Executive summary

This study investigates the potential for a product based approach to reducing emissions of volatile organic compounds (VOCs) due to the professional and non-professional use of decorative paints and varnishes. Limiting the adverse environmental and human health effects associated with the formation of tropospheric ozone and direct exposure to VOCs forms the background to the study.

Literature study, meetings and interviews with trade associations and individual companies and the distribution of questionnaires among suppliers and users within the sector and the associations representing them were the main ways of collecting information. In addition, the composition of a large number of current decorative paints has been analysed in the laboratory. Major issues have been discussed with stakeholders in the sector on several occasions.

For the purposes of this study, decorative paints and varnishes have been defined as products that are applied to buildings, their trim and fittings, for decorative and protective purposes. They are applied in situ by professional or private users. While their main function is decorative in nature, they also have a protective role.

Various ways of defining "VOC" have been assessed. Definitions based on Vapour Pressure (> 10 Pa at 20°C), Boiling Point (< 250°C or 280°C) or photochemical oxidant creation potential all have their own merits and supporters within the sector. A boiling point limit of 250°C excludes important coalescing solvents which have boiling points of > 250°C. The study team has chosen the following definition to cover all volatile organic compounds that are used in decorative paints:

"VOC are all organic compounds used in paint or associated with the application of paints that have an initial boiling point of lower than 280°C".

The European decorative coatings market

Despite the recent trend of concentration, there are almost 1300 significant paint manufacturers – and over 3200 when very small localised family businesses are included - in the European Union and six major 'accession countries'. These employ about 122,000 workers. However, the 10 largest paint manufacturers account for almost 50% of total production. The southern European markets tend to be less concentrated than the northern European markets.

The total annual production of decorative coatings in the EU member states was about 3344 kilotonnes in 1997. The total production value was at least 5.2 billion EUROs, while the retail value was considerably higher. When six major accession countries are included, the production is about 3800 kilotonnes.

More than 150,000 retail outlets for decorative coatings exist in the EU. Professional painters may purchase directly from the manufacturer, at wholesalers, or in producer-owned specialised retail stores. In the Do-It-Yourself (DIY) sector, the market share of DIY superstores is rising. The number of known DIY superstores in major chains is about 8000. Currently, the top 15 DIY chains own over 40% of all stores.

Well over 200 raw material suppliers serve the European paint industry. Multinational chemical companies dominate the binder, pigment and solvent markets. In addition, it has been suggested that many very small alkyd resin suppliers exist.

At the other end of the market, over 165,000 professional painting companies exist in the EU, which according to UNIEP employ about 1.65 million painters. The split between professional and DIY-paint consumption ranges from ~30% DIY in Greece to around 70% DIY in Sweden and Finland. Labour costs of professional painters and the increasing DIY-trend are major determining factors in this.

The overall market share of waterbased paints across the EU is about 70%. Highest penetrations can be found in the Scandinavian countries, Germany, Austria, Portugal and Spain; lowest penetrations in France, Italy and Hungary. Waterbased coatings have high penetrations (up to 100% in some countries) in wall paints, and considerably lower penetrations (5-40%) in trim paints and varnishes. In most countries, the market share of waterbased paints is lower among professional painters than in the DIY-sector. However, in some countries occupational health regulations have resulted in the opposite trend.

Major trends in the decorative coatings sector include concentration, specialisation into core business, internationalisation and increased competition. Competition in the decorative paints sector is not a technology contest, but a race for market coverage. Environmental regulation as well as increased customer demands have resulted in an acceleration of innovation.

Competition among painting contractors is intense in most countries. The increased DIY-trend, as well as the increasing availability of cheap, non-qualified painters are seen as a threat to their business as are restrictions on the use of high VOC products by professionals. Among DIY-retailers, price competition is common, although local differences exist. ‘Own label’ brands are used for price competition, while prices of well-known brands are maintained.

VOC emissions

The VOC-emissions due to the use of decorative paints and varnishes in the EU-member states and six major accession countries have been estimated at ~ 580 kilotonne annually. When the solvents used for cleaning and thinning are included, the ‘reasonable worst case’ estimate of the total VOC-emission connected to the use of decorative coatings is 720-830 kilotonnes annually. Emissions of ‘natural’ VOC account for ~ 20% of the total VOC emissions in the EU.

The contribution of the decorative paints sector to total man-made VOC-emissions in the EU is currently about 4-5%, thinning and cleaning included. After implementation of the Solvents Emissions Directive (SED), which aims at a 50% VOC-reduction, the relative contribution of the decorative paints sector may rise to about 10%.

Existing measures

In four EU-member states legal measures to reduce VOC-emissions due to the use of decorative coatings already exist. In many other member states as well as accession countries, non-legal measures such as ecolabelling schemes, voluntary agreements and information campaigns have been implemented.

It has been concluded from consultation with industry representatives, that the Solvents Emissions Directive (SED) will not significantly contribute to directly reducing VOC-emissions from decorative coatings. On this basis, the need for a separate Product Directive is justified. The Ecolabel has so far not resulted in a significant market shift, although product development towards lower-VOC (high solids) products may have been enhanced. The proposed National Emission Ceilings Directive provides a framework, and creates the need, for a Product Directive for decorative coatings.

Most representatives from the authorities in the Member States, as well as the industry representatives, except most solvent manufacturers and certain resin manufacturers, welcome the initiative of a product directive limiting the VOC-content of decorative coatings. Representatives from painting contractors also welcome the initiative, but requested a generous time path for implementation, in order to enable the sector to make the technological and cultural switch. The representatives have been consulted about which types of measures would be most effective. In order to level the playing field, legal limits to the VOC-content of decorative coatings are generally preferred over financial measures, ecolabels or other labels, information campaigns or voluntary agreements. However, some of the non-legal measures may enhance implementation of the legal measures.

Review of developments in decorative coatings technology

Review of available literature reveals that the following VOC contents are associated with the most commonly employed technologies for the manufacture of decorative paints and varnishes.

Conventional alkyds	350 g/l
High solids alkyds	250g/L
Alkyd emulsions	10-20g/L (estimate)
Acrylic latex(wall)	30 g/L
Acrylic latex(wood)	190g/L (excluding water)
Styrene acrylic solution (exterior wall)	450g/l

Alkyd emulsions have been highlighted as offering significant potential for VOC reduction. Seven to eight years exposure performance has been reported. However, uptake in the market has been slow and serious drawbacks still exist inhibiting the penetration of the technology into the marketplace. The expectation is that with further development, they will gain a significant market share.

High solids alkyds, in common with all alkyds, may suffer from yellowing and full hardness properties take longer to develop, with surface drying times being reported as being up to 5 hours. Product gate cost (cost of manufacturing up to dispatch) is higher than that of conventional alkyd products. However, it is believed that high solids products have a role to play, are being used in the marketplace and can work well where performance expectations are demanding. The one-coat application has proven beneficial for professional painters as a result of labour cost savings. Application and service lifetime attributes, especially under adverse conditions, places this technology in an important position in the event of the absence of conventional solventborne alkyd coatings from the marketplace.

Typical values of VOC content for conventional alkyd, acrylic dispersion, high solids alkyd and alkyd emulsion(excluding water) are reported as being 350, 190, 250 and 42g/L respectively. This agrees well with the findings of the study team.

Ambient temperature, cross-linking latex has been reported and it appears that this can be facilitated by an oxidatively cured cross-linking additive. Curing at temperatures of 1°C have been reported, however, the manufacturers do not recommend application below 5°C.

Research activity into dendrimer polymers has been marked with a leading raw material supplier actively licensing this technology. Although market impact has not been evident to date, it is expected that these materials will find application, albeit in the industrial coatings sector initially.

Research has highlighted the demands placed upon any wood coating for exterior use reporting that from 200 products, few were in good condition after two years. However, two products, which did perform well in particular were a polyurethane and an acrylic. This is expected as the acrylic would maintain flexibility as it is UV resilient and the urethane would have very stable cross-linking chemistry. A waterborne latex system over a solventborne, barrier type primer, offers the potential for VOC reduction along with the potential for increased service lifetimes.

Characterisation and comparison of conventional and low-VOC products

The review of decorative paints and varnish formulation technology compared conventional formulations with low VOC options. In addition, the formulation characteristics of decorative coatings were outlined in the context of the particular function and application circumstances in each case. Particular emphasis was placed on the VOC content, performance expectations, technical requirements, ease of use, application and cleaning operations, as well as professional versus DIY considerations associated with each product category.

Waterborne latex formulations have dominated the interior and exterior wall sector for several decades and only small technological changes are evident. These changes have been primarily associated with control over viscosity for application, enhancing durability in terms of scrub resistance and dirt pick-up, and the formulation of very low VOC ambient cure latices. The latter development is more recent and therefore has not had significant impact on market characteristics. In some instances, there has been continued use of solventborne technology for walls. One case is that of the application of exterior wall paint where conditions are adverse and good bridging properties are required. There are many instances, supported by comments from the questionnaires (chapter 9 section 9.9), where waterborne latex is vulnerable due to either low temperature or sporadic rainfall.

Waterborne latex has not had the same impact in many markets on trim/cladding paint and varnish applications as for walls, although there are exceptions such as the Danish market. Significant technical activity has occurred in this area, in order to improve the appearance and protective characteristics of these latex films for wood applications. The technical difficulties which affect flow, lack of separation of a clear unpigmented layer and the short open film times, all detract from the application of waterborne latex to trim. Application during humid or low temperature conditions is problematic, however, some professional painters have resorted to heated enclosures, to facilitate exterior painting during winter months. Latex paints and varnishes do have significant advantages. They offer low VOC alternatives to conventional solventbore equivalents, they may maintain gloss outside, do not yellow and remain thermoplastic which means that they are less prone to cracking, although thermoplasticity can lead to dirt pick-up. There is widely accepted opinion that waterborne trim coatings have established a performance track record and experiences in Denmark have been positive, although not without reservations. Spanish professional painters have endorsed the idea of the use of waterborne paints. It has been concluded that wood rot in Scandinavian countries, associated with the use of waterborne latex, could have been avoided if a solventborne primer had been applied to the substrate as soon as the substrate had been exposed. Other findings from the study highlighted the detrimental effect of exposing unprotected wood prior to coating for prolonged periods, the influence of a reduction in the quality of wood and changes in architectural design.

The main advantages of solventborne coatings have been, cheap raw material supplies, good appearance characteristics and good application characteristics for professional users. An important advantage has been the ability to use these products at lower temperatures and in between rainfall episodes. The conventional solventborne systems however, have serious drawbacks. Conventional alkyds may suffer from yellowing indoors, necessitating their overcoating even when other functional characteristics are maintained. Outdoors, continued oxidative cross-linking may lead to embrittlement and eventual cracking especially with varnishes. Odour and clean-up have always been a problem, although low odour alternatives are now available. The interior gloss advantage is lost for exteriors, as these materials quickly loose gloss outside.

Although waterborne technology can perform many functions to satisfaction, there is still concern over the application of these products during adverse conditions. Additionally, the impact of the solvent directive (1999/13/EC could place the performance capabilities of factory treated and coated joinery, under duress. It is expected that many joinery manufacturers will move to waterborne alternatives for joinery preservation and priming due to the solvent directive. The efficacy of the priming and treatment of joinery, as well as the system’s barrier properties, stimulated by these transitions, have yet to be proven in the field, and is a matter of serious concern for this sensitive market.

High solids trim coatings have evolved significantly over the last 15 years and offer a route to VOC reduction, offer good barrier properties and a product that could be crucial for professional painters during winter painting seasons. There are drawbacks such as cost and time to achieve full hardness properties. High solids have been compared to conventional in terms of VOC emission per square metre painted. The comparison between high solids, conventional and even waterborne, presents high solids VOC emissions in a good light when expressed in g/m^2 of surface painted, especially when two coats of conventional or waterborne might be needed to achieve the appropriate film thickness. However, the resultant film thickness for high solids tends to be significantly higher and compared on that basis no longer appear attractive when thinner films are sufficient.

There have been instances where blistering has occurred when waterborne was used to coat interior joinery and a conventional solventborne system was used on the exterior joinery. The blistering occurred due to egress of water from humid quarters within the building. The availability of a solventborne wood primer for this reason, as well as others, necessitates their inclusion in the market for the future.

VOC-reduction proposals

The concern over this risk and the changes in the joinery industry due to impending directives, has led to the proposal of two approaches. These proposals are presented in Table 1 below. Option 2 is developed to protect the health of painters when painting indoors by eliminating solvents exposure from the most frequently used products (groups 1 – 5). The principle difference between the two options is the differentiation of paints for interior and exterior use on trim. One approach includes high solids solventborne for interior and exterior use, while the other eliminates high solids for interiors. Other differences between the two proposals are the identification of products for adverse conditions, the elimination of solventborne woodstains and the early elimination of interior solventborne wall paint. The identification of a product for use under adverse conditions generates perceptions of superior performance and may increase its consumption. Elimination of interior solventborne wall coatings from the outset would have serious impact on certain markets that have retained these products for cultural reasons. The need for solventborne woodstains has been reiterated in the questionnaire responses and the performance and application capabilities of waterborne have been questioned. The penetration limitations of waterborne latex systems has also limited their use in the priming, sealing and stain blocking sector and currently, solventborne products offer better flexibility and capability.

Table 1. VOC-reduction scheme - OPTION 1 and 2 products based on VOC g/L ready to use including tinters.

Category	Type	Option 1 Phase 1	Option 1 Phase 2	Option 2 Phase 1	Option 2 Phase 2
1.1 Interior matt walls and ceilings gloss levels <25 @ 60°	W/B	55	30	55	30
1.2 Interior matt walls and ceilings gloss levels <25 @ 60°	S/B	**350**	**NLA**	**NLA**	**NLA**
2.1 Interior glossy walls and ceilings gloss levels >25 @ 60°	W/B	150	100	150	100
2.2 Interior glossy walls and ceilings gloss levels >25 @ 60°	S/B	**350**	**NLA**	**NLA**	**NLA**
3.1 Exterior masonry walls	W/B	60	40	60	40
3.2 Exterior masonry walls **3.2 Exterior masonry walls for adverse conditions-*option 2***	S/B	450	430	450	430
4.1 Interior trim and cladding paint, varnish and lasures for wood and metal.	W/B	130	130	130	130
4.2 Interior trim and cladding paint, varnish and lasures for wood and metal	S/B	**250**	**250**	**NLA**	**NLA**
4.3 Exterior trim and cladding paint, varnish and lasures for wood and metal	W/B	130	130	130	130
4.4 Exterior trim and cladding paint, varnish and lasures for wood and metal	S/B	250	250	250	250
5.1 Interior/exterior trim woodstains	W/B	140	100	140	100
5.2 Interior/exterior trim woodstains	S/B	**500**	**500**	**500**	**NLA**
6.1 Primer/sealer for wood and stain block for walls and ceilings	W/B	50	30	50	30
6.2 Primer/sealer for wood and stain block for walls and ceilings	S/B	450	350	450	350
7.1 One pack speciality coatings	W/B	140	140	140	140
7.2 One pack speciality coatings	S/B	600	500	600	500
8.1 Binding primers to stabilise loose substrate particles and to impart hydrophobic properties.	W/B	50	30	50	30
8.2 Binding primers to stabilise loose substrate particles and impart hydrophobic properties.	S/B	750	750	750	750
9.1Two pack reactive coatings for specific end use such as floors e.g. polyisocyanate plus polyol and epoxide plus amine coatings.	W/B	140	140	140	140
9.2 Two pack reactive coatings for specific end use such as floors e.g. polyisocyanate plus polyol and epoxide plus amine coatings.	S/B	550	500	550	500
10 One pack reactive coatings for specific end use such as floors e.g moisture curing polyisocyanate.	S/B	600	600	600	600

NLA = no longer available
VOC = any organic compound that has a boiling point of up to 280°C. This proposal includes all VOC's that have been identified for use in decorative coatings. The contents are quoted as those being the content ready to use. This includes added tinters which can add up to 35g/L VOC to the product, and the addition of thinners.

Table 1 is an ammalgamation of Tables 9.9 and 9.10 derived and discussed in the body of the report and is presented here in this form to highlight the differences between the two proposals.
It is the view of the study team that g/L alone is not an effective means for limiting VOC in decorative coatings. A VOC limitation proposal, based on coverage is presented in Tables 9.13 and 9.14.

The study has focused on the most significant categories of decorative coatings (1-5 in option 1 and 1-6 in option 2) from the point of view of a proposal for potential VOC reduction. These categories are,

Interior wall and ceiling paints for plaster etc.
Exterior wall paints for masonry, brick etc.
Interior and exterior wood/metal primers, undercoats and finish paints.
Interior and exterior stains and varnishes for wood.

The remaining classes have been described and characterised in terms of VOC content. It is proposed that current levels of VOC content, be maintained in this sector which is negligible in terms of VOC contribution. These categories could be revisited at some future date.

Aerosols have not been dealt with in detail in the study as they constitute only a minor part of the market. All aerosol paints accounted for 5 Ktonnes of the demand for paint in Europe in 1996. This accounts for less than 0.15% of the overall production of decorative paints in Europe in 1997. It is considered, however, that aerosols may be significant as a source of high VOC emissions.

The study team challenges the use of g/L as a means of expressing VOC content, in that it does not provide an effective means of comparing the total VOC emissions during a painting operation, due to the application of similar products used for that same application. Throughout this report, the VOC content has been expressed as weight (grams) of solvent per unit volume (litres) of paint. This is satisfactory provided that one is concerned only with the VOC generation potential of each type of paint as it exists in its container. It implies however that any two paints manufactured for the same purposes, and which have the same VOC contents, are on an equal footing in terms of the quantity of VOC that they will actually generate when they are used for the purposes for which they were intended. This is not necessarily so. Taking, for example, two matt water based masonry paints, each of which contains 70 g/L of VOC, the manufacturer of one of these products specifies its maximum coverage as 10 m^2/litre, while the other specifies 16 m^2/litre. Painting a $100m^2$ wall, the former therefore generates 700g of VOC while the latter only generates 437.5g. If the former product contains 50 g/L of VOC and the latter 70 g/L, the former generates 500g VOC for the same wall while the latter remains at 437.5g. Under the currently accepted format, g/L, the two products enjoy equal status in the first scenario, while the former would be favoured in the second. However, in practical use, the latter is clearly the better material from the environmental point of view. It is clear, that any directive based solely on in-can VOC content will not be effective, and will not deliver an even playing pitch for all paint manufacturers. It may even induce some manufacturers to reduce the coverage of their products for competitive reasons, giving rise to a VOC increase rather than a decrease following the introduction of the directive. In the worst case, the VOC emission could increase in a particular sector where formulations are altered to attain the VOC limit, yet provide a much reduced level of efficacy. The proposals have therefore been presented in the form of g/L for easy comparison with quoted figures in the public domain and as g/L VOC as a function of the coating volume solids in order to allow the application, VOC emission potential, comparisons.

VOC-reduction potential
Phase 2 of *option 1* of the VOC-reduction proposals will result in a VOC-reduction potential of 238 kilotonnes without thinners and cleaners, and of 365 to 493 kilotonnes when thinning and cleaning with white spirit is effectively prevented (EU-15 + six accession countries).

Phase 2 of *option 2* of the VOC-reduction proposals will result in a VOC-reduction potential of 263 kilotonnes without thinners and cleaners, and of 390 to 518 kilotonnes when thinning and cleaning with white spirit is effectively prevented (EU-15 + six accession countries). This means an additional 25 ktonnes reduction compared to option 1. In terms of health hazards for professional painters, option 2 provides an additional advantage, as for interior trim paints only waterborne products remain.

The percentage VOC-reduction potentials for the options 1 and 2, thinning and cleaning included, range from 51% to 62%. Additional action will have to be taken to reduce the use of solvents for cleaning and thinning effectively.

Economic costs and benefits

In relation to the criteria that can be formulated it seems likely that the proposed command-and-control limits will very significantly contribute to the application and diffusion of past innovations, as well as stimulate further innovations.

The first criterion formulated was that regulation should focus on outcomes, not on technology. In a sense the proposed limits do favour one technology, water-borne over another, solventborne, but not entirely so. The proposed limits do leave the option for the use of other technologies open, as long as VOC-content is significantly reduced. As such the regulation focuses on various outcomes, namely a significant reduction of VOC-emissions from nearly all different classes of different paints. As is, the regulation focuses on outcomes as much as is possible and in this respect will certainly lead to more success for low-VOC technologies.

The second criterion was that the regulation should set strict rather than lax standards. Clearly the standards set are reasonably strict, the hydrocarbon solvent emissions are likely to be reduced by over 60% and the oxygenated solvent emissions would be expected to decrease by around 15%. Consequently the limits are definitely strict enough to stimulate innovation.

The third criterion is the use of a phase-in period, which in the proposal is up to ten years. As the normal life of a paint formulation is around this time as well, the proposal creates a sufficient window for innovation and adaptation in order to eventually meet the proposed limits.

Market incentives are not proposed, but the possibility remains for the use of labelling and/or exceedance fee instruments to be used in synergy with the proposed limits. In this respect especially the paint application sector differs from other industries', as from the previous analysis it has become apparent that market incentives, as sole instruments can not lead to the desired results. However, the use of market incentives in addition to the proposed limits can increase the cost-effectiveness and efficiency of the proposed limits.

Harmonisation or convergence with regulation in associated fields, the fifth criterion, is clearly sought. Regulatory pressure on industrial VOC-emissions has mounted over the years, and occupational health regulation, at least in parts of Europe, has also focused on the reduction of especially interior VOC-emissions.

The proposed limits are ahead of the limits in most of the world. As similar regulations are likely to follow eventually throughout the world, European corporations can expect to be able to use the experience gained on the basis of the European regulation in non-European markets.

Stability and predictability of regulation is the seventh criterion. The proposed limits will stabilise the European regulatory situation. At the moment, widely diverging regulatory approaches to reducing VOC-emissions are in use in the different European countries. A Directive will harmonise and stabilise the European regulatory situation. Due to the long time horizon of the proposed limits they are very predictable. Thus the proposed limits will provide much needed clarity to industry on where regulation is going and consequently facilitate innovations in order to keep up with the regulatory requirements.

Industry participation is the eighth criterion, although it is early days yet for meeting this criterion. Industry has been extensively consulted in the pre-regulatory stage of this project, but it will be up to the regulator to facilitate industry participation in the actual formalising stage.

The ninth criterion, the need for strong technical capabilities of the regulator, is less crucial here, as the regulation proposed is relatively simple and because external expertise can and is used to assist the regulator.

The tenth and final criterion is the requirement to make the regulatory process more efficient. As a possible Decopaint Directive is still in its pre-regulatory stage, it is hard to judge to which extent this regulatory requirement will be met. However, particularly for the multinational players in the paint chain, a European standardisation of VOC-emissions from decorative paints regulation is certain to make the compliance part of the regulatory process more efficient.

The following scheme summarises the potential economic effects in the paint chain if the industry had to make an almost complete change-over to water-borne paints by 2010.

Table 1.(c) Economic effects.

paint chain	major economic effects
solvent suppliers	• revenues hydrocarbon solvents in decorative paint: minus € 65 million • revenues hydrocarbon solvents for thinning and cleaning : minus € 65 million • revenues oxygenated solvents: minus € 24-46 million or plus € 30 million (ESIG) • employment: minus 2.000 - 4.000 people (ESIG) • strong concentration • effect are modest in relation to economic strength of largest companies
resin suppliers	• additional R&D: € 45.000 per new resin • investment in new equipment • resins will become 1.3 - 2 times more expensive • revenues: up to plus € 211 million • concentration, shake out of small alkyd resin suppliers
paint manufacturers	• reformulation costs: 0,4% of sales • resins will become 1.3 - 2 times more expensive, additional resin cost up to € 211 million • stainless steel equipment: € 53 million • concentration, advantages for large companies
retail, wholesale	• no major effects
professional painters	• more expensive paint • more labour time per paint job (1% = € 600 million) • effects on quality and subsequently on demand
DIY users, consumers	• more expensive paint
waste processors	• no major effects
water treatment	• no major effects

If regulations spur innovations, it is likely that most of the above mentioned costs will get lower. Also, if the expected consolidation process occurs, the larger companies will profit from economies of scale, which will lower the cost of implementation even further. Such a concentration process will especially effect small alkyd resin and paint manufacturers and have an impact on employment. For the larger companies in the paint chain, that are often part of multinational industries, the costs will be relatively modest.

The cost effectiveness of a possible decorative paint directive seems to be better than the cost-effectiveness of the Solvents directive.

Environmental and occupational health impacts

The environmental and health impacts of the proposed VOC-reduction have been estimated by literature study and extensive consultation with experts.

The proposal may result in an overall contribution of 5-6% to further ozone reductions, although local circumstances might reduce the impact in specific cases. Benefits may be expected in reduced acute and chronic health effects due to ozone, the value of which is open to debate. Benefits may also be expected in a reduction of crop damage of over €300 million. It is not advisable to distinguish between VOC on the basis of the so-called Photochemical Oxygen Creation Potential (POCP-values), as all VOC eventually contribute to tropospheric ozone formation. The impact of 'natural' VOC on ozone formation is present, but very uncertain.

The practice of cleaning equipment under the tap may result in a total emission of an annual 10 kilotonnes of waterborne paints through sewage systems throughout the EU. Of this amount, 3 kilotonnes may be directly discharged to surface waters. Adverse effects to the sewage system itself are not likely to occur. The main concerns with respect to effects on wastewater treatment plants or aquatic environments concentrate on the use of certain preservatives and surfactants. However, effects in practice are hard to predict, as the emissions occur very diffusely. Nevertheless, the use of alkylphenol ethoxylates (APEOs) as surfactants and of isothiazolinone preservatives should be reduced as much as possible. APEO's have been substituted already in most cases. Most important however is discouraging the practice of cleaning equipment under the tap.

From a life-cycle-analysis (LCA) perspective, it is complicated to produce a well-balanced environmental comparison of the various types of paint. Experts dispute many assumptions made so far in current LCA's. Consequently, current LCA-studies do not result in any preference for a specific type of paint, although the major adverse environmental effects can be related to the manufacture of TiO_2 as a pigment and to emissions of solvents at application (traditional solvent-based paints).

As far as health impacts are concerned, due to the neurotoxic nature of most volatile organic solvents, the (interior) use of solvent-based paints has resulted in the identification of the development of an Organic Psycho Syndrome (OPS) in painters in Scandinavian countries and the Netherlands. It concerns several hundreds of patients in Scandinavia in the 80's. Recently it was estimated, that for the Netherlands, 1,1% of the painters suffer neurasthenic symptoms (first OPS-symptoms). The number of workers in paint manufacturing suffering from these neurasthenic symptoms, is even larger at 5,3%. However, the establishment of special medical diagnostic procedures is needed to identify OPS-patients unambiguously. As a consequence OPS-patients are not identified in many EU countries. An important trigger in the development of OPS is thought to be the regularly occurring short-term high peak exposures, which are common in the painters' practice using solvent–borne paints indoors.

A shift towards the indoor use of low-solvent-borne and especially water-borne paints seems to reduce the amount of new OPS-patients significantly. Option 2 of the VOC reduction proposals provides an advantage over option 1 in this respect, as for interior trim only waterborne products will remain.

The use of waterborne coatings provides clear improvements from an occupational health point of view. The risk of developing OPS is significantly reduced when waterbased paints are used. Residual monomers and additives are usually present in sufficiently low concentrations to prevent skin irritation or sensitisation. The most harmful cosolvents and coalescing agents (ethyleneglycolethers) are being or have been substituted by less harmful alternatives already. Further improvements can be made by carefully choosing the type and amount of biocides used.

An issue that might need attention in the future, due to potential irritative or sensitisation effects, is the use of reactive diluents in high solids paints.