BEST PRACTICE GUIDANCE DOCUMENT PRINTING AND PACKAGING SECTOR

1 INTRODUCTION

The Printing and Packaging sector has come under increasing pressure from customers and the government to reduce its impact on the environment. This has lead to increased costs for waste disposal and the necessity to comply with various licensing controls. This guide details the environmental issues experienced by the printing and packaging industry and describes best practice to improve environmental performance.

For the purpose of this guide, the printing and packaging sector covers various media, including:

- Paper and plastic bags
- Film
- Corrugated packaging
- Cartons
- Labels
- Magazines / brochures
- Newspapers
- Books
- Tapes

In order to make improvements, it is first necessary to assess current performance in relation to the main environmental issues. The current, most common environmental issues faced by the sector are listed as follows:

- Material Storage
- Waste (Process & Packaging)
- Effluent Discharge
- Solvent Usage
- Emissions to Atmosphere

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2 MATERIAL STORAGE

Printing and packaging companies typically store environmentally hazardous material for use on-site. The majority of sites in this sector do not have correct storage facilities for all materials which can lead to adverse environment impacts.

Materials use and storage should be in accordance with the relevant **Material Safety Data Sheet** (MSDS). Chemicals, oils, solvents etc should be stored in adequately bunded areas.

In addition to safe storage, it should be ensured that the loading, unloading and transfer of materials are carried out in designated areas protected against spillage and leachate run-off. Examples include:

- Have a designated, clearly marked area protected against spillage for **delivery** of hazardous materials e.g. this area should be bunded. All deliveries of hazardous materials should be supervised during loading or unloading. Ensure a contingency plan is in place; staff should be aware of steps to be taken in event of an accident.
- The **transfer** of hazardous materials around the site should be carried out on drum trolleys with a sump to prevent accidental spills.
- A **spill response kit** should be located on-site and staff should be trained in its proper use and disposal of spent absorbents.

It is important that correct handling and storage procedures are known to all employees and are followed at all times.

The correct storage of ink and other hazardous materials on-site:

- Reduces the risk of surface water / groundwater / soil contamination in the event of an accident;
- Eliminates costly clean-up in the event of an accident;
- Reduces negative exposure in the event of a spill;
- Incorporates best practice in the operation of the site.

3 WASTE

In order to incorporate Best Practice Waste Management into site operations, the **Waste Management Hierarchy** should be adopted i.e. in increasing order of preference:

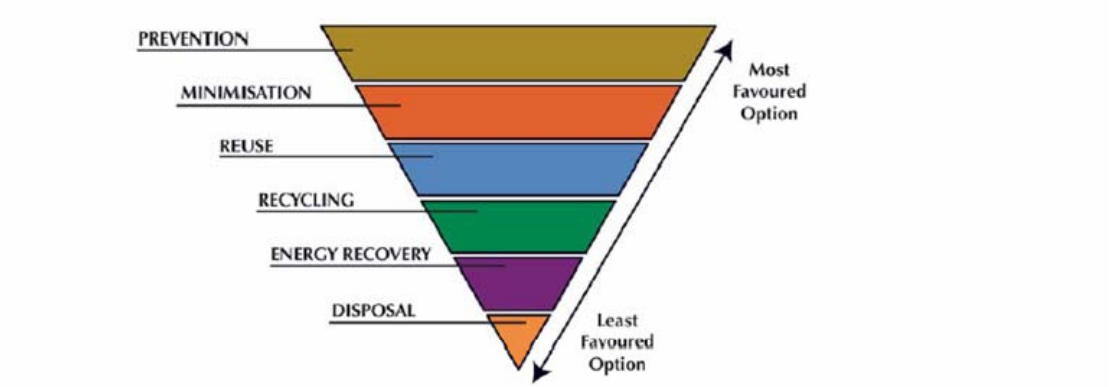


Figure 1 Waste Management Hierarchy

The major problem experienced by companies in this sector is lack of waste **segregation**. This hinders re-use and recycling and can often lead to the least-preferred option of disposal of large volumes of waste (including hazardous) to landfill. Good waste management practice requires the segregation of waste types into separate waste storage bins or storage areas (which may be labelled and colour-coded for ease-of-use by workers). Employees should receive training in correct segregation practices and regular site inspections should be undertaken to check that waste is being properly segregated.

3.1 Current Performance Measurement:

A company's **current performance** regarding its waste practices can be determined in various ways e.g.: make-ready waste is probably the largest area of waste; it can be measured using the following method:

- Quantify: Set up a special bin at the side of each press to collect spoilage.
- Analyse the loss from the job (weight or number of sheets). Calculate the percentage loss.
- Plot a graph to help trace losses (this should highlight a reduction over time).
- Record the reasons for losses.

It is also a useful exercise to evaluate waste management costs out of total expenditure.

3.2 Best Practice Management Options:

The main types of process waste generated include waste **substrate**, **ink and packaging waste**. Best practice management options to help avoid or reduce these waste types in various stages of the production process are discussed below.

3.2.1 SUBSTRATE

Estimating & Ordering:

- When ordering, specify metal reel cores instead of cardboard as these can reduce damage to reels.
- Consider doubling up jobs by printing two different jobs on one sheet to utilise the greatest area possible on the sheet.

Delivery & Storage:

- Check incoming substrate to ensure its quality and specification is correct; if not, return to supplier.
- Store pallets and reels singly, instead of on top of each other, to reduce the risk of damage when substrate is moved. Keep reel ends covered until press set-up to reduce damage and prevent deposition of dust.

Press Set-up & Make-ready:

- Ensure customers' requirements have been interpreted correctly to prevent generation of waste.
- Use lower quality substrate or spoiled sheets from previous press runs for the initial press set-up / make-ready.

Press Run:

- Monitor colour and ink density during printing to detect errors quickly.
- Train employees to operate the press correctly and correct errors without delay.

Cutting & Binding:

- Avoid cutting too many sheets at a time, as this can result in poor quality cuts and edges. Make operators aware of the maximum quantity of substrate that can be cut at a time
- Ensure blades, knives and dies are sharp to make clean cuts; implement a procedure to check regularly.
- Ensure that binding machines are lined up correctly and that sheets are loaded in the right order by including checking procedures at the binding stage.

3.2.2 INK

Printing **inks** are expensive and any opportunities to minimise waste ink can help save money. Waste ink is generated through colour changes, press cleaning and poor ink management, which allows drying and skinning. However, effective management techniques can help reduce waste ink. Don't treat excess ink as waste; instead, manage it like a product that should be reintroduced into the system when possible.

Estimating & Ordering:

- Help press operators accurately estimate the amount of ink needed for each job through training in ink estimating techniques.
- Keep accurate records of the quantity of ink that is used for specific jobs, particularly for re-orders or repeat customers.

Delivery & Storage:

- Keep ink containers sealed and contents level; place plastic or wax paper on top of the ink to prevent drying; use anti-skinning sprays (also useful on open ink wells on the printing machines). Always close lids after use.
- Carefully monitor inventory to ensure a "first in-first out" strategy.
- Ensure correct storage temperature to prolong the shelf-life of many inks.

Ink Mixing:

- Consider installation of a computerised ink mixing system.
- Otherwise, to reduce waste costs, try to identify a company with an ink mixing facility which would be willing to take left-over ink for recycling.

Press Set-up & Make-ready:

- Assess the feasibility of installation of digitised ink duct settings on presses.

Press Run:

- Use a standard ink sequence and try to schedule print runs from light to dark, if possible.
- Ensure a sufficient number of quality checks at the correct stages of the process, to identify earliest opportunity for remedial action if necessary.

Clean-down:

- Use anti-skinning measures on rollers to reduce the number of wash-downs required.
- Closed ink fonts reduce the degree of ink blocking and contamination, and hence the number of wash-downs needed.

3.2.3 INK RECYCLING:

- Scrape as much ink from empty containers as possible prior to disposal or recycling.
- Blend waste inks of different colours together to make black ink
- Donate off-spec ink to schools or give it to another printer rather than paying for disposal.

Another common waste stream generated by this sector is **cloth wipes** contaminated with potentially hazardous material e.g. ink / solvent. To reduce the quantity for disposal an option would be to send the wipes for laundering to a specialist laundry which would render them clean for use.

The maintenance of waste **records** is important to evaluate waste volume trends over time and track disposal/recycling routes to demonstrate compliance with legislation. The correct **storage** of waste should be integrated into good waste management practices. The following good practice is recommended:

- While awaiting disposal, all materials should be stored in designated areas protected against spillage and leachate run-off (i.e. bunded to contain any run-off / leachate)
- Skips / compactors should be covered to prevent build-up of contaminated leachate (i.e. rainwater mixed with skip contents). In addition, covered waste storage areas can help prevent the generation of **litter** on-site. The Litter Pollution Act, 1997 states that no litter should be visible on-site from a public area.

Staff training is important to ensure efficient environmental best practice on-site e.g. in relation to proper material storage and segregation of waste. Environmental training should be included in induction courses and reinforced with refresher programmes. The placing of signs in prominent locations is also a useful reminder for employees to adhere to good practices methods.

3.2.4 Packaging waste

One of the key concepts of the waste packaging regulations is a reduction in the amount of packaging placed on the Irish market. The regulations place additional environmental responsibility and cost on major producers. The more packaging placed on the Irish market the higher the annual cost of self-compliance or annual membership for REPAK. It is therefore in the interest of all producers of packaging material to reduce the amount of packaging material placed on the Irish Market. Some best practice guides to reduce producer responsibility costs associated with packaging are outlined in the table below:

Packaging reduction measures
1. At design stage of your product identify if packaging is always required? Discuss with your customers the minimum level of packaging acceptable to them, based on this information minimise the amount of packaging used.
2. Review product design in order to identify any areas for waste/packaging reductions; a. Is packaging always required? Is the current amount of packaging required? b. Review how many layers of packaging are needed to meet the required functionality of your product. c. Review how many raw materials associated with the packaging? d. Is your product designed to facilitate segregation, disassembly, recovery, reuse and recycling of the associated packaging by your customer or end user?
3. Where appropriate use returnable packaging rather than cardboard or plastic wrapping, Use reusable, returnable containers instead of one use disposal containers, and use bulk containers instead of portable containers.

3.3 Waste management/waste minimisation

In order to comply with waste related legal obligations and to reduce disposal costs, companies should establish a waste management programme.

Implementation of a waste management programme within your company
1. Appoint someone responsible for the implementation of a waste management programme within your company. This person should be responsible for the overall implementation and management of the programme, however the programme will not be successful unless each staff member is made aware and plays a role in the scheme. In addition waste management/waste minimisation should be a continuous objective of any environmental management programme in place.
2. Carry out an initial waste audit in order to establish the size of the problem and to establish the benchmark. This audit will quantify the types of packaging waste produced onsite and how much this is costing each year in terms of raw material consumption and disposal costs.
3. Identify and prioritise waste minimisation opportunities. Using the information obtained from the audit the company should identify ways to reduce waste produced on site. These opportunities may included using bulk containers rather that portable, use reusable, returnable containers instead of using one use disposal containers, asking suppliers to reduce or re-use packaging in the raw materials supplier to your company.
4. An action plan for the implementation of waste minimisation opportunities should be produced.
5. Provide facilities for the segregation of the specific waste types. Separate all waste materials at source to avoid contamination, Label all waste containers and provided clear instructions on their use. In addition, covered waste storage areas can help prevent the generation of **litter** on-site. The Litter Pollution Act, 1997 states that no litter should be visible on-site from a public area.

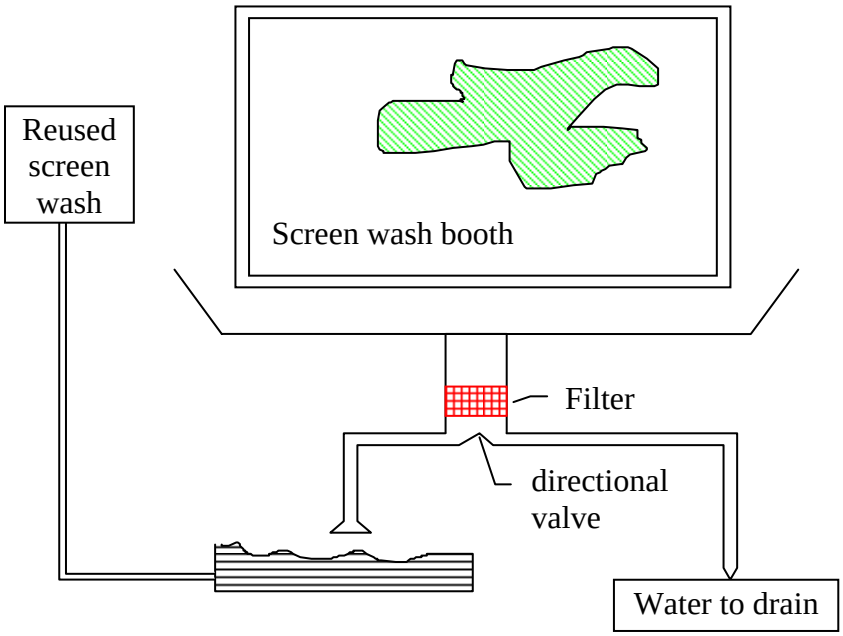
6. Ensure all waste collectors are authorised and have appropriate waste permits/licence. Copies of all waste permits/licences for contractors used should be requested and available on site. Retain copies of all waste collection documentation; this information will be required for the Annual Environmental Report for the EPA if the company is IPPC licensed and for the statistical returns report for Repak/Local Authority if the company is classified as a major producer.
7. Review progress regularly by carrying out internal audits. Waste management improvements and outcomes will be identified by subsequent audits; this information should be made available to all the company via notices boards etc. The action plan and objectives should also be reviewed and updated regularly.

4 EFFLUENT DISCHARGE

The main method of generating trade effluent by this sector is during cleaning i.e. washdown of equipment, rollers, screens, plates, etc. The following examples of Best Practice Effluent Reduction Techniques are recommended to minimise / reduce effluent generated on-site:

- Prevent or minimise washdown by covering inkwells and applying an anti-drying adhesive to rollers.
- Dry scrape as much ink as possible before washing.
- Use high-pressure jet washers for cleaning; they generally use less water than hand-held brushes or low-pressure sprays. Water may then be filtered through a filter pad for re-use.
- Use dip tanks for water-based screen cleaning; screens can be left to soak in the tanks and materials are used for relatively long periods until exhausted. (The use of organic solvents in dip tanks is not recommended because of the risk of fire).
- Rinse plates by using multiple counter-current rinse tanks.
- Install a re-circulation unit to recover wash-up solvent for re-use. A closed loop system with a solvent-recovery unit or a suitable settlement tank may be used.
- In some cases, ask the supplier to deliver black ink with 10% reduced water content. Wastewater may be added to black ink with no effect on the colour quality of the ink (run trials to determine if suitable).
- Eliminate solvents entering drains via screen washing. A specially adapted booth (see diagram) for cleaning screens and recycling the screen wash may be installed on-site. The machine will be connected to the main sewer outlet but this should only be used when non-solvent based materials are used i.e. water. The diagram below shows an outline of the recommended method. These machines are in situ at many screen printing facilities through the country and have proved a great benefit.

Skips / compactors should be covered to prevent build-up of contaminated leachate (i.e. rainwater mixed with skip contents).



Examples of other practices for effluent management include:

- Recover silver from photo processing waste. Silver is a valuable natural resource of finite supply, it has monetary value as a recovered commodity, and its release into the environment is strictly regulated.
- Use less hazardous alternatives for cleaning e.g. water-based cleaner should be used instead of solvent when suitable.

5 SOLVENT USAGE

5.1 Effects of Solvent Use

Volatile Organic Compounds (VOCs) are emitted from solvent-based ink and materials used by the printing and packaging sector. Not managed properly VOCs can be dangerous. These **risks** include:

- Environment: Use less hazardous alternatives for cleaning e.g. water-based cleaner should be used instead of solvent when suitable. The effects of VOC emissions to atmosphere from this sector are considered a significant issue (survey findings Section 3). In the presence of sunlight and Nitrogen Oxides (NOx), VOCs react to form ground-level ozone, a component of smog. Ozone is very toxic and it affects breathing and the eyes. (In the higher atmosphere, it is beneficial, forming a protective ozone layer). Smog has wide-ranging effects. This brown haze has the greatest impact on the air quality in urban areas. It can corrode buildings and machinery. Crops and leaves are damaged, and growth is reduced. Susceptibility to insects and disease increases. Smog also accelerates the deterioration of rubber products. Emissions from VOCs can also be responsible for odour pollution which can cause public complaints, bad publicity and the possibility of breach of legislation.
- Health risks: Many VOCs act as irritants or carcinogens.
- Financial: Most solvents are very expensive to buy and to dispose of as they are generally classified as hazardous waste.

- Benefits of Reducing Solvent Use: A reduction of solvent use has significant **advantages** for companies; these include both economic and environmental improvements e.g.:

Benefits of Reducing Solvent Use
1. Cost benefits through reduced purchasing costs and waste disposal charges
2. Reducing solvent use to below the thresholds for Licensing requirements (EPA Acts 1992 to 2003 and the Solvent Regulations)
3. Reduced insurance premiums due to lower solvent stock on-site
4. Safer working environment for employees & reduced potential for spillages

5.2 Measurement of Solvent Use

Current solvent usage should be measured to provide a baseline from which the solvent consumption figure should be reduced. Estimate the solvent inputs and outputs to track solvent usage i.e. inputs include purchases and stock on-site, and outputs consist of emissions to atmosphere, discharges to water and waste. Areas of loss can be highlighted and an action plan can be established to target areas of solvent reduction.

In order to make employees more aware of the potential extent of solvent wastage, the following demonstration can be used:

- Place a full container or drum of solvent on a floor scales in the middle of the production area.
- Record the initial weight.
- Then open the lid and record the decrease in weight at intervals over a specific period of time e.g. a week.
- The results can be used as a training exercise to increase employee awareness re solvent use and reduction.

5.3 Best Practice Solvent Management Techniques

The following examples of **Best Practice Solvent Management Techniques** are suggested to reduce solvent use:

Best Practice Solvent Management Techniques	
Substitution	•Consider a switchover from solvent-based ink to a water-based, vegetable oil-based or UV curing ink. The solvent content of water-based inks is approximately 10% - 15%, and UV ink is solvent-free. This particular feature of UV ink is regarded as one of its leading benefits. In addition, less solvent is used for wash-ups of UV inks due to their non-drying properties while on the press. •Reduced solvent or solvent-free adhesives are also available e.g. water-based or PU (Polyurethane) glue.
***Dispensing*:**	•Promote the use of squeezy bottles to dispense chemicals. These concentrate on the area being applied to and so less chemical is used, less solvent evaporates and waste chemical is reduced. •Use plunger cans to moisten cloth wipes to minimise evaporation of solvents. •Ensure containers / tanks of solvent are painted in light, reflective colours to minimise heating and evaporation. •Examine machinery, valves, pumps, etc. regularly to make sure that bolts are tight and that there are no obvious leaks. •Consider machine closures of areas of solvent evaporation. •Reduced solvent or solvent-free adhesives are also available e.g. water-based or PU (Polyurethane) glue. •Use protective films to prevent solvent ink drying out. •Always close containers which have their cap removed. •Use an ink stock controller to manage the amount of ink / solvent usage and reduce the risk of over-use. •Use a computerised ink mixing system to reduce the risk of overestimating quantities required.
Cleaning	•Pour solvent over equipment and then wipe clean with a rag. Solvent collected in drip pans under the equipment becomes waste solvent which can be reused. Use one container of solvent for each colour printing unit, solvents can then be reused without contaminating the inks. Used solvent can be reused in cleaning most ink from rollers and blankets, with only a small amount of fresh solvent needed for the final clean-up. In some cases, used solvents having one particular ink colour can be used to make up the solvent content of new inks of the same colour. •Ensure that the lid of a cleaning tank is closed to reduce solvent emissions. This could be achieved by fitting a spring/ valve that would slowly close the lid. This would eliminate the need for employees to close the lid which can be overlooked. •Reduce the size of cloth wipes used on-site for more efficient use and to reduce solvent use
Screen Cleaning:	•Use a dry cloth to clean excess ink off the screen before using solvent. •Reduce solvent evaporation by storing solvent-wet cloths between use in a re-sealable container •Use spray bottles to dispense solvent onto screens for cleaning •Clean screens promptly, as soon as print run is finished. If ink dries on the screen, cleaning is more difficult, hence more solvent would be required. •Instead of a hand-held brush which can be inefficient, use a pumped brush or high-pressure spray to clean screens.
Training	•Write procedures for each process that involves the handling or use of solvents, to emphasise ways of minimising solvent loss through splashing, over use, poor housekeeping, etc.

5.4 Solvent Recovery Technology

Recovered solvent can be re-used in the process as a thinner / cleaner or sold externally e.g. to a specialist recovery / recycling company or an ink manufacturer for recycling. There are three main technologies for the capture, recovery and subsequent re-use of solvents in industry i.e.:

Adsorption:

- Solvents are readily adsorbed onto activated carbon or other adsorbents.
- Extensively used; particularly practical for intermittent solvent sources.
- Desorption (recovery) can be carried out using steam, a hot inert gas such as nitrogen, or under vacuum.

Condensation:

- Uses coolant/refrigerant technology.
- Previously used for preliminary recovery units, currently used as a stand-alone option.

Absorption:

- Scrubbing.
- Takes place in columns.

5.5 Alternatives to Solvent-based Inks

Alternatives exist for solvent-based ink i.e.:

- Water-based ink
- UV ink
- Mineral / vegetable oil-based ink

5.5.1 Water-based Ink:

Water-based inks contain organic pigments, resins, and additives and can be used on a variety of substrates. Their best application is in flexographic printing on paper, but they are also recommended for some types of gravure printing. Both low-solvent (typically 10 – 15%) and 100% water-based inks are available.

5.5.2 UV Ink:

Radiation-curable inks include UV ink and electron beam ink. They consist of one or more monomers and oligomers that polymerize on exposure to radiation. They generally contain no solvent and are particularly recommended for some applications in lithography and letterpress.

UV inks are used primarily for printing on plastic, vinyl, metal, and paper. They contain no volatile organic compounds (VOCs) and they will not dry on a press or in the screen, which reduces the need for cleaning solvents.

It is noted that the use of UV ink involves some health and safety issues i.e. some contain acrylates which are skin irritants and potential skin sensitisers. However, appropriate training and safe systems of work should combat any health and safety effects and provide the benefit of improving environmental performance.

5.5.3 Vegetable Oil-based Ink:

Vegetable oil-based inks contain vegetable oils as a replacement for some or all of the petroleum oil in lithographic inks. They are available for heatset and non-heatset web presses and for sheetfed presses and generally require no equipment changes. Many vegetable inks are soy-based. Newspaper inks can contain high vegetable oil content due to the absorbency of newspaper.

Advantages of soya ink include:

- Soya oil is clearer than petroleum or linseed oils; hence soya ink may provide better print quality and brighter colours. Also, some printers claim that soy ink pick-up and transfer is quicker, resulting in shorter start-ups and less waste.
- Soya inks are less likely to build up on the plate, have fewer tendencies to skin over, and have greater stability, provide greater coverage.

In summary, many of the environmental problems of the printing and packaging sector can be resolved by use of alternatives to solvent-based inks i.e. less solvent use leads to:

- Improved material storage; less risk of hazardous spillage
- Reduced costs for disposal of waste solvents
- Potential avoidance of solvent licensing requirements

<<<For further information on solvent use reduction see Enterprise Ireland Best Practice Guide No. BPGCS001 Good Housekeeping Measures for Solvents>>

6 EMISSIONS TO ATMOSPHERE

6.1 Introduction

The control of VOCs emissions from printing facilities is important because of the recently implemented Solvents Directive, which controls the emissions of VOCs. This section provides information on the air abatement technologies available to treat VOC laden air from the printing and packaging sectors. The installation of appropriate abatement technology will allow companies to reach point and fugitive emission limit values as defined by Schedule 2 of the Solvents Regulations.

For a complete list of activities that are required to comply with the solvents regulations and the thresholds and emission limits that apply please refer to Schedule one and Schedule two of the regulations <<link to SI 543 of 2002>>. For companies, which are required to operate within the conditions of an integrated pollution licence issued by the Environmental Protection Agency, the requirements of the solvents directive will be incorporated into this licence.

The control of the air pollutant emissions from an industry can be achieved by

- Prevention and minimising the pollutant generation i.e. using alternatives to solvent based paints (as discussed in section 5 **<<link to section 5>>**).
- Installation of control equipment

6.2 Abatement technology available

While minimisation will reduce the volume of gas, which will require treatment, some form of air pollution control device may be required to reduce emissions below the emission limit values. A selection of control technologies available for the treatment of VOCs are listed below followed by a brief description of each technology.

- Adsorption
- Incineration
- Condensation
- Scrubbing Systems
- Biological treatment

6.2.1 Adsorption

Adsorption is used commonly for solvent recovery; with granular activated carbon and zeolite polymers the most commonly used adsorbents. During adsorption the solvent laded gas stream is directed to an adsorption bed where the VOCs are captured in the bed and removed from the air stream. The treated air is then directed to the atmosphere. Regeneration of the adsorption bed and solvent recovery can be achieved by using steam, which is passed over the saturated adsorption bed, and the VOCs are released from the bed.

6.2.2 Incineration

Incineration or combustion is widely used to destroy VOC's. The VOC's are oxidised to usually CO_2 and water at high temperatures within an oxidation chamber. This is usually preceded with an adsorption step prior to the incineration to concentrate the airflow. This increases the efficiency of the oxidation and reduces the auxiliary fuel requirements. The two most common methods of oxidation are thermal oxidation or catalytic oxidation. Thermal Oxidation destroy VOCs at very high temperatures i.e. >1400F whereas Catalytic oxidation use a catalyst in the oxidation process and therefore can operate at lower temperatures (600-900F).

6.2.3 Condensation

Condensation is most commonly used for high concentrated VOC streams. An example of condensation system is called cryogenic condensation, which uses liquid nitrogen in a heat exchanger to cool down the process gas. As the temperature drops so to does the capacity of the gas to carry the VOCs as vapour. The VOCs condense and freeze into particles, which are removed by filters.

6.2.4 Scrubbing Systems

In scrubbing technologies the contaminated air stream is exposed to a liquid solvent in a specially designed scrubber to induce the absorption of VOC's. This can take place in a tower designed to provide the liquid and VOCs the contact area needed for absorption. Packed bed is an example of a scrubbing system.

6.2.5 Biological treatment

Biological treatment is the capture and conversion of VOCs by microorganisms into biomass, CO_2 and water. Solvent laded air is passed through a bio-filter/bioreactor or bioscrubber where microbes remove the solvent. Biological treatment operations are dependent on temperature and humidity conditions.
Appropriate conditions are required:

- Temperature
- High moisture content
- High oxygen content
- Nutrient supply
- Neutral pH
- Absent of toxic compounds

Biofilters

The principle operation of a biofilter is that a contaminated gas stream passes through a packed bed containing microorganisims. These microorganisims degrade the contaminants in the gas stream.

a) Bioreactors

Bioreactors are designed to maintain the best conditions for the microorganism to effectively breakdown solvents to carbon dioxide and water

b) Bioscrubbers

Organics are dissolved in water and then biodegraded by microorganisms producing carbon dioxide and water.

6.3 Considerations when choosing an air pollution device:

The chosen abatement device is dependent upon a number of factors, which should be taken into consideration when choosing the most appropriate device for your company. Before choosing an air pollution device your company must first characterise the air emissions and carry out air dispersion modelling if necessary.

The following considerations should become part of feasibility study for choosing any abatement technology

- The characteristics/ nature of the air steam
- The properties of the solvents used (available from the MSDS)
- Process characteristics
- Airflow characteristics
- Potential for using the recovered solvent
- Solvent costs
- Installation and operational costs
- Space constraints
- Emission limit values

6.3.1 Nature of the Air stream

- *Temperature* of the gas stream: the temperature of the gases to be treated plays a role in the choice of abatement option or may require the need for pre-treatment. Gas streams with high temperatures may be unsuitable for biofilters or carbon adsorption. High temperature waste streams also reduce the costs for incineration.
- *Humidity*: The moisture content of the gas will also influence the choice for abatement device. Gas streams with high moisture content might be very suitable for biological treatment and would reduce the costs of irrigation. However high moisture contents are unsuitable for carbon adsorption.
- *Volume flow and concentration*: will also affect the choices of abatement technology, low volume, high concentration waste streams can be effectively treated by incineration.
- The presence of toxic substances makes a gas unsuitable for biological treatment.

In addition to the above factors environmental, economic and engineers factors also must be taken into consideration.

Environmental factors: selections of suitable location, space constraints on site, existing ambient conditions, the required ELVs imposed by an IPPC licence, visual intrusion of the device, planning permission, the introduction of an additional noise source.
Economic factors: Capital costs, Operating and maintenance costs, the expected lifetime of the equipment.

STEPS IN CHOOSING BEST ABATEMENT OPTION
1. Identify and characterise the gas stream
2. Establish acceptable limits for the pollutants in your waste gas referring to ELV's or results of Air dispersion modelling [1].
3. Identify suppliers and obtain quotations. Calculate the costs and benefits and disadvantages of each option.
4. Short list possible options that are most suitable and meet the required criteria

[1] A dispersion model attempts to predict how emissions to atmosphere are transported downwind and dispersed under the influence of atmospheric conditions. Modelling assesses the impact of emissions to the atmospheres on public health and environmental and indicates the amount of abatement required.

7 ENVIRONMENTAL LEGAL REQUIREMENTS

7.1 Introduction

This section outlines the main types of legal requirements applicable to print and packaging activities. The main types of items of legal requirements are:

Licensing and Legal Requirements
EPA (Licensing) Regulations, 1994-2004, EPA Acts 1992-2003 (IPPC Licence)
Emissions of Volatile Organic Compounds from Organic Solvents Regulations, 2002 (Certificate of Compliance)
Water Pollution Act 1977/'90 (Trade Effluent Discharge Licence)
Waste Management Act 1996-2003
Waste Packaging Regulations 2003 (Register with Local Authority or join compliance scheme –REPAK)

7.2 Licensing requirements

7.2.1 IPPC Licence under EPA Acts 1992-2003 and EPA (Licensing) Regulations, 1994-2004.

Many companies in the printing and packaging sector require an IPPC Licence as they fall into the following class of activity under the Regulations:

> *"The use of coating materials in processes with the capacity to use at least 10 tonnes per year of organic solvents."*

Organic solvents are present in solvent-based ink and other solvent-based materials. The requirement for a licence can be evaluated by obtaining purchasing records and examining MSDSs or contacting suppliers to determine the annual use of organic solvents. If deemed necessary, an application is forwarded to the EPA, a Proposed Determination Licence made available and then the final IPPC Licence is granted. The licensee must comply with various conditions and monitoring schedules, to ensure the site is operating without causing adverse environmental effects. It also allows for continuous improvement through an Environmental Management Programme which can set objectives such as solvent-use reduction. If a company is close to the annual 10 tonne threshold of solvent consumption, it is recommended that solvent usage is tracked accurately on an annual basis. To avoid the necessity to obtain a licence, consider solvent reduction techniques (see Section 8 for examples).

7.2.2 Certificate of Compliance under Emissions of VOCs from Organic Solvents Regulations, 2002 (also known as the Solvent Regulations)

Under these Regulations, the threshold of organic solvents to be used in various types of operations in this sector is specified. If a company is above the threshold and is obliged to comply with the Regulations the following applies:

- Register with the Local Authority.
- Operate in accordance with a Certificate of Compliance issued by the Local Authority.

- A Certificate of Compliance is issued on the basis of an annual inspection and report by an Accredited Inspection Contractor. Compliance may be by either:
    - Use of a reduction scheme specified in Schedule 3.
    - Meeting Emissions Limit Values (ELVs), fugitive emissions values or total emissions values specified in Schedule 1.

- If intending to comply via a reduction scheme, the company must:
    - Register by 31 Oct. 2005
    - Comply with target emissions no later than 31 Oct 2007 (target emissions x 1.5 by 31 Oct. 2005)
- If intending to comply via ELVs etc, the company must:
    - Register by 31 Oct. 2007
    - Comply no later than 31 Oct. 2007

Solvent reduction techniques (see Section 8) can be employed to attempt to avoid the obligation of compliance with this licensing requirement.

For further information see the EPA's Solvents Information website

7.2.3 Trade Effluent Discharge Licence under Water Pollution Act 1977/'90 (Trade Effluent Discharge Licence also referred to as a Consent to Discharge)

Under this legislation, a company which discharges trade effluent must hold a Trade Effluent Discharge Licence (trade effluent is defined in Section 6). Companies which require such a Licence must apply to the Local Authority, providing details of the effluent composition and volume. If a licence is granted, it will specify several conditions such as parameters to be monitored and their frequency, inspection requirements, storage details (including capacities) for hazardous materials, etc. An option to prevent the requirement for a Licence would be to stop the discharge to the effluent and store in containers for removal off-site by a suitable contractor.

7.3 Producer Responsibility for Packaging

7.3.1 Waste Management (Packaging) Regulations 2003 as amended by Waste Management (Packaging) Amendment Regulations 2004.

The Packaging Regulations places obligations on all producers who place packaging on the Irish market. Producers now must segregate specified waste materials arising on the premises and have it collected by an authorised waste operator for recycling. The specified packaging materials that must now be recycled are: glass, cardboard, paper, steel, aluminium, plastic sheeting and wood. No longer can these waste types go to landfill. The overall aim of these regulations is the elimination of packaging waste been disposed off to landfill.

Additional obligations are placed upon what the regulations define as **major producers** of packaging waste i.e. businesses that supply more that 25 tonnes of packaging in the Irish Market per annum and have a turnover of €1 million. Major producers have additional obligations under the regulations to either join the compliance scheme provided by REPAK, or register for Self-compliance with the relevant Local Authority.

- **Self compliance**

A major producer can decide to go down the self compliance route by registering with the relevant local authority. A number of obligations are placed on major producers as part of the self compliance scheme. The main obligations are summarised below:

- Provide facilities at each premise for the acceptance, segregation and storage of packaging waste.
- Registration fees are payable to local authorities by major producers not affiliated to the Repak scheme. The registration fees are associated with the amount of packaging placed on the Irish market, therefore it is in the interest of the producer to reduce the amount of packaging placed on the market thereby reduce the amount of costs.
- Major producers not affiliated to Repak are required to report regularly to the local authority.
- Signage is required on the premises notify customers that the producer accepts/takes back packaging waste on site.

- **Repak Membership**

Major Producers have the option of joining the approved compliance scheme provided by REPAK. Repak membership means exemptions from accepting or collecting back packaging wastes on site. The annual membership fee associated with REPAK is dependent on the amount and type of packaging waste placed on the Irish Market as well as the producer's role (retailer, manufacturing etc).

For further information on REPAK membership see www.repak.ie

7.3.2 Designing Packaging to Improve Environmental Performance and reduce recovery costs.

The key concept of packaging legislation in Ireland is the reduction/elimination of packaging wastes at source. This means that the reduction of packaging waste should be incorporated into the design stages of the packaging. The aim is too eliminate where possible or minimise the waste arising at all stages of the packaging lifecycle. The greater the environmental impact of the packaging the higher the costs. This is designed to motivate packaging producers to design packaging with improved environmental performance.

<<Link to: Best Practice Guidance document: Reducing Environmental Impact of Products; www.envirocentre.ie >>

7.4 Waste Management Act 1996 -2003

The Waste Management Act, 1996 sets out the responsibilities and functions of various persons in relation to waste. This Act provides the framework for the implementation of all waste regulations in Ireland and was recently amended by the Protection of the Environment Bill 2003. The provisions of the Act are intended to facilitate the practical implementation of the waste hierarchy.

The main objectives of the Act are to:

- Prohibits any person from holding, transporting, recovering or disposing of waste in a manner, which causes or is likely to cause environmental pollution

- Requires any person who carries on activities of an agricultural, commercial or industrial nature to take all such reasonable steps as are necessary to prevent or minimise the production of waste
- Prohibits the transfer of waste to any person other than an authorised person.
- Provides for substantial penalties for offences including fines and/or imprisonment and/or liability for clean-up measures.

8 FURTHER INFORMATION

www.envirocentre.ie
http://www.epa.ie/TechnicalGuidanceandAdvice/SolventRegulations/
www.irishstatutebook.ie
www.repak.ie