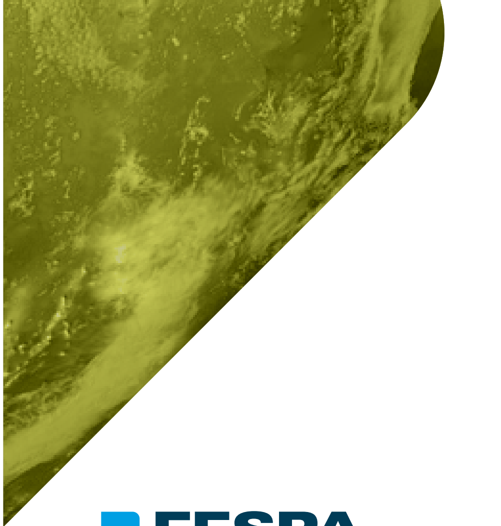
PLANET FRIENDLY GUIDE

FOR SCREEN PRINTERS

EMISSIONS TO WATER



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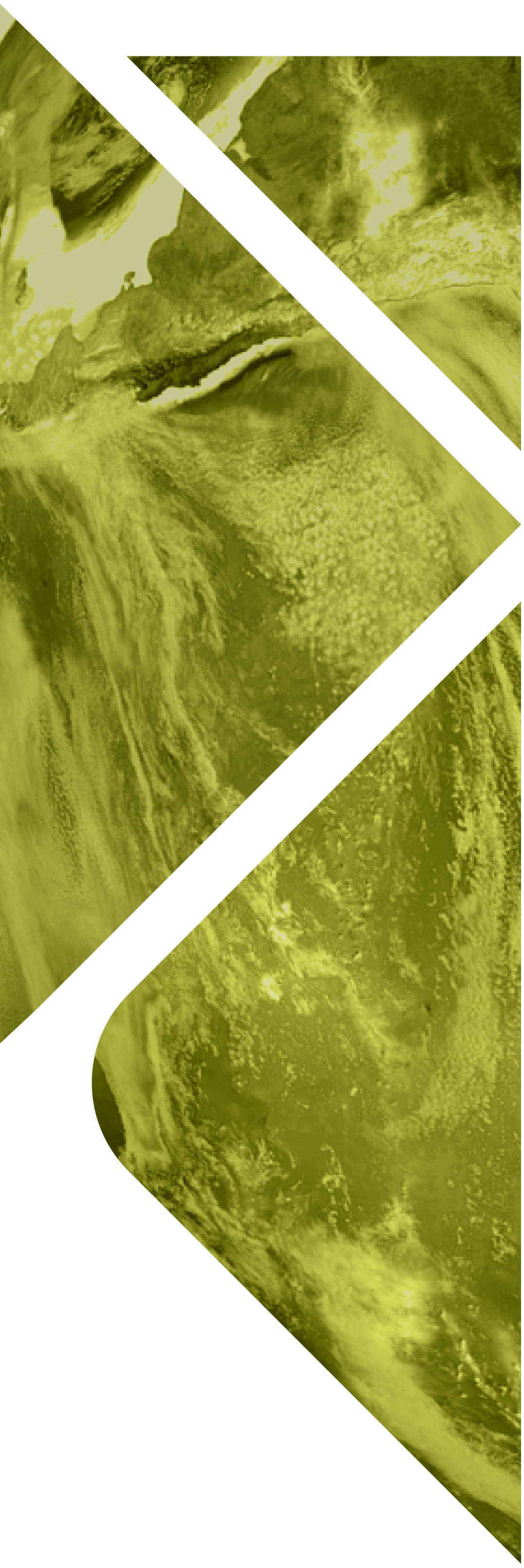


ABOUT THIS FESPA PLANET FRIENDLY SUMMARY GUIDE

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.

WATER

Water is not a commercial product like any other butrather it is a heritage which must be protected, defended and treated as such. Its availability may be low temporarily, owing, for instance to rainfall deficiency (drought), or low for a sustained period of time in which the demand for water exceeds the exploitable water resources (water scarcity). Water availability problems affect many regions in Europe and require combined action at EU level, and it is all the more necessary to take action given that sporadic or sustained water shortages are likely to persist due to climate change. The controls are usually placed in the hands of the local water provider and/or water treatment company. The actual limits specified will depend on localized conditions as well as individual EU Governments taking into consideration local topographical conditions. The control levels can vary substantially within a country and across Europe.

The liquid discharge from a printing plant comes mostly from the following activities:

- **Effluents from the photo-lab and pre-press (preparation of positives)**
- **Generation of screens including the rinsing of emulsions**
- **Cleaning of screens using solvents or water (aqueous systems in the textile print shops and printing with water based UV inks)**
- **De-coating of the screens**
- **Kitchens and toilets**
- **Surface water from roofs and yards**

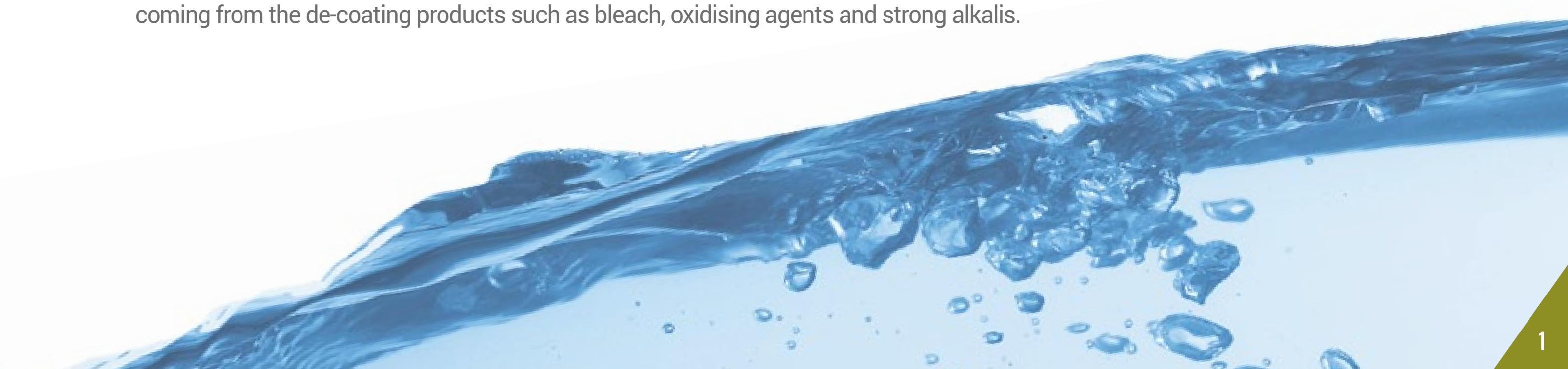
There are a number of chemicals used in the printing processes that have an adverse effect on the aquatic environment and these should be avoided or minimised wherever possible.

During the preparation of photographic positives silver salts as well as fixer and developer chemicals can be discharged. Silver and its compounds are strictly controlled under various EU Directives.

Rinsing emulsions; polyvinyl alcohol, polyvinyl acetate and acrylate based polymers present in the emulsions are highly biodegradable and are a major element for increasing the Biological Oxygen Demand/Chemical Oxygen Demand (BOD/COD). Limits on BOD/COD are often imposed by water treatment organisations. “Spotting out” filler is frequently based on polyvinyl alcohol and it has a similar effect. Acid stabilised diazonium salts are often used but these are present in extremely low concentrations.

Cleaning screens; the cleaner will typically contain aromatic hydrocarbons, alcohols and ketones. All these chemicals are highly biodegradable. Some of these chemicals are insoluble in water and cause problems to sewage workers. Water based screen printing inks are often more difficult to remove and more aggressive solvents are required. In exceptional circumstances chlorinated hydrocarbons are used. These are severe polluters to the aquatic environment. Some UV-based inks are cleaned using water and many of the constituents have a polluting effect on the discharge. Water from screen rinsing and reclaiming is often allowed to enter the sewage system without any agreement from the community or sewage treatment company.

De-coating screens: similar remarks to the above are applicable if the de-coating operation is not undertaken automatically and/or in a closed circuit. The water coming from de-coating and rinsing of the screens is often discharged into the main sewage system. This contains pollution in the form of particles (ink residue, polymerised emulsions, etc.) together with organic and inorganic pollution coming from the de-coating products such as bleach, oxidising agents and strong alkalis.

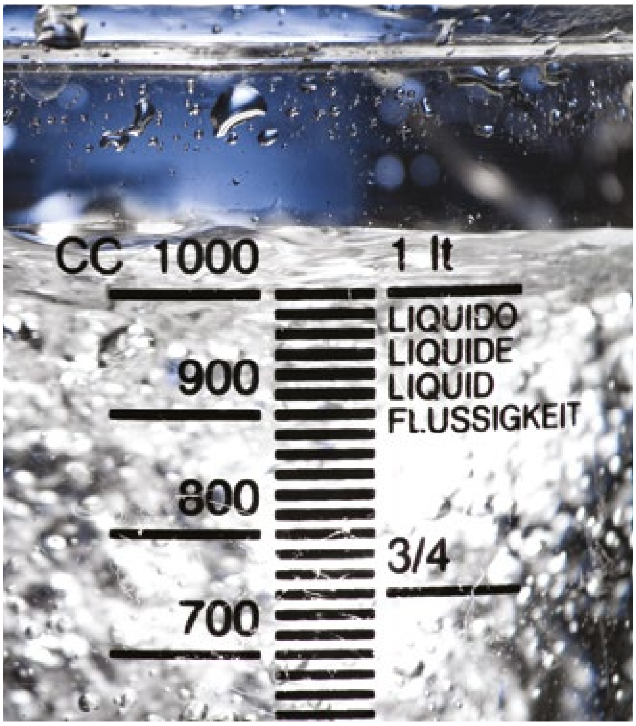


The supply and treatment of water can be undertaken by either public authorities or commercial enterprises.In either case it will be the designated public authority that will set the limits for any discharges from sanitary and refreshment facilities. Water supplied and waste water discharged to and from a printer are chargeable activities for which the printer must pay. As EU Directives impose stricter controls on the water that is allowed to be discharged to rivers and the sea so the charges will increase. It is therefore important that the printer understands the factors that will affect the total water cost. There are two significant factors that affect these costs. These are the volume of water consumed and the pollution treatment charge. In many countries it is necessary to segregate discharges of surface water (from roofs and outside areas such as yards) from waste or contaminated water (from toilets and production processes). To calculate the pollution charge, consideration is given to either the Chemical Oxygen Demand (COD) or the Biological Oxygen Demand (BOD) and the Suspended Solids (SS) found in the water discharged from the print premises.

Volume of Waste Water: The waste flow is proportionate to the volume of activity and the number of employees. It is possible to globally class the screen printing activities into 3 categories:

- **Small screen printing plant: 1 cubic metres per week**
- **Medium plant: 1 to 2 cubic metres per day**
- **Large plant 4: to 6 cubic metres per day**

Pollution charge: I This varies between 5 and 10 grams of COD per litre according to the work habits in the plant. The relation COD/BOD is in the order of 3. The SS varies generally between 200 – 500 mg/litre. The levels of COD, BOD and SS are compared against levels set by the water treatment plant. These levels can take into consideration the distance from the printing plant to the treatment plant and the biological loading on the effluent treatment plant. With the adoption of environmentally friendly work practices, this same pollution level can be reduced considerably.



The distribution of the flow is around 40% for emulsion rinsing (screen preparation) and 60% for the screen reclamation process (30% for screen cleaning and 30% for de-coating). Of course this data is not applicable for those plants having automatic closed circuit cleaning and de-coating machines in place. There are also discharges from toilet and washing facilities to take into consideration.

The characteristics of the effluent before disposal can contain components forming three main groups:

- **SS of a size greater than 10 nanometres (ink residues for example)**
- **Dissolved materials of less than a few nanometres, are generally cations and anions as well as organic components (diverse solvents and detergents)**
- **Sometimes sewage treatment organisations put a limit on the acidity/alkalinity (pH) of the discharge; it usually ranges from 6 to 8**

In some countries there is a legal requirement to obtain an authorisation from the sewage treatment plant to discharge industrially contaminated water to the sewer.

RESPONSIBILITY

The responsibility for ensuring that the printing plant has the appropriate authorisation to discharge effluent into the sewer lies with the owner or Chief Executive Officer of the business. Even if an authorisation is not required, there is a duty of care for ensuring that any effluent discharge does not exceed the limits imposed on certain chemicals covered by local and/or European wide legislation.

ACTION PLAN

• Determine whether an authorisation to discharge is required

• Ascertain the level of charges imposed by the water supplier/ treatment organisation

• Review the best available techniques (BAT) options for reducing the water consumption, discharge of contaminated water etc.

APPLICABLE EU DIRECTIVES AND REGULATIONS

Water discharges from printing sites can enter numerous water courses. Information on the controls on the emissions to water 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/water_protection_management/index_en.htm which is to be updated during the first semester of 2014 into the new EUR-Lex web-portal.

This web site will provide information on:

Water protection and management, pricing and long-term management of water, urban waste water treatment , environmental quality standards applicable to surface water, protection of groundwater against pollution, detergents, persistent organic pollutants (POPs) and the protection of the aquatic environment against discharges of dangerous substances.

BEST AVAILABLE TECHNIQUES

The suitability of the various BAT methods explained will be dependent upon the printing process that is being used and the production volume of the printing operation. The following could be used as methods to reduce emissions to water.

1. AVOIDANCE OF SILVER NITRATE ENTERING THE SEWAGE SYSTEM

• Silver treatment unit

During the photographic process silver nitrate can enter the sewage system and it is toxic to the aquatic environment. There are a variety of on-site silver recovery technologies available.

Silver recovery using metallic replacement is recommended for smaller printers. These cartridges are simple to use and maintain. Used cartridges must be sent to a silver refiner for further treatment and recovery of metallic silver.

Electrolytic silver recovery is the most efficient technique for removing silver from silver rich photographic solutions. The type of electrolytic recovery unit chosen depends on the solutions being treated and the daily volumes requiring treatment. Often, metallic replacement cartridges need to be used entailing electrolytic recovery equipment to ensure compliance with local sewer discharge limits. These units are more costly than simple metallic replacement cartridges and rather more complex to set up and operate effectively.

Achieved environmental benefits: *Removal of a toxic chemical. Recovered silver can be sold. The process involves capital expenditure as well as the purchase of fixers and developers.*

• Purchase positives from repro-labs

This avoids any in-plant environmental damage but does not resolve the total environmental issue as the supplier could have a problem.

Achieved environmental benefits: *Removal of a toxic chemical from site. No requirement to buy fixers and developers. There will be increased revenue cost and quality cannot be guaranteed.*

• Computer to screen

Removes the need for positive and therefore silver chemicals are not needed.

Achieved environmental benefits: *No use of toxic chemicals*

2. REDUCTION OF VOLUME OF WATER CONSUMED

• Sanitary controls Programmable discharge:

Considerable quantities of water are wasted because many systems supplying men's toilets discharge water when the cistern becomes full even though the urinals are not being used. This is particularly wasteful when the plant is not occupied. Sensors can be fitted that only activate the discharge of water whenever the urinal and hand washing facilities are being used. The latter facility can be used in female toilets.

Achieved environmental benefits: *A reduction in water usage; retro-fitting can involve costs and vandalism to the sensors can be a problem. It is better to fit such systems at the initial building stage or when a refurbishment is being undertaken.*

Waterless urinals:

There is no water consumption; low cleaning cost; no moving parts or flushing mechanism to go wrong; no water supply pipes; odour-free clean environment being bacteria free, due to absence of water; simple to retrofit as there is minimal maintenance with cartridge replacement.

Achieved environmental benefits: *A considerable reduction in water usage; easy retrofitting and improved environment makes this the preferred option. Does involve a continuing revenue cost as cartridges have to be replaced.*

• Recycle water during screen preparation.

Programmable discharge:

Considerable quantities of water are wasted because many systems supplying men's toilets discharge water when the cistern becomes full even though the urinals are not being used. This is particularly wasteful when the plant is not occupied. Sensors can be fitted that only activate the discharge of water whenever the urinal and hand washing facilities are being used. The latter facility can be used in female toilets.

Achieved environmental benefits: *A reduction in water usage; retro-fitting can involve costs and vandalism to the sensors can be a problem. It is better to fit such systems at the initial building stage or when a refurbishment is being undertaken.*

• Use of "grey" water:

It is possible by using certain foul water treatment (see later under end-of-pipe treatment) to use the "grey" water created by these methods within the toilet facilities of the printing plant.

Achieved environmental benefits: *This is the best environmental option, but it does require considerable investment and a technical understanding of the treatment process.*

• Bore hole:

Some printing plants can be sited above aquifers. Providing authorisation is given, the sinking of a bore hole can provide a cheap or in some cases free source of water. There is the outlay to access the aquifer; the cost of pumping the water to a header tank; filtration of the water and there is still the charge for treatment of any discharge to the sewage system. This option would involve considerable capital investment and would only be viable for a printing plant that consumed a large volume of water.

Achieved environmental benefits: *Large savings in the cost of supply. There are very limited opportunities for such an approach.*

3. MINIMISE ORGANIC SOLVENTS ENTERING THE SEWAGE SYSTEM

All organic solvents have a very high COD/BOD; some such as aromatic hydrocarbons can be banned from entering the sewage system by local authorities.

•Print shop housekeeping:

Remove as much of the remaining product from the screen as possible before sending the screen for reclamation. All inks, varnishes and adhesives have a high COD/BOD which can have an adverse impact upon the screen reclamation process.

Achieved environmental benefits: *Improvement in COD/BOD levels and as well as a lower usage of screen reclamation solvents. Unclean screens can have hardened coatings that require extra solvent and operator time to remove the residual deposits.*

• Separate reclaiming booths:

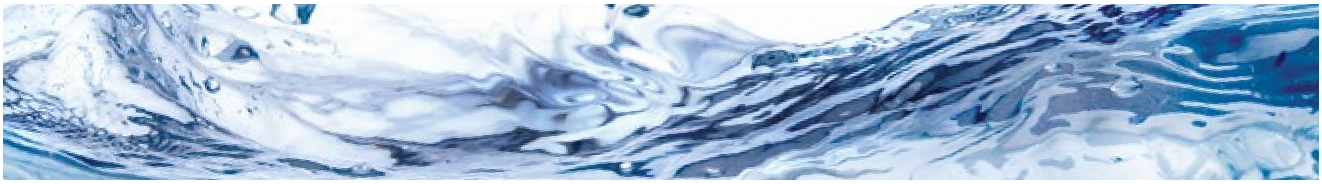
The initial booth is used only for the removal of any contaminant on the screen by means of a cleaning solvent prior to de-coating the stencil. The solvent is not permitted to enter the sewage system. This can be achieved by retaining the solvent in the bottom of booth, draining into a separate container or using a solvent recycling pump. The excess solvent on the screen is removed by means of a squeegee prior to transfer to the second booth.

Achieved environmental benefits: *Major reduction in COD/BOD levels, considerable savings in purchases of screen cleaning solvents. The savings in solvent purchases will fund any expenditure for the booth and/or recycling pump.*

•Automatic screen cleaning machine:

This method is suitable only for medium and large companies. These machines are programmable to accommodate a wide selection of screen sizes and types of inks used. They produce an excellent result when maintained and operated correctly. The solvent is retained within the system and does not enter the sewage system.

Achieved environmental benefits: *Considerable reduction in COD/BOD levels. There is a significant improvement in productivity. This type of equipment requires specialised solvent formulations, considerable capital expenditure and competent operatives.*



4. REDUCTION IN SUSPENDED SOLIDS (SS)

• Use of gravel trap

A pea gravel trap is fitted under the discharge point from the stencil removal booth. Some of the suspended solids generated from ink residues, polyvinyl acrylate and polyvinyl acetate resins and pigments from the photo-stencil emulsions are trapped. The water then passes into the sewage system.

Achieved environmental benefits: *Some reduction in SS is obtained. The equipment is cheap to purchase, install and operate. The gravel trap can easily become saturated without the operator being aware and thereby the system fails. Disposal of the contaminated pea gravel must subsequently be undertaken.*

• Flocculation treatment

The treated discharge is subsequently filtered, thereby removing the suspended solids. The filtrate can be discharged to the sewage system.

Achieved environmental benefits: *A measureable reduction in SS is obtained. The equipment is relatively cheap to purchase, install and operate. There is the necessary purchase of new flocculent. A substantial amount of materials from the filtration process require disposal.*

5. END-OF-PIPE TREATMENT PLANTS

• Reed Bed

The reed bed is an engineered method of treating pollutants using a biological planting containing typically the common reed, Phragmites australis. The reeds pass oxygen, absorbed by their leaf system, via their stems and rhizomes to their roots - the Rhizosphere. Polluted water passing around the roots is purified by the immense population of microorganisms living in the Rhizosphere.

Achieved environmental benefits: *Removes almost all the pollutants. This is an excellent natural and attractive method of treating industrial organic liquid wastes. It is extremely cheap to operate. It does require time for the reed bed to become acclimatized to the type of pollutant. There is a need for a sizeable area to set up the reed bed. The "grey" water produced can be reused in certain production areas. It will not tolerate wide fluctuations in the composition of the discharge.*

• Reverse osmosis

Reverse osmosis is a separation process that uses pressure to force a solution through a membrane that retains the solute or particles on one side and allows the pure liquid to pass to the other side. The membrane here is semi-permeable. The membranes used for reverse osmosis have a dense barrier layer in the polymer matrix where most separation occurs.

Achieved environmental benefits: *Removes almost all the pollutants. Water can be reused throughout the plant for industrial purposes and sanitation. The plant is expensive to purchase and requires technical support to operate. The membranes are expensive and can be adversely affected by certain solvents.*

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