BAT Guidance Note on Best Available Techniques for Solvent Use in Coating, Cleaning and Degreasing

(1st Edition)

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1. INTRODUCTION

1.1 GENERAL

This Guidance Note is one of a series issued by the Environmental Protection Agency (EPA) which provide guidance on the determination of Best Available Techniques (BAT) in relation to:

- applicants seeking Integrated Pollution Prevention and Control (IPPC) licences under Part IV of the Environmental Protection Agency Acts 1992 to 2007,
- existing Integrated Pollution Prevention and Control (IPPC) Licensees, whose licence is to be reviewed under the Environmental Protection Agency Acts 1992 to 2007,
- applicants seeking Waste Licenses under Part V of the Waste Management Acts 1996 to 2008,
- existing Waste Licensees, whose licence is to be reviewed under the Waste Management Acts 1996 to 2008.

This Guidance Note shall not be construed as negating the installation/facility statutory obligations or requirements under any other enactments or regulations.

1.2 BAT GUIDANCE NOTE STRUCTURE

This Guidance Note has been structured as follows:

Section	Details
1	Introduction
2	Interpretation of BAT
3	Sector covered by this Guidance Note
4	Process Description, Risk to the Environment, and Control Techniques
5	Best Available Techniques for the Solvents Use Sector
6	BAT Associated Emission Levels
7	Compliance Monitoring

Where relevant, references are made to other detailed guidance, such as the *Guidance Note for Noise in Relation to Scheduled Activities*, and the determination of BAT should be made giving regard to these.

The information contained in this Guidance Note is intended for use as a tool to assist in determining BAT for the industrial activities of solvent use in coating, cleaning and degreasing.

2. INTERPRETATION OF BAT

2.1 STATUS OF THIS GUIDANCE NOTE

This Guidance Note will be periodically reviewed and updated as required to reflect any changes in legislation and in order to incorporate technological advances as they arise.

Techniques identified in these Guidance Notes are considered to be current best

practice at the time of writing. The EPA encourages the development and introduction of new and innovative technologies and techniques which meet BAT criteria and look for continuous improvement in the overall environmental performance of the sector's activities as part of sustainable development.

2.2 INTERPRETATION OF BAT

The concept of BAT was introduced as a key principle in the IPPC Directive 96/61/EC. This Directive has been incorporated into Irish law via the Protection of the Environment Act 2003. To meet the requirements of this Directive, relevant Sections of the Environmental Protection Agency Act 1992 and the Waste Management Act 1996 have been amended to replace BATNEEC (Best Available Technology not Entailing Excessive Costs) with BAT.

Best available techniques (BAT) is defined in Section 5 of the Environmental Protection Agency Acts, 1992 to 2007, and Section 5(2) of the Waste Management Acts 1996 to 2008, as the "most effective and advanced stage in the development of an activity and its methods of operation, which indicate the practical suitability of particular techniques for providing, in principle, the basis for emission limit values designed to prevent or eliminate or, where that is not practicable, generally to reduce an emission and its impact on the environment as a whole", where:

B ***'best'*** in relation to techniques, means the most effective in achieving a high general level of protection of the environment as a whole

A ***'available techniques'*** means those techniques developed on a scale which allows implementation in the relevant class of activity under economically and technically viable conditions, taking into consideration the costs and advantages, whether or not the techniques are used or produced within the State, as long as they are reasonably accessible to the person carrying on the activity

T ***'techniques'*** includes both the technology used and the way in which the installation is designed, built, managed, maintained, operated and decommissioned.

The range of BAT associated emission levels values specified in Section 6 indicate those that are achievable through the use of a combination of the process techniques and abatement technologies specified as BAT in Section 5. The licensee must demonstrate to the satisfaction of the Agency, during the licensing process, that the installation/facility will be operated in such a way that all the appropriate preventative measures are taken against pollution through the application of BAT and justify the application of other than the most stringent ELV in the range.

At the installation/facility level, the most appropriate techniques will depend on local factors. A local assessment of the costs and benefits of the available options may be needed to establish the best option. The choice may be justified on:

- the technical characteristics of the installation/facility;
- its geographical location;
- local environmental considerations;
- the economic and technical viability of upgrading the existing installation.

The overall objective of ensuring a high level of protection for the environment as a whole will often involve making a judgment between different types of environmental impact, and these judgments will often be influenced by local

considerations. On the other hand, the obligation to ensure a high level of environmental protection including the minimisation of long-distance or transboundary pollution implies that the most appropriate techniques cannot be set on the basis of purely local considerations.

The guidance issued in this Note in respect of the use of any technology, technique or standard does not preclude the use of any other similar technology, technique or standard that may achieve the required emission standards and is demonstrated to the Agency to satisfy the requirement of BAT.

2.3 BAT HIERARCHY

In the identification of BAT, emphasis is placed on pollution prevention techniques rather than end-of-pipe treatment.

The IPPC Directive 96/61/EC and the Environmental Protection Agency Acts 1992 to 2007 (Section 5(3)), require the determination of BAT to consider in particular the following, giving regard to the likely costs and advantages of measures and to the principles of precaution and prevention:

(i) the use of low-waste technology,

(ii) the use of less hazardous substances,

(iii) the furthering of recovery and recycling of substances generated and used in the process and of waste, where appropriate,

(iv) comparable processes, installations or methods of operation, which have been tried with success on an industrial scale,

(v) technological advances and changes in scientific knowledge and understanding,

(vi) the nature, effects and volume of the emissions concerned,

(vii) the commissioning dates for new or existing activities,

(viii) the length of time needed to introduce the best available techniques,

(ix) the consumption and nature of raw materials (including water) used in the process and their energy efficiency,

(x) the need to prevent or reduce to a minimum the overall impact of the emissions on the environment and the risks to it,

(xi) the need to prevent accidents and to minimise the consequences for the environment, and

(xii) the information published by the Commission of the European Communities pursuant to any exchange of information between Member States and the industries concerned on best available techniques, associated monitoring, and developments in them, or by international organisations, and such other matters as may be prescribed.

3. SECTOR COVERED BY THIS GUIDANCE NOTE

This Guidance Note covers the following activities under the First Schedule of the Environmental Protection Agency Acts 1992 to 2007:

12.1 Operations involving coating with organo-tin compounds, not included in paragraph 12.2.1 or 12.2.2

12.2.1 The surface treatment of substances, objects or products using organic solvents, in particular for dressing, printing, coating, degreasing, waterproofing, sizing, painting, cleaning or impregnating with a consumption capacity of more than 150 kg per hour or more than 200 tonnes per year.

12.2.2 The use of coating materials in processes with a capacity to use at least 10 tonnes per year of organic solvents, not included in paragraph 12.2.1.

It should be noted that the following processes are excluded from this Guidance Note:

- printing
- impregnation of wood
- coating manufacture

It should also be noted that coating activities which fall under the capacity to use at least 10 tonnes of solvent per year, and cleaning and degreasing installations which have a consumption capacity of less than 150 kg per hour or less than 200 tonnes per year may still come under the Emissions of Volatile Organic Compounds from Organic Solvents Regulations 2002 (S.I. No. 543 of 2002). While not requiring an IPPC licence, such activities still have a number of legal obligations to fulfill. EPA has produced Guidance Notes for such activities. These guidance notes should be consulted.

4. PROCESS DESCRIPTION, RISK TO THE ENVIRONMENT, AND CONTROL TECHNIQUES

(Note: any reference to:

- STS-BREF in this document means the reference document on *Best Available Techniques on Surface Treatment using Organic Solvents*, January 2007.
- STM-BREF in this document means the reference document on *Best Available Techniques for the Surface Treatment of Metals and Plastics*, August 2006.)

4.1 DESCRIPTION OF PROCESS

The type of processes which come under this Guidance note include the following at the levels specified in Section 3 of this document:

- Coating of metals:
  - winding wire manufacture (see STS-BREF Section 3)
  - automotive vehicles (see STS-BREF Section 6)
  - buses (see STS-BREF Section 8)
  - trains (see STS-BREF Section 9)
  - agricultural and construction vehicles (see STS-BREF Section 10)
  - ships and yachts (see STS-BREF Section 11)
  - aircraft (see STS-BREF Section 12)
  - metal surfaces (see STS-BREF Section 13)
  - coil manufacture (see STS-BREF Section 14)
  - metal packaging (see STS-BREF Section 15)
  - trucks and commercial vehicles (see STS-BREF Section 17)
- Coating of plastics such as automotive parts, electronics, electrical equipment, etc. (see STS-BREF Section 18)
- Coating of wood (furniture, etc.) (see STS-BREF Section 17)
- Adhesive coating:
  - abrasives manufacture (see STS-BREF Section 4)
  - adhesive tape manufacture (see STS-BREF Section 5)
- Coating of other materials:
  - mirror manufacture (see STS-BREF Section 19)
  - the application of solder mask in printed circuit board manufacture (see STM-BREF Sections 4.15.11 and 2.11.2.11)
- Solvent cleaning and degreasing of products such as in printed circuit board manufacture, metal product manufacture, etc. Vapour phase solvent degreasing, cold cleaning, and hand wiping are described in general in STM-BREF Section 2. Also certain coating processes listed above can have cleaning steps that utilise solvents.

4.2 RISK TO THE ENVIRONMENT

The key environmental issue for processes using solvents in coating, cleaning and degreasing is the emission of volatile organic compounds (VOCs) to air.

4.2.1 Emissions to Air

VOC emissions arise from process areas (coating application, drying, and cleaning), solvent handling and storage, and ancillary activities such as equipment cleaning, solvent recovery, etc.

For enclosed processes, abatement can be used on the principal VOC emission sources. Where incineration or oxidation is in use, nitrogen oxides (NOx), and carbon monoxide (CO) emissions to air are also of relevance. Other possible emissions may include isocyanates from polyurethane products and fluorides from coatings containing fluoride (e.g. certain coil coating processes).

Dust can be relevant for certain processes, for example, removal of old coatings from surfaces, and sanding/planning of wood surfaces. Certain sizes of hard wood dust particulates which are respirable have been classified as carcinogenic.

There are certain solvents which have been proven to possess carcinogenic or mutagenic properties or properties which may affect reproduction via the air.

- For more information on emissions to air from specific coating processes, and where relevant cleaning/degreasing processes:
    - winding wire (see STS-BREF Section 3.3.3.1)
    - abrasives (see STS-BREF Section 4.3.3.1)
    - adhesive tape (see STS-BREF Section 5.3)
    - automotive (see STS-BREF Section 6.3.3.1)
    - trucks and commercial vehicles (see STS-BREF Section 7.3.3.1)
    - buses (see STS-BREF Section 8.3.3.1)
    - trains (see STS-BREF Section 9.3.3.1)
    - agricultural and construction vehicles (see STS-BREF Section 10.3.3.1)
    - ships and yachts (see STS-BREF Section 11.3.3.1)
    - aircraft (see STS-BREF Section 12.3.1.4)
    - metal surfaces (see STS-BREF Section 13.3)
    - coil (see STS-BREF Section 14.3.3.1)
    - metal packaging (see STS-BREF Section 15.3.4.1)
    - plastics (see STS-BREF Section 16.3.3.1)
    - wood (see STS-BREF Section 17.3.3.1)
    - mirrors (see STS-BREF Section 19.3.3.1).

For general information on emissions to air from solvent cleaning and degreasing processes (see STM-BREF Section 1.4.4.8).

4.2.2 Emissions to Water

There is no process waste water directly associated with solvent based coating and cleaning processes. Waste water mainly arises from certain abatement systems (such as wet spray booths), cooling water, and surface water.

The storage and handling of solvent is a potential source of contamination for soil and groundwater.

A certain amount of waste water is generated by some solvent cleaning processes, for example, water from the water/solvent separator of a vapour degreaser. However BAT is to handle it as waste and not to discharge it to water.

An installation using aqueous cleaning or pretreatment may have emissions to water. An installation using water based coatings may also have emissions to water.

An installation using solvents for coating or for cleaning/degreasing may also carry out other activities not covered by this document with process emissions to water (e.g. semiconductor manufacture). These are not dealt with any further under the scope of this document.

- For more information on waste water from specific coating processes, and where relevant cleaning/degreasing processes:
    - abrasives – waste water from cleaning of machine parts (see STS-BREF Sections 4.3.3.2)
    - automotive, trucks and commercial vehicles - waste water from wet spray booths and from other aqueous treatment processes (see STS-BREF Section 6.3.3.2)
    - buses - waste water from wet spray booths (see STS-BREF Section 8.3.3.2)
    - trains - waste water from wet spray booths and from cleaning equipment (see STS-BREF Section 9.3.3.2)
    - agricultural and construction vehicles - waste water from other aqueous treatment processes (see STS-BREF Section 10.3.3.2)
    - ships and yachts – waste water from blasting processes (see STS-BREF Section 11.3.3.2)
    - aircraft - waste water from wet spray booths (see STS-BREF Section 12.3.1.4)
    - coil - waste water from other aqueous treatment processes (see STS-BREF Section 14.3.3.2)
    - metal packaging - waste water from other aqueous treatment processes (see STS-BREF Section 15.3.4.2)
    - wood - waste water when using water based coatings (see STS-BREF Section 17.3.3.2)
    - mirrors - waste water from other aqueous treatment processes (see STS-BREF Section 19.3.3.2).

For general information on emissions to water from solvent cleaning and degreasing processes see STM-BREF Section 2.13.1 and Section 3.

4.2.3 Waste

Waste from solvent use in coating, cleaning and degreasing processes can include collected waste solvent; materials contaminated with solvent such as rags, paper, empty containers, sludges, paint residues, filters, spent carbon from adsorbers, used

spill kits, personal protective clothing/equipment, etc.; collected dried paint (e.g. on dry filters in spray booths), grinding/blasting dust, miscellaneous uncontaminated solid waste such as sand paper, masking tape, off-cuts/scrap, used personal protective clothing/equipment, etc.

- For more information on wastes from specific coating processes, and where relevant cleaning/degreasing processes:
  - winding wire (see STS-BREF Sections 3.3.3.3)
  - abrasives (see STS-BREF Sections 4.3.3.3)
  - adhesive tape (see STS-BREF Section 5.3)
  - automotive (see STS-BREF Section 6.3.3.3)
  - trucks and commercial vehicles (see STS-BREF Section 7.3.3.3)
  - buses (see STS-BREF Section 8.3.3.3)
  - trains (see STS-BREF Section 9.3.3.3)
  - agricultural and construction vehicles (see STS-BREF Section 10.3.3.3)
  - ships and yachts (see STS-BREF Section 11.3.3.3)
  - aircraft (see STS-BREF Section 12.3.1.6)
  - coil (see STS-BREF Section 14.3.3.3)
  - metal packaging (see STS-BREF Section 15.3.4.3)
  - plastics (see STS-BREF Section 16.3.3.3)
  - wood (see STS-BREF Section 17.3.3.3)
  - mirrors (see STS-BREF Section 19.3.3.3).

4.2.4 Noise

This Guidance Note does not cover noise emission sources. For guidance on measures in relation to noise, have regard to the IPC Guidance Note for Noise in relation to scheduled activities and any other guidance issued by the Agency.

4.3 CONTROL TECHNIQUES

The existing or possible measures for eliminating, reducing and controlling emissions in solvent coating, cleaning and degreasing are described in this section. References to more detailed descriptions in the BREF documents are given.

4.3.1 General Preventive Techniques

The following general techniques can be applied to all coating, cleaning and degreasing processes using solvents:

- Environmental management (see STS-BREF Section 20.1 and STM-BREF Section 4.1.1)
- The compilation of regular solvent balances (see STS-BREF Sections 20.3.1 and 20.3.2)
- Monitoring of energy and raw material consumption, emissions and waste generation, within individual processes and the regular comparisons of these with previous data for the installation, sector, national benchmarks (see STS-BREF Section 20.1.3 and STM-BREF Section 4)

- Training provision, in particular for spray gun operators
- Optimisation of processes/equipment (see STS-BREF Section 20.2.5)
- Planned maintenance programme
- Planned hazard identification and mitigation programme (see STS-BREF Section 20.2.1).

4.3.1.1 Minimisation of Material Consumption

The following preventive techniques can minimise raw material consumption in coating, cleaning and degreasing:

- Use of programmable scales for the mixing of coating materials (see STS-BREF Section 20.6.3.1)
- For two component coatings, use in-line paint mixing equipment (see STS-BREF Section 20.6.3.1 and 17.41.3)
- Use of fixed pipework for solvent/coatings supply (see STS-BREF Section 20.6.3.4 and 20.6.3.5)
- Use of reusable containers (see STS-BREF Section 20.13.6)
- Use of pig clearing systems (see STS-BREF Section 20.6.3.7)
- Use of automatic equipment (see STS-BREF Section 20.2.3)
- Use of mobile pumps rather than pouring
- For manual cleaning use of enclosed piston-type dispensers rather than pouring
- Use of batch coating or colour grouping (see STS-BREF Section 20.6.3.6)
- Use quality assurance procedures for paints and solvents that take into account environmental and health and safety risks (see STS-BREF Section 20.6.2)
- Use control measures, closed loop systems, cascade rinsing, ion exchange, filtration, bath desludging, decantation and coagulation to minimise water consumption (see STS-BREF Section 20.4.1.1 to 20.4.1.4 and 20.7.5).

4.3.1.2 Minimisation of Energy Consumption

The following preventive techniques can minimise energy consumption in coating, cleaning and degreasing:

- Minimisation of the amount of extraction air from process areas (see STM-BREF Section 4.15 and STS-BREF Section 20.11.3.1) and the use of controls on the extraction system (see STS-BREF Section 20.11.1.3, 20.11.1.4, 20.11.1.5 and STM-BREF Section 4.15)
- Install energy efficient equipment such as high efficiency motors, reduce start demand, appropriate sizing of equipment, etc. (see STS-BREF Sections 20.5.2 and 20.5.3)
- For drying of coatings, use the following energy efficient processes:
  - air recirculation and dehumidification (see STS-BREF Section 20.8.1.1)
  - use of inert gas which allows higher solvent concentrations and lower volumes of air (see STS-BREF Section 20.8.1.2)
  - infrared radiation curing (STS-BREF Section 20.8.2.1), near infrared radiation curing (see STS-BREF Section 20.8.2.2) or systems with dual infrared and thermal curing (see STS-BREF Section 20.8.3)
  - UV radiation curing (see STS-BREF Section 20.8.2.3). Requires use of UV radiation cure coatings
  - electron beam curing (see STS-BREF Section 20.8.2.4). High investment cost has limited its use to high throughput processes

- induction drying where an electromagnetic coil induces heat in the parts (see STS-BREF Section 20.8.1.3). Applicable to metal only
- microwave drying or high frequency drying (see STS-BREF Section 20.8.1.4).

4.3.2 Preventive Techniques for Specific Processes

The following preventive techniques can be applied in coating, cleaning and degreasing:

- Eliminate/minimise the need for coating, cleaning and degreasing
- Use of alternative processes for coating, cleaning and degreasing
- Increase coating, cleaning and degreasing efficiency.

4.3.2.1 Eliminate/Minimise the Need for Coating

The following techniques can eliminate/minimise the need for coating:

- Achieve the properties that a coating imparts to a product by using an alternative product material
- Compare the number of coating layers used against the end requirements of the coating. It may be possible to reduce the number of layers and achieve the same functionality/decoration
- Obtain materials that are precoated using techniques such as coil coating which would have lower overall emissions (see STS-BREF Section 20.7.2.8).

4.3.2.2 Eliminate/Minimise the Need for Cleaning

The following techniques can eliminate/minimise the need for cleaning by identifying the root cause of the contamination and eliminating or minimising it at source:

- Selection of the correct cleaning system can reduce solvent emissions and/or the formation of tropospheric ozone (see STS-BREF Section 20.9.1)
- Working in conjunction with product manufacture (in-house or suppliers) to:
  - reduce the amount of oil/grease on the product, for example through changing the amount, or the application methods being used
  - allow the most environmentally friendly degreasing or cleaning system to be used, for example through changing the type of oil (see STM-BREF Section 4.3.2)
- Careful product storage and protection (see STM-BREF Section 4.3.1) including a clean and dry environment; use of protective packaging, including reusable packaging, and sealed containers for small products; and use of moisture absorbents
- Limiting the amount of time between cleaning and further processing (see STM-BREF Section 4.3.1.1)
- Eliminating or changing interim cleaning stages where possible through the consideration of subsequent production requirements against the level of cleaning carried out
- Carrying out initial or basic cleaning before main cleaning operation
- Remove excessive oil before cleaning, by heating and centrifuging smaller components, or using wiping or air knives for larger components (see STM-BREF Section 4.9.14).

4.3.2.3 Alternative Processes for Coating

Alternatives to solvent based coatings include the following:

- Powder coatings
  - Consist of 95 - 100% solids content
  - Established for metal coating and now being used for wood and composite coating
  - Suitable for high volume installations
  - For clear coat applications powder slurries can be used (see STS-BREF Section 20.7.2.7)
  - For general powder coating information and for further references for specific sectors
    - conventional curing (see STS-BREF Section 20.7.2.6)
    - radiation curing (see STS-BREF Section 20.7.2.5)
- Water based coatings.
  - These coatings can still contain a certain amount of solvent. Available for certain coats for metals, wood, and plastics
  - For general information and for further references for specific sectors (see STS-BREF Section 20.7.2.3 and 20.7.2.4)
- High solids coatings.
  - These coatings still contain solvent but solid content is > 65%.
  - Available for certain coats for metals
  - For general information and for further references for specific sectors (see STS-BREF Section 20.7.2.2)
- Low solvent content or water based radiation cured coatings (infrared, UV, or electron beam)
  - Not all radiation cured coatings are low in solvent
  - Certain powder coatings are radiation cured
  - Available for certain coats for metals, wood, and plastics
  - For general information and for further references for specific sectors (see STS-BREF Section 20.7.2.5 and 20.8.2)
- Chromate free coatings for corrosion protection, where possible
  - In general (see STS-BREF Section 20.7.1.2.4)
  - For aircraft (see STS-BREF Section 12.4.3)
- 2-component epoxy systems for enamelling of winding wire where the temperature class of the product allows (see STS-BREF Section 3.4.6.3)
- Use of solvent free adhesives where possible.
  - adhesive application (see STS-BREF Section 5.4.2)
  - abrasives (see STS-BREF Section 23.1.2)
  - adhesive tape (see STS-BREF Sections 5.4.3)
- Use of fluoridation prior to plastic coating to reduce filling layer requirements (see STS-BREF Section 16.4.4.4)
- Use of alternatives to antifouling on boats/ships (see STS-BREF Section 11.4.7)
- Use of alternative solvents that are less hazardous or dangerous for the environment (see STS-BREF Sections 20.10.2 to 20.10.4).

4.3.2.4 Alternative Processes for Cleaning and Degreasing

The choice and suitability of an alternative which eliminates or minimises solvent use in cleaning/degreasing depends on the degree of cleaning required, the nature and quantity of contaminant(s) present, the nature of the product surface, the size and shape of the product, subsequent production process requirements, subsequent product use requirements, and economic considerations.

The transfer of environmental effects from one medium to another should always be considered when looking at alternative processes.

Processes include, in no particular order:

- Mechanical cleaning such as power wire brushing, centrifuging (see STM-BREF Section 4.9.14.1), air knives and rollers (see STM-BREF Section 4.9.15), or shot blasting for removal of particulates, rust, scale, and unwanted coatings. Can be used as initial pre-cleaning prior to degreasing
- Use of clean hot water at 80 – 90^{o}C without any chemicals (see STM-BREF Section 4.9.15). Can remove the majority of oil and grease that comes on work-pieces in certain applications
- Use of high pressure water jets to increase cleaning effect
- Use of steam cleaning, assisted with detergents where necessary
- Water based cleaners (see STM-BREF Section 4.9.14.3). Wide variety available for different types of soiling, substrate and follow on processes. Usually soaking or manual cleaning. Equipment can range from simple dip tanks, to cabinet type washers, and on to in-line continuous systems. Additional features sometimes incorporated such as ultrasonics, rinsing steps and drying steps. Aqueous cleaners sometimes contain certain amounts of solvent
- Water based detergent solutions (see STS-BREF Sections 20.7.1.2.1 and 20.9.8) or cleaning agents where water based paints are used (see STS-BREF Section 20.10.5)
- Manual cleaning (see STM-BREF Section 4.9.15, see STS-BREF Sections 20.9.9). Use of spray bottles, aerosols, together with rags, wipes, or swabs. Solvent or aqueous cleaners can be used. Can be used as initial pre-cleaning prior to degreasing
- Ultrasonic cleaning (see STM-BREF Section 4.9.14.7, see STS-BREF Sections 20.9.13). Enhances cleaning action using sound waves. Usually operated with aqueous media, but can also be used with solvents
- Megasonic cleaning. A more gentle form of ultrasonic cleaning for cleaning delicate, sensitive parts.
- Unstable emulsion cleaners (see STM-BREF Section 4.9.14.4) which dissolve oil and grease to form an emulsion which readily separates in a settling tank
- Semi aqueous systems. Can consist of a cleaner which is a mixture of water and solvent or a cleaning process with a combination of solvent cleaning steps and aqueous rinsing steps
- Alternative solvents that are less hazardous (see STS-BREF Sections 20.9.7, 20.10.2 to 20.10.4)
- Alternative solvents that are less volatile (see STS-BREF Sections 20.9.5, 20.9.6, 20.10.1.1 to 20.10.1.5)
- Use of electrolytic enhancement in aqueous degreasing (see STM-BREF Sections 4.9.14.8 and 4.9.14.9)

- Biological degreasing (see STM-BREF Sections 4.9.14.5 and 4.11.13.4). Specialised equipment uses surfactants to lift oil/grease and microorganisms to break it down
- Enzyme cleaning solutions which break down oil/grease. Solutions cannot be regenerated but can usually be discharged to sewer
- Plasma degreasing using an ionised gas in specialist equipment. Suitable for removing oil, grease and other organic contaminants in precision applications
- Laser cleaning for removal of small amounts of particulates, photoresist, adhesives, epoxy layers, urethane layers, or oxide layers. Capital cost is significant
- Carbon dioxide (dry ice) cleaning (see STM-BREF Sections 4.9.14.6 and 2.3.5.3, see STS-BREF Sections 20.9.14) for removal of small amounts of oil, grease and other organic contaminants. Three different process types: liquid, gas, and super critical
- UV cleaning for removal of organic contamination such as certain photoresists and carbonaceous material from semiconductors.

4.3.2.5 Increase Coating Efficiency

Increased coating efficiency can be achieved by the following:

- Use just-in-time management system for external suppliers of paints and inks (see STS-BREF Section 20.6.1)
- Use of high transfer efficiency application techniques including:
  - Roller coating. Applicable for flat or slightly curved surfaces. For general information and further references (see STS-BREF Section 20.7.3.1)
  - Casting, general (see STS-BREF Section 20.7.3.2) Mainly used in furniture. For wood (see STS-BREF Sections 17.4.4.3)
  - Dipping. Conventional dipping is used on wood and metal, while electrophoretic dipping is confined to metals, using an electric current between the metal surface and an electrode in the tank; conventional (see STS-BREF Section 20.7.3.3 and 17.4.4.4) and electrophoretic (see STS-BREF Section 20.7.3.4)
  - Flooding, general (see STS-BREF Section 20.7.3.5) and wood (see STS-BREF Section 17.4.4.5)
  - Vacuum coating, general (see STS-BREF Section 20.7.3.6) and wood (see STS-BREF Section 17.4.4.6)
  - In-mould coating, general (see STS-BREF Section 20.7.3.7) and for plastics (see STS-BREF Section 16.4.5.1)
  - Electrostatic assistance. Applicable for a range of substrates and coating types including powder, solvent, and water based:
    - general (see STS-BREF Section 20.7.3.14)
    - high rotation bells (see STS-BREF Section 20.7.3.15)
    - high rotation disks (see STS-BREF Section 20.7.3.16)
    - electrostatic assistance for compressed air, airless, and air–assisted airless spraying (see STS-BREF Section 20.7.3.17)
    - electrostatic assistance for powder coating (see STS-BREF Section 20.7.3.18)
  - High volume low pressure (HVLP) spray equipment.

    - general (see STS-BREF Section 20.7.3.9)
    - plastics (see STS-BREF Section 16.4.5.3)
    - wood (see STS-BREF Section 17.4.4.8)
    - trucks/commercial vehicles (see STS-BREF Section 7.4.3.2)
    - trains (see STS-BREF Section 9.4.3.2)
    - agricultural/construction vehicles (see STS-BREF Section 10.4.3.3)
  - Hot spray (see STS-BREF Section 20.7.3.10). Applicable for ships/boats (see STS-BREF Section 11.4.6.2)
  - Airless spray. Suitable for large areas such as ships/boats, trains (see STS-BREF Section 20.7.3.11)
  - Air assisted airless spray. Suitable for large areas such as trains (see STS-BREF Section 20.7.3.12)
  - Carbon dioxide atomization (see STS-BREF Section 20.7.3.12)
  - Sintering of powder coatings (see STS-BREF Section 20.7.3.19)
  - Reverse coaters for wood filling (see STS-BREF Sections 17.4.4.1)
- Proper operation of manual spray gun coating equipment, including:
  - Holding the spray gun perpendicular to the work piece surface
  - Holding the spray gun 15 to 20 cm (6 to 8 inches) from the work piece
  - Ensuring each stroke overlaps the previous stroke by 50%
  - Triggering the gun at the beginning and ending of each pass (i.e. release the trigger just before the stroke ends while the gun is directly over the product)
  - Maintaining a consistent gun speed — general recommendation is 1.3 m/s (250 ft/min)
  - Choice of the correct coating flow rate (common practice is to use too high a flow, resulting in poor finishing)
  - Maintaining the correct air pressure for spraying, and use of the air-cap pressure tester in checking this (using too high a pressure is again common practice, and also leads to poor finish results)
  - Choice of the appropriate nozzle to suit the item being coated
  - Adjusting the spray pattern to suit the item being coated
  - Establishing the recommended thickness of coating on the product.

4.3.2.6 Increase Degreasing/Cleaning Efficiency

Increased degreasing/cleaning efficiency can be achieved by the following:

- Maintenance of cleaning/degreasing solutions through the use of decanting, gravity separation, skimming, centrifugation, filtration, membrane filtration, or combinations of these methods (see STM-BREF Section 4.11.13). Applicable to both solvent and aqueous solutions
- Operate cascade cleaning or degreasing solutions (see STM-BREF Section 4.11.13.1).

4.3.3 Techniques for Containment

Techniques for containment which can be applied to solvent using processes in coating, drying, cleaning and degreasing include the following:

- Enclosed spray gun cleaning equipment (see STS-BREF Section 20.11.2.1)

- Use of paint mixing equipment, including in-line mixing for 2-component coatings (see STS-BREF Section 20.6.3.1)
- Pumping and dispensing controls
- Use of covers on process equipment including degreasers and cold cleaners. Considerations for degreaser covers include fitting it below the rim ventilation slot and at the top of the freeboard zone, use of a roller or slide design, use of double-door systems, timed interlocks, and automated covers
- Use of covers on containers before and after use and during handling/transport around the premises, including part-empty containers, solvent waste containers and solvent–contaminated waste containers. Avoid use of damaged or dented containers
- For small to medium sized items such as cars, furniture, etc. the use of spray booths with appropriate air extraction rates and with suitable techniques to manage overspray (see STS-BREF Section 20.7.4)
- For large items such as ships, aircraft, etc. use of closed workshop halls (see STS-BREF Section 11.4.2.2 and 11.4.2.3) and waste gas treatment as appropriate (see STS-BREF Section 20.11), or use of mobile application units with integrated waste gas treatment (see STS-BREF Section 12.4.4.3). For outdoor spraying, use of nets to reduce wind effects (see STS-BREF Section 11.4.2.1 and 11.4.2.2)
- Use enclosed washing machines for cleaning work pieces or machine parts (see STS-BREF Section 20.9.10)
- Use of air seals at the entrance and on the exit of the ovens/driers (see STS-BREF Section 20.11.2.2)
- Use of negative pressure in drying (see STS-BREF Section 20.11.2.3)
- Air extraction from coating processes, drying processes, cooling zone, cleaning processes and raw material/waste storage areas (see STS-BREF Sections 28.11.2.4 to 20.11.2.8)
- Adequate solvent storage - secure, impervious, suitably bunded, away from drains. Indoor day store for coatings. Refer to the Draft Reference Document on Best Available Techniques on Emissions from Storage (July 2003) and STS-BREF Section 20.2.2.

4.3.4 Techniques for Recovery and Recycling

Techniques for recovery and recycling which can be applied to solvent using processes in coating, cleaning or degreasing include the following:

- Recovery and reuse of coatings using spray booths with cooled collection screens (STS-BREF Section 20.7.4.4). Applicable for 1 component coatings and infrequent colour change
- Recycling of recovered water based coatings (see STS-BREF Section 20.6.3.3), including through the use of ultra or nanofiltration (see STS-BREF Section 20.7.1), and coating collection for off-site recovery of 1 component coatings using water emulsion techniques (see STS-BREF Section 20.7.4.3)
- Recovery of VOCs from waste gases and reuse using condensers (see STS-BREF Sections 20.11.5.1, 20.11.5.2, and 20.11.5.3), cryogenic recovery (see STS-BREF Section 20.11.5.4), membranes (see STS-BREF Section 20.11.3.4), or carbon adsorption with on-site desorption (see STS-BREF Section 20.11.6.1 and 20.13.7.1)
- Reuse of returned paints from coater header in coil coating (see STS-BREF Section 20.6.3.2)
- Collection of used solvent, e.g. cleaning solvent for on-site recycling via filtration, or distillation (see STS-BREF Section 20.9.11, 20.13.2.1 and 20.13.2.2), off-site

recovery, recycling and return for reuse or reuse elsewhere (see STS-BREF Section 20.13.1)

- Recovery of solvent from waste coatings, etc. by distillation for reuse as cleaning solvent (see STS-BREF Section 20.13.2.2)
- Use of recovered solvent from other industries for cleaning applications
- Recovery of solvent from rags/wipes by centrifuge or a wringer (see STS-BREF Section 20.13.5)
- Recovery of used activated carbon on-site or off-site (see STS-BREF Section 20.13.7.1 and 20.13.7.2)
- Filtration and reuse of water from wet spray booths. Continuous discharge of paint sludge (see STS-BREF Section 20.7.5.6) and the use of decanters (see STS-BREF Section 20.7.5.7) to extend the service life of water in wet separation spray booths
- The use of membrane filtration to maintain aqueous degreasing baths (see STS-BREF Section 20.7.5.3).

4.3.5 Treatment Techniques

4.3.5.1 Treatment of Air Emissions

For new installations and existing installations proposed for modification considerations should be given to the selection, design, optimisation and management of extraction and abatement techniques to reduce emissions and energy consumption (see STS-BREF Section 20.11.1).

Prior to abatement, recirculation of waste gases in booths/dryers to internally increase concentration, taking into account the lower explosive limit (see STS-BREF Section 20.11.3.1), or external concentration via carbon adsorption and desorption or using a plenum (see STS-BREF Section 20.11.3.2 and 20.11.3.3).

An overview of application ranges of the VOC abatement technologies is available in Figure 20.5 of the STS BREF document (see STS-BREF Section 20.11). The following techniques can be used to treat emissions to air from coating, cleaning or degreasing (see BREF references for applicable sectors):

- Venturi systems to remove particles from coating overspray (see STS-BREF Section 20.11.3.5)
- Dry filter system to remove coating particles from coating overspray (see STS-BREF Section 20.11.3.6)
- Wet filter/water scrubber (see STS-BREF Section 20.11.3.8) or wet electrostatic filter (see STS-BREF Section 20.11.3.7) to remove particles from coating overspray
- Carbon adsorption of VOC gases. Suitable for high volumetric flows and VOC concentrations and for fluctuating waste gas streams. Can be purely abatement or the solvent can be desorbed and reused. Different types include fixed bed (main type), fluidised bed, and rotation adsorbers (see STS-BREF Section 20.11.3.2 and 20.11.6)
- Absorption of VOC gases. Utilises a liquid to physically (or in some cases chemically) absorb the VOCs. Suitable for low volumetric flows, high VOC concentrations and fluctuating waste gas streams (see STS-BREF Section 20.11.7)
- Thermal oxidiser (see STS-BREF Section 20.11.4.2), including with heat recovery (recuperative) (see STS-BREF Section 20.11.4.3), and regenerative

thermal oxidiser (see STS-BREF Sections 20.11.4.4, 20.11.4.5). Suitable for steady, continuous VOC loads

- Catalytic oxidiser. Lower temperature needed due to use of a catalyst, so reduced fuel use and reduced NO_x formation. Suitable for steady, continuous VOC loads (see STS-BREF Section 20.11.4.6)
- Treatment of VOC gases in on-site boiler (see STS-BREF Section 20.11.4.1). Boiler needs to be operational at all times during waste gas production
- UV-oxidiser for VOC treatment (see STS-BREF Section 20.11.4.7). Suitable for low solvent concentrations
- Condensation of VOC rich gas by direct cooling, indirect cooling, refrigeration, cryogenic treatment or condensation above freezing point (see STS-BREF Section 20.11.5.1to 20.11.5.5)
- Membrane filtration is a concentration technique for VOC rich gas (see STS-BREF Section 20.11.3.4)
- Biological treatment of VOC gases using biofilters or bioscrubbers. Biofilters suitable for low solvent concentrations and water soluble, biodegradable solvents. Bioscrubbers suitable for low solvent concentrations, large gas flows and water soluble, biodegradable solvents (see STS-BREF Section 20.11.8).

4.3.5.2 Treatment of Waste Water & Sludges

The following techniques can be used to treat any waste water from coating, cleaning or degreasing (see BREF references for applicable sectors):

- The use of filtration, continuous discharge of paint sludge, decantation and coagulation of paint solids in wet cleaners to treat waste water from spray booths (see STS-BREF Section 20.7.5.5, 20.7.5.6 and 20.7.5.8)
- Techniques used to treat waste water includes flocculation, separation, electroflocculation, vacuum distillation, biological treatment, ultra and nanofiltration, and reverse osmosis (see STS-BREF Section 20.12.1 to 20.12.6).

The following techniques can be used to treat any waste water sludges;

- Centrifuges
- Filter press.

4.3.6 Techniques for Appropriate Disposal

Techniques for appropriate disposal of wastes which can be applied to solvent using processes in coating, cleaning and degreasing include the following:

- Residual hazardous waste is disposed off-site usually by incineration
- Incineration of the used activated carbon which cannot be regenerated after use (see STS-BREF Section 20.13.7.3)
- Landfill or municipal waste incineration of process materials that are not contaminated with solvent or any other dangerous substances.

4.3.7 Applicability of Techniques for Specific Processes

Sections 3 to 17, 19 and 20 of STS-BREF discuss the applicability of the above techniques to the individual processes outlined in section 4.1 of this document.

4.3.8 Techniques for Non-solvent using Unit Operations

For the processes outlined in section 4.1 of this document, there are certain unit operations which are not concerned with the use of solvent in coating, cleaning or degreasing (for example the use of conversion coatings). This document does not cover such processes.

5. BEST AVAILABLE TECHNIQUES FOR SOLVENT USING PROCESSES IN COATING, CLEANING AND DEGREASING

5.1 INTRODUCTION

As explained in Section 2, this Guidance Note identifies BAT but obviously does so in the absence of site-specific information. Accordingly, it represents the requirements expected of any new activity covered by the Note, and ultimately the requirements expected of existing installations, but exclude additional requirements, which may form part of the granting of a licence for a specific site.

The technical feasibility of the measures listed below has been demonstrated by various sources. Used singly, or in combination, the measures represent BAT solutions when implemented in the appropriate circumstances. These circumstances depend on plant scale, product type, nature of process, etc.

5.2 BAT - GENERAL PREVENTIVE MEASURES

For all coating, cleaning and degreasing processes using solvents, BAT is to do the following:

- operate an environmental management system (see STS-BREF 21.1, BAT 12, 13 & 14 and STM-BREF 5.1.1) and where practicable, carry out regular sectoral benchmarking
- carry out appropriate training
- optimise activities (see STS-BREF 20.2.5)
- plan and establish the operational procedures
- carry out regular solvent balances and use relevant techniques for direct measurements (see STS-BREF Sections 20.3.1 and 20.3.2)
- use materials that have the lowest possible environmental impacts (see STS-BREF Sections 20.6.2, 20.7 and 20.10)
- replace solvents which have any of the following risk phrases: R45, R46, R49, R60 and R61 with less hazardous solvents
- replace substances with risk phrases R58, R59, and R50/53 where alternatives exist
- have a planned maintenance programme and where critical equipment is changed, either maintain the original specification or recalibrate the system by direct measurement
- Identify hazards and pathways and implement a plan of actions for pollution prevention (see STS-BREF Sections 21.1, BAT 15 and 20.2.1).

5.2.1 Minimisation of Material Consumption

For all coating, cleaning and degreasing processes using solvents, BAT is to do the following:

- Automating surface treatment as applicable to the activity and industry (see STS-BREF Section 20.2.3)
- Use reusable containers as far as possible (see STS-BREF Section 20.13.6)

- Where the quantity of coating/solvent in use is sufficient use fixed pipework (see STS-BREF Section 20.6.3.4 and 20.6.3.5) for coatings/solvent supply with pig clearing for coatings (see STS-BREF Section 20.6.3.7)
- Conserve raw materials and water by recycling, cascade rinsing, ion exchange, membrane separation or other concentration techniques and control measures (see STS-BREF Section 20.4.1.1 to 20.4.1.4 and 20.7.5).

In addition for all coating processes using solvents, BAT is to do the following:

- Use programmable scales, automatic or Pantone matching for mixing coating materials (see STS-BREF Section 20.6.3.1)
- Use batch coating or colour grouping where possible (see STS-BREF Section 20.6.3.6)
- Where the quantity of coating in use is sufficient, use in-line paint mixing equipment for two component coatings (see STS-BREF Section 20.6.3.1).

5.2.2 Minimisation of Energy Consumption

For all coating, cleaning and degreasing processes using solvents, BAT is to do the following:

- Minimise the amount of extraction air from process areas (see STM-BREF Section 4.18.3 and STS-BREF Section 20.11.3.1) and put controls on the extraction system (see STS-BREF Section 20.11.1.3, 20.11.1.4, 20.11.1.5 and STM-BREF Section 4.18.5).
- Seek opportunities to use excess heat from thermal oxidation and maintain autothermic conditions
- Minimise energy losses by installing energy efficient equipment, notably motors. See section 4.3.1.2 of this document.

In addition, for all coating processes using solvents, BAT is to do the following:

- Use the most energy efficient dryer that is appropriate to the type of coatings in use, the nature of products being coated, and the scale of the operation. See section 4.3.1.2 of this document.

5.3 BAT - Preventive Measures for Specific Processes

For all coating, cleaning and degreasing processes using solvents, in addition to the general measures in Section 5.2, BAT is to do the following for all relevant processes.

5.3.1 Minimisation of need for Coating/Cleaning

For all coating processes using solvents, BAT is to do the following:

- Consider all of the techniques outlined in section 4.3.2.1 of this document in order to minimise coating required, and implement where appropriate.

For all cleaning and degreasing processes using solvents, BAT is to do the following:

- Consider all of the techniques outlined in section 4.3.2.2 in order to minimise cleaning/degreasing required, and implement where appropriate.

5.3.2 Use of Alternative Coating Processes

For all coating processes using solvents, BAT is to do the following:

- Where appropriate to the product material, the functional requirements of the coating, and the scale of operation, use commercially available alternatives to conventional solvent based coatings as outlined in section 4.3.2.3.

5.3.3 Use of Alternative Cleaning Processes

For all cleaning or degreasing processes using solvents, BAT is to do the following:

- Where appropriate to the product material, the nature and quantity of contaminant(s) present, the degree of cleanliness required, subsequent processing and use requirements, and the scale of operation, use alternative cleaning processes to conventional solvent cleaning as outlined in section 4.3.2.4.

5.3.4 Increased Coating Application Efficiency

For all coating processes using solvents, BAT is to do the following:

- From those techniques outlined in section 4.3.2.5 for increasing transfer efficiency, implement those technique(s) that are appropriate to the product, the coating material, and the scale of operation.

For all coating processes using manual spray techniques, BAT is to do the following:

- Train operators on proper equipment operation as outlined in section 4.3.2.5 of this document.

5.3.5 Increased Cleaning Efficiency

For all cleaning or degreasing processes using solvents, BAT is to do the following:

- Implement the appropriate degreasing/cleaning solution maintenance techniques outlined in section 4.3.2.6 for increasing cleaning efficiency.

5.3.6 Containment

For all coating, cleaning and degreasing processes using solvents, BAT is to do the following:

- Give regard to the Draft Reference Document on Best Available Techniques on Emissions from Storage (July 2003)
- Consider all of the techniques outlined in section 4.3.3 of this document, and implement where appropriate
- Use enclosed containers for all solvent containing materials including waste solvent, and wastes contaminated with solvent
- Have adequate solvent storage incorporating the techniques outlined in section 4.3.3, as appropriate
- Have over ground tanks and pipelines, where possible
- Have unique filling points for bulk materials and store large quantities separately
- Have high levels alarms on all fixed storage tanks
- Back vent bulk storage tanks when filling where this is appropriate (see STS-BREF Section 20.2.2)
- Storing solvents, waste solvents and waste cleaning materials in sealed containers

- Store small amounts of hazardous materials at the point of application and large quantities separately.

For all coating processes using solvents, BAT is to do the following:

- carry out spray application in enclosed booths/areas with adequate ventilation, except where permission is given to operate in uncontained conditions.

For all cleaning or degreasing processes using solvents, BAT is to do the following:

- carry out cleaning in enclosed equipment or equipment fitted with removable covers.

For all vapour degreasing processes, BAT is to do the following:

- ensure covers fit below the rim ventilation slot and at the top of the freeboard zone
- use a roller or slide design for covers.

5.3.7 Recovery and Recycling

For all coating, cleaning and degreasing processes using solvents, BAT is to do the following:

- From those techniques outlined in section 4.3.4, implement those technique(s) that are relevant and feasible.

5.4 BAT – Measures for Treatment, Abatement and Disposal

5.4.1 Treatment of Air Emissions

For all coating, cleaning and degreasing processes using solvents, BAT is to minimise the formation of air emissions using the measures outlined in section 5.2 and 5.3 of this document, and then,

- to remove particulates for all coating processes using venturi systems, dry filtration or wet filtration as appropriate (see section 4.3.5.1)
- if necessary, use the most appropriate of the following techniques which are outlined in section 4.3.5.1 to treat VOCs:
  - adsorption
  - oxidation
  - absorption
  - condensation
  - membrane filtration
  - biological treatment.

5.4.2 Treatment of Waste Water

For all coating, cleaning and degreasing processes using solvents, BAT is to minimise the quantity and load of any waste water generated using the measures outlined in section 5.2 and 5.3 of this document, then treat waste water as follows:

- separate cooling water, storm water, bund water and any other effluents of different origin in order to permit appropriate treatment/recycling options
- remove solids from waste water from wet separation spray booths through filtration
- to reduce solids or solvents from waste water use separation, flocculation, electroflocculation or vacuum distillation techniques (see STS-BREF Section 20.12.1 to 20.12.4).

5.4.3 Treatment and Disposal of Waste

For all coating, cleaning and degreasing processes using solvents, BAT is to minimise the quantity and load of waste generated using the measures outlined in section 5.2 and 5.3 of this document, then treat/dispose waste as follows:

- dispose all solvent containing wastes by appropriately licensed hazardous waste incineration with heat recovery
- dispose process materials that are not contaminated with solvent or any other dangerous substances by appropriately licensed landfill or municipal waste incineration.

Further information on a number of waste gas and wastewater treatment techniques can be found in the BREF document on Common Waste Water and Waste Gas Treatment/Management Systems in the Chemical Sector, EIPPCB, February 2003.

5.4.4 BAT - Measures for Specific Processes

In addition to the BAT techniques listed above, activity specific BAT on individual production processes outlined in section 4.1 of this document as detailed in the following BREF Sections

- Sections 21.3 to 21.17 and 21.19 of STS-BREF.

If there are known exceptions when a BAT is not applicable in certain circumstances, this issue is noted in the appropriate section.

6. BAT ASSOCIATED EMISSION LEVELS

6.1 EMISSION LEVELS FOR DISCHARGES TO AIR

This sections outlines the emission limit values for emissions to air as required by Council Directive 1999/13/EC on the limitation of emissions of volatile organic compounds due to the use of organic solvents in certain activities and installations. It is recommended that the Directive be consulted regarding compliance and derogations, which may be applicable in special circumstances.

6.1.1 Emission Limit Values for VOCs with Specified Risk Phrases Above Stated Mass Flow Emissions

The table outlines the emission limit values for emissions to air for VOCs with the specified risk phrases and above the stated mass flow threshold:

Risk Phrase	**Mass flow threshold of the sum of such compounds** [Note 1]	**Emission Limit Value (mass sum of the individual compounds)**
R45 (may cause cancer)	≥ 10 g/h	2 mg/Nm^3
R46 (may cause heritable genetic damage)		
R49 (may cause cancer by inhalation)		
R60 (may impair fertility)		
R61 (may cause harm to the unborn child)		
R40 (limited evidence of a carcinogenic effect) and halogenated	≥ 100 g/h	20 mg/Nm^3

Note 1: this applies at the point of discharge whether abatement is present or not.

6.1.2 Emission Limit Values for Existing Installations Using Existing Equipment

The following emission limit values may be applied until 01 April 2013 for existing installations using existing abatement equipment and emitting VOCs with Risk Phrases not listed above:

Existing installations using existing equipment	Incineration	50 mg C/Nm^3
	Any other abatement equipment	150 mg C/Nm^3

6.1.3 Emission Limit Values for All Other Installations

Installations, which do not have specified risk phrase VOC emissions above the stated mass flow and which do not operate existing equipment must meet the ELVs specified for their particular sector(s):

- Other coating, including metal, plastic, textile, fabric, film and paper coating
- Solvent coating of wooden surfaces
- Vehicle coating and refinishing

- Adhesive coating
- Coil coating
- Winding wire coating
- Leather coating
- Surface cleaning.

The following definitions apply:

Solvent consumption: the total input of organic solvents into an installation per calendar year, or any other 12-month period, less any VOCs that are recovered for reuse.

Reuse: the use of organic solvents recovered from an installation for any technical or commercial purpose and including use as a fuel but excluding the final disposal of such recovered organic solvent as waste.

Solvent input: the quantity of organic solvents and their quantity in preparations used when carrying out an activity, including the solvents recycled inside and outside the installation, and which are counted every time they are used to carry out the activity.

6.1.3.1 Other coating, including metal, plastic, textile, fabric, film and paper coating

The emission limit values are as follows for other coating (apart from those existing installations using existing equipment and apart from specified risk phrase VOC emissions above the mass flow thresholds):

Other coating, including metal, plastic, textile, fabric, film and paper coating			
Solvent consumption (t/year)		**VOCs emission limit value** mg C/m^3 Note 1	**VOCs Fugitive emission Value** % of solvent input
< 15		100	20%
> 15	Drying processes	50	20%
	Coating processes	75	

Note 1: For textile coating, if techniques are used which allow the reuse of recovered solvent, the ELV applied to coating and drying processes taken together is 150 mg C/m^3.

6.1.3.2 Solvent Coating of Wooden Surfaces

The emission limit values are as follows for solvent coating of wooden surfaces (apart from those existing installations using existing equipment, apart from specified risk phrase VOC emissions above the mass flow thresholds, and apart from those coating activities which cannot be operated under contained conditions):

Solvent Coating of Wooden surfaces			
Solvent consumption (t/year)		**VOCs emission limit value** mg C/m^3	**VOCs Fugitive emission Value** % of solvent input
< 25		100	25%
> 25	Drying processes	50	20%
	Coating processes	75	

6.1.3.3 Vehicle Coating and Refinishing

The emission limit values are as follows for vehicle coating and vehicle refinishing (apart from those existing installations using existing equipment and apart from specified risk phrase VOC emissions above the mass flow thresholds):

Vehicle Coating and Refinishing			
Solvent consumption (t/year)		**VOCs emission limit value** mg C/m^3	**VOCs Fugitive emission Value** % of solvent input
Vehicle coating	< 15	50	25%
Vehicle refinishing	> 10		

6.1.3.4 Adhesive Coating

The emission limit values are as follows for adhesive coating (apart from those existing installations using existing equipment and apart from specified risk phrase VOC emissions above the mass flow thresholds):

Adhesive Coating		
Solvent consumption (t/year)	**VOCs BAT emission limit value** mg C/m^3	**VOCs Fugitive emission Value** % of solvent input
< 15	50 Note 1	25%
> 15		20%

Note 1: If techniques are used which allow the reuse of recovered solvent, the ELV is 150 mg C/m^3.

6.1.3.5 Coil Coating

The emission limit values are as follows for coil coating (apart from those existing installations using existing equipment and apart from specified risk phrase VOC emissions above the mass flow thresholds):

Coil Coating		
Solvent consumption (t/year)	**VOCs BAT emission limit value** mg C/m^3	**VOCs Fugitive emission Value** % of solvent input
>25	50 [Note 1]	5%

Note 1: If techniques are used which allow the reuse of recovered solvent, the ELV is 150 mg C/m^3.

6.1.3.6 Winding Wire Coating

The emission limit values are as follows for winding wire coating (apart from those existing installations using existing equipment and apart from specified risk phrase VOC emissions above the mass flow thresholds):

Winding Wire Coating	
	Total Emission Limit Value g/kg
Average diameter of wire ≤ 0.1 mm	10
All other installations	5

6.1.3.7 Leather Coating

The emission limit values are as follows for leather coating (apart from those existing installations using existing equipment and apart from specified risk phrase VOC emissions above the mass flow thresholds):

Leather Coating		
Solvent consumption (t/year)		**Total Emission Limit Value g/m^2 of product produced**
Leather coating activities in furnishing and particular leather goods used as small consumer goods like bags, belts, wallets, etc.		150
Other leather coating activities	< 25	85
	> 25	75

6.1.3.8 Surface Cleaning

The emission limit values are as follows for surface cleaning (apart from those existing installations using existing equipment and apart from specified risk phrase VOC emissions above the mass flow thresholds):

Surface Cleaning		
	VOCs BAT emission limit value	**VOCs Fugitive emission Value** % of solvent input
Surface cleaning using solvents with risk phrases R45, R46, R49, R60, R61, or halogenated solvents with risk phrase R40.	20 mg/m^3	10%
Other surface cleaning [Note 1]	75 mg C/m^3	15%

Note 1: Installations which can demonstrate that the average organic solvent content of all cleaning material used does not exceed 30% by weight may be exempt from the application of these values.

6.1.4 Emission Limit Values for Particulates

Parameter	**Emission Level (mg/m^3)**
Total Particulate	3 - 5

6.2 Emission Levels for Discharges to Water

The following table sets out emission levels that are achievable using BAT for wastewater treatment. However establishing emission limit values within a licence for direct discharges to surface water from wastewater treatment plant and stormwater discharges must ensure that the quality of the receiving water is not impaired or that the current Environmental Quality Standards (EQS) are not exceeded.

All discharges to sewer are subject to approval from the Water Services Authority.

Compliance with the Water Framework Directive (2000/60/EC) is required where relevant, in particular Article 16.

BAT Associated Emission Levels for Discharges to Water *

Constituent Group or Parameter	Emission Levels (mg/l)	Percentage Reduction [3]	Notes
pH	6 - 9		
Toxicity	5 -10 TU		1
BOD_5	20	>91 - 99%	
COD	30 - 500	>75%	
Suspended Solids	10 - 35mg/l		
Total Ammonia (as N)	10mg/l		
Total Nitrogen (as N)	5 - 25mg/l	>80%	2,4
Total Phosphorus (as P)	2mg/l	>80%	4
Oils Fats and Greases	10mg/l		
Mineral Oil (from interceptor)	20mg/l		
Mineral Oil (from biological treatment)	1.0mg/l		
Phenols			5
Metals			5
Organohalogens			5
Priority Substances (as per Water Framework Directive)			5
Cyanides			5
Other			5, 6

* All values refer to daily averages based on a 24-hour flow proportional composite sample, except where stated to the contrary and for pH, which refers to continuous values. Levels apply to effluent prior to dilution by uncontaminated streams, e.g. storm water, cooling water, etc.

* Temperature measured downstream of a point of thermal discharge must not exceed the unaffected temperature by more than 1.5°C in salmonid waters and 3°C in cyprinid waters (Freshwater Fish Directive 79/659/EEC).

Note 1: The number of toxic units (TU) = 100/x hour EC/LC50 in percentage vol/vol so that higher TU values reflect greater levels of toxicity. For test regimes where species death is not easily detected, immobilisation is considered equivalent to death.

Note 2: Total Nitrogen means the sum of Kjeldahl Nitrogen, Nitrate N and Nitrite N.

Note 3: Reduction in relation to influent load.

Note 4: Limits will depend on the sensitivity of the receiving waterbody.

Note 5: BAT associated emissions levels are highly dependent on production process, wastewater matrix and treatment. These parameters shall be considered on a site-specific basis when setting emission limit values.

Note 6: Any relevant polluting substances as specified in Schedule to S.I. No. 394 of 2004: EPA (Licensing)(Amendment) Regulations, 2004.

7. COMPLIANCE MONITORING

The methods proposed for monitoring the emissions from these sectors are set out below. Licence requirements may vary from those stated below due to site location considerations, and scale of the operation.

7.1 MONITORING OF EMISSIONS TO AIR

- Compilation of solvent mass balances on an annual basis.
- Continuous monitoring of VOCs where an average of > 10 kg/hr of total organic carbon is emitted at the final point of discharge.
- Periodic monitoring of VOCs from waste gas emission points, where present (minimum once per annum).
- Where oxidisers are in use, periodic monitoring of NO_X and CO the frequency to be set taking account of the nature, magnitude and variability of the emission and the reliability of the controls.

7.2 MONITORING OF AQUEOUS EMISSIONS

- For uncontaminated cooling waters, continuous monitoring of temperature and flow.
- Continuous monitoring of flow discharge from wastewater treatment plant and any other parameters deemed necessary by the Agency.
- Daily monitoring of flow, volume, pH, temperature and any other relevant parameters deemed necessary by the Agency, taking account of the nature, magnitude and variability of the emissions and the reliability of the control technique.
- Establish existing conditions prior to start-up of key emission constituents and salient flora and fauna.
- Monitoring of influent and effluent for the waste water treatment plant to establish % BOD reduction and early warning of any difficulties in waste water treatment, or unusual loads.
- The potential for the treated effluent to have tainting and toxic effects should be assessed and if necessary measured by established laboratory techniques.
- Periodic biodegradability checks where appropriate on effluents to municipal waste treatment plants, both prior to start-up and thereafter.

7.3 MONITORING OF EMISSIONS TO GROUNDWATER

There should be no direct emissions to groundwater, including during extraction and treatment of groundwater[1].

7.4 MONITORING OF SOLID WASTE

- The recording in a register of the types, quantities, date and manner of disposal/recovery of all wastes.
- Leachate testing of sludges and other material as appropriate being sent for landfilling.
- Annual waste minimisation report showing efforts made to reduce specific consumption together with material balance and fate of all waste materials.

[1] Council Directive 80/68/EEC of 17 December 1979 on the protection of groundwater against pollution caused by certain dangerous substances

Appendix 1

PRINCIPAL REFERENCES

1. E.C.

1.1. Council Directive 96/61/EC of 24 September 1996 concerning Integrated Pollution Prevention and Control.

1.2. Council Directive 99/13/EC of 11 March 1999 on the limitation of emissions of volatile organic compounds due to the use of organic solvents in certain activities and installations.

1.3. Draft Reference Document on Best Available Techniques for Surface Treatment using Organic Solvents (May 2004).

1.4. Reference Document on Best Available Techniques for the Surface Treatment of Metals and Plastics (September 2005).

1.5. Reference Document on Best Available Techniques on Emissions from Storage (January 2005).

2. IRELAND

2.1. Integrated Pollution Control Licensing BATNEEC Guidance Note For The Manufacture or Use of Coating Materials (EPA 1997).

2.2. Integrated Pollution Control Licensing BATNEEC Guidance Note For Noise in Relation to Scheduled Activities (EPA No. LC 8 (1995)).

2.3. Guidance Note For Noise in Relation to Scheduled Activities - 2ND Edition (EPA (2006)).

3. GERMANY

3.1 Integrated Pollution Prevention and Control in selected Industrial Activities - Installations for Surface Treatment using organic solvents for Dressing, Impregnating, Printing, Coating - Part I "Dressing, Impregnating, Coating" Final Report (Federal Environmental Agency, Berlin October 2002).

3.2 Best Available Techniques (BAT) for Paint and Adhesive Application in Germany - (Deutsch-Französisches Institut für Umweltforschung (DFIU) Universität Karlsruhe (TH) August 2002).

Appendix 2

GLOSSARY OF TERMS AND ABBREVIATIONS

BAT	Best Available Technique
STS-BREF	Draft reference document on Best Available Techniques for Surface Treatment using Organic Solvents, published by the European Commission, May 2004
STM-BREF	Reference document on Best Available Techniques for the Surface Treatment of Metals and Plastics, published by the European Commission, September 2005
BOD	Biochemical Oxygen Demand
°C	Degree Celsius
CO	Carbon monoxide
CO_2	Carbon dioxide
COD	Chemical Oxygen Demand
kg	Kilogramme
m^3	Cubic metre
mg	Milligram
Nm^3	Normal cubic metre (101.3 kPa, 273 K)
NO_x	Nitrogen oxides
O_2	Oxygen
t	Tonne (metric)
VOC	Volatile Organic Compounds