PLANET FRIENDLY GUIDE

FOR SCREEN AND DIGITAL PRINTERS

EMISSIONS TO AIR

FESPA

profit for purpose

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ABOUT THIS FESPA PLANET FRIENDLY SUMMARY GUIDE

This FESPA PLANET FRIENDLY SUMMARY GUIDE has been developed as part of a series.

The Guides aim to provide screen and digital printers with everything they need to know about printing sustainably.

The best available techniques, included in the Guides, give proven practical methods that can also generate financial savings. The Guides can assist printers who are planning to undertake any Environmental Management Certification.

The environment is a global topic that involves all the major industrialised nations. This has led to multi-international agreements such as the Kyoto and Montreal Protocols, the Durban Climate Change Conference, the Rio Earth and the Copenhagen Summits.

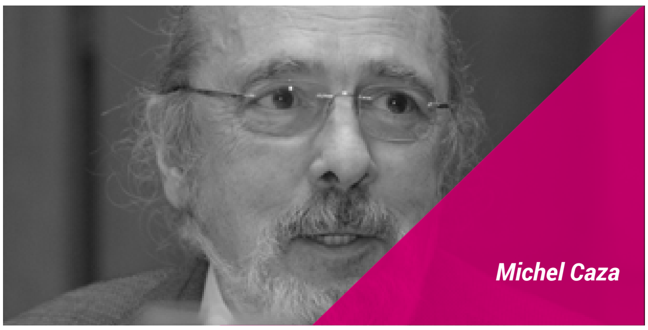
The European Union (EU) has been an early adopter of these agreements through various Directives and Regulations. The standards set by the EU in this field are often used as the benchmark by countries all over the world. However, there may be differences and the Guide user should always check with their local government bodies.

THE FESPA PLANET FRIENDLY SUMMARY GUIDES are based on these EU Directives and full details of references to this legislation can be found in the appropriate section of the Guide.

FESPA's Associations and their print company members can use and translate the Guides and the images used in them at no cost.

THE HISTORY OF THE GUIDE

The Guides are based on FESPA's Planet Friendly Guide which has been used as the print industry's reference on this subject since it was created by FESPA in January 2012. Under the expert guidance of Michel Caza and Paul Machin, the Planet Friendly Guide has been developed and regularly updated for use by screen and digital printers all over the world.



Michel Caza is a multiple award-winning leading light in the global screenprinting industry, and one of the 'founding fathers' of FESPA in 1962 and has been a Board Member since 1990.

Paul Machin is a chemist and lawyer Paul has spent 40 years dealing with European and international issues relating to the health, safety and environmental topics within the printing industry.

While every effort has been made to ensure that the information contained in the Guides is correct as at August 2014, readers are asked to note that FESPA makes no representation, expressed or implied.

EMISSIONS TO AIR

Emissions to air will be organic solvents but also includes ozone and dust.

The major element will be organic solvents. Organic solvents are referred to as Volatile Organic Compounds (VOCs) and these will have an adverse effect on the environment. These chemicals may not be harmful to the environment in their own right, but if they mix with nitrogen oxides (NOx) under the right conditions (for example in the presence of sunlight and warm temperatures) they can react to produce ground-level ozone that can have harmful effects on human health. Many VOCs degrade rapidly in the lower atmosphere which means that these VOCs do not cause any problems with the stratospheric ozone layer. There are some VOCs that don't degrade in the lower atmosphere, but do react in the stratosphere and thereby contribute to the formation of so-called ozone holes.

Severe restrictions are imposed for chemicals with the EU Classification, Labelling and Packaging Regulations and those products that have the Hazard Statement H300, H301, H302, H304, H310, H311, H312, H330, H331, H332, H334, H340, H350, H351, H360, H361, H400, H410 and H411.

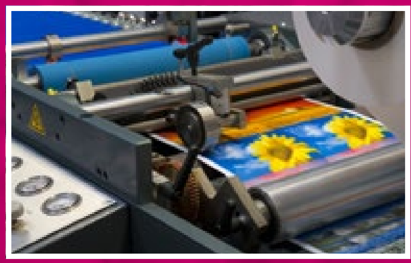
To be considered as a VOC, a chemical must have a vapour pressure of 0.01 kilo Pascals (kPa) or more at 293.15K (20o C). UV curing ink monomers and most plasticisers used in inks are not VOCs by this definition. The discharge of VOCs to the atmosphere from a printing plant can arise from the following process procedures: colour matching, printing, drying the substrate; and cleaning machinery especially contaminated screens. Discharges will take place from the extraction points of dryers, local exhaust ventilation (LEV) equipment and fugitive emissions (work place emissions through doors and windows).

RESPONSIBILITY

The level of responsibility is determined by the quantity of VOCs that are discharged from a printing plant. Where printing activities use more than 150kg/hour or 200 tonnes per year of VOCs they are subject to the controls of the European Union (EU) Industrial Emissions Directive (IED). This covers all forms of emission including effluent, waste disposal and airborne emissions.

Rotary screen printing is required to control only airborne emissions if the annual VOC consumption is greater than 30 tonnes when printing onto textiles and cardboard or greater than 25 tonnes onto other substrates.

Individual countries within the EU can impose controls on printing processes, other than those specified in the IED under the principle of subsidiarity. These printing plants can only be subject to controls on airborne emissions. Flat bed screen and digital printing are normally excluded from these controls, however individual countries have imposed levels as low as 5 tonnes per annum.



ACTION PLAN FOR PRINTERS

- **Review local legislation to determine whether it includes controls of VOC emissions.**
- **Generate an inventory of all inks, cleaners and other chemicals used**
- **Undertake a Solvent Management Plan**
- **If necessary obtain from the supplier the annual quantity of VOCs present in each item purchased**
- **If controls are applicable, ascertain all the emission sources from the plant, for example dryers and LEV points**
- **Review the best available techniques (BAT) options for reducing the emission levels, such as replacement of solvent based inks and reduced extraction levels**

APPLICABLE EU DIRECTIVES AND REGULATIONS

Information on the controls on the emissions to air from printing sites can be found in the following European Directives and Regulations at the following web site address: **http://europa.eu/legislation_summaries/environment/soil_protection/ev0027_en.htm** which is to be updated during the first semester of 2014 into the new EUR-Lex web-portal.

BEST AVAILABLE TECHNIQUES (BAT)

SMALLER PRINTING PLANTS

If the VOC emissions to air from printing sites are less than 150 kilos/hour or 200 tonnes per year but they exceed 5 tonnes per year it would be defined as a smaller printing plant. They may be controlled; however, the requirements will be restricted to controlling the levels of VOC emissions.

BAT TO REDUCE VOC EMISSIONS

1. ELIMINATE VOCS IN INKS USING UV CURING INKS

Radiation curing is based on resins and reactive diluents (monomers) which react together on exposure to ultraviolet light (UV), for example. The resins are generally polyesters, polyurethanes or epoxies, with acrylate or methacrylate functionality, though other coating chemistries may also be used. The formulations are liquid, but are solvent-free and curing can be very fast.

Achieved environmental benefits: *TThe print process is solvent-free. There are normally no significant emissions during curing and the cured coatings no longer contain volatile components. There can be improved energy efficiency with flash curing or LED. Minimal use of VOCs is needed as drying-in of print heads is less likely to occur. The use of VOCs will only arise through cleaning of the screen or digital equipment, either after printing or the reclamation of the screen.*

The added benefits are that the use of UV inks will substantially improve productivity through reduced capital expenditure on abatement equipment, actively supporting the Solvent Reduction Scheme advocated in the IED and possibly removing installations from the requirements of IED.

2. REDUCE VOCS IN INKS USING WATER BASED INKS

Water based inks are usually based on a co-solvent system that includes a water soluble VOC that acts as a "bridge" with the other non-aqueous constituents. They can be latex based and the technology allows for these inks to be used on a wide range of substrates. The level of VOC will vary depending on the type of water-based ink that is used.

Achieved environmental benefits: *A considerable reduction in the VOC content is obtained. Drying-in of screens is less likely to occur compared with conventional solvent based inks.*

The added benefits are that the use of water-based inks will reduce capital expenditure on abatement equipment, actively support the Solvent Reduction Scheme advocated in the IED and could remove installations from the requirements of IED.

3. REDUCE OVERALL VOC CLEANING EMISSIONS

High boiling point solvents have a slower rate of evaporation than lower boiling point solvents. The use of higher boiling point solvents will lower the VOC concentration in the working environment. These higher boiling point solvents can be effectively used in the cleaning processes.

Cleaning agents with a flashpoint of >40ºC: The evaporation speed of traditional solvents is significantly higher than the evaporation speed of solvents with a flashpoint of >40°C. Consequently, the evaporation during cleaning can be reduced by using medium flashpoint solvents. These solvents may be useful as an intermediate step when switching from volatile cleaning agents to less volatile cleaning agents.

Cleaning agents with a flashpoint of >55ºC: The evaporation speed of traditional solvents can be some 100 times higher than the evaporation speed of solvents with a flashpoint of >55ºC. Consequently, the evaporation during cleaning can be reduced dramatically by using high flashpoint solvents.

Achieved environmental benefits: *Reduction of VOC emissions to air depends on the situation at the start: changing from solvents with a flashpoint of <21ºC achieves a reduction of about 90%; changing from solvents with a flashpoint of 21-55ºC can result in a reduction of about 50%. Another advantage is that there is less risk of soil contamination. As less solvent evaporates, solvent consumption decreases.*

Operational data: High flashpoint solvents may not be as effective and efficient in cleaning as traditional solvents, but with experience, the results tend to become acceptable.

Cleaning with high flashpoint solvents will require more time, although with training and experience this time loss will be reduced to an acceptable level.

4. REDUCE OVERALL VOCS BY MANAGING EXPOSURE

Wherever VOC solvents are used, the following general measures and principles can be applied to ensure they are kept in airtight (or nearly airtight) containers and:

- **Provide an enclosure (for example using lid) of the sources of potential emissions**
- **Re-lid partly emptied drums or cans of solvent to prevent vapour losses**
- **Keep solvent containers away from sources of heat and draughts to minimise evaporation**
- **Store wastes containing solvents (for example contaminated wipes and solvent-based residues) in sealable containers**
- **Avoid excess material containing solvent being used, (for example plunger type solvent containers and the use of pre-impregnated wipes can be effective for cleaning small parts).**

Achieved environmental benefits: *Reduced amount of fugitive VOCs emitted to the air. In general this method of reducing VOCs is cheap to undertake but does require constant monitoring to ensure that the methodology is being followed.*

5. OTHER METHODS

It is highly unlikely the following techniques would to be required for screen or digital printing operations. As waste gas treatment is generally expensive to install and operate any of the methods given below should only be considered in the event that the previously described techniques do not produce the necessary reduction in VOCs to comply with the local legal requirements.

TECHNIQUES AVAILABLE:

The following are end-of-pipe techniques: oxidation, regenerative carbon adsorption, polymer adsorption, condensation at ambient temperature, refrigerated and cryogenic condensation and reed-bed biological treatment.

Recycling RE-USE Reduction Responsibility Sustainability Responsibility Recycling Reduction RE-USE Sustainability Recycling RE-USE

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ABOUT FESPA

FESPA is a global federation of 37 national associations for the screen printing, digital printing and textile printing community. Founded in 1962, FESPA organises the leading exhibitions and conferences for this community and reinvests profits from these activities into the global print community.

WWW.FESPA.COM

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