorities and operators. Independent Accredited Inspection Contractors (AIC) must be employed by a proprietor to primarily establish if the installation is compliant with the Regulations and if the installation demonstrates their compliance they will be issued with an AIC report. Upon receipt of this report and payment of €50, the local authority will issue the installation with a certificate of compliance within 14 days. AIC reports are only valid for one year and therefore they must be submitted to the local authority on an annual basis for renewal of certification. The National Accreditation Board has established panels of AICs.

If an installation is in breach of the Regulations, the operator and the AIC have the duty to inform the appropriate authority. If there is an immediate danger to human health, then operations must be suspended until the situation has been remedied. Details of non-compliance must be recorded on the register, the local authority must maintain this register.

The Department of Environment, Heritage and Local Government conclude this circular by advising that “these Councils should acquaint themselves with the Regulations, their functions, powers and duties hereunder and the contents of this Circular Letter”.

### 3.0 Methodology

The Aims of this study were:

- To assess the level of awareness of the Regulation within the vehicle refinishing sector in County Cavan
- To establish the level of knowledge of the key issues in relation to volatile organic compounds (VOCs) in the vehicle refinishing sector in Co. Cavan
- To indicate how the EPA Best Practice Guidelines increase the knowledge of roles and responsibilities in the vehicle-refinishing sector.
- To assess the level of awareness of the Regulations within some local authorities.
- To establish the level of knowledge of the main provisions of the Regulations within these local authorities.
- To assess how the EPA Best Practice Guidelines increase the knowledge of roles within these local authorities.

The Objectives were to:

- Perform face-to-face interviews and questionnaires to obtain the information from both vehicle refinishing sector and the local authorities.
- Establish if there was a need to develop training packages for Local Authorities and proprietors of spray paint facilities in order to facilitate the better implementation of these Regulations.
- If so, to develop and pilot a training package for each of the target audiences.
- Establish how the training packages improve the awareness and knowledge of the Regulations within the participating vehicle refinishing installations and local authorities.

### 3.1 Methodology Key Dates

In order to obtain the correct information at the correct time, it was essential to ask the appropriate questions at the appropriate time. Therefore, careful consideration was given to designing a timeframe in which all information would be obtained, issued and exchanged. The key dates for this methodology are detailed below.

- 08/03/04. Copies of the EPA Best Practice Guidelines were issued to all participants from both the vehicle refinishing sector and local authorities.
- 29/03/04. The first set of questionnaires (phase I) were completed by both sectors. Once completed questionnaires were received, all participants were issued with the appropriate training package. This training package used a user-friendly language focussing on the main requirements of the Regulations. A simple and uncomplicated approach was taken to emphasise the main requirements and care was taken not to confuse the participant with irrelevant information.
- 19/04/04. The second set of questionnaires (phase II) were completed by both sectors. Face-to-face interviews were conducted with participants from the vehicle refinishing sector and local authority employees.

### **3.2 Summary of EPA Best Practice Guidelines for Vehicle Coating and Refinishing Sector for the Implementation of S.I. 543 of 2002**

A more in-depth analysis of the EPA Best Practice Guidelines for vehicle coating and refinishing sector is included in Section 2.15.6.

Copies of the EPA Best Practice Guidelines for Vehicle Coating and Refinishing Sector were issued by the author to the proprietors of spray paint facilities who also completed two sets of questionnaires and received training packages. A copy of the Guidelines was issued approximately two weeks prior to the completion of the first questionnaire.

The EPA Best Practice Guidelines were carefully analysed by the author, in order to design a questionnaire. The main provisions of the Guidelines are given below.

- An introduction to the Solvent Emissions Directive.
- Who will be regulated in the vehicle coating and refinishing sector.
- Summary of legal requirements of the Directive.
- Registration with the appropriate Local Authority and Certificates of Compliance
- Solvents with specific risk phrases.
- Emission Limit Values.
- Reduction Scheme.
- Solvent Management Plan.
- Emissions and Sources.
- Reducing Emissions.

Once the Guidelines had been critically analysed, a questionnaire was prepared for use with the vehicle-refinishing sector. The clarity of the key provisions in these guidelines was explored through specific questions in the questionnaires.

### **3.3 Analysis of Questionnaires designed for proprietors of Vehicle Coating and Refinishing installations.**

Analysis, by the author, of the contents of the EPA Best Practice Guidelines for the Vehicle Coating and Refinishing Sector, enabled the design of the questionnaires. The clarity of the guidelines was gauged through specific questions. Results were only obtained from the vehicle refinishing installations in County Cavan, a larger study in a different area may have produced different results.

Twenty-three proprietors of spray paint facilities across the county of Cavan were issued with questionnaires. Only twenty of the proprietors could participate in phase I and phase II of the questionnaire, as three of the proprietors were not aware of the introduction of the Regulations. The questionnaires were completed face-to-face and the participants were assured complete confidentiality. Each town and village in County Cavan were represented, the names and addresses of proprietors of vehicle refinishing installations were obtained from telephone directories, town councils and inhabitants of the area. To the best of the author's knowledge, all vehicle-refinishing installations, which are currently operational in County Cavan, participated in this study, however, there may be some workshops, particularly in rural areas that the author was unaware of and therefore were excluded from this study.

All of the spray paint facilities that participated in this questionnaire would be classified as a small size business, because the maximum quantity of employees in any of the facilities was found to be three, inclusive of the proprietor.

The following outlines the questions, which were posed to proprietors of vehicle coating and refinishing installation.

Q1 Are you aware of the new Regulations, which have been introduced to control harmful emissions from your workshop into the atmosphere?

Yes  No

This question was designed to identify the quantity of proprietors who are or are not familiar with the Regulations. The participants who answered yes to this question were requested to complete the remainder of the questionnaire and those who responded no

Q2 How did you hear about the introduction of these Regulations?

Media  Local Seminar  Public Sector   
Paint Company  Word of Mouth  Other Means

The response to this question gave an insight into their source of information.

Q3 How would you rate your knowledge of these Regulations?

Detailed  Knowledge of Main Requirements   
Brief Overview  Very Little

The result from this question was compared with the overall result of this questionnaire to establish if the participants in this questionnaire are in fact as knowledgeable as they perceived themselves to be.

Q4 Do you know what a Volatile Organic Compound (VOC) is?

Yes  No

The response to this question would indicate if the participants are aware of the key definitions within the Regulations.

Q5 Do you know the source of VOC emissions in your workshop?

Yes  No

The answers collected from this question would establish if the proprietor has actually looked around their workshop for sources of VOC emissions.

Q6 Do you know how to calculate the quantity of VOCs, which are emitted from your garage annually?

Yes  No

The response to this question would establish if the calculation laid out in the guidelines is comprehensive.



Q7 Do you know what the VOC emission limit value is from your premises?

Yes  No

This again would demonstrate how comprehensive the guidelines are and the level of interest that the proprietor has in complying with the Regulations.

Q8 Do you know how to control or reduce the VOC emissions from your premises?

Yes  No

These controls have been laid out in the guidelines. If the guidelines are clear and comprehensive, the participant should have had a clear knowledge of how to control VOC emissions.

Q9 From the amount of VOC emitted from your premises, do you know whom you should report to i.e. Local Authority or EPA?

Yes  No

The answers obtained from this question were to demonstrate if the proprietor was aware if they are required to register, and if so with whom should they register.

Q10 Do you feel you have been properly informed of what is required of you under these regulations?

Yes  No

This question was designed to establish the level of confidence the participants had in the method of implementing this Directive.

Q11 Do you think the Regulations and Guidelines were clear and comprehensive?

Yes  No

The response to this question would demonstrate if proprietors perceive that the Guidelines and Regulations were designed in a comprehensive manner.

### 3.4 Analysis of Questionnaires designed for Environmental Personnel at a representative number of Local Authorities

A total of fifteen local authorities were requested to participate in this questionnaire, as the author considered this figure to be a representative number, however, only six returned completed questionnaires. Town Councils were, generally, not requested to participate because the majority of town councils do not have an environmental section and fall under the jurisdiction of their local authority. Two of the local authorities that participated in the questionnaire were urban local authorities, the remaining four local authorities were rural. Questionnaires were issued and returned by post and again, the participating local authorities were offered complete confidentiality, which they all requested. Care was taken, that the questionnaires were issued to the correct member of staff, therefore they were issued to the employee who dealt with air pollution and the enforcement of this Regulation, or where there was not an assigned member of staff to that particular area, the questionnaire was issued to the senior engineer in the environmental department

The language and questions used in this questionnaire differed significantly from those used in the questionnaire issued to proprietors of spray paint facilities. As the target audience for this questionnaire, were assumed to have experience in environmental issues and the interpretation of Acts, Regulations and Directives, the questions were designed with the appropriate language in mind. The local authorities that participated in this questionnaire were requested to answer the following questions.

Q1 How did you first learn about the introduction of these Regulations?

- EPA  Department of the Environment & Local Government   
Media  Other Means

This question was designed to establish their source of information.

Q2 How would you rate your knowledge of these Regulations?

- Detailed  Knowledge of Main Requirements   
Brief Overview  Very Little

This question was put forward to indicate the level of awareness that exists in local authority employees who will be directly involved in the implementation of this Regulation.

Q3 Do you know where the source of VOC emissions exists in a spray paint facility?

Yes  No

The response to this question will demonstrate the level of knowledge and interest that exists within the personnel who will be dealing with proprietors of spray-paint facilities.

Q4 Do you know how the different Emission Limit Values from spray paint facilities are segregated and who is responsible for regulating the different groups?

Yes  No

The answer to this question was to establish if the relevant personnel are aware of some of the basic provisions of the Regulations.

Q5 Do you know which vehicle coating and refinishing sector will be licensable by Local Authorities?

Yes  No

This question was designed to establish if the relevant personnel were aware of which sector that the local authority will be responsible for.

Q6 Are you familiar with the role that the Local Authority will be playing in the implementation of this Regulation?

Yes  No

The response to this question would again reflect the level of awareness that exists within the Local Authorities and would confirm whether they are appropriately prepared for the introduction of this regulation.

Q7 Have you been offered any training to prepare you for the implementation of this Regulation?

Yes  No

The answers collected from this question would demonstrate if any form of training had been offered to employees or if they are expected to equip themselves with the necessary information.

Q8 Do you feel that your department is prepared for the introduction of these Regulations?

Yes  No

The response to this question would establish if the department has been issued with the necessary resources to implement this Regulation.

Q9 In your opinion, do you feel you have been properly informed of the provisions of this Regulation?

Yes  No

This was designed to demonstrate if the relevant employees are satisfied with the method by which this Regulation has been introduced.

### **3.5 Analysis of face-to-face interviews with proprietors of vehicle refinishing installations and local authority employees who will be directly involved in the enforcement of S.I. No. 543**

In phase II, face-to-face interviews were carried out with all persons who completed the phase I questionnaires. These interviews were conducted immediately (where possible) after the participants completed the second questionnaire. The purpose of completing face-to-face interviews was to give all participants the opportunity to speak freely about their regard for S.I. No. 543 and the manner in which it was being implemented. All participants were asked for their opinion on how the system for introducing new items of legislation could be improved and how communication could be improved between the EPA, local authorities and the vehicle-refinishing sector and to voice any other suggestions they may have.

The participants were allowed free reign in their responses and by assuring them complete confidentiality encouraged them to open up.

## 4.0 Results and Discussion

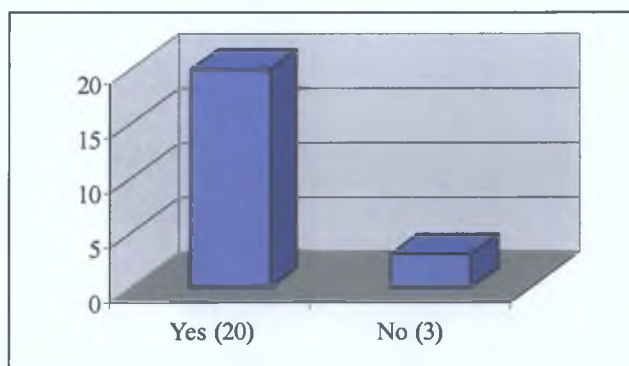
### 4.1 Results obtained from the Questionnaire completed by proprietors of vehicle refinishing installations

As previously mentioned, two sets of questionnaires were issued to proprietors of vehicle refinishing installations, the first questionnaire (phase I) was issued to participants after they had received a copy of the EPA Best Practice Guidelines and before they had been issued with the training package. The responses received to this questionnaire will be referred to as VRSQ1. The second questionnaire (phase II) was issued to the proprietors after they had received the training package, the responses received to this questionnaire will be referred to as VRSQ2.

23 questionnaires were issued and all questionnaires were answered. Of the 23 questionnaires, only 20 respondees were able to complete the entire VRSQ1, and subsequently VRSQ2.

The following question was posed to participants of this questionnaire: *Are you aware of the new Regulations, which have been introduced to control emissions from your workshop into the atmosphere?*

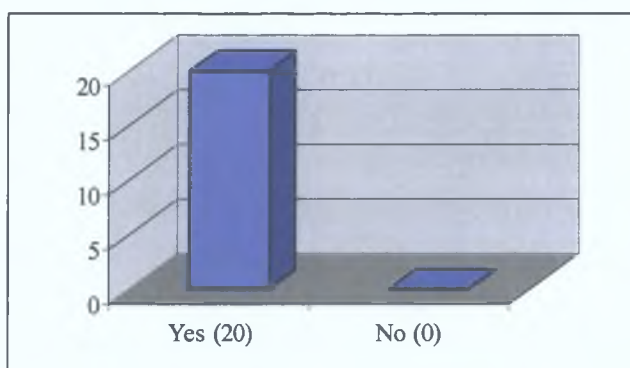
**Figure 2** Response to Q1 of VRSQ1



20 out of the 23 proprietors, who participated in this questionnaire, indicated that they were aware of the introduction of the Emissions of Volatile Organic Compounds from Organic Solvents Regulations 2002 (S.I. No 543 of 2002). Respondee who answered no to this question, were issued with a training package to inform them of the main requirements of S.I. No. 543 of 2002 and requested to return the questionnaire at this point, these participants had no further participation in this survey. Because only 20 of the proprietors involved this questionnaire could proceed with completion of the questionnaire from this point on, they will be referred to as the participants.

On completion of the first questionnaire, all participants were issued with the training package, which was specifically designed with the target audience in mind. All participants were requested to read the training package and complete the same questionnaire again.

**Figure 3 Response to Q1 of VRSQ2**



As expected all 20 of the participants stated that they were now aware of the introduction of the Emissions of Volatile Organic Compounds from Organic Solvents Regulations, 2002.

**Table 10 – Response obtained from Q1**

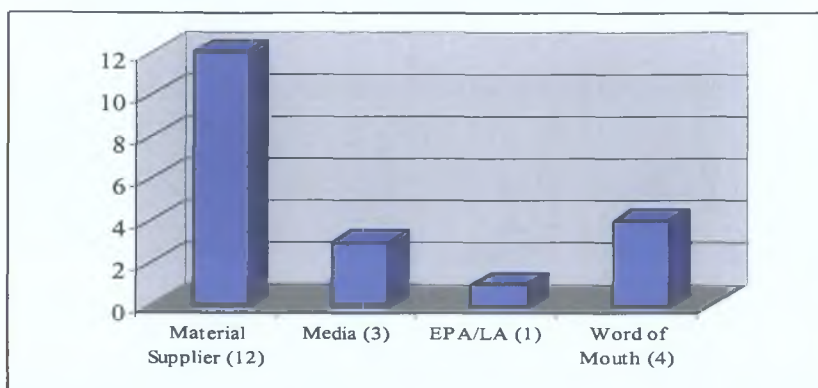
	Yes	No
<b>1<sup>st</sup> Questionnaire</b>	20	3
<b>2<sup>nd</sup> Questionnaire</b>	20	0

3 out of the 23 participants were unaware of the Regulations. This, if representative of the entire population, would be very problematic in implementation since these companies will need to be fully informed of their responsibilities and the cost to adapt their workplace accordingly.



Once it had been established which participants were aware of the introduction of the Solvent Emissions Directive they were then asked: *How did you hear about the introduction of these Regulations?*

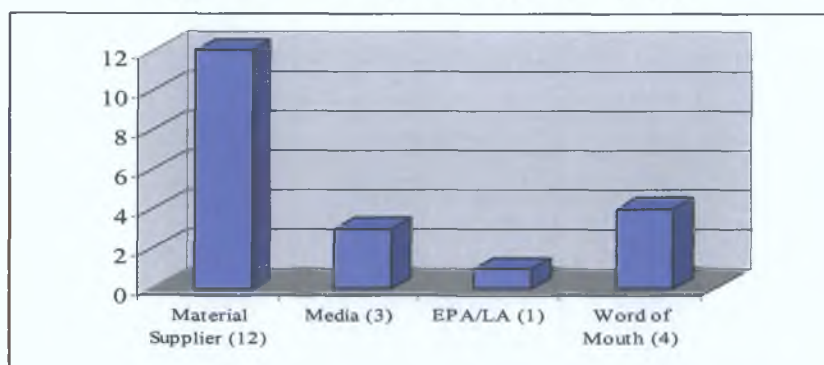
**Figure 4 Response to Q2 of VRSQ1**



The results to this question were very enlightening to the overall study, indicating that the material supplier proved to be the main source of information. 7 of the participants indicated that media and word of mouth accounted for their source of information, which poses the question, “how credible is this information?”

Only 1 of the participants indicated that the EPA/local authorities provided their source of information, this is a worrying statistic, as these bodies will be primarily responsible for the implementation of this Regulation.

**Figure 5 Response to Q2 of VRSQ2**



Because the source of the information did not change, the responses to this question did not change.

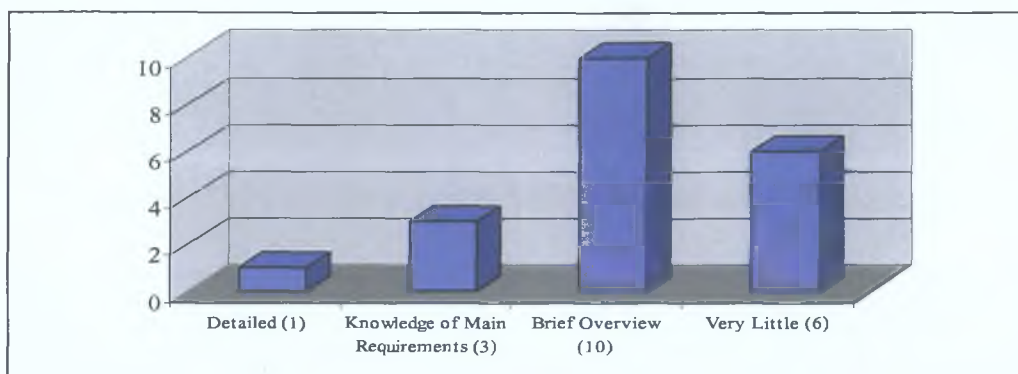
**Table 11 – Response obtained from Q2**

	<b>Material Supplier</b>	<b>Media</b>	<b>EPA</b>	<b>Word of Mouth</b>
<b>1<sup>st</sup> Questionnaire</b>	12	3	1	4
<b>2<sup>nd</sup> Questionnaire</b>	12	3	1	4

After further investigation into this response, by means of face-to-face interviews with all of the proprietors, who also completed the questionnaires, it became apparent that some suppliers were perceived by proprietors of the vehicle refinishing sector to be driving some of the provisions of the Regulation as a sales pitch, suggesting to proprietors that they buy their materials in batch while they still can and implying that the Government will impose restrictions on the quantities of materials purchased. Because the majority of proprietors had not been properly informed of the main requirements, they unfortunately believed this and have invested significantly into the purchase of surplus materials, which might have been better spent on preparing the workplace appropriately for the introduction of this Regulation.

Once the source of information was established, it was essential to establish how the participants rated their level of knowledge prior to the delivery of a training package. Subsequently, the following question was posed: *How would you rate your knowledge of these Regulations?*

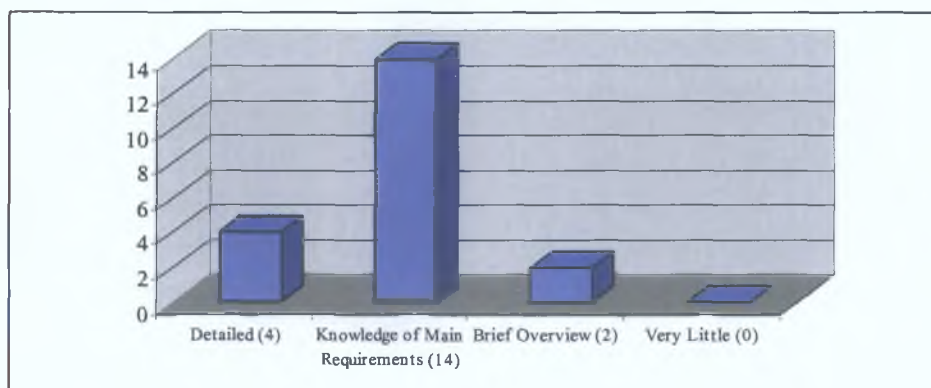
**Figure 6 Response to Q3 of VRSQ1**



Only 1 of the participants claimed to have a detailed knowledge of S.I. No 543 of 2002 and a further 3 participants claiming to be familiar with the main requirements. Again, these are worrying statistics as the Regulation is in place and currently applicable to new installations, it should also be highlighted that existing installations should be actively preparing for the implementation of this Regulation.

10 of the participants believed that they had a brief overview of the requirements of the Regulations, whilst 6 of the participants admitted to possessing very little knowledge of the requirements.

**Figure 7 Response to Q3 of VRSQ2**



Four of the proprietors claimed to possess a detailed knowledge of the Regulations after they had been issued with the training package. Fourteen of the participants claimed to be familiar with the main requirements leaving only two of the participants with a brief overview of the Regulations.

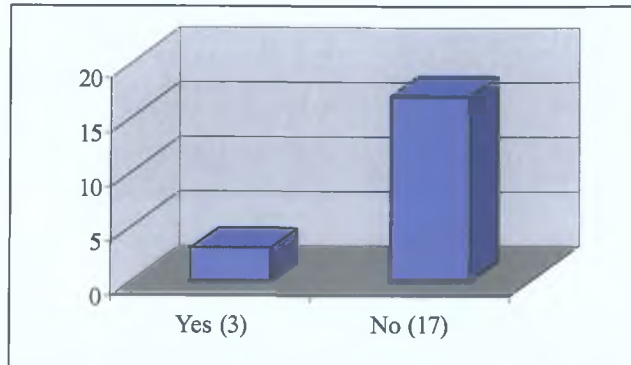
**Table 12 – Responses obtained from Q3**

	<b>Detailed</b>	<b>Knowledge of Main Requirements</b>	<b>Brief Overview</b>	<b>Very Little</b>
1 <sup>st</sup> Questionnaire	1	3	10	6
2 <sup>nd</sup> Questionnaire	4	14	2	0

The responses received to this question differed substantially from the first to the second questionnaire. Initially, only 4 of the proprietors claimed to have a knowledge of the main requirements of the Regulations, leaving 16 who were unaware of the main requirements. These are worrying statistics as the proprietors had been provided with a copy of the EPA Best Practice Guidelines, which would lead us to expect a better response. Although, no check was carried out by the author, on whether the proprietors had read the Guidelines or not. Once the proprietors had been issued with the training documents these statistics changed significantly, now 18 of the proprietors indicated that they understood the main requirements of the Regulations and only 2 stated that they remained unsure. These figures may indicate an improved level of confidence in the proprietor’s knowledge of the regulations, since being provided with the training packages.

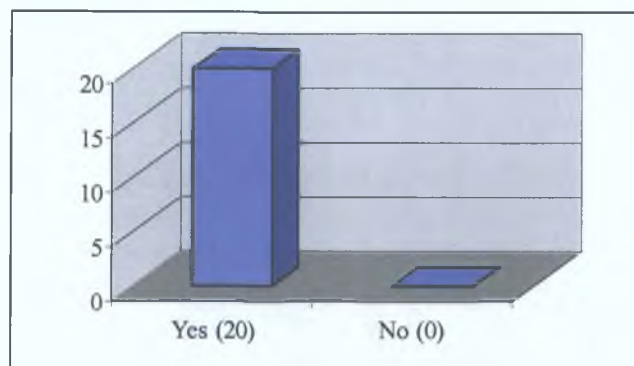
The responses received in the previous question were the participant's own personal opinion. This self claimed level of knowledge was challenged further by asking specific questions, which were dealt with in detail in the Guidelines. *Do you know what a VOC is?*

**Figure 8      Response to Q4 of VRSQ1**



The vast majority, 17, of participants did not know what a VOC was, this is a worrying factor, as, the control of VOCs and their emissions are the very essence for the introduction of S.I. No 543 of 2002 and is clearly defined in the Guidelines. However, this could also suggest that the terminology used is unclear.

**Figure 9      Response to Q4 of VRSQ2**



The response to this question is very significant to the over all results obtained in this study, once participants had been issued with training packages, they all claimed to know what a VOC was.

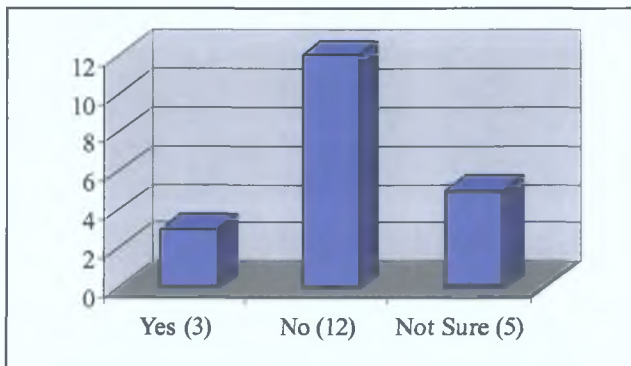
**Table 13 – Responses obtained from Q4**

	<b>Yes</b>	<b>No</b>
<b>1<sup>st</sup> Questionnaire</b>	3	17
<b>2<sup>nd</sup> Questionnaire</b>	20	0

The responses to this question varied greatly from the first questionnaire to the second questionnaire. As the proprietors were supplied with a copy of the EPA Guidelines, it was expected that more of the participants would have been aware of the basic definition of a VOC, however this was not the case. The fact that only 3 of the participants claimed to know what a VOC was, would question the clarity of this definition in the Guidelines or the overall presentation of the Guidelines. Once the participants were provided with the training document, this figure increased to 20, which would suggest that the training document was more comprehensive and/or approachable. It could also be that once the participants were ‘involved’, this group of 20 became more motivated to read the training package than they had been the EPA Best Practice Guidelines. It might be that if this method were used in the more general population that some proprietors would not read it or would give it scant consideration.

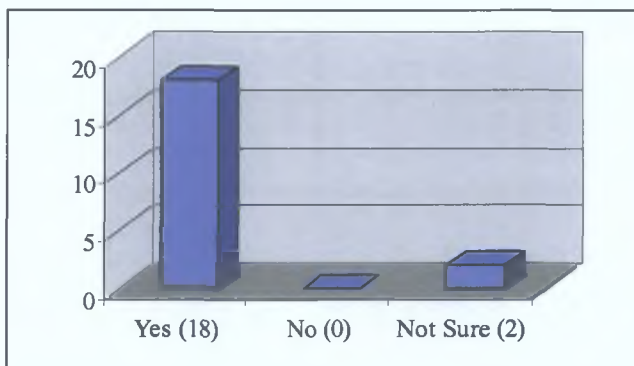
Proprietors were then questioned if they could pinpoint the source of VOC emissions in their workplace, by means of the following question: *Do you know the source of VOC emissions in your workshop?*

**Figure 10** Response to Q5 of VRSQ1



3 of the participants claimed to be aware of the sources of VOC emissions in their workplace. 12 of the responses stated that they did not know the source of VOC emissions and 5 of proprietors were unsure of the sources of VOC emissions in their workplace.

**Figure 11** Response to Q5 of VRSQ2



18 of the participants indicated that they were aware of the source of VOC emissions in their workshop, only 2 of the participants remained unsure.

**Table 14 – Responses obtained from Q5**

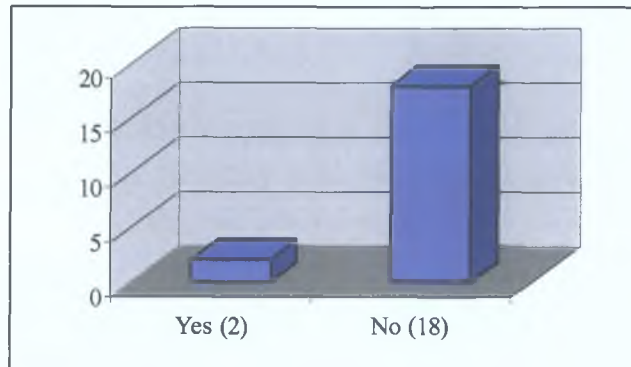
	<b>Yes</b>	<b>No</b>	<b>Not Sure</b>
<b>1<sup>st</sup> Questionnaire</b>	3	12	5
<b>2<sup>nd</sup> Questionnaire</b>	18	0	2

Of the responses obtained in the initial questionnaire, 17 of the participants were unsure of the source of VOC emissions in their workshops. Although this topic is not dealt with in the Guidelines, one would imagine that a proprietor would take a personal interest in establishing a basic fact such as this, for the purpose of health and safety if for nothing else. The initial response to question 1 indicated that 15 of the participants were already aware of the introduction of this Regulation, you would envisage that possessing this knowledge would trigger a sense of curiosity in the proprietor to establish the source of VOC in their own workshop. This would further confirm the inexperience in interpreting and complying with legislation possessed by proprietors.



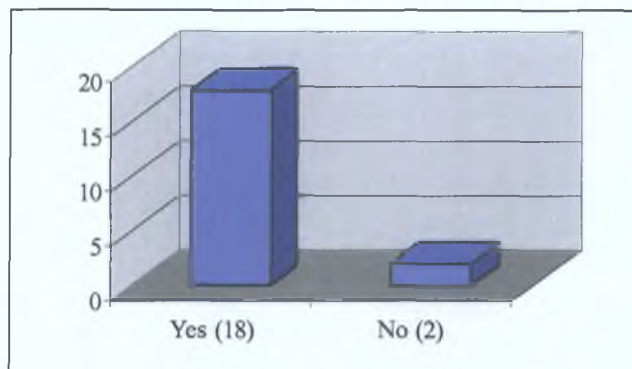
The Guidelines give working examples of how to calculate VOC emissions. The Participants were questioned on their understanding of this through the following question: *Do you know how to calculate the quantity of VOC that is emitted from your garage annually?*

**Figure 12** Response to Q6 of VRSQ1



The results from this question indicate that the worked examples in the Guidelines were not comprehensive by 18 of the participants of this questionnaire. Only 2 of the proprietors questioned, understood the Guidelines and claimed to be able to calculate their annual VOC emissions.

**Figure 13** Response to Q6 of VRSQ2



Eighteen of the participants indicated in the second questionnaire, that they were able to calculate the quantity of VOC emitted from their garage annually. Only 2 of the participants indicated that they still were unable to complete this calculation.

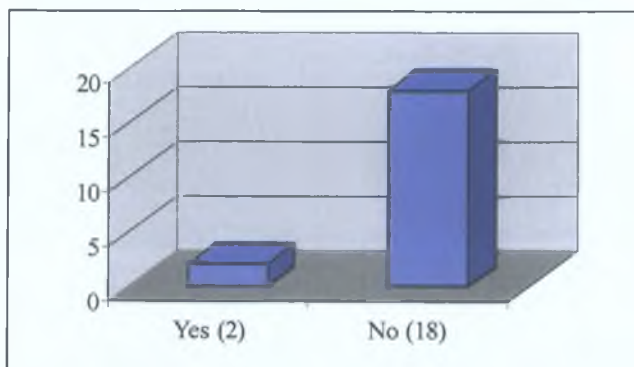
**Table 15 – Responses obtained from Q6**

	<b>Yes</b>	<b>No</b>
<b>1<sup>st</sup> Questionnaire</b>	2	18
<b>2<sup>nd</sup> Questionnaire</b>	18	2

The EPA Guidelines contain worked examples of how to calculate VOC emissions, however, only 2 of the participants were aware of how to calculate this initially. The clarity and the method used to demonstrate this in the Guidelines, again comes into question, particularly as in the second questionnaire, 18 of the participants claimed to be able to calculate their VOC emissions.

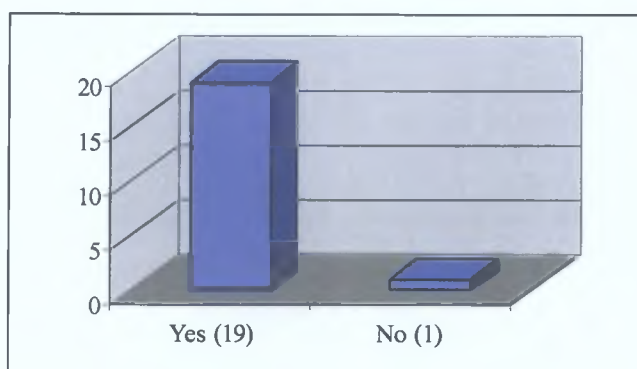
The clarity of the Guidelines was questioned further, when participants were asked: *Do you know what the limit is for emissions of VOC from your premises?*

**Figure 14** Response to Q7 of VRSQ1



2 of participants stated that they were aware of the VOC emission limit from their premises, however 3 of the participants indicated in an earlier question that they were familiar with the main requirements of the Regulations. This could suggest a lack of confidence in the understanding of the provisions of the Regulations, particularly after the participants had been issued with a set of guidelines. 18 of proprietors stated that they did not know the VOC emission limit for their premises.

**Figure 15** Response to Q7 of VRSQ2



The response to this question demonstrated that only 1 of the participants claimed to be unsure of the emission limit value from their workshop, leaving 19 of the participants claiming to be aware of this limit.

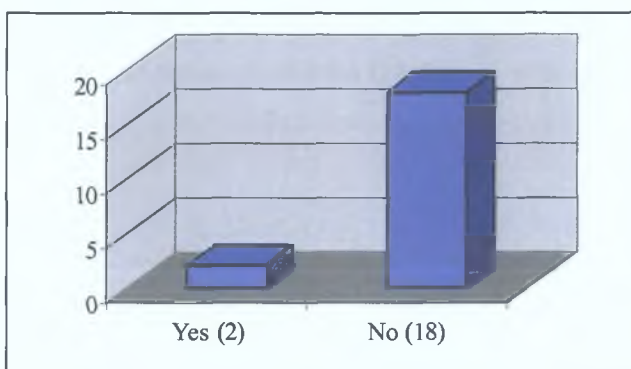
**Table 16 – Responses obtained from Q7**

	<b>Yes</b>	<b>No</b>
<b>1<sup>st</sup> Questionnaire</b>	2	18
<b>2<sup>nd</sup> Questionnaire</b>	19	1

As previously mentioned, these limits are addressed on the first page of the EPA Guidelines, in the form of a flowchart. As an introduction page to the Guidelines and the first item that a proprietor will see, it can generate slight confusion and may have dissuaded proprietors from reading any further. This may suggest the reason for the negative responses received from the proprietor in the first questionnaire. However, it is apparent that once the participants were issued with the training document, they felt much clearer on this matter as 19 of the proprietors claimed to be aware of the different limits for VOC emissions. Results obtained from question 4 of VRSQ1 previously indicated that participants were unaware of what a VOC was, therefore it was not surprising that 18 of the participants did not know what the limit was for VOC emissions from their premises in VRSQ1.

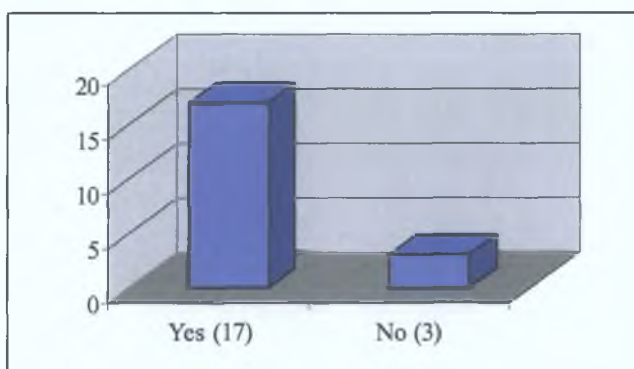
The Guidelines issued by the EPA identify the different approaches to reducing or controlling VOC emissions from a spray paint facility, however whether this was understood by the participants of this questionnaire would be addressed through the following question: *Do you know how to control or reduce the VOC emissions from your premises?*

**Figure 16** Response to Q8 of VRSQ1



The response to this question, again suggested a lack in understanding and/or confidence in the presentation of the Guidelines with 18 of the participants revealing that they did not know how to control or reduce VOC emissions from their premises. Only 2 of the proprietors indicated that they were aware of the different approaches to reducing or controlling VOC emissions.

**Figure 17** Response to Q8 of VRSQ2



17 of the participants indicated that they were aware of how to control or reduce VOC emissions from their premises.

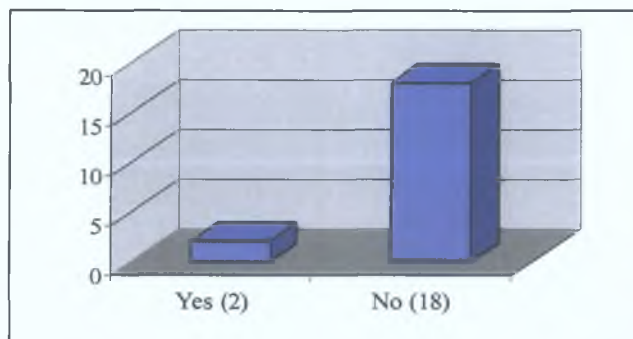
**Table 17 – Responses obtained from Q8**

	<b>Yes</b>	<b>No</b>
<b>1<sup>st</sup> Questionnaire</b>	2	18
<b>2<sup>nd</sup> Questionnaire</b>	17	3

The EPA Guidelines indicate the various options for reducing or controlling VOC emissions from a spray paint facility, but it is obvious the responses obtained in the first questionnaire that these options were only fully understood by 2 of the participants. This figure increased to 17 in the second questionnaire once they had reviewed the training document.

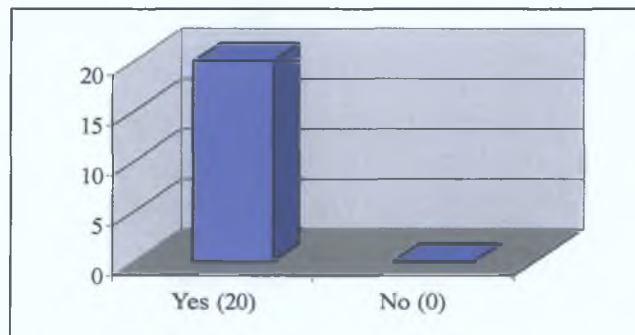
The first page of the Guidelines issued by the EPA displays a flow chart, which indicates who a spray paint facility should report to depending on the quantities of VOCs emitted from the premises. As an introduction page to these Guidelines, the presentation of this flowchart appears quite daunting to the author. To assess the effectiveness of this flowchart for persons in the vehicle refinishing sector, participants were asked the following question: From the amount of VOC emitted from your premises, do you know who you should report to, i.e. The Local Authority or the EPA?

**Figure 18 Response to Q9 of VRSQ1**



18 of the participants indicated that they did not know who they were to report to, with only 2 of the participants stating they were aware of this requirement. The fact that this flowchart was presented on the first page of the Guidelines and that it generated some confusion, may suggest that the remainder of the document appeared unapproachable to the target audience.

**Figure 19 Response to Q9 of VRSQ2**



All 20 participants indicated that they were now aware of who they should report to.

**Table 18 – Responses obtained from Q9**

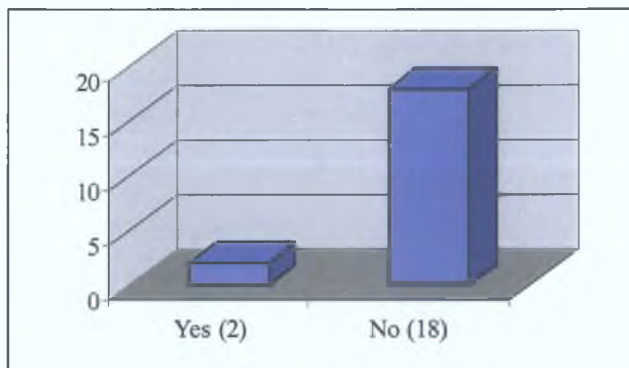
	<b>Yes</b>	<b>No</b>
<b>1<sup>st</sup> Questionnaire</b>	2	18
<b>2<sup>nd</sup> Questionnaire</b>	20	0

These facts are also displayed in the flowchart on the first page of the EPA Guidelines, however, again to the untrained eye this may not be clear, the fact that only 2 of the participants stated they were aware of who they were to report appear to confirm this. The responses obtained to the same question in the second questionnaire, again, confirm that when the facts are presented in a clear and approachable way that the main requirements, once presented in a concise manner with the target audience in mind.



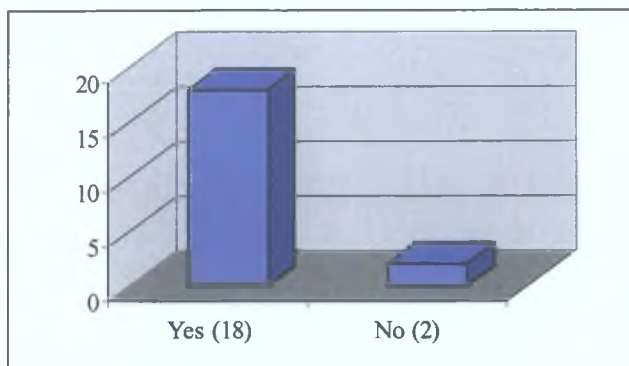
The questions presented to the participants up to this point, were generally designed to demonstrate how well understood the Regulations and the Guidelines were by the vehicle refinishing sector who participated in this questionnaire. It essential to the successful completion of this questionnaire to establish the level of satisfaction the participants have in the manner by which these Regulations were implemented. Subsequently the participants were requested to answer the following question: *Do you feel you have been properly informed of what is required of you under these Regulations?*

**Figure 20      Response to Q10 of VRSQ1**



Only 2 of the participants felt prepared for the introduction of the Emissions of Volatile Organic Compounds from Organic Solvents Regulations, 2002 and the vast majority, 18 of proprietors questioned believing they were not properly informed of the requirements. These 2 participants answered consistently throughout phase I and phase II, that they were aware of the main requirements of this Regulation. These same participants came from vehicle refinishing installations with a higher number of employees than the other vehicle refinishing installations who participants and therefore may have greater resources which could allow them to be better informed.

**Figure 21 Response to Q10 of VRSQ2**



18 of the participants indicated that they felt they have been properly informed of what is required of them under the Regulations.

**Table 19 – Responses obtained from Q10**

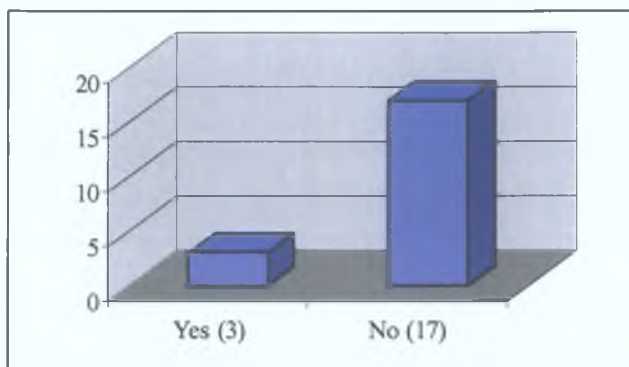
	Yes	No
<b>1<sup>st</sup> Questionnaire</b>	2	18
<b>2<sup>nd</sup> Questionnaire</b>	18	2

This question is more general, it was posed to the participants to gauge their feelings on the manner these Regulations were introduced. Only 2 of the participants initially felt that they were properly informed of what was required of them under S.I. No. 543, 2002, which is understandable considering that this is probably the first time many of them have been exposed to the introduction of a new Regulation that directly affects their operations. This could be because the proprietors expected more support or consultation in order to assist them in complying with this Regulation. However, it may be because the EPA Guidelines are quite complicated to someone who is unfamiliar with interpreting legislative requirements and whose normal workday does not involve reading legislative material.

Once the participants had reviewed the training document it became apparent that 90% of them now appeared to be more satisfied with the method by which they had been informed of the requirements of the Emissions of Volatile Organic Compounds from Organic Solvents Regulations, 2002.

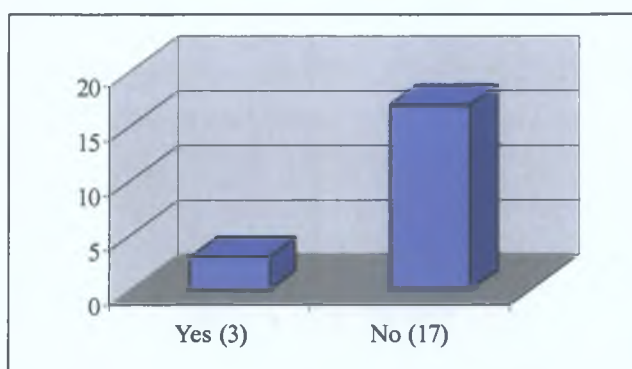
As a concluding question to the first questionnaire, the participants were asked: *Do you think the Regulations and Guidelines were clear and comprehensive?*

**Figure 22** Response to Q11 of VRSQ1



17 of participants felt that that the clarity of the Regulations and Guidelines were inadequate. This could indicate that the body responsible for compiling the Guidelines did not consider the target audience who had little experience in complying with environmental legislation. Only 3 of the participants claimed to fully understand the Guidelines.

**Figure 23** Response to Q11 of VRSQ2



17 of the participants indicated that they were not satisfied with the method by which the EPA Guidelines and Emissions of Volatile Organic Compounds from Organic Solvents Regulations, 2002 are being implemented and clearly there is room for significant improvement in the introduction of future environmental legislation.

**Table 20 – Responses obtained from Q11**

	<b>Yes</b>	<b>No</b>
<b>1<sup>st</sup> Questionnaire</b>	3	17
<b>2<sup>nd</sup> Questionnaire</b>	3	17

The response to this question did not change. Participants made their feelings clear during face-to-face interviews, that they were dissatisfied with the manner by which these Regulations have been introduced. Some of the participants felt isolated and did not know where to turn to for support or consultation. Many were of the opinion that understanding and complying with the main requirements was beyond them and that they would be shut down once the Regulation was enforced. There was an air of resentment in many of their participants, as they were readily prepared to invest heavily into their business in order to comply with the Regulations, however the general consensus was that they were clueless as to where or how to go about it. The majority found the Guidelines intimidating, impossible to understand and therefore a rather useless document.

## 4.2 Results obtained from face-to-face interviews with proprietors of vehicle refinishing installations

The purpose of conducting face-to-face interviews was to attempt to establish the general feelings within the vehicle refinishing industry with regards to the introduction of this Regulation and the manner by which it was going to be enforced. The questions which were put forward to the proprietors during the face-to-face interviews were generally the same as those included in the questionnaires, however, proprietors were allowed to speak freely and not simply restrict themselves to the options offered to them in the questionnaires. In addition the proprietors were encouraged to voice any other concerns they may have had in relation to the way the Regulation was being implemented in this country. Again, all participants were assured complete confidentiality. All proprietors who participated in phase I and phase II of the questionnaires also participated in the face-to-face interviews. Participants who gave responses, which are significant to this study, will be included in this section.

The question ‘How did you hear about the introduction of these Regulations?’ was posed to the participants, and they were given the following options to respond to in the questionnaire:

Media	<input type="checkbox"/>	Local Seminar	<input type="checkbox"/>	Public Sector	<input type="checkbox"/>
Paint Company	<input type="checkbox"/>	Word of Mouth	<input type="checkbox"/>	Other Means	<input type="checkbox"/>

A direct response as outlined in Section 4.1, was received from the participants, however after further investigation into this response, by means of face-to-face interviews with all of the proprietors who also completed the questionnaires, six of the participants who indicated that material suppliers were their main source of information, also indicated that from the manner by which the material supplier informed them of the Regulations, in hindsight appeared to have an alternative motive. These participants claimed that after reading the training document it became apparent that the actual main requirements of the Regulations were significantly different from those highlighted by the suppliers involved. These participants indicated that the suppliers involved, led them to believe that there would be restrictions on how much coating materials could be purchased once the Regulation was fully implemented. Because the existing information relevant to the

implementation of S.I. No. 543 is readily available to the public and can be easily misconstrued and there is nothing in place to prevent this from reoccurring. The compilation and issuing of a comprehensive training package in the early stages of the introduction of S.I. No. 543 might have reduced this confusion.

When the participants were asked 'How would you rate your knowledge of these Regulations?'

The majority of proprietors who participated in the face-to-face interviews indicated that they were feeling very unsure about the introduction of S.I. No. 543. These same participants claimed that they felt isolated and were unsure of facts such as cost of implementation, who could they consult with if they experienced difficulties and how the Regulation was going to be enforced. These participants emphasised their enthusiasm at complying with the main requirements. However their insecurities about where to turn to was very apparent.

During the face-to-face interviews, the participants were asked 'Do you think the Regulations and Guidelines were clear and comprehensive?'

Eighteen of the participants indicated that they were totally dissatisfied with the manner by which these Regulations have been introduced. Some of the participants felt isolated and did not know where to turn to for support or consultation. Many were of the opinion that understanding and complying with the main requirements was beyond them and that they would be shut down once the Regulation was enforced. These same participants claimed that they found the Guidelines intimidating, and extremely difficult to understand and interpret.

As a concluding question, the participants were asked for suggestions on how the method for introducing new items of legislation could be improved.

All of the participants indicated that communications on the whole must be improved in order for a new item of legislation to be understood and implemented. In addition, all of the participants claimed that if there was an accessible support network in place that they

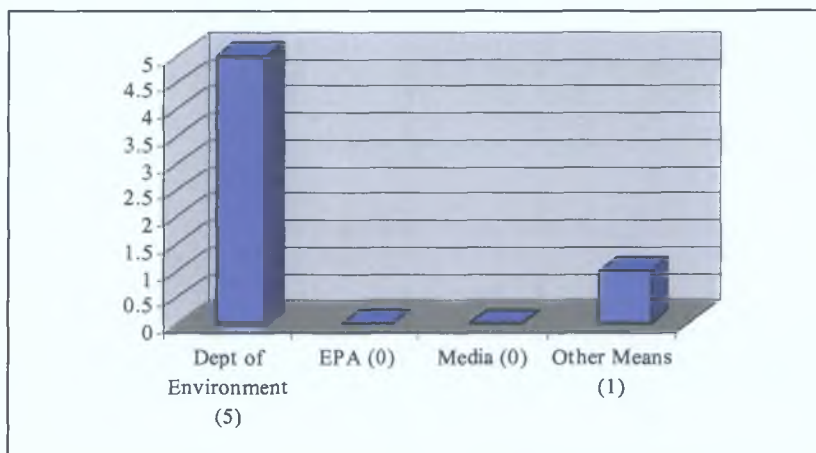
would feel less isolated and would feel better prepared to grasp and understand what was required of them.

### 4.3 Results obtained from the Questionnaires completed by Local Authority employees

The questionnaire from phase I was issued to fifteen local authorities, however only six local authorities participated in this study, the first questionnaire was issued to local authorities after they had received a copy of the EPA Best Practice Guidelines and before they had been issued with the training package. The responses received to this questionnaire will be referred to as LAQ1. The second questionnaire was issued to local authorities after they had received the training package (see appendix III), the responses received to this questionnaire will be referred to as LAQ2.

It was essential to establish how the participants of this questionnaire discovered the introduction of the Emissions of Volatile Organic Compounds from Organic Solvents Regulations, 2002. This would be established through the following question: *How did you first learn about the introduction of these Regulations?*

Figure 24 Response to Q1 of LAQ1



The response gathered from this question clearly indicates that the main source of information was through the Department of the Environment. 1 of the participants stated that they first learnt about the introduction of these Regulations through different means.

The responses received in the second questionnaire did not change.



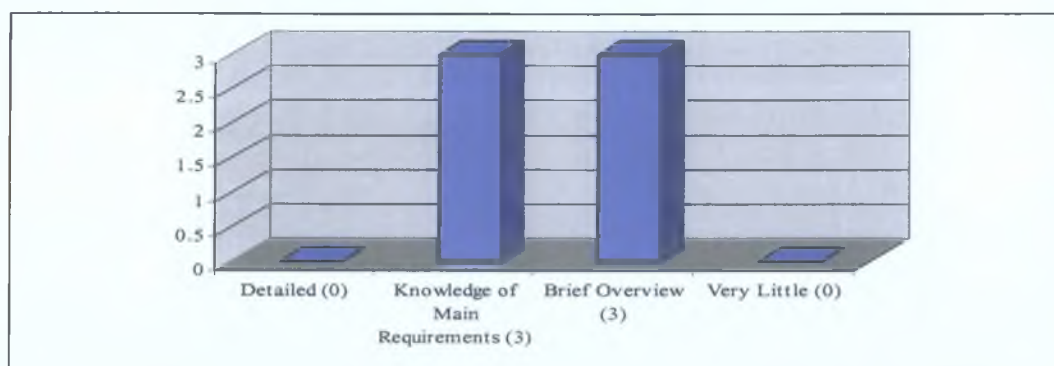
**Table 21 – Responses obtained from Q1**

	<b>Dept of the Environment</b>	<b>EPA</b>	<b>Media</b>	<b>Other Means</b>
<b>1<sup>st</sup> Questionnaire</b>	5	0	0	1
<b>2<sup>nd</sup> Questionnaire</b>	5	0	0	1

Five of the local authorities were informed of the introduction of this Regulation by a Circular Letter, issued by the Department of the Environment and Local Government (see appendix I). This Circular Letter gave a brief overview of the main requirements of S.I. No. 543 and since being issued with this letter, there had been no further consultation between the Department of the Environment and the local authorities. During face-to-face interviews carried out with a select number of local authorities, the results revealed that this was the method by which they were normally introduced to a new item of legislation, even when they were involved in its implementation. In the author's opinion, this is unsatisfactory, local authority employees who will be directly involved in the enforcement of a new item of legislation should be briefed appropriately, by means of training and the provision of reference material, neither of which has been provided in this instance.

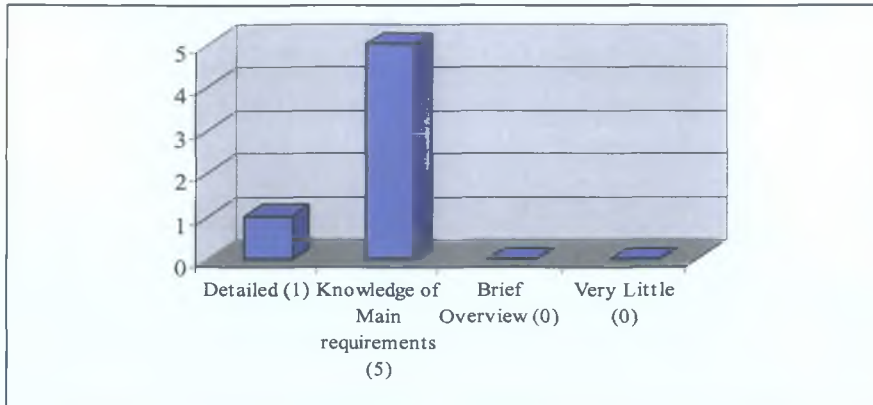
After determining the source of information, it was then important to establish their awareness of the main requirements of the Regulation, this would reflect how prepared the Local Authorities were for the introduction of the Regulation and the role they would play in its implementation. The participants were asked the following question, *How would you rate your knowledge of these Regulations?*

**Figure 25 Response to Q2 of LAQ1**



The response obtained from this question was quite surprising, with none of the participants feeling that they had a detailed knowledge of the Regulations. Half of the participants indicated that they were aware of the main requirements of the Regulations and the other half claiming that they only had a brief knowledge of the Requirements. These responses suggest that at the time of participating in the first questionnaire, that half of the Local Authorities did not appear confident in their knowledge and subsequently unprepared for the implementation of the Emissions of Volatile Organic Compounds from Organic Solvents Regulations, 2002. This is quite worrying as local authorities will be responsible for the registration of most paint spray facilities in the country.

**Figure 26 Response to Q2 of LAQ2**



All 6 of the participants stated that they possessed a knowledge of the main requirements of the Regulation, with 1 of these participants confidently indicating that they possessed a detailed knowledge of the Regulation.

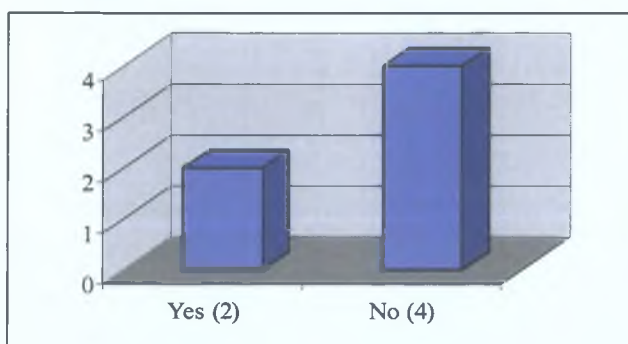
**Table 22 Responses obtained from Q2**

	Detailed	Knowledge of main requirements	Brief Overview	Very Little
1 <sup>st</sup> Questionnaire	0	3	3	0
2 <sup>nd</sup> Questionnaire	1	5	0	0

As can be seen from the responses obtained from this question, all participants indicated that they had a knowledge of the main requirements of the Regulations once they had been issued with the training packages. This statistic is a significant improvement on that obtained from the first questionnaire, where only half of the participants possessed a knowledge of the main requirements. This would not inspire confidence in the success of this Regulation within the 6 participating local authorities, as the local authority is one of the regulatory bodies that will be partially responsible for the successful implementation of this Regulation.

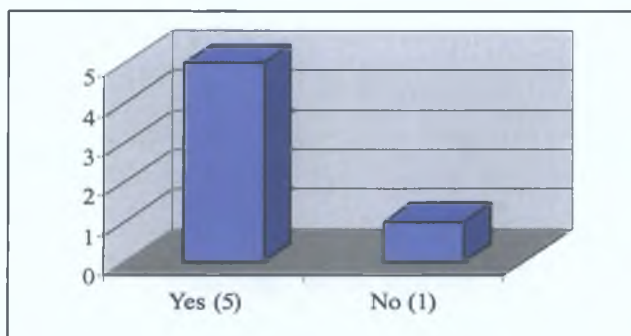
Participants were then questioned on their knowledge of the operation of a spray paint facility, which would be relevant to compliance with the Regulations. The local authority will be perceived as the consultative body for the successful implementation of the Regulation, because of this, they must be equipped with a basic operational knowledge of a spray paint facility. To determine the level of knowledge the participants were asked: *Do you know where the source of VOC emissions exists in a spray paint facility?*

**Figure 27 Response to Q3 of LAQ1**



Only 2 of participants claimed that they were aware of the sources of VOC emissions in a spray paint facility, 4 answered 'no'. Local authority employees who will be involved in the implementation of this Regulation will be expected to be equipped with this basic knowledge.

**Figure 28 Response to Q3 of LAQ2**



After the training document was issued to all participants, the response to this question indicated that 5 of the participants claimed to be aware of the source of VOC emissions.

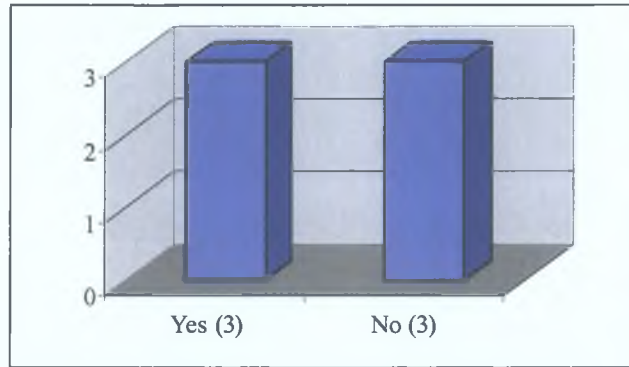
**Table 23 – Responses obtained from Q3**

	<b>Yes</b>	<b>No</b>
<b>1<sup>st</sup> Questionnaire</b>	2	4
<b>2<sup>nd</sup> Questionnaire</b>	5	1

It has already been established in section 4.1 of this thesis that the majority of proprietors of spray paint facilities are unsure where to turn to for consultation, therefore it is presumed that they will approach the local authorities for information. Employees of the environmental departments in local authorities will be expected to have some insight into the basic operation of a spray paint facility in order to deal with queries. It is clear from the responses obtained from this answer that only 2 of the participants felt equipped to answer in the first questionnaire, however once they had been issued with training documentation this figure increased to 5. This would suggest that with training, local authorities would now be more capable of dealing with and responding to queries.

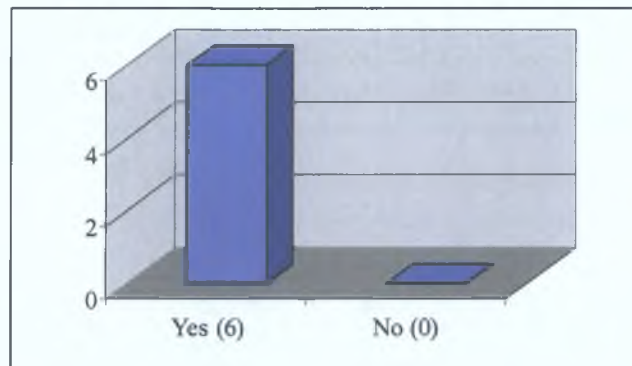
Participants were then asked: *Do you know how the different Emission Limit Values from spray paint facilities are segregated and who is responsible for regulating the different groups?*

**Figure 29** Response to Q4 of LAQ1



Half of the participants indicated that they were aware of how the different emission limits were segregated and who was responsible for each division, the remaining half stated that they were unaware of segregation issues.

**Figure 30** Response to Q4 of LAQ2



After participants were provided with a training document, all six of the participants were aware of the different emission limit values and who were responsible for each.

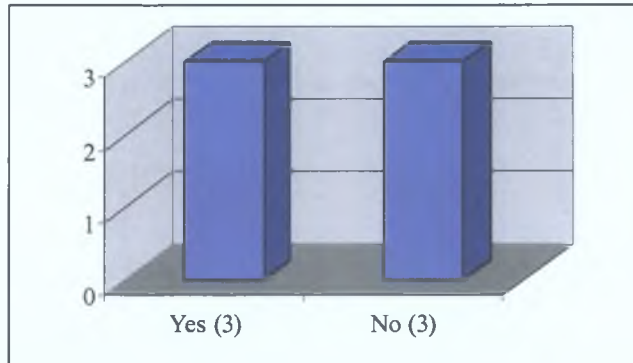
**Table 24 – Responses obtained from Q4**

	<b>Yes</b>	<b>No</b>
<b>1<sup>st</sup> Questionnaire</b>	3	3
<b>2<sup>nd</sup> Questionnaire</b>	6	0

This information is available in the EPA Guidelines. Local authority employees would be expected to be competent in the interpretation of Guidelines, however, during face-to-face interviews it became apparent that this was the first time many of the participants had seen the Guidelines. There has obviously been a breakdown in communication somewhere along the way, for many of the local authorities not to be issued with a copy of the EPA Guidelines, which is an essential tool in the successful implementation of this Regulation. After the participants had been issued with the training documents, all of the participants were aware of how the different Emissions Limit Values from spray paint facilities are segregated and who is responsible for regulating the different groups.

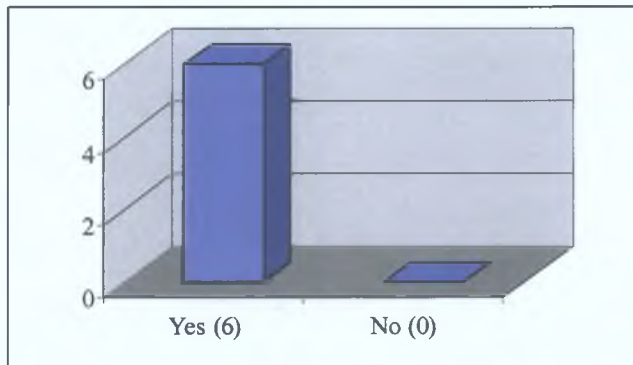
Knowledge of enforcement responsibilities was questioned further to determine if the participants were aware of which section they were responsible for. The following question was posed to the participants: *Do you know which vehicle coating and refinishing sector will be licensable by Local Authorities?*

**Figure 31 Response to Q5 of LAQ1**



Half of the participants stated that they were aware of which vehicle refinishing sector they would be responsible for, the remaining half of participants were unaware of this fact.

**Figure 32 Response to Q5 of LAQ2**



The response to this question indicates that all of the participants are aware of which sector is licensable by local authorities.



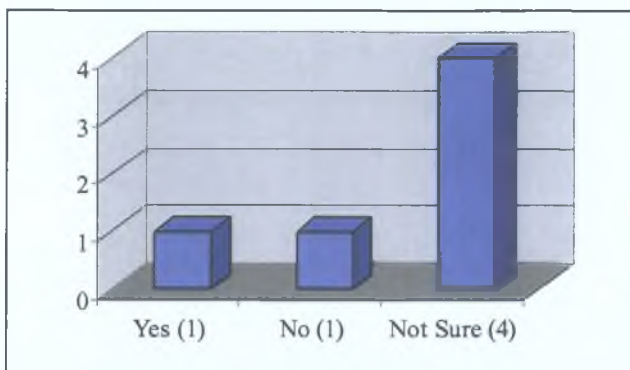
**Table 25 – Responses obtained from Q5**

	<b>Yes</b>	<b>No</b>
<b>1<sup>st</sup> Questionnaire</b>	3	3
<b>2<sup>nd</sup> Questionnaire</b>	6	0

In the first questionnaire that was completed by participants, 3 were unaware of which vehicle coating and refinishing sector will be licensable by local authorities. As the Regulation is already in place and new installations are currently supposed to be registering with local authorities, this is a disappointing statistic. This would raise the question, how were local authorities dealing with queries from proprietors of new installations to this point? After the participants were issued with the training documents, however, they all claimed to be aware of which sector they would be responsible for.

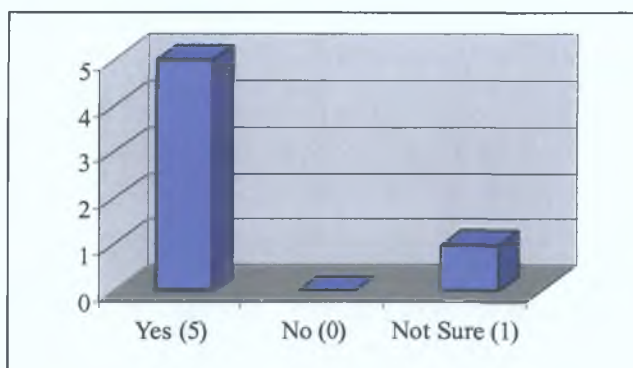
Participants were then questioned on their involvement in the successful implementation of this Regulation, through the following question: *Are you familiar with the role that the Local Authority will play in the implementation of this Regulation?*

**Figure 33 Response to Q6 of LAQ1**



Only 1 of the participants were familiar with the role that the local authority will play in the implementation of Emissions of Volatile Organic Compounds from Organic Solvents Regulations, 2002. 4 of the participants were unsure of what exactly would be required of them in order to successfully implement this Regulation.

**Figure 34 Response to Q6 of LAQ2**



The response to this question indicates that 5 of the participants are familiar with the role they will play in the enforcement of this regulation.

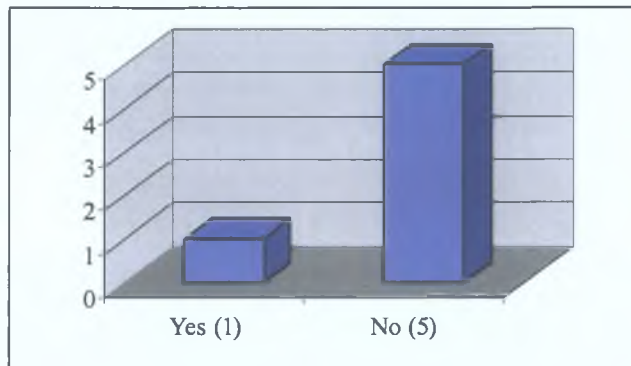
**Table 26 – Responses obtained from Q6**

	<b>Yes</b>	<b>No</b>	<b>Not Sure</b>
<b>1<sup>st</sup> Questionnaire</b>	1	1	4
<b>2<sup>nd</sup> Questionnaire</b>	5	0	1

The responses to this question, again, indicated that before being issued with the training package, the participants possessed a lack of confidence in the role they will be playing during the implementation of S.I. No. 543, 2002. 5 of the participants indicated that they were unsure of the role they would be playing, indicating poor communication between the Department of the Environment and Local Government, the EPA and local authorities. Initially, only 1 of the participants claimed to be aware of the role they would play. This figure increased, however, to 5 once they had the opportunity to review the training package, this would suggest that once the participants have been supplied with the appropriate training material presented in a comprehensive manner, they can extract from it the information they require to successfully implement an item of legislation.

It was then considered essential to establish what, if any, training had been offered to Local Authority employees. The following question was asked to establish this: *Have you been offered any training to prepare you for the implementation of this Regulation?*

**Figure 35 Response to Q7 of LAQ1**



At the time this questionnaire was completed, only 1 of the participants of this questionnaire had been offered some form of training, 5 had not. The participant who had been offered training, answered positively in most questions, indicating that training was successful. Training is essential to ensure the successful implementation of this Regulation, staff cannot be expected to be appropriately prepared for the introduction of the Emissions of Volatile Organic Compounds from Organic Solvents Regulations, 2002 if they have not been provided with some form of training.

The response to this question did not alter in the second questionnaire.

**Table 27 – Responses obtained from Q7**

	Yes	No
<b>1<sup>st</sup> Questionnaire</b>	1	5
<b>2<sup>nd</sup> Questionnaire</b>	1	5

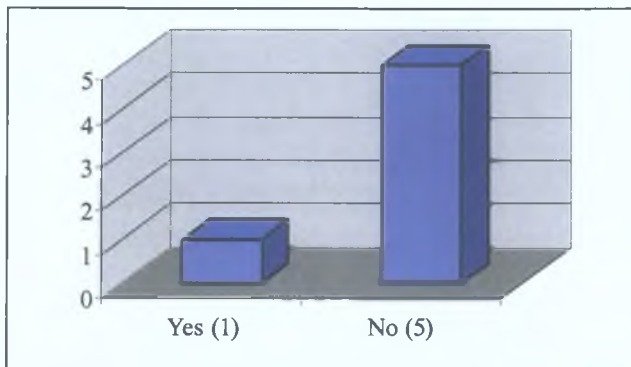
At the time the questionnaires were complete, only 1 of participants had been offered some form of training to prepare them for the introduction of this Regulation. The Department of the Environment and Local Government and the EPA should examine this

issue. The provision of training is the foundation for reaching goals and therefore should be provided, particularly for the introduction of a new item of legislation.

In mid July, one of the local authorities that participated in this questionnaire informed the author that the Department of the Environment, Heritage and Local Government had made contact with their Senior Engineer indicating that they were planning to host a training seminar for the implementation of this Regulation.

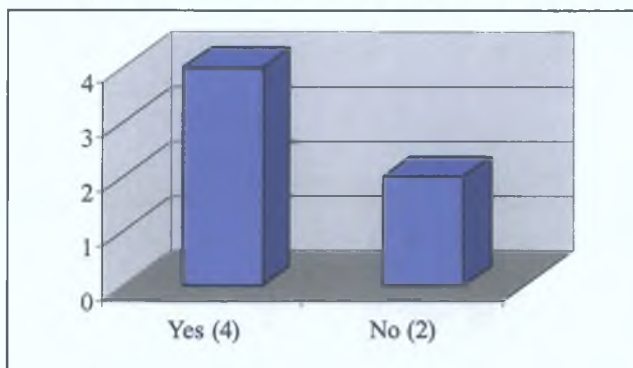
At this point of the questionnaire, it was essential to determine the level of confidence that exists in Local Authority employees, subsequently they were asked: *Do you feel that your department is prepared for the implementation of these Regulations?*

**Figure 36** Response to Q8 of LAQ1



5 of the participants suggested that their department was not adequately prepared for the implementation of this Regulation, this is a worrying statistic as this Regulation is already in place for new installations. Only 1 of the participants felt that their department were prepared for the successful enforcement of these regulations, this was the same participant who had been offered training.

**Figure 37** Response to Q8 of LAQ2



Four of the participants felt that their departments were adequately prepared for the introduction of this Regulation.

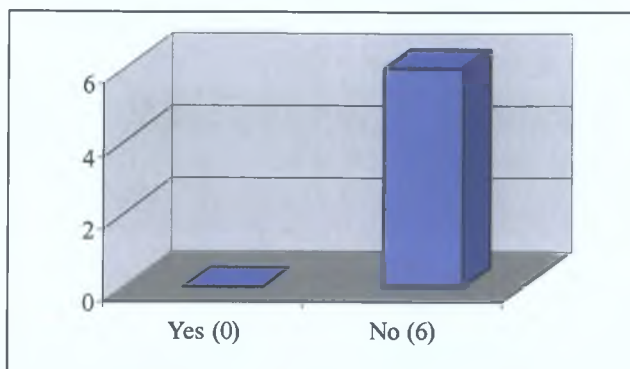
**Table 28 – Responses obtained from Q8**

	<b>Yes</b>	<b>No</b>
<b>1<sup>st</sup> Questionnaire</b>	1	5
<b>2<sup>nd</sup> Questionnaire</b>	4	2

1 of the participants indicated that their department were prepared for the introduction of this Regulation and this statistic only increased to 4 once they had been provided with training documentation, this was an unsatisfactory result which had to be investigated further. During face-to-face interviews with the participants, it became apparent why participants felt that their departments were not fully prepared for the introduction of S.I. No. 543, 2002, the majority of participants felt that they had limited resources already to deal with their existing duties. The introduction of additional duties, as a result of this Regulation, would exert increased pressures to an already stretched work force, in addition, the additional funds required to process these duties would obviously release funds from another area, in which they were also required. However, the main reason participants felt unprepared was because they had not received any formal training on the matter, and this would be the simplest issue to address. The results obtained from this question could suggest that 4 out of the 6 participating local authorities found the training package adequate and 2 of the participating local authorities did not.

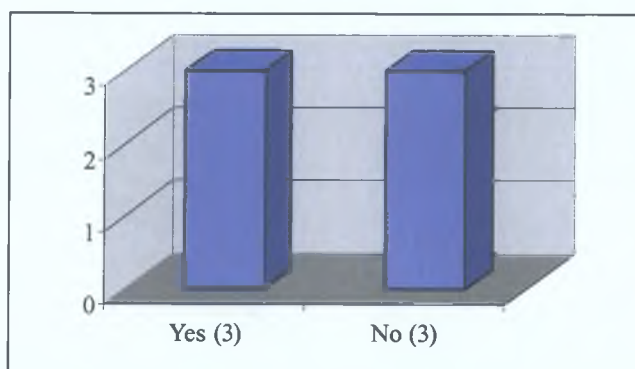
As a concluding question to the initial questionnaire, participants were asked: *In your opinion, do you feel you have been properly informed of the provisions of this Regulation?*

**Figure 38 Response to Q9 of LAQ1**



All six participants felt that they were not informed properly of the main requirements of the Emissions of Volatile Organic Compounds from Organic Solvents Regulations, 2002. This figure indicates a very poor level of confidence from local authority employees.

**Figure 39 Response to Q9 of LAQ2**



Results to this question indicate that half of the local authority personnel who participated in this questionnaire felt satisfied that they were properly informed of the provisions of the Regulation.



**Table 29 – Responses obtained from Q9**

	<b>Yes</b>	<b>No</b>
<b>1<sup>st</sup> Questionnaire</b>	0	6
<b>2<sup>nd</sup> Questionnaire</b>	3	3

Initially, none of the participants felt they had been properly informed of the provisions of this Regulation and this figure increased to 3, once the participants had reviewed the training documents. Again, during the face-to face interviews with participants the reasons for this became clearer. The local authority reiterated their concern of limited resources, they expressed that their existing workforce was already stretched to its limit and because of this they were unable to spend time researching the main requirements of this Regulation, therefore they have not had the opportunity to inform themselves properly of the main provisions.

The author issued the participating local authorities with training packages and expected them to review it, however, there was no evidence that they had actually spent time reviewing the contents of the training package. In the author's opinion, perhaps the participating local authorities did not perceive the training package as formal training because it was not presented to them in a classroom environment, and therefore, perhaps they do not feel properly equipped until they have received training by a recognised body.

#### 4.4 Results obtained from face-to-face interviews with Local Authority Employees

Participants who gave responses, which were significant to this study, will be included in this section.

The question ‘How did you first learn about the introduction of these Regulations?’ was put forward to the participants and they were given the following options for their response:

- |       |                          |                                                  |                          |
|-------|--------------------------|--------------------------------------------------|--------------------------|
| EPA   | <input type="checkbox"/> | Department of the Environment & Local Government | <input type="checkbox"/> |
| Media | <input type="checkbox"/> | Other Means                                      | <input type="checkbox"/> |

The results from the questionnaire indicated that five out of the six participants learnt about the introduction of S.I. No. 543 from the Department of the Environment, Heritage and Local Government. However, during the face-to face interview carried out, the results revealed that this was the method by which they were normally introduced to a new item of legislation, even when they were involved in its implementation. All of the participants suggested that this could be improved and perhaps a consultative committee could be set up at the initial stages of passing an item of legislation through the Houses of the Oireachtas. This consultative committee should include representatives from local authorities.

Participants were asked ‘Do you know how the different Emission Limit Values from spray paint facilities are segregated and who is responsible for regulating the different groups?’

Only three of the participants claimed to be aware of who was responsible for regulating the different groups. This is a disappointing statistic as this information is available in the EPA Best Practice Guidelines. Local authority employees would be expected to be familiar with the interpretation of Guidelines, however, during face-to- face interviews it became apparent that this was the first time many of the participants had seen the Guidelines. This highlights the need for improved communication links between the Department of the Environment, Heritage and Local Government, the EPA and the local authorities.

Participants were then asked ‘have you been offered any training to prepare you for the implementation of this Regulation?’

Only one of the participants claimed to have been offered formal training at the time of these interviews. This is a disappointing statistic as the Regulation has been in operation since the 30<sup>th</sup> of November, 2002. Participants aired their frustration at not being properly equipped with the appropriate information to deal with enquiries from the public and some participants claimed that they feared being perceived as ‘incompetent’ by the public. All participants, however, indicated that if a specific training course was provided for all other local authorities, that it would enable them to carry out their duties efficiently and ensure that the implementation of S.I. No. 543 and other similar items of legislation would have been more successful.

The participants were asked ‘Do you feel that your department is prepared for the introduction of these Regulations?’

Refer to Section 4.3 for the response to this question.

Participants were asked ‘In your opinion, do you feel you have been properly informed of the provisions of this Regulation?’

Initially, none of the participants felt they had been properly informed of the provisions of this Regulation. However, during the face-to face interviews with participants the reasons for this became apparent, all of the local authorities that participated in these interviews emphasised their concern of limited resources. They again stated that their current workforce had an intense workload and they could not release themselves from any of their duties in order to spend time researching the main requirements of the Regulations, therefore they have not had the opportunity to inform themselves properly of the main provisions.

## 5.0 Conclusion

This thesis has reviewed current information, which is relevant to the introduction and implementation of the Emissions of Volatile Organic Compounds from Organic Solvents Regulations, 2002 (S.I. No. 543, 2002). It can be concluded from the results obtained from questionnaires and through face-to-face interviews that the majority of literature available to both the proprietors of vehicle refinishing installations surveyed and the local authority employees surveyed is unclear and not user friendly.

Upon examination of results obtained from questions presented to proprietors of spray paint facilities in County Cavan, it is apparent that participants were not satisfied with the manner in which these Regulations have been introduced. The statistics collected from the questionnaires, which were verified through face-to-face interviews, indicate a significant amount of uncertainty and subsequent panic amongst proprietors. Many are of the belief that they will have to cease operation once the Regulation has been enforced simply because they do not understand what is required of them under these Regulations. As stated through the course of this dissertation, this is the first time the majority of participants from the vehicle refinishing sector have been exposed to complying with a major item of legislation, which is directly applicable to them and more than likely they expected a better support network. However, they expressed great disappointment at the lack of communication between all parties involved. The majority of proprietors are eager to comply with all legislative requirements, particularly as their main source of income is from insurance repairs. Insurance companies will not employ the services of a proprietor who is non-compliant and who is not registered with their local authority. Therefore, proprietors do not have an issue with investing significantly in improvements to adapt their workplace so that they will be compliant, however they remain unsure of what exactly is required of them or who they could consult with to establish the requirements. Results also indicate that the EPA Best Practice Guidelines were not effective in the sample group from the vehicle-refinishing sector who were questioned. Feedback received through the face-to-face interviews suggest that the language used throughout the EPA Best Practice Guidelines was technical and quite confusing to the

majority of participants from the vehicle refinishing sector, suggesting further that the EPA were not as aware as they might be of the needs of their target audience.

Employees from the Environmental Departments of local authorities concurred with this general opinion. They indicated that their primary source of information for the introduction of this Regulation, circular letter AC 1/03, was severely lacking in core information and generally, very vague. Local authority employees who are experienced in interpreting legislation also found the EPA Guidelines slightly confusing. However, they did state that although they are dissatisfied with the method by which items of legislation are introduced, they are used to it that way. They have found in the past that more often than not, members of the public have informed them of the introduction of new items of legislation through queries. This portrays a very poor image of local authorities. The local authority are the regulatory body responsible for the enforcement of S.I. No. 543, therefore, how can one expect it's implementation to be successful if the regulatory body have not yet received formal training, nor is it available. This must be addressed immediately. The introduction of an item of legislation in this country in the future, should not even be considered unless due regard has been given to the practicalities required to implement it. These include training, for both the enforcement bodies and the industries involved, estimated additional costs (again for enforcement bodies and industries) and the level of consultation available, where required.

The lines of communication between the EPA, the Department of the Environment, Heritage and Local Government, Local Authorities and the public sector involved in these regulations thus far, appear to have been weak and inconsistent, the results obtained from this thesis support this. Therefore it can be concluded that in order for the enforcement of the Emissions of Volatile Organic Compounds from Organic Solvents Regulations, 2002 (S.I. No. 543, 2002) and all future Regulations and Acts to be successful, a significant improvement in communications between all relevant sectors is required.

All stakeholders who will play a role in the implementation of a new item of legislation need to be involved from the beginning. The setting up of a consultative committee at

the initial stages of the introduction of an item of legislation would mean that all parties would have an input into the way an item of legislation was implemented and complied with. All parties involved or affected by the introduction of a new item of legislation would have to be represented on a consultative committee. If a consultative committee had been in place at the time S.I. No. 543 was being introduced, it should have had representatives from the following:

- The EPA
- The Department of Environment, Heritage and Local Government
- National Accreditation Board
- Potential accreditors
- A representative number of local authorities, including both rural based and urban based local authorities.
- A representative number from each of the industries listed in Schedule I of S.I. No. 543
- Material suppliers to these industries
- Trade unions, where applicable.

Technical experts could be co-opted to the committee where required. If each of these sectors were involved from the beginning, there would probably have been considerably less confusion and all parties involved would be better prepared for the introduction of S.I. No. 543. Each sector would be more familiar with the main requirements of the Regulation and what was required of them to ensure smooth implementation.

This dissertation only focussed on the implementation of this Regulation in County Cavan, a wider nationwide survey should be carried out to determine the success of the actual implementation of S.I. No. 543 of 2002 across Ireland as a whole.

To conclude, serious consideration must be given to the manner by which future items of legislation are introduced and enforced in this country. It is no longer acceptable to introduce a new item of legislation without any consultation from those who will be directly involved with its enforcement and those who are expected to comply with it, significant improvement is required in order to ensure its success.

## 6.0 References

Air Pollution Act, 1987 (No. 6 of 1987), Dublin: The Stationary Office.

Andresen, A.L. (1999). Factors behind Environment-Saving Technological Change – the Case of the Norwegian Paint Industry. IN: *The annual ESST Scientific Conference, 29-30 May 1999 Lausanne, Switzerland*. Centre for Technology, Innovation and Culture, University of Oslo, 1-21

Anon (1993). Treating Paint Waste. *Paint & Coatings Industry*, 7, 47-57

Baker, E.L. and Fine, L.J. (1986). Solvent neurotoxicity: the current evidence. *Journal of Occupational Medicine*, 28 (2), 126 – 129

Baker, E.L. (1994). A Review of Recent Research on Health Effects of Human Occupational Exposure to Organic Solvents. A Critical Review. *Journal of Occupational Medicine*, 36 (10), 1079 - 1092

Bureau of Air Quality (2004). *Proposed State Implementation Plan Revised for the Rate of Progress Plan for the One-hour Ozone National Ambient Air Quality Standard for the Philadelphia Interstate Non-attainment Area*. Pennsylvania Department of Environmental Protection. 1-2

Central Statistics Office, *PRODCOM Manufacture of Paints, Varnishes and Similar Coatings 1998, 1999 and 2000*. Central Statistics Office, Skehard Road, Cork.

CEPE Technical Committee Vehicle Refinishes (1999). *Technology Guidelines for Vehicle Refinishes, A Guide to Best Available Technique*. Brussels, CEPE. Available from: <http://www.cepe.org> [Accessed 18 February 2004]

Council Directive 1999/13/EC (proposed amendment) of 23<sup>rd</sup> of December 2002 on the Limitation of emissions of Volatile Organic Compounds due to the use of Organic Solvents in decorative paints and varnishes and vehicle refinishing products and amending Directive 1999/13/EC. *Commission of the European Communities*

Council Directive 2001/81/EC of 23<sup>rd</sup> October 2001 on the National Emission Ceilings for certain Atmospheric Pollutants *Official Journal of The European Communities L309/22-L309/28*

Council Directive 1999/13/EC of 11<sup>th</sup> March 1999 on the Limitation of Emissions of Volatile Organic Compounds due to use of Organic Solvents in Certain activities and Installations. *Official Journal of the European Communities L85/1 to L85/22*

Council Directive 1996/61/EC of 24<sup>th</sup> September 1996 on Integrated Pollution Prevention and Control. *Official Journal of European Communities, 10/10/1998, 026-0040*

Department of the Environment (DOE), (1993). *CORINAIR 1990 Emission Inventory for Ireland*. Dublin: McGettigan, M.F., Final Report

Dobson, D. (1998). Trends in Solvent Emission Legislation: A European viewpoint. *Paint India*, August. 105-111

Entec UK and The Paint Research Association (2000). *Reducing VOC emissions from the Vehicle Refinishing Sector*. 38-115

Environmental Protection Agency Act, 1992 (No. 7 of 1992), Dublin: The Stationary Office.

Environmental Protection Agency (EPA) (2004). *Implementation of the 'Solvents Directive' in Ireland (Council Directive 1999/13/EC)*. EPA, Wexford. Available from: <http://www.epa.ie/solvent/> [Accessed 18 May 2004]



Environmental Protection Agency (EPA) (2003). *Best Practice Guidelines for Vehicle Coating and Refinishing*. EPA, Wexford. Available from: <http://www.epa.ie/solvent/> [Accessed 18 February 2004]

Environmental Protection Agency (EPA) (2003). *Solvents Regulations 2002 and the Accredited Inspection Contractor (AIC) system*. EPA, Wexford. Available from: <http://www.epa.ie/solvent/> [Accessed 5 May 2004]

Environmental Protection Agency (EPA) (1996). *BATNEEC Guidance Note for The Chemical Sector EPA Integrated Pollution Control Licensing*. EPA, Wexford.

Envirowise (2000). *Metal Finishing Sector: Vehicle Refinishing*. Envirowise UK Ref Note 086. 1-3. Available from: <http://www.envirowise.gov.uk/envirowisev3.nsf/key/MBEN4PBHSE> [Accessed 30 March 2004]

Graedel, T.E., Bates, T.S., Bouwman, A.F., Cunnold, D., Dignon, J., Fung, I., Jacob, D.J., Lamb, B.K., Logan, J.A., Marland, G., Middleton, P., Pacyna, J.M., Placet, J., and Veldt, C. (1993). *A compilation of inventories of emissions to the atmosphere, Global Biogeochem. Cycles*, 7, 1-26.

Hansen, M.K., Larsen, M. and Cohr, K.H. (1987). *Waterborne Paints a Review of their Chemistry and Toxicology and the Results of Determinations made during their use. Scandinavian Journal of Work Environment and Health*, 13, 474- 482.

Hare, C.H. (1997). *Atmospheric Chemistry, VOC Regulations and The New Exemptions. Paint and Coatings Industry*, Vol. XIII, (10), 202 - 214.

Harrison, R.M. and Hester, R.E. (1995). *Issues in Environmental Science and Technology. Volatile Organic Compounds in the Atmosphere*. 4<sup>th</sup> Ed. The Royal Society of Chemistry, London. 1-6

Health and Safety Executive (2003). *Safety in Motor Vehicle repair*. Available from: <http://www.hse.gov.uk/press/2003/e03203.htm> 1-11 [Accessed 30 March 2004]

Health and Safety Executive (2000). *Control of Compressed Air Spraying in Motor Vehicle Refinishing*. Available from: <http://www.hse.gov.uk/lau/lacs/71-3.htm> [Accessed 30 March 2004]

International Institute for Applied Systems Analysis, Austria, and AEA Technology, UK (1999). *Economic Evaluation of a Directive on National Emission Ceilings for Certain Atmospheric Pollutants, Part A: Cost-effectiveness Analysis*. Available from: <http://www.europa.eu.int/comm/environment/enveco/air/cost-effectiveness.pdf> 9-30. [Accessed 30 March 2004]

Murphy, J. (2002). *A Review of Paint Manufacture and Usage in Ireland and its Associated Environmental Impact*. M.Sc. dissertation. Institute of Technology, Sligo.

National Occupational Health and Safety Commission (1999). *National Guidance Material for Spray Painting*. Available from: <http://www.nohsc.gov.au/ohslegalobligations/nationalstandards/spraypainting> [Accessed 5 March 2004]

National Occupational Health and Safety Commission (1998). *Adopted National Exposure Standards for Atmospheric Contaminants in the Occupational Environment*, [NOHSC: 1003 (1995)]. Australian Government Publishing Service, Canberra. Available from: [http://www.nohsc.gov.au/PDF/Standards/amend\\_NESApril1998.pdf](http://www.nohsc.gov.au/PDF/Standards/amend_NESApril1998.pdf) [Accessed 5 March 2004]

O'Riain, G. (2000). *State of the Environment – Ireland*. Extended Summary. Compass, Dublin. Available from: <http://www.compass.ie/gap/111epasummary.html> [Accessed 25 July 2004]

Protection of the Environment Act, 2003 (No. 27 of 2003), Dublin: The Stationary Office.

Protocol to the 1979 Convention on Long range Transboundary Air Pollution, Concerning the Control of Emissions of Volatile Organic Compounds or their Transboundary Fluxes, Geneva, November 1979

Safety, Health and Welfare at Work (Chemical Agents) Regulations, 2001 (S.I. No. 619 of 2001), Dublin: The Stationary Office.

Safety, Health and Welfare at Work Act, 1989 (No. 7 of 1989), Dublin: The Stationary Office.

Scottish Environment Protection Agency (2003). *Vehicle Resprayer Template*. Available from: <http://www.sepa.org.uk/ppc/manual/7/7> [Accessed 30 March 2004]

Scottish Environment Protection Agency (2002). *Consultation on the Implementation in Scotland of EC Directive 1999/13EC on the Limitation of Emissions of Volatile Organic Compounds due to the use of Organic Solvents in Certain Activities and Installations*. Scottish Executive Consultations. 1-7

Ulfvarson, U., Alexandersson, R., Dahlgvist, M., Ekholm, U., Bergström, B. and Scullman, J. (1992). Temporary Health effects from exposure to water-borne Paints. *Scandinavian Journal of Work Environment and Health*, 18, 376-385.

United States Environmental Protection Agency (USEPA) (2000). HVLP spray guns in the auto refinishing shop: A success story. (USEPA). Available from:

[http://www.epa.gov/opptinti/dfc/pubs/auto/spraygun\\_success/spraygun\\_success.pdf](http://www.epa.gov/opptinti/dfc/pubs/auto/spraygun_success/spraygun_success.pdf)

[Accessed 11 June 2004]

United States Environmental Protection Agency (USEPA) (1990). Clean Air Act, 1990 (amended). (USEPA). Available from: <http://www.epa.gov/oar/caa/contents.html> [Accessed 30 March 2004]

Wall, C. (1992). Environmental break-through in refinish paints. *Polymers Paint Colour Journal*, Vol. 182 (4318), 610 – 611

Waste Management Act, 1996 (No. 10 of 1996), Dublin: The Stationary Office.

World Health Organisation (1987). *Air quality guidelines for Europe*. Copenhagen: WHO Regional Publications European Series no 23

# Appendix I

8 January 2003

**Circular Letter AC 1/03**

**Emissions of Volatile Organic Compounds from Organic Solvents**  
**Regulations 2002 (S.I. No. 543 of 2002)**

Dear Sir or Madam,

**Introduction**

1. This Circular Letter sets out the arrangements for the regulation of emissions of volatile organic compounds (VOCs) from the commercial and industrial use of organic solvents under the above Regulations (copy attached). The Regulations transpose EU Directive 1999/13/EC on the limitation of emissions of volatile organic compounds due to the use of organic solvents in certain activities and installations. The Regulations impose certain functions on local authorities under the Air Pollution Act, 1987 (No. 6 of 1987).

**Volatile Organic Compounds (VOCs) and their effects**

2. VOCs are air pollutants which can have detrimental effects on human health by contributing to respiratory illnesses, and some VOCs are mutagenic or toxic to reproduction and harmful to the unborn. They also have harmful environmental effects (crop, vegetation and materials damage, reduced visibility) when they chemically interact with oxides of nitrogen and sunlight to form ground-level ozone.
3. High ozone levels usually occur during, warm, sunny weather and typically ozone levels peak in mid to late afternoon, after the sun has had time to promote the photochemical reaction of oxides of nitrogen and VOCs emitted earlier in the day.
4. There are a multitude of VOCs as they include any compound containing at least the element carbon and one or more of hydrogen, halogens, oxygen, sulphur, phosphorus, silicon or nitrogen but with the exception of carbon oxides and inorganic carbonates and bicarbonates. Damage arises when they volatilise into the atmosphere.

**Sources of VOCs**

5. There are various sources of VOCs including vehicle emissions, fuel combustion and domestic solvent usage. However, one of the main sources of VOCs are commercial and industrial activities using organic solvents. It is this sector which the Regulations are aimed at to prevent and reduce harmful effects of VOCs emissions mainly into air (**Article 4**).

6. The Regulations cover 20 sectoral activities ranging from small and medium enterprises (SMEs) such as vehicle refinishing (car spraying) and dry cleaning to large-scale industrial processes in the pharmaceutical and printing sectors. The relevant activities are set out in **Schedule 1** with compliance requirements triggered when the solvent consumption thresholds specified in **Schedule 2** are exceeded. In the case of dry cleaning there is no threshold so all such activity is comprehended.

#### **Competent Authorities**

7. Given the scope of activities covered by the Regulations and the disparity in size, solvent consumption, emissions etc. as between SMEs and large scale point sources of VOCs emissions, two type of competent authorities are defined in the Regulations (**Article 3**).
8. In the case of those activities and installations which are subject to Integrated Pollution Control (IPC) licensing by the Environmental Protection Agency (EPA) the various provisions of the Regulations which apply will be integrated into the IPC licensing system
9. For those activities and installations not regulated under IPC licensing the relevant local authority (County and City Councils) is designated the competent authority.
10. **For the purposes of this Circular Letter “competent authority” means the relevant local authority and not the EPA unless otherwise specifically identified.**

#### **Compliance Requirements**

11. All installations must comply with either emission limit values in waste gases and fugitive emission values, or total emission limit values as specified in Schedule 2, **or** the requirements of a tailored reduction scheme (whereby solvents are reduced or substituted by less harmful products e.g. switching to aqueous based materials or processes) as specified in **Schedule 3. (Article 7)**
12. It is a matter for the individual operator to decide which compliance route is taken. This is likely to be dependant in large part on the particular type of activity involved and the technical and economic feasibility of particular compliance routes.

13. Where “end of pipe” abatement equipment is used by the operator of an installation to comply with the relevant emission limit values the operator must supply data (measured or monitored emissions) to the competent authority annually or upon request (**Article 16**). Different compliance requirements apply depending on whether monitoring is carried out continuously or on a periodic basis (**Articles 17 and 18**). This data is not required where the operator is using a reduction scheme to comply with the requirements of the Regulations. Compliance may be demonstrated using the guidance in **Schedule 6** on Solvent Management Plans. (**Article 20(2)**)
14. Where a reduction scheme approach is used, it is intended that efficiencies equivalent to attainment of emission limit values will be reached.

#### **New Installations**

15. A new installation is one which is put into operation on or after **1 July 2003** (**Article 3**). A new installation must be registered (in the form specified in **Schedule 4**) with the competent local authority before commencing to operate and must obtain a certificate of compliance from the local authority before doing so (subject to the requirements of **Schedule 3, paragraph 2** where an appropriate reduction scheme is being used to comply and where there are progressive target emissions, reducing eventually to target levels, to be attained by specified dates).

#### **Existing Installations**

16. An existing installation is one which is in operation on or before **30 June 2003** (**Article 3**). Later dates apply to existing installations for registration and compliance purposes. Operators of such installations must register with the competent local authority no later than **31 October 2005** where a reduction scheme is being used, or no later than **31 October 2007** where abatement equipment is being used to attain emission limit values.
17. Existing installations must comply with the requirements of the Regulations no later than **31 October 2007** (subject to the requirements of **Schedule 3, paragraph 2** where an appropriate reduction scheme is being used to comply and where there are progressive target emissions, reducing eventually to target levels, to be attained by specified dates).
18. Where an existing installation operates existing abatement equipment on or before 30 June 2003 and such equipment meets the emission limit values specified in **Article 7(4)** of the Regulations that equipment shall be exempt from the waste gases emission limit values of **Schedule 2** until **1 April 2013** in certain prescribed circumstances.
19. All abatement equipment installed in **new and existing** installations after the operative dates in paragraphs 14 and 15 above must meet the relevant requirements of **Schedule 2** in terms of emission limit values etc.



### Risk Phrases

20. Substances and preparations containing VOCs and which are assigned or carry a Risk Phrase R46, R46, R49, R60, R61 (denoting a VOC content to be carcinogenic, mutagenic or toxic to reproduction) are required to be replaced as far as possible by less harmful substances and preparations from the date of entry into force of the Regulations (30 November 2002). Certain other special requirements as regards emission limit values also apply.  
(Articles 8 – 12)

### Installations comprising two or more activities

21. With certain processes more than one activity may be carried out at an installation e.g. drying and coating processes. In such cases where Risk Phrase substances and preparations are involved, the relevant requirements of **Articles 8 – 12** shall apply to each activity individually.
22. For all other substances and preparations the compliance requirements (**Article 7**) may be met either individually for each activity, or where compliance is on the basis of total emissions, these shall not exceed such emissions as would have resulted had each activity been individually regulated.

### Competent Authority Certification

23. Many of the comprehended activities require technical and specialist expertise and knowledge to ensure demonstration of compliance and certification. This will not always necessarily be available in-house in a local authority. Thus, a regulatory system has been devised to ensure uniformity and transparency of compliance with the Regulations while minimising administrative and financial burdens on both competent authorities and operators through a form of independently verified self-certification.

### Accredited Inspection Contractors

24. The operator of an installation in which a **Schedule 1** activity is operated, above the relevant specified solvent consumption threshold in **Schedule 2**, must demonstrate the installation's compliance with the requirements of the Regulations (**Article 20**) by means of a report prepared by an independent **Accredited Inspection Contractor (AIC)**. (**Article 24**) This report will be sufficient for the local authority to certify the installation demonstrates compliance with the Regulations where the authority is so satisfied. It is expected, unless the local authority has information to the contrary, that it will operate on the basis of the AIC report. AIC reports must be submitted annually to the local authority for renewal of certification. (**Article 26**) It is envisaged that monitoring data (see paragraph 13) may be contained in the annual AIC report but this may not always be the case.

25. The National Accreditation Board (NAB) will establish panels of AICs nationally (**Article 22**). Operators are at liberty to choose from the panels a suitable AIC to report on their compliance with the Regulations. This is designed to ensure choice and price competitiveness for the operator.
26. AICs may be contracted by a competent authority itself if the authority is uncertain whether the Regulations apply to an installation or if the local authority has cause to be concerned about compliance with the Regulations in any individual case.

#### **Certificates of Compliance**

27. Operators shall pay a fee of €50 to the competent authority for the processing of an AIC report submitted by the operator pursuant to an initial application for registration and annually when applying for a certificate of compliance. (**Article 25**)
28. Upon receipt of an AIC report a competent authority shall issue a certificate of compliance in the form specified in **Schedule 5** within 14 days of its receipt where it is satisfied compliance is demonstrated. Where this is not the case the competent authority shall notify the operator of its refusal to issue a certificate and the reasons for such refusal. (**Article 26**)
29. Certificates of compliance shall not be valid for more than one year. (**Article 26(2)**)

#### **Non-Compliance**

30. A duty is imposed on an operator and an AIC to inform the competent authority where a requirement of the Regulations has been or is being breached. Operators must take all necessary measures to return to compliance within the shortest possible time.
31. Where non-compliance causes immediate danger to human health the operator is required to suspend operations until the competent authority is satisfied the installation has returned to compliance.
32. The provisions of the Air Pollution Act, 1987 regarding penalties, prosecution of offences and the powers of authorised persons apply to these Regulations.

#### **Public Information Requirements**

33. All AIC reports, certificates of compliance and notifications of non-compliance must be recorded by the competent authority in the register established under **Section 17 of the Air Pollution Act, 1987 (No. 6 of 1987)**.

### Guidance Documentation

34. The EPA is currently preparing guidance on the best available techniques in the vehicle refinishing and dry cleaning sectors. This guidance is expected to be published early in 2003.
35. The Department is planning to develop a Solvent Management Scheme which will act as a template or blueprint for each individual sectoral activity and by reference to which the AIC may demonstrate an installation's compliance. It is envisaged that the Scheme will detail, for relevant sectors, the best available techniques, technologies and work practices by which VOC emissions may be reduced to ensure compliance.
36. Guidance on Solvent Management Plans which can be used to demonstrate compliance is provided in **Schedule 6** of the Regulations.
37. All guidance published by the European Commission (as required by **Article 7 of Directive 1999/13/EC**) on the use of substances and techniques which have the least potential impacts on air, water, ecosystems and human health will be made available by the Department. No such guidance has issued to date. Any such guidance shall inform the operation of the Solvent Management Scheme.

### Competent Authority Requirements

38. As all City and County Councils are likely to have at least one or more of the sectoral activities located in their functional area, including in relevant Boroughs and Towns, these Councils should acquaint themselves with the Regulations, their functions, powers and duties thereunder and the contents of this Circular Letter.
39. In the first instance only new installations will fall to be regulated by competent authorities given the longer timeframes applying to the registration and compliance of existing installations (2005 – 2007). Competent authorities should, through their Planning and other appropriate Sections, identify all new activities commencing which may come within the ambit of the Regulations and advise their operators of their obligations under the Regulations.
40. Where existing installations wish to register and comply with the requirements of the Regulations from an earlier date than that specified, competent authorities should facilitate this. It is to be borne in mind that the operative dates are the latest dates by which registration, compliance etc. must be achieved. Environmental, health and economic benefits will flow sooner from their earlier achievement.

### Queries

41. Any queries to the Department as regards this Circular Letter may be addressed to: -

- Mr. John McDermott, Assistant Principal, Tel: (01) 888 2373. Fax (01) 888 2014. e-mail: [john\\_mcdermott@environ.irlgov.ie](mailto:john_mcdermott@environ.irlgov.ie)
- Mr. Micheal Young, Engineering Inspector (Environment), Tel: (01) 888 2389. Fax (01) 888 2014. e-mail: [micheal\\_young@environ.irlgov.ie](mailto:micheal_young@environ.irlgov.ie)

Any queries as regards the IPC licensing system as integrated with S.I. No. 543 of 2002 or on matters of further technical guidance may be addressed to:

- Dr. Gerry Byrne, Environmental Protection Agency, P.O. Box 3000, Johnstown Castle Estate, Co. Wexford. Tel: 053-60600. Fax: 053-60699. e-mail: [g.byrne@epa.ie](mailto:g.byrne@epa.ie)
- Mr. Brendan Kissane, Environmental Protection Agency, P.O. Box 3000, Johnstown Castle Estate, Co. Wexford. Tel: 053-60600. Fax: 053-60699. e-mail: [b.kissane@epa.ie](mailto:b.kissane@epa.ie)

Any queries as regards the accreditation of AICs may be addressed to: -

- Mr. Tom Dempsey, National Accreditation Board, Wilton Park House, Wilton Place, Dublin 2. Tel: 01- 607 3003. Fax: 01-607 3109. e-mail: [tom.dempsey@nab.ie](mailto:tom.dempsey@nab.ie)

Yours sincerely

---

John McDermott  
Assistant Principal  
Air/Climate Section

To each County and City Council

Copy for information to: -

Each Borough and Town Council, EPA, IBEC, ISME, SFA, NAB, NSAI, Enterprise Ireland, Department of Enterprise, Trade and Employment, HSA

## Appendix II

**Training Document**  
**For The**  
**Vehicle Refinishing Sector**

**Emissions of Volatile Organic**  
**Compounds from Organic Solvents**  
**Regulations, 2002**

## Introduction

In the past, Vehicle Refinishing relied on solvent-based coatings. The emissions from these solvents have a negative effect on the environment. Because of this, The Emissions of Volatile Organic Compounds from Organic Solvents Regulations 2002 was introduced to reduce the emissions of solvents into the atmosphere and as a result, limit the impact on the environment.

The majority of solvents used during the vehicle refinishing process are referred to as 'organic solvents'. If a substance dissolves in a liquid, this substance is referred to as 'soluble'. The liquid in which the substance dissolves in is called the '**solvent**'. In vehicle refinishing, solvents make up the part of the coating that allow wet paint film to mix and flow properly, but they do not form part of the final hardened film, they evaporate during the process. The term '**organic solvents**' refers to a group of volatile organic compounds (VOCs) or mixtures that are relatively stable chemically and that exist in liquid state at temperatures of approximately 0° to 250°C. When organic solvents are used in vehicle refinishing they emit **volatile organic compounds (VOCs)** into the atmosphere, the release of VOCs can aid the development of ground level ozone which can cause smog. In addition, this can have an adverse effect on human health, by causing severe chest problems. The introduction of this Regulation aims to reducing VOC emissions by 40%, compared to 1990 levels.

Organic solvents have many uses, however their most common uses in spray painting are:

- to dissolve raw materials, i.e. paint removal,
- to dissolve contaminants, i.e. surface cleaning,
- to adjust viscosity, i.e. thin the paint
- to preserve materials

This document will inform you of what you need to do in order to comply with the new Regulation. If you have any difficulty in understanding and part of this training document, do not hesitate to contact the author.

*This document is only applicable to workshops who use between 500kgs and 10000kgs of solvent per annum.*

## **Where are solvents used in spray paint facilities?**

It is important to know where solvents are used in body-shops so that you know where they can be reduced. VOCs are commonly found in the following materials in bodyshops:

- Gunwash
- Spiritwipe/Degreaser
- Deruster/Stripper
- Bodyfillers/ Stoppers
- Primers/Sealers (low to medium solids contain more VOCs)
- Plastic and etch primers are particularly high in VOC content
- Sealer/Adhesion
- Surfacer/Fillers
- Topcoats/Finishes (Low solids materials contain more VOCs)
- Hardeners/Modifiers/Activators
- Thinners
- Special Finishes

It is important to remember that when any of these materials are used, you are releasing VOC emissions into the workshop and the atmosphere, unless you are using water based materials.



VOCs are found in abundance throughout the spray painting process, therefore you must look carefully at the materials and equipment you are using and establish if it can be improved.

## Compliance Dates

There are different requirements under the Regulations for existing and new installations, therefore it is important to clearly define both, these definitions are detailed below:

- An existing installation is an installation that was in operation on or before 30 June 2003.
- A new installation is an installation that was put into operation on or after 1 July 2003.

New installations must obtain a certificate of compliance and register with their local authority before they can commence operations.

Existing installations who intend to comply with the requirements of a '**Reduction Scheme**' must register with their local authority and obtain a certificate of compliance on or before **31<sup>st</sup> October, 2005**.

Existing installations who intend to comply with '**Emission Limit Values**' must obtain a certificate of compliance and register with their local authority on or before **31<sup>st</sup> October, 2007**.

## Registration

A spray paint facility who use between 500kgs and 10,000kgs per annum must register with their local authority. You must pay a registration fee of €50 to your local authority and submit an **Accredited Inspection Contractors (AIC)** report in order to start or continue your operations. Registration with your local authority must be **renewed annually**, or if the installation has undergone a substantial change.

## Accredited Inspection Contractors (AIC) Report

An accredited inspection contractor must be accredited by the Irish National Accreditation Board (NAB) to ISO 17020 standard to carry out inspections on workshops. They will carry out an assessment of the workshop and determine if the workshop complies with the Regulations. They will also advise you on where emission reductions can be made. Once the A.I.C. is happy with their inspection, they will give you a **certificate of compliance**. This certificate may include recommendations or conditions. Once you have a certificate of compliance, you can register with your local authority. This assessment must be carried out every year and the AIC report must be re-submitted to your local authority annually or if a substantial change in the process is proposed.

## Risk Phrases

A risk phrase is a phrase that describes the **hazards** of a substance. Risk phrases will be displayed on the container of the material or in the Material Safety Data sheet (**MSD**) which accompanies the material. You must check you see what risk phrase is associated with the material you use. Under the new Regulation you must **replace** materials which contain certain risk phrases with materials which are less dangerous. Materials which contain the following risk phrases must be replaced: (Overleaf)

<b>Risk Phrase</b>
R45 (May cause cancer)
R46 (May cause heritable genetic damage)
R49 (May cause cancer by inhalation)
R60 (May impair fertility)
R61 (May cause harm to the unborn child)
R40 (Limited evidence of a carcinogenic effect)

There are many materials available which do not contain any of these risk phrases, therefore you should have no difficulty in replacing any material in stock which contains any of the risk phrases highlighted above.

### **Solvent Management Plan**

The solvent management plan is an essential tool to help to comply with this Regulation. All paint spray facilities, regardless of size should maintain a solvent management plan. You will probably need the help of a consultant to do this. A solvent management plan works out where all of the solvent you use, eventually ends up. This is called the 'mass balance'. In order to carry out a solvent management plan, you must start keeping records on a regular basis. The table overleaf outlines a solvent management plan, which is relevant to spray paint facilities who participated in this study.

Ref	Mass Balance Terms	Relevance to vehicle coating and refinishing	Where to get information
I1	The amount of organic solvents or the amount in preparations purchased which are used during the process over the time the mass balance is being calculated.	Relevant. The amount of solvent bought and used in a year.	Purchase records/ supplier Stock at start of year minus stock at end of year.
I2	The amount of organic solvents or the amount in preparations recovered or reused as solvent during the process	Relevant to some, e.g. if you use an enclosed gun wash system, the amount of solvent collected and used again on the premises	Estimate based on amount recovered and number of batches processed
O1	Emissions in waste gases	Relevant. The amount of solvent emitted from booth stacks that isn't treated	Monitor waste gases (if complying with ELVs) What has been used minus what has been treated (if complying with the reduction scheme)
O2	Emissions from organic solvents which are released into the air, e.g. from windows, doors, etc	Relevant.	Total used minus actual used.
O3	Organic solvents contained in collected waste	Relevant. Includes solvent waste itself plus materials contaminated with solvents	Volumes sent for off-site disposal.
O4	Preparations containing organic solvents which are recovered for reuse, but not used in the process	Relevant to some. waste solvent collected & sent away for recovery/recycling rather than disposal.	Volumes sent off site for recovery & reuse elsewhere

You should make a note of this as you will need to use this table when you are calculating your annual consumption.

From the solvent management plan you can calculate the amount of solvent you use every year, this is referred to as your annual solvent consumption. By doing this you will establish

which authority you must report to. If you calculate that you have an annual solvent consumption of less than 500kgs, then the requirements of the Regulations do not apply to you, however, you must continue to calculate your annual solvent consumption to ensure you do not use more than 500kgs of solvent in any year. If you possess a solvent consumption of between 500kgs and 10,000kgs per annum then you will be regulated by your local authority. If you utilise more than 10,000kgs per annum, you will be regulated by the Environmental Protection Agency.

There are different options available to you, so that you can comply with the method that best suits you.

These options are to comply with

- ***The Reduction Scheme***, which must be complied with by 31<sup>st</sup> October 2005 for an existing installation. Or
- ***The Emission Limit Values***, which must be complied with by 31<sup>st</sup> October 2007 for an existing installation.

## **The Reduction Scheme**

This involves reducing emissions to an acceptable level, and putting a plan in place to achieve this level. It is expected that most workshops will use the reduction scheme.

There are various ways that you can reduce your emissions of solvent, these are outlined below:

### ***Load Minimisation or Source Recovery***

This involves reducing the amount of solvent in use, for vehicle refinishing this includes:

- Substituting products. Replace products which have a high VOC content with either water-based products or products with a higher solids content. According to the EPA Best

Practice Guidelines (2003), the state of the art – VOC emission reduction for vehicle coating and refinishing is considered to be:

<b>State of the Art – VOC Emission Reduction</b>
High solids primer or water based primer
Medium solids surfacer
Medium solids basecoat or water based basecoat
Very high solids clear

- Use spray guns with increased efficiency. Change to high volume low pressure (HVLP) spray equipment, this is 50 % more efficient than conventional spray equipment.
- Use the correct mix rates. Follow the manufacturer’s instructions carefully.
- Ensure all operators are trained appropriately. Training should be carried out by a competent body and include correct use of spray equipment, training on batch preparation, training on the correct use of enclosed gunwash stations, paint mixing and its associated equipment, training in the correct storage and handling of materials and training in appropriate disposal of contaminated materials.
- Improved batch preparation. By using electronic scales the amount of waste can be reduced.
- Use spray bottles/disposable wipes for surface cleaning, this reduces contaminated waste.
- Use precleaners that can be diluted with water.
- Careful stock control and management of materials

## *Containment*

This involves taking measures to prevent the solvent escaping to air, water or into the ground.

These include:

- Premises location, it is recommended that a vehicle refinishing premises be located at least 100m from schools, hospitals and private dwellings.
- Spray Booths should be fitted with filters to remove paint particles. Air extraction rates should be at the approved rate of 6m<sup>3</sup> per second.
- Enclosed gun wash stations are readily available on the market, waste streams can be separated and recycled.
- Paint mixing equipment which reduces the release of VOCs is available to purchase.
- Closed containers prevent evaporation of solvents. Ensure all containers are kept closed when not in use.
- Store contaminated rags and paper in a closed container.
- A spill kit should be kept nearby to clean up any solvent spills. Any materials used in a spill kit should be treated as contaminated waste and disposed appropriately.
- Appropriate solvent storage. Ensure solvents are stored in an area which cannot be struck by vehicles. Solvents should be stored in a secure location and away from drains.

## **Calculating your Annual Solvent Consumption:**

The new Regulation requires you to calculate how much solvent you use annually. It is expected that most body shops will employ a consultant to help with this calculation.

In order to calculate if you are complying with the reduction scheme use the following:

**Consumption (C) = I1 – O4** (Refer to section on Solvent Management Plan)

= (amount of solvents purchased & used during the process) – (solvents recovered for reuse but not used during the process)

*This can only be used when using the reduction scheme.*

## **Emission Limit Values (ELVs)**

An emission limit value (ELV) sets the maximum amount of VOCs that you are allowed to emit from your workshop. There are different types of ELV, however, the two that are relevant to the vehicle refinishing sector are:

- An ELV for waste gases: This sets the maximum amount of VOCs that may be released from stacks (i.e. stacks taking air from the spray booth)
- A fugitive emission value: This sets the maximum amount of solvent used that may be released from fugitive sources. Fugitive sources in a workshop are doors, windows, etc.

In order to comply with ELVs, you must monitor your emissions. You will have to employ the services of a professional company to monitor the emission from your workshop, this company should be recognised by the Irish National Accreditation Board (INAB). Your emissions must be monitored every year and results will be used by the AIC contractor when they are compiling their report.

Emissions do not need to be monitored if you are following the reduction scheme.



## Summary of what you must do

- 1) Look at the contents of all of your materials – do they contain any of the Risk Phrases highlighted in this document? If so, they must be replaced by less hazardous materials.

**Replace dangerous materials with less dangerous materials.**

- 2) Decide if you are going to comply by using the Reduction Scheme or the Emission Limit Values.

- 3) Keep a record of your stock. Record how much material you buy, use, spill and send for disposal. You need records for at least one year before you can register with your local authority. **Start Recording Now!**

- 4) Know what date you have to comply by and prepare for that date well in advance. Below is a list of things you can start to do:

- Get a contact number for a consultant who will lead you in the right direction
- Get a contact number for an AIC inspector
- Get a contact number for a competent trainer
- Talk to your local authority
- Purchase efficient spray equipment which will reduce emissions (eg HVLP gun)
- Look at your materials, can you replace any of them with high solids or water based materials?
- Ensure you store all solvents correctly and securely – always close the lid tight after use.
- Use paintless dent repair and dry guide coat where possible
- Use specialised systems for repairing chips and scratches.

- Before starting a job, work out the exact quantity of paint required to complete the process and adhere to it. Do not prepare more paint than is required to complete the job. Use digital intelligent scales for colour mixing.
  - If two cars of the same colour require refinishing, they should be repaired in batch (common colour scheduling)
  - Ensure that all personnel are appropriately trained in efficient spray techniques.
  - Purchase an enclosed gun wash system and recycle waste solvent.
  - Separate waste into contaminated waste and domestic waste. Store contaminated waste in a sealed container and dispose of appropriately.
- 5) Once you have recorded your solvent consumption for one year, book an AIC inspector. Remember there will be a limited amount of AIC inspectors and they may be heavily booked up.
- 6) Once you have an AIC report, register with your local authority.
- 7) Do it all again next year!

## Appendix III

**Training Document**

**For**

**Local Authorities**

**Emissions of Volatile Organic  
Compounds from Organic Solvents  
Regulations, 2002**

## Introduction

The Solvents Emission Directive 99/13/EC was introduced on the 13<sup>th</sup> of March 1999 as a result of the increasing problem of tropospheric ozone formation. On the 30<sup>th</sup> of November, 2002, The Solvents Emission Directive was transposed into Irish legislation under The Emissions of Volatile Organic Compounds from Organic Solvents Regulations 2002. This Regulation applies to more than 20 processes and industrial sectors, which use relatively large quantities of VOC's and which directly or indirectly release these into the atmosphere. The sectors to be covered by this Regulation are:

- Coatings of Metals and Plastics, Coil Coating and Textile Coating
- Dry Cleaning
- Impregnation of Wood
- Pharmaceuticals
- Printing Process
- Rubber Manufacture
- Surface Cleaning
- Vehicle Refinishing

This document includes the role that the local authority will play in enforcing S.I. No. 543, 2002, and it will also include information on what is required of the vehicle refinishing sector under this Regulation.

## Threshold Limits

This Regulation was introduced primarily to control emissions of solvent vapours from 20 specified activities, listed in Schedule 1 of the Regulations, when they exceed the relevant solvent consumption thresholds, which are set down in Schedule 2 of the Regulations. The thresholds for the vehicle refinishing sector are broken into three groups, for regulatory purposes:

- Where the annual solvent consumption of a vehicle refinishing installation is less than 500kgs, which requires no formal regulating.
- Where the annual solvent consumption of a vehicle refinishing installation is between 500kgs and 10,000kgs, which will be regulated by the relevant local authority.
- Where the annual solvent consumption of a vehicle refinishing installation is greater than 10,000kgs, which is regulated by the EPA and requires an IPC licence.

The majority of vehicle refinishing installations in Ireland have an annual solvent consumption of between 500kgs and 10,000kgs and therefore will be regulated by the relevant local authority.

# The Role of The Local Authorities in the Implementation of S.I. No. 543 of

2002

In Ireland, the local authority has been designated as the 'competent authority' for regulating the vehicle refinishing sector who consume between 500kgs and 10,000kgs of solvent per annum. These installations must comply by either participating in a solvent reduction scheme or complying with Emission Limit Values. An Emission Limit Value (ELV) sets the maximum amount of VOCs allowed to be discharged from an installation. There are two ELVs set for the vehicle refinishing sector:

- ELV for waste gases
- ELV for fugitive emissions

An ELV for waste gases sets the maximum quantity of VOCs that may be emitted per cubic metre of air released from stacks. An ELV for fugitive emissions sets the maximum percentage of solvent that may be emitted from fugitive sources.

All installations will be required to register with the relevant local authority. All new installations, which became operational on or after 1<sup>st</sup> July 2003 and consume or predict to consume between 500kg and 10,000kg of solvent annually are required under the Regulations to register with their local authority before they commence operation. This installation must obtain a certificate of compliance from an Accredited Inspection Contractor (AIC) prior to registration with a local authority. An accredited inspection contractor must be accredited by the Irish National Accreditation Board (NAB) to ISO 17020 for the conduction of inspections to the Emissions of Volatile Organic Compounds from Organic Solvents Regulations 2002. They will complete an assessment of the installation and determine if the emission limits from the installation or the solvent reduction scheme are compliant with the Regulation. They will

also advise the proprietor on where emission reductions can be made. Once the assessor is satisfied with their inspection, they will issue the proprietor with a certificate of compliance. This certificate may include recommendations or conditions. Once the proprietor of the installation possesses a certificate of compliance, they can register with their local authority for a fee of €50. The AIC report must be re-submitted annually or if a substantial change in the process is proposed.

An existing installation complying with the requirements of a reduction scheme must be registered and must obtain a certificate of compliance no later than 31<sup>st</sup> October 2005. If an installation does not possess a certificate by this date, operation will be prohibited.

An existing installation complying with emission limit values must be registered and must obtain a certificate of compliance no later than 31<sup>st</sup> October 2007. Again, continued operation beyond this date will not be permitted without a certificate of compliance.

The local authority are required to maintain a register of certified installations and take appropriate action if a breach of conditions of a certificate occurs or should an installation fail to submit their certificate of compliance. In addition, the local authority will be expected to be knowledgeable in the provisions of this directive and subsequently, support its successful implementation through advising proprietors appropriately.

An enforcement officer should be appointed by each local authority to monitor the compliance of vehicle refinishing installations. If the enforcement officer deems that an installation is in breach of S.I. No. 543, they will be reprimanded accordingly, either by means of withdrawing their licence to operate or by issuing legal proceedings against the offending installation.

The proprietor of a vehicle refinishing installation will be required to maintain records of solvent consumption and these records will be examined by the local authority enforcement



officer. In addition, the enforcement officer will be required to monitor emissions from an installation, therefore the enforcement must be competent in collecting and analysing samples.

In some rural local authorities, the level of industrial activity may not warrant the appointment of an enforcement officer, therefore they must employ the services of an AIC to monitor compliance within their jurisdiction.

The EPA intend to organise a training seminar for local authorities in September 2004, it is hoped that this seminar will enable local authorities to successfully enforce S.I. No. 543.

## Sources of VOC emissions in spray paint facilities

It is essential to know where solvents are used in body-shops so that a proprietor can establish where they can be reduced. VOCs are commonly found in the following materials in bodyshops:

- Gunwash
- Spiritwipe/Degreaser
- Deruster/Stripper
- Bodyfillers/ Stoppers
- Primers/Sealers (low to medium solids contain more VOCs)
- Plastic and etch primers are particularly high in VOC content
- Sealer/Adhesion
- Surfacer/Fillers
- Topcoats/Finishes (Low solids materials contain more VOCs)
- Hardeners/Modifiers/Activators
- Thinners
- Special Finishes

## **Risk Phrases**

Any substance or preparation, which because of its VOC content is classified as carcinogens, mutagens or toxic to reproduction under Directive 67/548/EEC must carry the risk phrases R45, R46, R49, R60 and R61 must be replaced by less harmful substances or preparations. Compliance with this will be checked by the AIC inspector

## **Registration Dates**

New installations must obtain a certificate of compliance and register with their local authority before they can commence operations.

Existing installations who intend to comply with the requirements of a 'Reduction Scheme' must register with their local authority and obtain a certificate of compliance on or before 31<sup>st</sup> October, 2005. Existing installations who intend to comply with 'Emission Limit Values' must obtain a certificate of compliance and register with their local authority on or before 31<sup>st</sup> October, 2007.

## **Registration**

A vehicle refinishing installation with a solvent consumption of between 500kgs and 10,000kgs per annum must register with their local authority. The proprietor of an installation must submit a registration fee of €50 along with an AIC report in order to commence or continue operations. The AIC report demonstrates whether or not an installation complies with the requirements of the Regulations. Registration must be renewed annually, or if the installation has undergone a substantial change.

## **Accredited Inspection Contractors (AIC) Report**

An accredited inspection contractor must be accredited by the Irish National Accreditation Board (NAB) to ISO 17020 standard to carry out inspections on workshops. They will carry out an assessment of the workshop and determine if the workshop complies with the Regulations. They will also advise proprietors on where emission reductions can be made. Once the AIC is satisfied with their inspection, they will issue the proprietor with a certificate of compliance. This certificate may include recommendations or conditions. Once a proprietor obtains a certificate of compliance, they can register with the appropriate local authority. This assessment must be carried out every year and the AIC report must be re-submitted to the appropriate local authority annually or if a substantial change in the process is proposed.

## **Solvent Management Plan**

The solvent management plan is an essential tool to complying with this Regulation. All paint spray facilities, regardless of size should maintain a solvent management plan. A proprietor will more than likely require the assistance of a consultant to complete a solvent management plan. A solvent management plan determines where all of the solvent used eventually ends up. This is referred to as the 'mass balance'. In order to carry out a solvent management plan, the proprietor must start keeping records on a regular basis. The table overleaf outlines a solvent management plan, which is relevant to spray paint facilities who participated in this study.

Ref	Mass Balance Terms	Relevance to vehicle coating and refinishing	Where to get information
I1	The amount of organic solvents or the amount in preparations purchased which are used during the process over the time the mass balance is being calculated.	Relevant. The amount of solvent bought and used in a year.	Purchase records/ supplier Stock at start of year minus stock at end of year.
I2	The amount of organic solvents or the amount in preparations recovered or reused as solvent during the process	Relevant to some, e.g. if you use an enclosed gun wash system, the amount of solvent collected and used again on the premises	Estimate based on amount recovered and number of batches processed
O1	Emissions in waste gases	Relevant. The amount of solvent emitted from booth stacks that isn't treated	Monitor waste gases (if complying with ELVs) What has been used minus what has been treated (if complying with the reduction scheme)
O2	Emissions from organic solvents which are released into the air, e.g. from windows, doors, etc	Relevant.	Total used minus actual used.
O3	Organic solvents contained in collected waste	Relevant. Includes solvent waste itself plus materials contaminated with solvents	Volumes sent for off-site disposal.
O4	Preparations containing organic solvents which are recovered for reuse, but not used in the process	Relevant to some. waste solvent collected & sent away for recovery/recycling rather than disposal.	Volumes sent off site for recovery & reuse elsewhere

From the solvent management plan a proprietor can calculate the amount of solvent consumed every year, this is referred to as the annual solvent consumption.

Proprietors of vehicle refinishing installations are given two options in order to comply with this Regulation, they must either comply with emission limits or comply with a reduction scheme, these will be discussed in more detail below:

### **Emission Limit Values (ELVs)**

An emission limit value (ELV) sets the maximum amount of VOCs emissions permitted from an installation. There are different types of ELV, however, the two that are relevant to the vehicle refinishing sector are:

- An ELV for waste gases: This sets the maximum amount of VOCs that may be released from stacks
- A fugitive emission value: This sets the maximum amount of solvent used that may be released from fugitive sources.

In order to comply with ELVs, emissions must be monitored. The services of a professional company will have to be employed to monitor emissions. This company should be recognised by the Irish National Accreditation Board (INAB). Emissions must be monitored every year and results will be used by the AIC contractor when compiling their report.

Where incineration or alternative abatement systems have been in use in an existing installation, they are exempt from meeting these ELV's until 1 April 2013.

Emissions do not need to be monitored if an installation is following the reduction scheme.

## Reduction Scheme

The reduction scheme involves a target for reduced emissions and a plan setting out the measures that a proprietor will take to achieve this target. The reduction scheme is given as an option instead of meeting the emission limit values. It is estimated that the majority of vehicle refinishing installations will comply with the Reduction Scheme.

There are various ways that a proprietor can reduce solvent emissions, these are outlined below:

### *Load Minimisation or Source Recovery*

This involves reducing the amount of solvent in use, for vehicle refinishing this includes:

- Substituting products. Replace products which have a high VOC content with either water-based products or products with a high solids content. According to the EPA Best Practice Guidelines (2003), the state of the art – VOC emission reduction for vehicle coating and refinishing is considered to be:

<b>State of the Art – VOC Emission Reduction</b>
High solids primer or water based primer
Medium solids surfacer
Medium solids basecoat or water based basecoat
Very high solids clear

- Spray guns with increased efficiency should be used. By using high volume low pressure (HVLP) spray equipment, a 50 % reduction in overspray can be achieved.

- The correct mix rates should always be used. Manufacturer's instructions must always be followed.
- All operators must be trained appropriately. Training should be carried out by a competent body and include correct use of spray equipment, training on batch preparation, training on the correct use of enclosed gunwash stations, paint mixing and its associated equipment, training in the correct storage and handling of materials and training in appropriate disposal of contaminated materials should be provided.
- Batch preparation should be improved. By using electronic scales the amount of waste can be reduced.
- Spray bottles/disposable wipes for surface cleaning should be used, this reduces contaminated waste.
- Pre-cleaners that can be diluted with water should be used where possible.
- Careful stock control and management of materials should be practiced at all times

### ***Containment***

This involves taking measures to prevent the release of solvent emissions to air, water or into the ground. These include:

- Premises location, it is recommended that a vehicle refinishing premises be located at least 100m from schools, hospitals and private dwellings.
- Spray Booths should be fitted with filters to remove paint particles. Air extraction rates should be at the approved rate of  $6\text{m}^3$  per second.
- Enclosed gun wash stations should be purchased, waste streams can be separated and recycled.
- Paint mixing equipment which reduces the release of VOCs is available to purchase.



- Closed containers prevent evaporation of solvents. All containers are kept closed when not in use.
- Contaminated rags and paper should be stored in a closed container.
- A spill kit should be kept nearby to clean up any solvent spills. Any materials used in a spill kit should be treated as contaminated waste and disposed of appropriately.
- Appropriate solvent storage. Ensure solvents are stored in an area which cannot be struck by vehicles. Solvents should be stored in a secure location and away from drains.

### **Calculating the Annual Solvent Consumption:**

The new Regulation requires the proprietor to calculate the quantity of solvent used annually

The following formula should be used to calculate the annual solvent consumption :

**Consumption (C) = I1 – O4** (refer to the table under solvent management plan)

= (amount of solvents purchased & used during the process) – (solvents recovered for reuse but not used during the process)

*This can only be used when using the reduction scheme.*

## **Summary of what a vehicle refinishing installation must do**

- 1) Examine the contents of all process materials – if they contain any Risk Phrases highlighted in this document, they must be replaced by less hazardous materials.
- 2) Decide if they are going to comply by using the Reduction Scheme or the Emission Limit Values.
- 3) Maintain a record of all stock. Records for at least one year are required before a proprietor can register with a local authority.
- 4) They must be aware of compliance date and commence preparations for a smooth implementation.
- 5) Once a proprietor has recorded his annual solvent consumption, they should book an AIC inspector.
- 6) When a proprietor has obtained an AIC report, they must register with their local authority (on or after 31<sup>st</sup> October 2005).