



Department  
for Environment  
Food & Rural Affairs

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## **Process Guidance Note 6/44(11)**

### **Statutory guidance for manufacture of coating materials**

**Revised: June 2014**



Llywodraeth Cymru  
Welsh Government



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Defra would like to acknowledge the work of the Environment Agency's Local Authority Unit in the drafting of this guidance note.



## Revision of the guidance

The electronic version of this publication is updated from time to time with new or amended guidance. **Table 0.1** is an index to the latest changes (minor amendments are generally not listed).

**Table 0.1 - Revision of the guidance**

Date of change	Section/ paragraph where change can be found	Nature of change - what paragraphs have been inserted, deleted or amended - what subject matter is covered by the change
June 2014	Fig 4.1	Error corrected in solvent management plan inputs and outputs diagram – in the text below the diagram, in the line ‘actual solvent emission’, O1 should not have been included
June 2013	SE Boxes 5,6 &7	Addition of colour coding to clarify requirements
June 2013	Table 7.1	Addition of colour coding to clarify requirements
March 2013	throughout	Replacement throughout the solvent PG notes of ‘Solvent Emissions Directive’ with ‘industrial emissions Directive’ or ‘the Directive’ as appropriate
	throughout	Replacement of the abbreviation ‘SED’ with ‘solvent emission’ ‘SE’ or ‘solvent emission activity(ies)’ as appropriate e.g. SED box will become SE box
	SE Box 1	No longer needed under the industrial emissions Directive
	SE Box 2	No longer needed under the industrial emissions Directive
	SE Box 3	Definition of substantial change has altered; both new definitions are taken from Directive and as the definitions relate to different classes of installations, the SE Box is split into two boxes to make the differences clear
	SE Box 4	To clarify the Directive basis for the provisions, three new notes have been added. They concern - report compliance, restore compliance if it is breached and for accidents and incidents, the Directive basis for the provisions is clarified
	SE Box 5	Monitoring of VOC emissions after abatement is no longer required to be annual – status of the monitoring column has changed from Directive to BAT with no shading to indicate non-Directive
	SE Box 6	
	SE Box 7	
	SE Box 8	The Directive adds ‘or threatens to cause an immediate significant adverse effect upon the environment’
SE Box 9	Monitoring of VOC emissions after abatement is no longer required to be annual ‘No compliance by dilution’ has been added to SE box to clarify the	

		Directive basis for the provision
	SE Box 10	Minimal change - updating of Article references
	SE Box 11	Minimal change - updating of Article references
	Table 3.1	Links to new regulations updated

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# 1. Introduction

## Legal basis

- 1.1 This note applies to the whole of the UK. It is issued by the Secretary of State, the Welsh Government, the Scottish Government and the Department of the Environment in Northern Ireland (DoE NI) to give guidance on the conditions appropriate for the control of emissions into the air from the manufacture of coating materials. It is published only in electronic form and can be found on the Defra website. It supersedes PG6/44(04) and NIPG6/44(04).
- 1.2 This guidance document is compliant with the [Code of Practice on Guidance on Regulation](#) page 6 of which contains the "golden rules of good guidance". If you feel this guidance breaches the code or you notice any inaccuracies within the guidance, please [contact us](#).
- 1.3 This is one of a series of statutory notes giving guidance on the Best Available Techniques (BAT). The notes are all aimed at providing a strong framework for consistent and transparent regulation of installations regulated under the statutory Local Air Pollution Prevention and Control (LAPPC) regime in [England and Wales](#), [Scotland](#) and [Northern Ireland](#). The note will be treated as one of the material considerations when determining any appeals against a decision made under this legislation. Further guidance on the meaning of BAT can be found for [England and Wales](#) (in chapter 12 of the General Guidance Manual), [Scotland](#), and [Northern Ireland](#), (in chapter 9).
- 1.4 In general terms, what are BAT for one installation in a sector are likely to be BAT for a comparable installation. Consistency is important where circumstances are the same. However, in each case it is, in practice, for regulators (subject to appeal) to decide what are BAT for each individual installation, taking into account variable factors such as the configuration, size and other individual characteristics of the installation, as well as the locality (e.g. proximity to particularly sensitive receptors).
- 1.5 The note also, where appropriate, gives details of any mandatory requirements affecting air emissions which are in force at the time of publication, such as those contained in Regulations or in Directions from the Government. In the case of this note, at the time of publication the mandatory requirements are those contained in the EU industrial emissions Directive. The Regulations referenced in paragraph 1.3 put the Directive requirements into UK law.



1.6 In **Section 4** and **Section 5**, arrows are used to indicate the matters which should be considered for inclusion as permit conditions. It is important to note, however, that this should not be taken as a short cut for regulators to a proper determination of BAT or to disregard the explanatory material which accompanies the arrows. In individual cases it may be justified to:

- include additional conditions;
- include different conditions;
- not include conditions relating to some of the matters indicated.

In addition, conditions will need to be derived from other parts of the note, in particular to specify emission limits, compliance deadlines and mandatory requirements arising from directions or other legislation.

## Who is the guidance for?

1.7 This guidance is for:

### Regulators

- local authorities in England and Wales, who must have regard to this statutory guidance when determining applications for permits and reviewing extant permits;
- the Scottish Environment Protection Agency (SEPA) in Scotland, and district councils or the Northern Ireland Environment Agency (NIEA), in Northern Ireland for whom this is statutory guidance;

**Operators** who are best advised also to have regard to it when making applications and in the subsequent operation of their installation;

**Members of the public** who may be interested to know what the Government considers, in accordance with the legislation, amounts to appropriate conditions for controlling air emissions for the generality of installations in this particular industry sector.

## Updating the guidance

1.8 The guidance is based on the state of knowledge and understanding, at the time of writing, of what constitute BAT for this sector. The note may be amended from time to time to keep up with developments in BAT, including improvements in techniques, changes to the economic parameters, and new understanding of environmental impacts and risks. The updated version will replace the previous version on the [Defra](#) website and will include an index to the amendments.

- 1.9 Reasonable steps will be taken to keep the guidance up-to-date to ensure that those who need to know about changes to the guidance are informed of any published revisions. However, because there can be rapid changes to matters referred to in the guidance – for example to legislation – it should not be assumed that the most recent version of this note reflects the very latest legal requirements; these requirements apply.

## Consultation

- 1.10 This note has been produced in consultation with relevant trade bodies, representatives of regulators including members of the Industrial Pollution Liaison Committee and other potentially-interested organisations.

## Policy and procedures

- 1.11 General guidance explaining LAPPC and setting out the policy and procedures is contained in separate documents for [England and Wales](#), [Scotland](#) and [Northern Ireland](#).

## EU industrial emissions Directive

- 1.12 Most of the activities covered by this note are solvent emission activities (SE) under the [industrial emissions Directive](#). To be a solvent emission activity, it must:
- a) be a manufacture of coating preparations, varnishes, inks and adhesives activity listed as a solvent emission activity in the LAPPC Regulations (see **Table 3.1**); and
  - b) consume 100 tonnes or more of solvent in any 12-month period.

## Which paragraphs of this note apply to solvent emission activities?

- 1.13 Everything in boxes labelled ‘SE box’ is mandatory, as is text which they invoke because it repeats what is required by the industrial emissions Directive. The rest of the note is guidance on Best Available Techniques for the sector.
- 1.14 The industrial emissions Directive requires replacement of certain solvents, as far as possible, in the shortest possible time. These are substances or mixtures which, because of their VOC content, are assigned or need to carry any of the following hazard statements H340, H350, H350i, H360D or H360F; there are further requirements which apply to the use of those materials, and to halogenated VOCs assigned hazard statements H341 or H351.

In June 2015, 'hazard statements' replace 'risk phrases'. Until then both categories are in use, and the preceding paragraph should be read with 'or risk phrases R45, R46, R49, R60, and R61' following H360F, and read with 'or risk phrases R40 and R68' following H351. The [CLP Directive](#) implements the change from risk phrases to hazard statements. For further information on the Globally Harmonized System of Classification and Labelling of Chemicals (GHS), visit the [United Nations Economic Commission for Europe](#) website.

1.15 The industrial emissions Directive then offers two ways of compliance for coating manufacture activities:

- complying with the Directive emission limits for waste gases and fugitive emissions;
- complying with the Directive total emission limits (with or without abatement).

1.16 The SE boxes in this note are:

1 - new VOC abatement plant (no longer needed under the industrial emissions Directive)

2 - new installations (no longer needed under the industrial emissions Directive)

3A - substantial change to all installations

3B - substantial change to existing installations

4 - VOC compliance

5 - waste gas and fugitive emission limits and requirements

6 - total emission limit values

7 - requirements for designated materials

8 - non-compliance causing immediate danger

9 - VOC monitoring

10 - installations with two or more activities

11 - start up and shut down

1.17 **Tables 1.1, 1.2 and 1.3** pick out the paragraphs and SE boxes that apply depending on which of these ways an operator chooses to comply:

- complying with the Directive emission limits and fugitive emission limits (see **Table 1.1**);
- complying with the Directive total emissions limits (see **Table 1.2**);
- applying the Directive reduction scheme (see **Table 1.3**).

**Table 1.1 - Activities applying emission and fugitive limits**

Installation	Paragraphs of guidance note which apply
<b>Single SE activity:</b> All installations	<b>All of sections except:</b> SE Box 6 SE Box 10
<p>A solvent emissions activity (SE) is an activity falling within the scope of the industrial emissions Directive (that is, an activity as defined in Annex VII, Part 1 and which exceeds the thresholds in Annex VII, Parts 2 &amp; 3 of the Directive).</p> <p>Consumption is the organic solvent consumption of the activity (see Article 57(9) of the Directive). The determination of consumption is described in paragraph 4.7 of this note.</p> <p><b>Coating materials manufacturing processes / activities where the organic solvent consumption of the installation is &lt;100 tonnes are not covered by this note.</b></p>	

**Table 1.2 - Activities applying total emission limit**

Installation	Paragraphs of guidance note which apply
	With or without VOC abatement
<b>Single SE activity:</b> All installations	<b>All of sections except:</b> SE Box 5 SE Box 10
<p>A solvent emissions activity (SE) is an activity falling within the scope of the industrial emissions Directive (that is, an activity as defined in Annex VII Part 1, and which exceeds the thresholds in Annex VII, Parts 2 &amp; 3 of the Directive).</p> <p>Consumption is the organic solvent consumption of the activity (see Article 57(9) of the Directive). The determination of consumption is described in paragraph 4.6 of this note.</p> <p><b>Coating materials manufacturing processes / activities where the organic solvent consumption of the installation is &lt;100 tonnes are not covered by this note.</b></p>	

**Table 1.3 - Activities applying reduction scheme**

This compliance option is not available for this activity.

## Which provisions in this note apply to non-Directive activities?

- 1.18 None of the SE boxes applies to non-Directive activities. All the remaining provisions are guidance on Best Available Techniques for the sector.

## General guidance on industrial emissions Directive

- 1.19 The general guidance mentioned in paragraph 1.11 contains an outline of the industrial emissions Directive requirements, advice on derogations (that is, cases where, if specified criteria are met, an activity/activities can be excused from some requirements), the meaning of the 'shortest possible time' and other matters concerning industrial emissions Directive compliance.

### When to use PG6/44 rather than another PG note

- 1.20 This note deals with the manufacture of coating materials. The note covers the manufacture of the final products of coating preparations, varnishes, inks and adhesives including intermediates where carried out on the same site by the mixing of pigments, resins and adhesive materials with organic solvent or carrier, including dispersion and pre-dispersion activities, viscosity and tint adjustments and operations for filling the final product into its container (more details can be found in **Section 3**).

### Designated hazard statement materials

- 1.21 Some mixtures may contain a substance which is assigned one of the risk phrases R45, R46, R49, R60 or R61 (**see paragraph 1.14**). Where the concentration of this substance in the mixture is below the threshold limit for that classification, then the whole mixture is not classified as a designated risk phrase material.

Example 1: 1-methoxy-2-propanol, when manufactured, contains 2-methoxy-1-propanol (R61 amongst other) as an impurity at less than 0.49% by weight. The classification threshold for R61 risk phrase materials is 0.5% by weight. The impurity is present at <0.5% so 1-methoxy-2-propanol is not a designated risk phrase material despite containing a substance which carries one or more of the risk phrases.

- 1.22 It should be noted that some substances in a mixture may be assigned these risk phrases but are not VOCs. In these cases the mixture is not deemed to be a risk phrase materials for the purposes of this note

Example 2: Lead chromate is not a VOC. Therefore, lead chromate and the mixture containing lead chromate, provided that mixture does not contain any other designated risk phrase VOCs, is out of scope of these requirements.

## 2. Timetable for compliance and reviews

### Existing processes or activities

- 2.1 This note contains all the provisions from previous editions which have not been removed. Some have been amended. For installations in operation at the date this note is published, the regulator should have already issued or varied the permit having regard to the previous editions. If they have not done so, this should now be done.
- 2.2 The new provisions of this note and the dates by which compliance with these provisions is expected are listed in **Table 2.1**, together with the paragraph number where the provision is to be found. Compliance with the new provisions, which apply to both Directive and non-Directive activities, should normally be achieved by the dates shown. Permits should be varied as necessary, having regard to the changes and the timetable.

**Table 2.1 - Compliance timetable**

Guidance	Relevant paragraph/row in this note	Compliance date
Light coloured painting of outdoor tanks containing VOC*	Paragraph 5.8	By 31 December 2013
All other provisions		Normally within 12 months of the issue date of this note.

\*Here and elsewhere in this note, this includes outdoor tanks containing any organic solvent and organic solvent-borne coating material, inks and adhesives.

- 2.3 Replacement plant should normally be designed to meet the appropriate standards specified for new installations/activities.
- 2.4 Where provisions in the preceding guidance note have been deleted or relaxed, permits should be varied as necessary as soon as reasonably practicable. **Section 6** provides a summary of all changes.
- 2.5 For new activities, the permit should have regard to the full standards of this guidance from the first day of operation.
- 2.6 For substantially changed activities, the permit should normally have regard to the full standards of this guidance with respect to the parts of the activity that have been substantially changed and any part of the activity affected by the change, from the first day of operation.

## Permit reviews

- 2.7 Under LAPPC, the legislation requires permits to be reviewed periodically but does not specify a frequency. It is considered for this sector that a frequency of once every eight years ought normally to be sufficient for the purposes of the appropriate Regulations. Further guidance on permit reviews is contained in the appropriate Guidance Manual for [England and Wales](#), [Scotland](#), [Practical guide](#) section 10 and Northern Ireland [Part B Guidance](#) page 9, Northern Ireland [Part C Guidance](#) chapter 17. Regulators should use any opportunities to determine the variations to permits necessitated by paragraph 2.2 above in conjunction with these reviews.
- 2.8 Conditions should also be reviewed where complaint is attributable to the operation of the process and is, in the opinion of the regulator, justified.

## Specific industrial emissions Directive requirements

- 2.9 Since 31st October 2007 the full requirements of the solvent emissions Directive applied and have been continued in the industrial emissions Directive. All requirements, as set out in the SE boxes below and in **Section 4**, ought to have been complied with by that date.

### SE Box 1 - New VOC abatement plant

No longer needed under the industrial emissions Directive.

### SE Box 2 - New installations

No longer needed under the industrial emissions Directive.

### SE Box 3A - Substantial change to all installations (Article 3(9) and 63)

'**Substantial change**' means a change in the nature or functioning, or an extension, of an installation which may have significant negative effects on human health or the environment.

**Re-verify compliance:** following a substantial change, compliance must be re-verified.

### SE Box 3B - Substantial change to existing installations

'**Existing installation**' means an installation in operation on 29 March 1999 or which was granted a permit before 1 April 2001 or the operator of which submitted a complete application for a permit before 1 April 2001, provided that that installation was put in operation no later than 1 April 2002:

'**Substantial change**' **additional meaning** - a **change** of the maximum mass input of organic solvents by an **existing installation** averaged over 1 day, where the installation is operated at its design output under conditions other than start-up and shut-down operations and maintenance of equipment, shall be considered as **substantial** if it leads to an increase of emissions of volatile organic compounds of more than:

- a) 25 % for an installation carrying out activities with a solvent consumption of less than 1000 tonnes per year;
- b) 10 % for all other installations.

**Change of limits:** where an **existing installation** undergoes a **substantial change**, or falls within the scope of this Directive for the first time following a substantial change, that part of the installation which undergoes the substantial change shall be treated either as a new installation or as an existing installation, provided that the total emissions of the whole installation do not exceed those that would have resulted had the substantially changed part been treated as a new installation.



### 3. Activity description

#### Regulations

3.1 This note applies to LAPPC installations for the manufacture of coating materials. The activities for regulation are listed in **Table 3.1**.

Table 3.1 - Regulations listing activities				
LAPPC	Solvent consumption of coating manufacture activity	England and Wales	Scotland	Northern Ireland
		EPR reference	PPC reference	PPC reference
Solvent emission activity	100 tonnes or more in any 12-month period	<a href="#">Reg 2 EPR as amended in 2013</a> refers to <a href="#">industrial emissions Directive Annex VII Parts 1 and 2</a>	<a href="#">Schedule 2</a>	n/a
Part B	100 tonnes or more in any 12-month period	<a href="#">Schedule 1 section 6.5 Part B</a>	<a href="#">Schedule 1 section 6.5, Part B</a>	
Solvent emission activity	100 tonnes or more in any 12-month period	n/a	n/a	<a href="#">Schedule 1 section 7</a>
Part C	100 tonnes or more in any 12-month period			<a href="#">Schedule 1 Section 6.5 Part C</a>

The links are to the original version of the Regulations. A consolidated version is not available on [www.legislation.gov.uk](http://www.legislation.gov.uk) .

For England and Wales, an [unofficial consolidated version](#) is available but read the first page of that document in order to understand its status and content.

## Installation

- 3.2 'Installation' means a stationary technical unit within which one or more activities listed in Part 1 of Annex VII are carried out, and any other directly associated activities on the same site which have a technical connection with the activities listed in those Annexes and which could have an effect on emissions and pollution.
- 3.3 Coating materials are manufactured using a similar range of process steps. The manufacturing process/activity is typically a batch process, which involves combining raw materials, in one or more steps, to produce the finished product. All coating materials are comprised of appropriate mixtures of four main raw material component categories:
- resins (organic (usually) or inorganic polymers);
  - pigments (primary (colours), extenders/fillers or actives (e.g. anti-corrosives));
  - carriers (organic solvents, water, non-volatile liquids); **and**
  - additives (a wide range of specific materials, used in small quantities to provide particular properties during manufacture, in storage, during application, in service life etc).
- 3.4 The raw materials used in coating materials manufacture are usually purchased from either specialist, upstream manufacturers of substances or from companies manufacturing reaction products (e.g. resin and polymers) or mixtures (e.g. solutions of solids). Some coating materials manufacturers may produce certain of the raw materials themselves. This typically would be restricted to the manufacture of resins and polymers.
- 3.5 The coating materials manufacturing stage rarely involves any chemical reaction processes, products being produced by mixing or blending usually at ambient temperatures.
- 3.6 Typical batch sizes range from 3 -25,000 litres (kilos) depending on the products manufactured and the end markets.
- 3.7 A number of routes are used for coating materials manufacture:
- a) 'traditional' process - this route produces a batch of coating from first principles. It consists of four key steps:
- pre-assembly and premixing;
  - pigment dispersing and grinding/milling;
  - product let-down, tinting and finishing;
  - product filtering and filling.

- b) 'dispense' process - this route produces a batch of coating from the blending of finished or semi- finished components ("intermediates"). The intermediates are either:
- dispensed, via a dispensing machine equipped with dosing heads, directly into the shipping containers, in which they are mixed in order to produce the coating; **or**
  - dispensed into a mixing vessel, blended and filled into the supply package
- c) 'single step' process - this route produces a batch of coating from first principles. It consists of the first three key steps of the "traditional" process in a single dispersing machine with pigmented pre-dispersed chips followed by product filtering and filling.

3.8 In addition to the above, there are a number of supporting steps, which are critical to the coating material manufacturing process. These include the following:

- delivery, unloading and storage of raw materials;
- storage, warehousing and despatch of finished goods;
- cleaning of manufacturing vessels;
- disposal of raw material packaging, process wastes.

3.9 The process steps for the traditional route are as follows:

### **Delivery, unloading and storage of raw materials**

3.10 Powder raw materials are delivered in bags on pallets and unloaded by forklift trucks and stored in designated buildings. High volume usage pigments and extenders may be delivered by road tanker in bulk and stored in silos or 'Big Bags'.

3.11 Liquid raw materials are delivered in a variety of various sized containers, ranging from 5 to 205L, and up to 1000L IBC containers. These are stored in designated storage areas, made from suitably impervious material and are bunded. Large volume usage liquids such as organic solvents and some resins are normally delivered by road tanker and stored in bulk in a bunded tank farm. Tank farms are typically located outside the manufacturing plant and piped via a ring main system to dispensing locations inside the plant.

## **Dispensing of raw material**

- 3.12 Raw materials can be dispensed in various ways, depending on the size of the batch being manufactured and the scale of the process equipment, to the pre-dispersion plant. Bulk dry powders stored in silos can be transferred pneumatically, in an enclosed system. Whole bags of dry powders are assembled, typically on pallets, together with any part-bags and charged manually into the pre-dispersion equipment.
- 3.13 Large volume usage liquids can be piped via a ring main system to dispensing locations within the production plant or measured into intermediate containers for internal transport. Smaller volumes may be pumped from delivery barrels direct into the manufacturing stage, or may be measured into intermediate containers.

## **Premixing**

- 3.14 In the premix step, liquid raw materials (e.g. organic solvents and carriers, resins and additives) are assembled and then blended in a suitable mixing container to form a viscous material. Pigments (and other extenders) are added and held in suspension in order to supply the dispersion equipment with a consistently mixed material. The premix stage results in the formation of an intermediate product that is referred to as the base or mill base.
- 3.15 Typical raw materials for organic solvent-borne coatings include resins, organic solvents, plasticizers, pigment and extenders. Raw materials used for water-borne coatings include polymers, water, ammonia or other amines, dispersants, pigments and extenders. Raw materials for paste ink manufacture include pigments, oils, resins, liquid carriers, and driers. Raw materials for UV cured coatings include acrylate polymers, monomers, initiators, pigments and extenders.
- 3.16 The type of equipment used for premixing will depend on the batch size and the type of coating being produced. Drums equipped with a portable mixer may be used for small batches. These mixers normally have an impeller with three or four blades. Other materials made in portable mix tanks may be blended using larger, permanent high-speed dispersers or variable-speed mixers fitted with paddle, propeller, turbine, or disc-type agitators.
- 3.17 Coating materials manufacturing facilities may use grinding equipment to accomplish the premix operations. This approach, common with water-borne coatings, eliminates the need to transfer the material to another type of equipment for the grinding/milling step described below.

## **Pigment dispersion and milling/grinding**

- 3.18 Grinding or milling reduces the agglomerate particle size of the pigment to achieve fine particle dispersion. This process can be classified into three stages of wetting, dispersion and grinding.
- 3.19 In the wetting stage, various wetting agents may be used to displace the air, moisture, and gases that are adsorbed on the surface of the pigment particles. This is usually carried out at the same time as the dispersion stage. This results in the break up of the large aggregates of pigments into smaller agglomerates. Finally, milling (or grinding) is the mechanical break-up and separation of pigment clusters into individual particles and the distribution of the wetted pigment into the body of the liquid vehicle to produce a fine particle suspension. Milling usually involves the use of grinding media such as pebbles, balls, or beads to facilitate the break-up of the pigment agglomerates.

### **Wetting and dispersion**

- 3.20 For many products, the first manufacturing step is the dispersion of powdered pigments in a resin/organic solvent blend. This is usually carried out using a high speed rotating disk (high speed dispersers) immersed in the powder/liquid mixture. The equipment can be fully enclosed - generally for large batches or long continuous runs - or commonly an open tank with a removable lid.
- 3.21 Where high volume production justifies it, the pre-dispersion can be diluted with extra resin solution/organic solvent, and pumped directly to the next stage of milling. More commonly, the pre-dispersion tank is mobile, and is mechanically transported to the mill.

### **Milling**

- 3.22 As noted below, in some cases, dispersion can provide the required fineness of grind, but it is common to take the material from the dispersion stage, dilute it with extra resin solution/carrier, and to grind the pigment more finely in a mill. This dispersion stage generally involves pumping the paste through a mill, which may be enclosed or open, though in ball mills (now uncommon) the whole charge is held in the mill chamber during dispersion.
- 3.23 Wherever possible, enclosed mills are preferred, as they minimise any losses of volatile components (e.g. organic solvents). However, open mills are still necessary - for example, roll mills for some inks.

3.24 A wide array of milling equipment is available. The choice is determined by a number of factors, including the resin system, the ease of dispersibility and type of pigments, the coating characteristics and the scale of production. More commonly used equipment include the following: roller mills, ball and pebble mills, attritors, sand mills, bead and shot mills, high-speed stone and colloid mills, high-speed dispersers, high-speed impingement mills, and horizontal media mills. Roller and ball mills are somewhat outdated methods in current pigment dispersion technology.

### **Single step process**

3.25 Some products are manufactured entirely in one piece of equipment using high-speed, disk-type impellers. Because no grinding media are present in the mixing vessel, the pigment disperses through shearing forces acting in the bulk. Whilst high-speed disk milling may be appropriate for products such as thick film undercoats and primers, it will not be sufficient for products where a high degree of dispersion and fineness of pigment particle size is required.

### **Product adjustment**

3.26 When an acceptable degree of pigment particle size reduction and stability has been reached, either by dispersion alone, or by a combination of dispersion and milling, the batch is completed. Up to three stages may be involved:

- letdown;
- tinting;
- final adjustment.

3.27 These stages may be carried out in the same vessel containing the mill base or finishing is completed in larger closed or fixed tanks, fitted with a stirrer or other form of agitation, with hatches that can be opened to make additions and to take samples. They may also be fitted, optionally, with piped supplies of organic solvent or resin solution.

### **Letdown**

3.28 At this stage, additions of resins, carriers and other components are made to the mill base to produce the final intended product composition. Such additions are usually made under slow speed stirring.

## **Tinting**

- 3.29 Products are formulated to produce a close colour match at the milling stage. However, final adjustment may be required on each batch, due to raw material and batch processing variations. Tinting of batches may be made with concentrated colour intermediates or with finished products. Such additions are usually made under slow speed stirring.
- 3.30 An alternative method incorporating the stages described in paragraphs 3.26, 3.27 and 3.28 can be achieved using specialist colour concentrates. These are mixed with a mixing varnish or extender to the desired colour and gloss level. Such additions are made under slow speed stirring. No other additions are necessary.

## **Final adjustment**

- 3.31 Immediately prior to filling, a batch may require the addition of specific components or adjustment of viscosity. Such additions are usually made under slow speed stirring.

## **Filtering/filling**

- 3.32 The final step in the manufacturing process is the product filling operation. During filling, the product is filtered to remove any oversize or un-dispersed particulate material and to enhance the quality and uniformity of the product.
- 3.33 A variety of filtering methods are used and the end use of the product determines the type of filtration required. Some products require only a cloth bag filter; other products require filtering equipment such as strainers or sieves. For high quality finishes, wound polypropylene or other resin cartridge filters are used.
- 3.34 The coating is filled through the filter into the appropriate sized container (pails, drums, totes, tank wagons, or other containers). Filling may be accomplished either manually or mechanically depending on the number and size of the containers to be filled.

## Process equipment cleaning

- 3.35 Process equipment cleaning is a necessary stage in the manufacturing process and can be performed in situ or external to the manufacturing plant, depending on the equipment to be cleaned. Fixed process tanks and vessels and associated connecting pipes, pumps and filters can only be cleaned in situ. The range of cleaning equipment and method will vary according to the shape of the tanks, the coating and resin systems concerned, the degree of cleanliness to be achieved and quality. Fixed tanks are often cleaned using static spray heads that can be fixed into position over the top of the tank or through a cleaning port. Usually organic solvent is used in such systems as the cleaning media and is sprayed at low pressure into the top of the vessel. Other cleaning methods may involve physical techniques using brushes instead of spray heads, and manual cleaning performed from outside or directly inside the tank. Cleaning media other than organic solvent may include caustic solutions, water-based cleaners and abrasive impact techniques using inert particles.
- 3.36 Pipes lines connecting tanks are normally flushed clean using organic solvent and typically an organic solvent compatible with the material in process or the next planned batch. Pigging is also a common method of cleaning pipes by directly pushing out product residues from the line by sending a missile through the pipe. Pigging is a very useful system to recover product and minimise waste.
- 3.37 Process equipment that are mobile, such as portable tanks and IBCs or tote tanks, are usually cleaned external to the manufacturing plant. Portable tank cleaning methods are typically automated or semi- automated, using spray heads or brushes, and using one or a combination of organic solvent, water, and caustic solutions as the cleaning media. Often, it is difficult to find one machine that can clean all sizes and shapes of portable tanks and invariably, some manual cleaning will be carried out, normally the external shell of the tank and valves.
- 3.38 Small parts and tools used during the manufacturing process are cleaned either in situ manually or in small baths, which contain cleaning solution, typically organic solvent. These baths are closed and can be interlocked to local exhaust ventilation. Tools are left to soak and then cleaned with brushes manually.
- 3.39 Filters are cleaned either in situ as part of the pipe flushing/pigging process or as an open manual process under local or general exhaust ventilation. The method of cleaning will depend on the type of filter. Filter cleaning can be avoided by using disposable filters, which are available for certain equipment and are suitable for certain products.



## **Waste**

3.40 Waste is generated from all the above manufacturing steps, including indirect processes such as material delivery, unloading, warehousing and process equipment cleaning. Examples of wastes generated directly from the manufacturing processes include the following:

- preassembly and premixing will generate waste packaging (e.g. bags, drums, plastic wrap and pallets);
- grinding, milling and dispersing and product finishing and blending processes will also generate waste packaging as well as liquid samples from quality control; paint residues; and spent equipment cleaning organic solvents;
- product filling will generate dirty filters and packaging.

Figure 3.1 - Traditional process

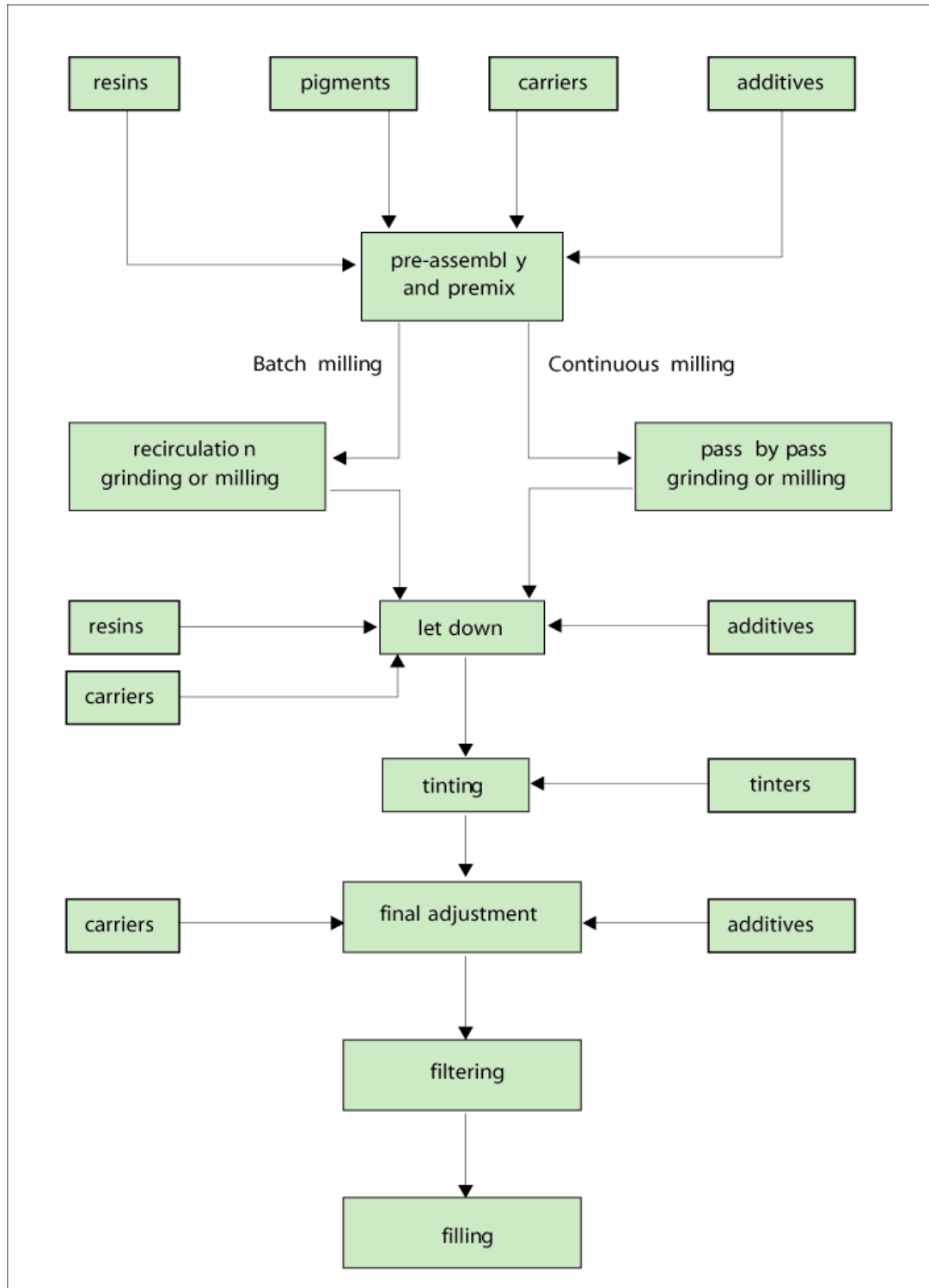
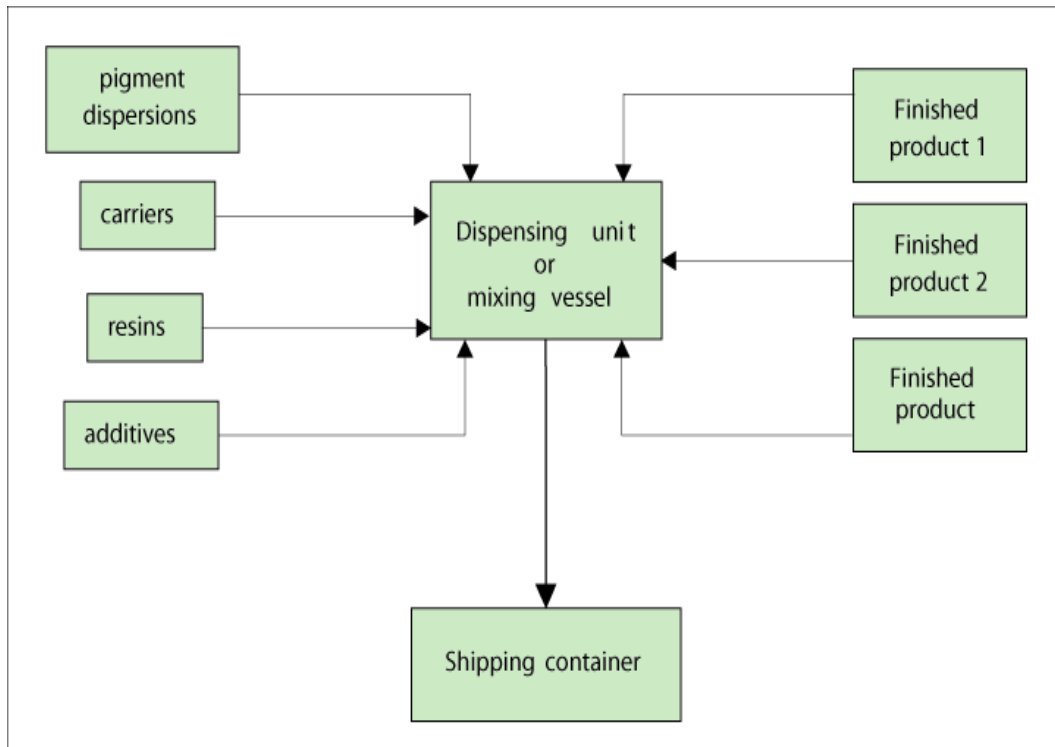


Figure 3.2 - Dispense process



## 4. Emission limits, monitoring and other provisions

- 4.1 Emissions of the substances listed the Tables and SE boxes below should be controlled.
- 4.2 Guidance on techniques to achieve compliance with the industrial emissions Directive and BAT limit values and provisions is in **Section 5**. Monitoring of emissions should be carried out according to the method specified in this section or by an equivalent method agreed by the regulator. The latest information regarding the monitoring standards applicable can be found at the [Source Testing Association website](#). Further information on monitoring can be found in Environment Agency publications, [M1 and M2](#).
- 4.3 All activities should comply with the emission limits and provisions with regard to non-VOC releases in **Table 4.1**.

**Table 4.1 and SE boxes 5 and 7** should be considered in conjunction with the monitoring paragraphs found later in this section.

The reference conditions for limits in **Section 4** are: 273.1K, 101.3kPa, without correction for water vapour content, unless stated otherwise.

**Table 4.1 - Emission limits, monitoring and other provisions for non-VOC releases**

Row	Substance	Source	Emission limits/provisions	Type of monitoring	Monitoring frequency
1	Carbon Monoxide	Oxidation plant	100 mg/Nm <sup>3</sup> as a 30-minute mean for contained sources	<b>Catalytic oxidiser</b> Monitoring and recording <b>plus</b> Manual extractive testing	Continuous  <b>plus</b> Annual
		From turbines, reciprocating engines or boilers used as VOC abatement equipment.	500 mg/Nm <sup>3</sup> at 5% oxygen dry gas, as 30-minute mean for contained sources.	<b>All other types of abatement</b> Manual extractive testing	Annual
2	Particulate matter	All coating materials manufacturing processes (except for ink manufacture)	50 mg/Nm <sup>3</sup> as 8-hour mean where non-continuous monitoring is undertaken for contained sources	Manual extractive testing	Annual
		All ink manufacturing processes	20 mg/Nm <sup>3</sup> as 8-hour mean where non-continuous monitoring is undertaken for contained sources		
		All processes	No visible emission		
3	Oxides of nitrogen (measured as nitrogen dioxide)	Oxidation plant	100mg/Nm <sup>3</sup> as a 30-minute mean for contained sources.	Manual extractive testing	Annual
5	Sulphur dioxide	All activities using heavy fuel oil or other residual type /comparable <a href="#">Quality Protocol Processed Fuel Oil</a>	1% wt/wt sulphur in fuel	Sulphur content of fuel is regulated under the Sulphur Content of Liquid Fuels Regulations	
		All activities using gas oil / comparable <a href="#">Quality Protocol Processed Fuel Oil</a>	0.1% wt/wt sulphur in fuel		

**Table 4.2 - Emission limits, monitoring and other provisions for non-Directive activity VOC releases**

As the industrial emissions Directive threshold and the LAPPC threshold are numerically the same, no installations are expected to need this non-Directive Table 4.2 for VOC limits.

4.4 For VOC compliance, the Directive gives three compliance options (not all options are available to all activities and Option c (below) is **not** available to activities covered by this note).

**SE Box 4 - VOC compliance (Articles 7, 8, 58, 59)**

**All activities**

All installations must comply with the provisions of SE Box 7.

All installations must then comply with either:

- a) the emission limit in waste gases and the fugitive emission limit in SE Box 5; or
- b) the requirements of the total emission limit values in SE Box 6; or
- c) the requirements of the reduction scheme in paragraph 4.5 (not available to activities covered by this note).

All installations must report on compliance and the regulator requests the information needed. See paragraph 4.7 for consumption and for the solvent management plan, see paragraph 4.8.

Annual data is required for the reduction scheme, see paragraph 4.5.

For compliance with emission, fugitive and total limits, the regulator determines the frequency of monitoring. See the monitoring requirements alongside SE boxes 5, 6 & 7 and paragraph 4.29 on varying monitoring frequency.

If compliance is breached, it should be restored within the shortest possible time (see also paragraphs 4.11 and 4.19).

For accidents and incidents significantly affecting the environment, paragraph 4.11 and 4.19 apply. In addition, further possible incidents or accidents should be prevented.

<b>SE Box 5 - Waste gas and fugitive emission limits and requirements (Article 59 and Annex VII, Parts 2 &amp; 3)</b>			
<b>For all activities using the waste gas and fugitive emission limits and requirements</b>			
Organic solvent consumption: <b>100 tonnes or more and less than 1000 tonnes</b>	<b>VOC in waste gases</b>	<b>Emission limits / requirement</b> VOC expressed as total mass of organic carbon	<b>Fugitive emission values</b>
	Waste gases from oxidation plant used as abatement	50mg C/Nm <sup>3</sup>	5% of organic solvent input
	Any other waste gases	150mg C/Nm <sup>3</sup>	
Organic solvent consumption: <b>1000 tonnes or more</b>	Waste gases from oxidation plant used as abatement	50mg C/Nm <sup>3</sup>	3% of organic solvent input
	Any other waste gases	150mg C/Nm <sup>3</sup>	
<b>Note 1</b> - the fugitive emission limit value does not include solvent sold as part of a coatings mixture in a sealed container.			

<b>Monitoring</b>
<p><b>Abated releases:</b> Continuous monitoring and recording</p> <p><b>PLUS</b> Manual extractive testing</p> <p><b>Unabated releases:</b> Manual extractive testing</p>

SE Box 6 - All activities using the total emission limit values (Article 59, Annex VII, Parts 2, 3 & 4)		Monitoring	
VOC in waste gases	Total emission limit values / requirements	Unabated releases	Abated releases
Organic solvent consumption: <b>100 tonnes or more and less than 1000 tonnes</b>	5% of organic solvent input	Manual extractive testing*	Continuous monitoring and recording*  <b>PLUS</b> Manual extractive testing*
Organic solvent consumption: <b>1000 tonnes or more</b>	3% of organic solvent input	* Note: When used in accordance with the above requirements, the <a href="#">'VOC Workbook'</a> provides suitable methods for determining contained and fugitive releases.	
<b>Compliance with total emission limit values</b> Compliance is achieved if the total emission from the activity expressed as a percentage of the organic solvent input to the activity is equal to or less than the total emission limit value: Where total emission is equal to the mass of organic solvent released in the waste gases <b>plus</b> the fugitive releases. Total emission = O <sub>1</sub> + Fugitive And organic solvent input is equal to the quantity of organic solvents purchased and used in the process <b>plus</b> the quantity of organic solvents recovered and reused as organic solvent input into the process as determined as part of the solvent management plan. Organic solvent input (I) = I <sub>1</sub> + I <sub>2</sub> Compliance with the total emission limit value is achieved if: $\frac{\text{Total emission}}{\text{Organic solvent input}} \times 100$ is equal to or less than the total emission limit value  The <a href="#">'VOC workbook'</a> follows the compliance requirements above and provides suitable methods for determining both the contained and fugitive releases from an installation and may be used as a tool for demonstrating compliance with the Total emission limit value.			
<b>Note 1</b> - the fugitive emission limit value does not include solvent sold as part of a coatings mixture in a sealed container.			



## Solvent reduction scheme

- 4.5 Solvent reduction scheme is not a valid route to compliance for this sector.

## Determination of solvent consumption

- 4.6 Construction of inventories of materials consumed and disposed of may involve the identification of individual organic solvents, or solids. This may give rise to an issue of commercial confidentiality. Information supplied must be placed on the public register, unless exclusion has been granted on the grounds of commercial confidentiality or national security. Further information can be found in the appropriate chapter of the relevant General Guidance Manual.
- 4.7 A determination of the organic solvent consumption, the total mass of organic solvent Inputs minus any solvents sent for reuse/recovery off-site, should be made and submitted to the regulator annually, preferably to coincide with the operators stocktaking requirements. This should be in the form of a mass balance in order to determine the annual actual consumption of organic solvent (C):

Where:  $C = I_1 - O_8$  (See Definitions, paragraph 4.9).

## Solvent management plan

- 4.8 Operators buy solvents to replace those lost during the process or included in the product. There are both environmental and cost savings from reducing the losses. The industrial emissions Directive requires a solvent management plan to demonstrate compliance with fugitive emission limits (SE Box 5), and give the public access to information about solvent consumption etc.
- 4.9 The industrial emissions Directive provides guidance on what constitutes a solvent input and an output. This can be described more simply as needing data on:

### Inputs:

How much solvent is:

- bought, whether in pure form or contained in products;
- recycled back into the process.

## **Outputs:**

How much solvent is:

- emitted to air, whether directly or via abatement equipment;
- discharged to water, whether directly or via water treatment;
- sent away in waste;
- lost by spills, leaks etc;
- leaving the installation in the product.

The definitions in Annex VII, Part 7 of the industrial emissions Directive are as follows and are shown diagrammatically in Figure 4.1.

**Inputs of organic solvent** in the time frame over which the mass balance is being calculated (**I**)

**I<sub>1</sub>** The quantity of organic solvents or their quantity in mixtures purchased which are used as input into the process/activity (including organic solvents used in the cleaning of equipment, but not those used for the cleaning of the products).

**I<sub>2</sub>** The quantity of organic solvents or their quantity in mixtures recovered and reused as solvent input into the process/activity. (The recycled solvent is counted every time it is used to carry out the activity.)

**Outputs of organic solvents** in the time frame over which the mass balance is being calculated (**O**)

**O<sub>1</sub>** Emissions in waste gases.

**O<sub>2</sub>** Organic solvents lost in water, if appropriate taking into account waste water treatment when calculating O<sub>5</sub>.

**O<sub>3</sub>** The quantity of organic solvents which remains as contamination or residue in products output from the process/activity. The fugitive emission limit value does not include solvent sold as part of a coatings mixture in a sealed container.

**O<sub>4</sub>** Uncaptured emissions of organic solvents to air. This includes the general ventilation of rooms, where air is released to the outside environment via windows, doors, vents and similar openings.

**O5** Organic solvents and/or organic compounds lost due to chemical or physical reactions (including for example those which are destroyed, e.g. by thermal oxidation or other waste gas or waste water treatments, or captured, e.g. by adsorption, as long as they are not counted under O6, O7 or O8).

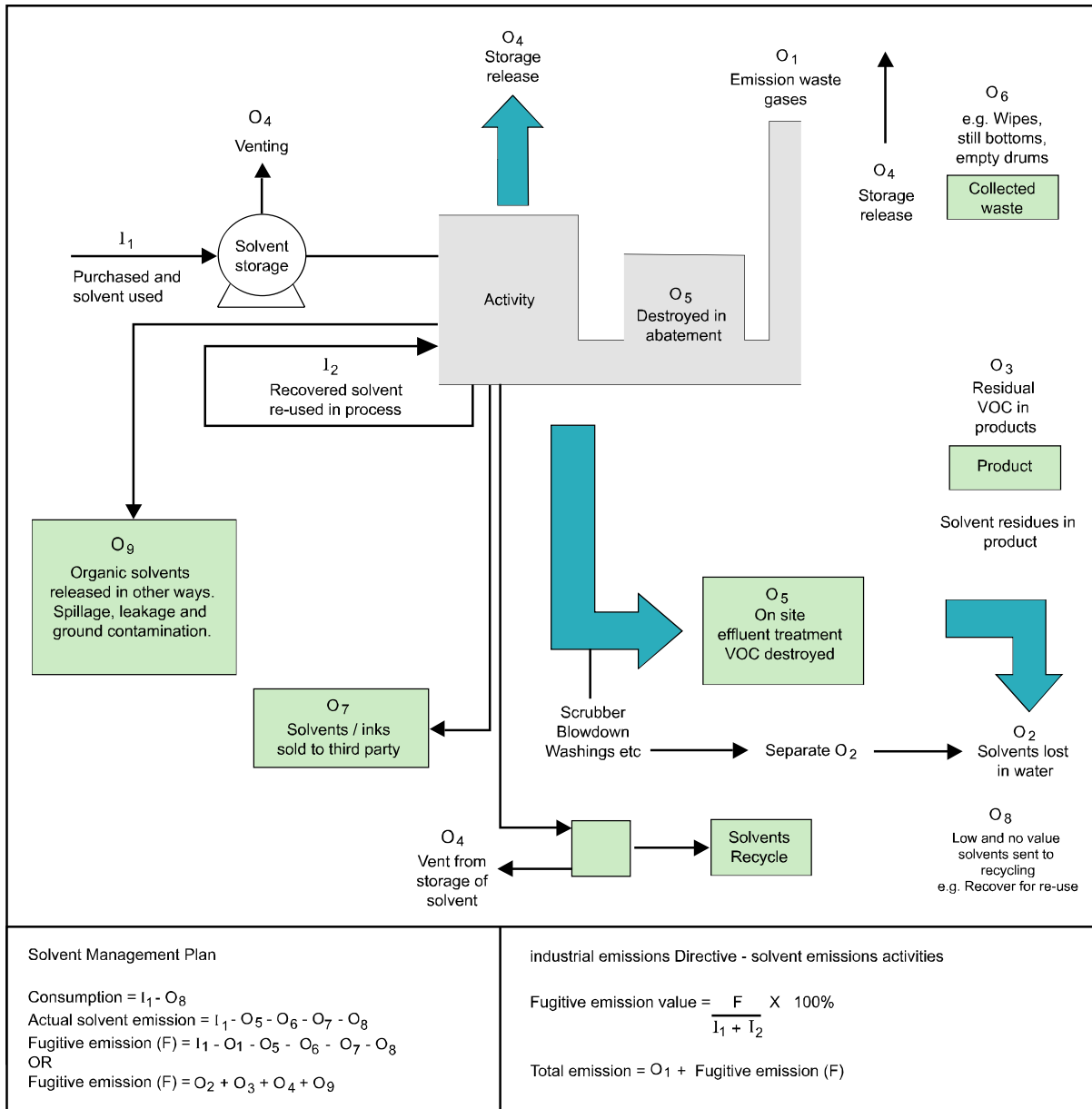
**O6** Organic solvents contained in collected waste.

**O7** Organic solvents, or organic solvents contained in mixtures, which are sold or are intended to be sold as a commercially valuable product.

**O8** Organic solvents contained in mixtures recovered for reuse but not as input into the process/activity, as long as not counted under O7.

**O9** Organic solvents released in other ways.

**Figure 4.1 - Solvent management plan inputs and outputs**



**SE Box 7 - industrial emissions Directive requirements for designated materials  
(Articles 58, 59, 80(7))**

**All activities using designated materials**

Designated materials used in industrial emissions Directive installations must be either replaced, or controlled contained and limited, as set out below.

**All Directive installations**

**1. Materials designated because of their VOC content:**

- **hazard statement H340, H350, H350i, H360D, or H360F**
- **until 1 Jun 2015: risk phrases R45, R46, R49, R60, or R61**

Requirements:

**Replace** as far as possible (Taking into account guidance under Article 64 of the industrial emissions Directive. See note 3 and Appendix 1) by less harmful substances or mixtures.

Timescale:

Installations must comply within the shortest possible time

**Control** under **contained** conditions as far as technically and economically feasible to safeguard public health and the environment, normally, in accordance with the guidance provided within Section 5 of the note.

Timescale:

Immediately (and see note 1 below)

**Limit** - where the sum of the mass flows of all the discharges of all the compounds causing the designated labelling is greater or equal to 10g/h, a limit value of 2mg/Nm<sup>3</sup> for the mass sum of the individual compounds must apply.

Monitoring:

Manual extractive testing

**2. Materials designated because of their halogenated VOC content:**

- **hazard statements H341 or H351**
- **until 1 Jun 2015 : risk phrases R40, or R68**

Requirements:

**Control** under **contained** conditions as far as technically and economically feasible to safeguard public health and the environment, normally, in accordance with the guidance provided within Section 5 of the note.

Timescale:

Immediately (and see note 1 below)

**Limit** - where the sum of the mass flows of all the discharges of all the compounds causing the designated labelling is greater or equal to 100g/h, a limit value of 20mg/Nm<sup>3</sup> for the mass sum of the individual compounds must apply.

Monitoring:

Manual extractive testing

**Note 1** - substances or mixtures which are classified after the date of publication of this note as designated materials because of their VOC content, must apply the replace, control and limit requirements above within the shortest possible time from the date at which substances or mixtures became/become designated materials.

In determining the 'shortest possible time', the operator will need to justify their timetables taking account of the guidance in the relevant chapter of the appropriate Guidance Manual.

**Note 2** - until 1 June 2015 'hazard statement' materials will, broadly, also be known as 'risk phrase' materials. After 1st June 2015, only the term 'hazard statement' materials will apply; see Section 7 for further details.

**Note 3** - the European Commission have published information on [substituting and containing designated solvents](#)

## Monitoring, investigating and reporting

4.10 The operator should monitor emissions, make tests and inspections of the activity. The need for and scope of testing (including the frequency and time of sampling) will depend on local circumstances.

- The operator should keep records of inspections, tests and monitoring, including all non-continuous monitoring, inspections and visual assessments. Records should be:
  - kept on site;
  - kept by the operator for at least two years; **and**
  - made available for the regulator to examine.
- If any records are kept off-site they should be made available for inspection within one working week of any request by the regulator.

## Information required by the regulator

4.11 As well as being sent information to show compliance with solvent limits, the regulator needs to be informed of monitoring to be carried out and the results. The results should include process conditions at the time of monitoring.

- The operator should notify the regulator at least 7 days before any periodic monitoring exercise to determine compliance with emission limit values. The operator should state the provisional time and date of monitoring, pollutants to be tested and the methods to be used.
- The results of non-continuous emission testing should be forwarded to the regulator within 8 weeks of completion of the sampling.
- Adverse results from any monitoring activity (both continuous and non-continuous) should be investigated by the operator as soon as the monitoring data has been obtained. The operator should:
  - identify the cause and take corrective action;
  - clearly record as much detail as possible regarding the cause and extent of the problem, and the remedial action taken;
  - re-test to demonstrate compliance as soon as possible; **and** inform the regulator of the steps taken and the re-test results.

## Visible emissions

4.12 The aim should be to prevent any visible airborne emission from any part of the process. This aim includes all sites regardless of location. Monitoring to identify the origin of a visible emission should be undertaken and a variety of indicative techniques are available.

- where ambient monitoring is carried out it may also be appropriate for the regulator to specify recording of wind direction and strength;
- where combustion units are in use for dryers then the combustion process should be controlled and equipment maintained as appropriate.

4.13 Emissions from combustion processes in normal operation should be free from visible smoke. During start up and shut down the emissions should not exceed the equivalent of Ringelmann Shade 1 as described in British Standard BS 2742.

- All other releases to air, other than condensed water vapour, should be free from persistent visible emissions.
- All emissions to air should be free from droplets.

Where there are problems that, in the opinion of the regulator, may be attributable to the installation, such as local complaints of visual emissions or where dust from the installation is being detected beyond the site boundary, the operator should investigate in order to find out which part of their operation(s) is the cause.

If this inspection does not lead to correction of the problem then the operator should inform the regulator who will determine whether ambient air monitoring is necessary. Ambient monitoring may either be by a British Standard method or by a method agreed with the regulator.

Whilst problems are ongoing, a visual check should also be made at least once per day/shift, by the operator, when an installation is being operated. The time, location and result of these checks, along with weather conditions such as indicative wind direction and strength, should be recorded. Once the source of the emission is known, corrective action should be taken without delay and where appropriate the regulator may want to vary the permit in order to add a condition requiring the particular measure(s) to be undertaken.

## Emissions of odour

- 4.14 The overall aim should be that all emissions are free from offensive odour outside the site boundary, as perceived by the regulator. However, the location of the installation will influence the assessment of the potential for odour impact as local meteorological conditions may lead to poor dispersion conditions. Where the site has a low odour impact due to its remoteness from sensitive receptors, the escape of offensive odour beyond the installation would be unlikely to cause harm.
- 4.15 Where there are problems that, in the opinion of the regulator, may be attributable to the installation, such as local complaints of odour or where odour from the installation is being detected beyond the site boundary, the operator should investigate in order to find out which part of their operation(s) is the cause.
- 4.16 Whilst problems are ongoing, a boundary check should also be made at least once per day/shift, by the operator, when an installation is being operated. The time, location and result of these checks, along with weather conditions such as indicative wind direction and strength, should be recorded. Once the source of the emission is known, corrective action should be taken without delay and where appropriate the regulator may want to vary the permit in order to add a condition requiring the particular measure(s) to be undertaken.
- Where it is installed any odour arrestment equipment should be inspected at least once a day to verify correct operation and to identify any malfunctions. Depending upon the type of any arrestment plant used this inspection should include:
- identification of any leaks in air handling equipment and ductwork;
  - in the case of scrubbing equipment, thermal oxidisers and other combustion equipment, the inspection should include verification of the operation of any continuous monitoring equipment, the presence of any blockages and also identification of any leaks of either odorous air or liquid;
  - in the case of biofilters, the surface should be inspected to identify any cracking of the surface or voids in the bed, leaks around the edge of the filter or air handling equipment, review of the moisture content (considering both flooding and drying out) and looking for signs of compaction or uneven flow;
  - In the specific case of soil biofilters, the growth of plants and weeds should be inspected as any excessive flow or odour escape is often indicated by scorching of the earth or plant growth dying off.



## Emissions from silos

- 4.17 During silo filling it is most likely that any emissions would be released during the first and last five minutes of the delivery. The first few minutes are when emissions due to leaks or split hoses would first be noticed. The last few minutes is when excess pressure from the tanker/blowing system may cause an emission through the pressure relief valve if the delivery is not controlled correctly. During silo filling procedures isokinetic monitoring of emissions from the arrestment plant is not likely to be possible as the delivery period is so short. For this reason there is no numerical emission limit for such plant. It is important however that the plant is designed to cope with the delivery flow rate that is used for the silo.
- All new or replacement silo filtration plant should be designed to operate to an emission standard of less than 10 mg/m<sup>3</sup> for particulate matter.
- 4.18 Silo systems require appropriate inspections and assessments to minimise potential for emissions during the filling process. The following measures relating to arrestment plant on silos and other silo management techniques are only applicable where the silo vents to the external environment or where silo emissions may escape from inside a building into the external environment.
- Operators should have a procedure in place to ensure that visual assessment of emissions from silo inlet connections and the silo arrestment plant are undertaken throughout the duration of all bulk deliveries. The start and finish times of all deliveries should be recorded.
  - The outlet should be checked for signs that emissions have occurred. The equipment should also be checked for defects in the air flow or the cam shakers. If emissions or defects are detected then corrective action should be taken promptly and before another delivery takes place. Any failure of the silo management system (e.g. high level alarms, filter pressure relief valve) should lead to full investigation of the operation of the plant and equipment.

## Inspection of arrestment plant

- All arrestment plant (including silos) serving process operations should be inspected at the frequency specified in **Table 4.3**.

<b>Table 4.3 - Filtration plant inspection frequency</b>	
Filter cleaning method	Frequency of visual inspection
<b>Silos</b>	
Fitted with reverse jets	Visual inspection during discharge of first delivery for each week
Fitted with mechanical shakers	Visual inspection weekly during operation
Requiring manual shaking	Daily inspection or prior to any delivery being made if deliveries are not daily
<b>Other filtration plant</b>	
Fitted with reverse jets	At least once a month
Fitted with mechanical shakers	At least once a week
Requiring manual shaking	Daily inspection

- Reduced inspection frequency of bag filter (or cartridge) arrestment plant may be appropriate, as follows:
  - a) where pressure drop sensors or other continuous monitors are used to monitor the arrestment plant; such monitors should be inspected according to manufacturers' recommendations to ensure their proper operation.
  - b) where continuous camera operation enables observation of all emission points from the arrestment plant and pressure relief valves.
  - c) for filters fitted with reverse jets or with mechanical shakers where operating experience has demonstrated satisfactory operation of the arrestment plant.
  - d) where the process operation is infrequent.

## Abnormal events

- 4.19 The operator should respond to problems which may have an adverse effect on emissions to air.
- In the case of abnormal emissions, malfunction or breakdown leading to abnormal emissions the operator should:
    - investigate and undertake remedial action immediately;
    - adjust the process or activity to minimise those emissions; **and**
    - promptly record the events and actions taken.
  - The regulator should be informed without delay, whether or not there is related monitoring showing an adverse result:
    - if there is an emission that is likely to have an effect on the local community; **or**
    - in the event of the failure of key arrestment plant, for example, bag filtration plant or scrubber units.
  - The operator should provide a list of key arrestment plant and should have a written procedure for dealing with its failure, in order to minimise any adverse effects.

### **SE Box 8 - Non-compliance causing immediate danger (Articles 7 and 8)**

#### **All activities**

In cases of non-compliance causing immediate danger to human health, or threatening to cause an immediate significant adverse affect upon the environment, operation of the activity must be suspended.

All of following criteria should be taken into account:

- the toxicity of the substances being released;
- the amount released;
- the location of the installation; **and**
- the sensitivity of the receptors.

## Continuous monitoring

4.20 Continuous monitoring can be either 'quantitative' or 'indicative'. With quantitative monitoring the discharge of the pollutant(s) of concern is measured and recorded numerically. For pollution control this measurement is normally expressed in milligrams per cubic metre of air ( $\text{mg}/\text{m}^3$ ). Where discharge of the pollutant concerned is controlled by measuring an alternative parameter (the 'surrogate' measurement), this surrogate is also expressed numerically.

Continuous indicative monitoring is where a permanent device is fitted, for example, to detect leaks in a bag filter, but the output, whether expressed numerically or not, does not show the true value of the discharge. When connected to a continuous recorder it will show that emissions are gradually (or rapidly) increasing, and therefore maintenance is required. Alternatively it can trigger an alarm when there is a sudden increase in emissions, such as when arrestment plant has failed.

4.21 Where continuous indicative monitoring has been specified, the information provided should be used as a management tool. Where used, the monitor should be set up to provide a baseline output when the plant is known to be operating under the best possible conditions and emissions are complying with the requirements of the permit. Where used to trigger alarms, the instrument manufacturer should be able to set an output level which corresponds to around 75% of the emission limit. Thus the alarms are activated in response to this significant increase in pollutant loading above the baseline, so that warning of the changed state is given before an unacceptable emission occurs. The regulator may wish to agree the alarm trigger level.

4.22 Where continuous monitoring is required, it should be carried out as follows:

- All continuous monitoring readings should be on display to appropriately trained operating staff.
- Instruments should be fitted with audible and visual alarms, situated appropriately to warn the operator of arrestment plant failure or malfunction.
- The activation of alarms should be automatically recorded.
- All continuous monitors should be operated, maintained and calibrated (or referenced, in the case of indicative monitors) in accordance with the manufacturers' instructions, which should be made available for inspection by the regulator.
- The relevant maintenance and calibration (or referencing, in the case of indicative monitors) should be recorded.

- Emission concentrations may be reported as zero when the plant is off and there is no flow from the stack. If required a competent person should confirm that zero is more appropriate than the measured stack concentration if there is no flow.
- Any continuous monitor used should provide reliable data >95% of the operating time, (i.e. availability >95%). A manual or automatic procedure should be in place to detect instrument malfunction and to monitor instrument availability.

## Calibration and compliance monitoring

- 4.23 Compliance monitoring can be carried out either by use of a continuous emissions monitor (CEM), or by a specific extractive test carried out at a frequency agreed with the regulator.
- 4.24 Where a CEM is used for compliance purposes it must be periodically checked, (calibrated), to ensure the readings being reported are correct. This calibration is normally done by carrying out a parallel stand-alone extractive test and comparing the results with those provided by the CEM.
- 4.25 For extractive testing the sampling should meet the following requirements:
- For batch processes, where the production operation is complete within, say, 2 hours, then the extractive sampling should take place over a complete cycle of the activity.
- 4.26 Should the activity either be continuous, or have a batch cycle that is not compatible with the time available for sampling, then the data required should be obtained over a minimum period of 2 hours in total.
- For demonstration of compliance where a CEM is used no daily mean of all 30-minute mean emission concentrations should exceed the specified emission concentration limits during normal operation (excluding start-up and shut-down); **and**
  - No 30-minute mean emission concentration should exceed twice the specified emission concentration limits during normal operation (excluding start-up and shut-down).
  - For extractive testing, no result of monitoring should exceed the emission limit concentrations specified.

4.27 Exhaust flow rates should be consistent with efficient capture of emissions, good operating practice and meeting the requirements of the legislation relating to the workplace environment.

- The introduction of dilution air to achieve emission concentration limits should not be permitted.

Dilution air may be added for waste gas cooling or improved dispersion where this is shown to be necessary because of the operational requirements of the plant, but this additional air should be discounted when determining the mass concentration of the pollutant in the waste gases.

## Continuous monitoring of VOC abated releases

4.28 These paragraphs also apply where continuous monitoring and recording is required to demonstrate compliance with the VOC requirements of the note. For existing VOC abatement equipment surrogate measurements for VOC are acceptable. Where new VOC abatement equipment is installed, or existing VOC abatement equipment is modified or the operating conditions are changed, VOC monitoring should be carried out once more to demonstrate that the surrogate measurements are adequate to ensure compliance.

**Thermal oxidisers** must have continuous monitoring and recording for VOC expressed as total carbon excluding particulate matter. After sufficient monitoring data has been collected to clearly demonstrate adequate VOC destruction continuous monitoring of temperature may be used as a surrogate measurement.

**Catalytic oxidisers** must have continuous monitoring and recording for VOC expressed as total carbon excluding particulate matter. After sufficient monitoring data has been collected to clearly demonstrate adequate VOC destruction continuous monitoring of carbon monoxide and temperature may be used as a surrogate measurement. (It may be possible to waive the requirement for carbon monoxide monitoring, if the operator can demonstrate to the regulator that the catalytic oxidiser is designed in such a way that it cannot exceed the carbon monoxide limit (see Non VOC Emission Limits))

**Bio scrubbers and reactors** must have continuous monitoring and recording for VOC expressed as total carbon excluding particulate matter. After sufficient monitoring data has been collected to clearly demonstrate adequate VOC destruction continuous monitoring of the flow and pH of the re-circulating water, fan suction, exhaust temperature and pressure drop across the packing, coupled with daily monitoring of the nutrient may be used as a surrogate measurement.

**Turbines, reciprocating engines, boilers** or any other form of VOC abatement equipment must have continuous monitoring and recording for VOC expressed as total carbon excluding particulate matter.

## SE Box 9 - VOC monitoring (Articles 60 and 61)

### All activities using

- **emission and fugitive limits; or**
- **total emission limit values with abatement**

For periodic measurements of VOC at least three readings must be obtained during each measurement exercise.

VOC emission limit values shall be considered to be complied with if, in one monitoring exercise:

- a) the average of all the readings does not exceed the emission limit values, and
- b) none of the hourly averages exceeds the emission limit value by more than a factor of 1.5\*.

Where continuous monitoring is carried out to demonstrate compliance with VOC emission limits:

- c) none of the averages over 24 hours of normal operation exceeds the emission limit values, and
- d) none of the hourly averages exceeds the emission limit values by more than a factor of 1.5.\*

\*the hourly average of the 30-minute means value may be used to demonstrate compliance.

Where monitoring does not meet the requirements of a) or b), then no result should exceed the emission concentration limits specified.

Compliance by dilution is not permitted – see paragraph 4.27

## Varying of monitoring frequency

4.29 Where non-continuous quantitative monitoring is required, the frequency may be varied. Where there is consistent compliance with emission limits, regulators may consider reducing the frequency. However, any significant process changes that might have affected the monitored emission should be taken into account in making the decision.

4.30 The following should be considered when deciding whether compliance is consistent:

- a) the variability of monitoring results, for example, results which range from 15 - 45 mg/m<sup>3</sup>, against an emission limit of 50 mg/m<sup>3</sup> might not qualify for a reduction in monitoring.
- b) the margin between the results and the emission limit, for example, results which range from 45 - 50 mg/m<sup>3</sup> when the limit is 50 mg/m<sup>3</sup> might not qualify for a reduction in monitoring.

Consistent compliance should be demonstrated using the results from at least;

- three or more consecutive annual monitoring campaigns; **or**
- two or more consecutive annual monitoring campaigns supported by continuous monitoring.

Where a new or substantially changed process is being commissioned, or where emission levels are near to or approach the emission concentration limits, regulators should consider increasing the frequency of testing.

- 4.31 A reduction in monitoring frequency should not be permitted where continuous quantitative or indicative monitoring is required. These types of monitoring are needed to demonstrate at all times when the plant is operating, that either the emission limits are being complied with or that the abatement equipment is functioning correctly.

## **Monitoring of unabated releases**

- 4.32 Where emission limit values are consistently met without the use of abatement equipment, the monitoring requirement for those pollutants should be dispensed with subject to the 'Varying of monitoring frequency' paragraphs above.

Where monitoring is not in accordance with the main procedural requirements of the relevant standard, deviations should be reported.

## **Representative sampling**

- 4.33 Whether sampling on a continuous or non-continuous basis, care is needed in the design and location of sampling systems, in order to obtain representative samples for all release points.
- Sampling points on new plant should be designed to comply with the British or equivalent standards (see paragraph 4.2).
  - The operator should ensure that relevant stacks or ducts are fitted with facilities for sampling which allow compliance with the sampling standards.



### **SE Box 10 - All Installations with two or more activities (Article 59(6))**

#### **Installations with two or more activities**

Installations where two or more of the activities in Annex VII, Part 1 of the industrial emissions Directive are carried out, each of which exceeds the threshold in Annex VII, Part 2 of the industrial emissions Directive must:

- (1) as regards to designated hazard statement materials, meet the requirements specified in SE Box 7, for each activity individually;
- (2) as regards all other substances, either:
  - (i) meet the requirements for each activity individually; **or**
  - (ii) have total emissions not exceeding those that would have resulted had point (i) been applied.

When applying 2 (ii) above, the solvent management plan should be completed to determine total emissions from all activities concerned. That figure must then be compared with the total emissions from the installation that would have resulted had the requirements of Annex VII, Part 2 of the industrial emissions Directive been met for each activity separately.

## **Start up and shutdown**

4.34 Higher emissions may occur during start-up and shut-down of a process. These emissions can be reduced, by minimising, where possible, the number of start-ups and shut-downs and having adequate procedures in place for start-up, shut-down and emergency shut-downs.

- The number of start-ups and shut downs should be kept to the minimum that is reasonably practicable.

### **SE Box 11 - Start-up and shut-down (Article 59(7))**

All appropriate precautions shall be taken to minimise emissions during start-up and shut-down.

## 5. Control techniques

### Summary of best available techniques

- 5.1 **Table 5.1** provides a summary of the best available techniques that can be used to control the process in order to meet the emission limits and provisions in **Section 4**. Provided that it is demonstrated to the satisfaction of the regulator that an equivalent level of control will be achieved, then other techniques may be used.

Table 5.1 - Summary of control techniques		
Release source	Substance	Control techniques
Storage and handling of organic solvents and materials containing organic solvents	VOC	Use of enclosed mixing and storage vessels
		Siting of storage tanks, Back venting deliveries if needed
		Capture; or Capture and disposal; or Capture and destruction
Handling and storage of dusty materials	Particulate matter	Particulate capture if required
Flue Gas	Sulphur oxides	Limit sulphur in fuel
	Nitrogen oxides	Low NOx burners
	Carbon monoxide	Good combustion
	VOC	Efficient thermal oxidation

### Non-VOC releases control techniques

#### Silos

- 5.2 The silo management system includes the high level alarms, arrestment plant and pressure relief valve. If best practice is being applied then any failure of the silo management system leads to full investigation of the operation of the plant and equipment. Continuous high level monitoring systems are currently available for use in storage silos. They may be used telemetrically to monitor stock within the silo. They may also be used to automatically stop delivery of material to the silo. It is expected that such systems will become more widely used in the future.

- 5.3 Careful delivery by trained personnel will avoid materials being blown into silos at a rate which is likely to result in pressurisation of the silo, especially towards the end of the delivery when the quantity of material entering the ducting is reduced. If deliveries are accepted from tankers without on board relief valve and filtration systems, particular care to avoid pressurisation of silos when venting air through the silo at the end of the delivery is needed.
- 5.4 The following measures relating to arrestment plant on silos and other silo management techniques are only applicable where the silo vents to the external environment or where silo emissions may escape from inside a building into the external environment.
- All dusty or potentially dusty materials should be stored in silos, in confined storage areas within buildings, or in fully enclosed containers / packaging. Where the storage is open within a building, then suitable precautions should be taken to prevent wind whipping.
  - When delivery to a silo or bulk storage tank takes place, displaced air should either be vented to suitable arrestment plant (for example cartridge/bag filters) or backvented to the delivery tanker, in order to minimise emissions. Arrestment plant fitted to silos should be of sufficient size (and kept clean) to avoid pressurisation during delivery.
  - In order that fugitive emissions are minimised during the charging of silos, transfer lines should be securely connected to the silo delivery inlet point and the tanker discharge point, in that order. Tanker drivers should be informed of the correct procedures to be followed.
  - Bulk storage tanks and silos containing dry materials should be equipped with audible and/ or visual high level alarms, or volume indicator, to warn of overfilling. The correct operation of such alarms should be checked in accordance with manufacturers' instructions. If manufacturers' instructions do not specify, then the check should be weekly or before a delivery takes place, whichever is the longer interval.
  - If emissions of particulate matter are visible from ducting, pipework, the pressure relief valve or dust arrestment plant during silo filling, the operation should cease; the cause of the problem should be rectified prior to further deliveries taking place. Tanker drivers should be informed of the correct procedure to be followed.
  - Seating of pressure relief valves on silos should be checked at least once a week, or before a delivery takes place, whichever is the longer interval.

- Immediately it appears that the valve has become unseated during silo filling, no further delivery should take place until corrective action has been taken. The pressure relief valve should be examined to check for defects before being re-set and a replacement valve fitted if necessary. Tanker drivers should be informed of the correct procedure to follow.
- Deliveries to silos from road vehicles should only be made using tankers with an on-board (truck mounted) relief valve and filtration system. This means that venting air from the tanker at the end of a delivery will not take place through the silo. Use of alternative techniques may be acceptable provided that they achieve an equivalent level of control with regard to potential for emissions to air.
- Care should be taken to avoid delivering materials to silos at a rate which is likely to result in pressurisation of the silo. If compressed air is being used to blow powder into a silo then particular care is required towards the end of the delivery when the quantity of material entering the ducting is reduced and hence the air flow is increased.
- All new silos should be fitted with an automatic system to cut off delivery in the event of pressurisation or overfilling. Use of alternative techniques may be acceptable provided that they achieve an equivalent level of control with regard to potential for emissions to air.

## Sulphur dioxide

- 5.5 In combustion processes the most significant release of sulphur dioxide occurs as a result of the sulphur content of the fuel burnt and should be addressed by using low sulphur fuel as specified in **Table 4.1**.

## Nitrogen oxides

- 5.6 In combustion processes nitrogen oxides can be formed as a result of the combustion of nitrogen in the fuel or the formation of thermal nitrogen oxides from nitrogen in the air used for combustion.
- Where necessary, the nitrogen content of the fuel and other material being burnt should be controlled.
  - Where necessary, low NO<sub>x</sub> burners should be installed.

## VOC control techniques

### VOC and odour control storage

- 5.7 Odour may arise from the receipt, handling and storage of organic solvents and organic solvent containing liquids. Careful siting of storage and mixing tanks, particularly in relation to new and replacement tanks, and controlled handling of odorous liquids may help prevent offensive emissions off-site. In addition:
- Bulk storage tanks for organic solvents and organic solvent-containing liquids should wherever practicable be back vented to the delivery tank during filling. Where this is impracticable, displaced air vents should be sited in such a way as to prevent the arising of offensive odour beyond the site boundary.
  - All potentially odorous waste materials should be stored in suitable closed containers or bulk storage vessels, where appropriate vented to suitable abatement plant.
- 5.8 Breathing losses from bulk storage tanks can be minimised by fitting pressure vacuum relief valves. The vapour pressure within the bulk storage can also be minimised by reducing the solar absorbency of the storage tank.
- The exterior of outdoor bulk storage tanks for organic solvent storage should normally be light coloured.
  - If necessary, emissions from fixed organic solvent storage tanks should be vented to suitable arrestment equipment to meet the emission limits in **Section 4**.
  - All new static bulk organic solvent storage tanks containing organic solvent with a composite vapour pressure that is likely to exceed 0.4kPa at 20°C (293K) should be fitted with pressure vacuum relief valves. Pressure vacuum relief valves should be examined at regular intervals for signs of contamination, incorrect seating and be cleaned and/or corrected as required. The normal minimum examination frequency should be once every six months, but less frequent examination may be justified having regard for the tank contents and the potential emissions as a result of valve failure.
- 5.9 Both major and minor spillage of organic solvent from bulk storage tanks can arise as a result of a number of scenarios such as: overfilling of tanks, incorrect draining of filling lines, operator error or vandalism.
- Delivery connections to bulk storage tanks should be located within a bunded area.

- Where the operator can not demonstrate to the satisfaction of the regulation that suitable management controls and training with regard to bulk storage deliveries of organic solvents and organic solvent containing materials are in place, along with adequate on-site security, then connections to bulk storage tanks should be fixed and locked when not in use.
- All fixed storage tanks should be fitted with high-level alarms or volume indicators to warn of overfilling. Where practicable the filling systems should be interlocked to the alarm system to prevent overfilling.
- Bunding should:
  - completely surround the bulk liquid storage tanks;
  - be impervious and resistant to the liquids in storage; **and**
  - be capable of holding 110% of the capacity of the largest storage tank.

In certain circumstances, the specification of bunds may be controlled by other regulations. A code of practice on the use and storage of solvents is available at <http://archive.defra.gov.uk/environment/quality/water/waterquality/ground/solvents.htm>

## VOC control handling

5.10 The receipt, handling, use and storage of organic solvents and organic solvent containing liquids will give rise to fugitive releases of VOC.

- Raw materials containing VOC should be stored in closed storage containers.
- All measures should be taken to minimise VOC emissions during mixing, i.e. the use of covered or closed mixing vessels.
- Emissions from the emptying of mixing vessels and transfer of materials should be adequately contained, preferably by the use of closed transfer systems. This may be achieved by the use of closed mobile containers, containers with close-fitting lids, or, preferably, closed containers with pipeline delivery.
- The design and working procedures of Fixed and Pan Change processes, dispersion and completion vessels should prevent, or where not practicable due to process characteristics, minimise and render harmless the emission to air of VOC.
- Wherever practical in relation to occupational safety and explosion hazards, continuous extraction of air from vessels should be avoided for example, by the use of an interlock to ensure that extraction can only commence when the vessel inspection hatch or manhole is opened.

## VOC control cleaning

5.11 Cleaning operations will give rise to fugitive releases of VOC.

- Cleaning operations involving organic solvents should be periodically reviewed, normally at least once every two years, to identify opportunities for reducing VOC emissions (e.g. cleaning steps that can be eliminated or alternative cleaning methods). The regulator should be provided with a report on the conclusions of the review.
- Dispensing of cleaning solvents should be:
  - In the case of fixed manufacturing equipment from a contained device or automatic system when applied directly;
  - dispensed by piston type dispenser or similar contained device, when used on wipes.
- When organic solvent is used on wipes:
  - pre-impregnated wipes should be held within an enclosed container prior to use;
  - where practicable no organic solvent cleaning fluids or significantly less volatile organic solvents cleaning fluids should be used (with or without the addition of mechanical, chemical or thermal enhancements).
- Where practicable, fixed equipment should be cleaned in-situ and such equipment should, where practicable, be kept enclosed whilst cleaning is carried out.
- Where equipment is cleaned off-line cleaning should be carried out using enclosed cleaning systems, wherever possible. Enclosed cleaning systems should be sealed to prevent emissions whilst in operation, except during purging at the end of the cleaning cycle. If this is not practicable emissions should be contained and vented to abatement plant where necessary.

## VOC control waste

5.12 Waste contaminated with VOC may give rise to both odorous and fugitive emissions.

- All reasonably practicable efforts should be made to minimise the amount of residual organic solvent bearing material left in drums and other containers after use. All organic solvent contaminated waste should be stored in closed containers.

- Prior to disposal, empty drums and containers contaminated with organic solvent should be closed to minimise emissions from residues during storage prior to disposal and labelled, so that all personnel who handle them are aware of their contents and hazardous properties.
- Nominally empty drums or drums containing waste contaminated with VOC awaiting disposal should be stored in accordance with the requirements for full or new containers.
- Prior to disposal used wipes and other items contaminated with organic solvent should be placed in a suitably labelled metal bin fitted with a self-closing lid.

Note: from a health and safety point of view it is advised that bins should be emptied at least daily, as they not only present a fire hazard, they may also undergo spontaneous combustion.

- For materials that may undergo spontaneous combustion special bins that allow air to circulate beneath and around them to aid cooling are advised or other bins specifically designed for this purpose.

## General control techniques

### Dust and spillage control

- 5.13 Adequate provision to contain liquid and solid spillage is needed. Closed containers can prevent wind whipping of dusty, dry waste materials such as materials collected during combustion chamber cleaning or arising from particulate abatement plant:
- dusty wastes should be stored in closed containers and handled in a manner that avoids emissions;
  - dry sweeping of dusty materials should not normally be permitted unless there are environmental or health and safety risks in using alternative techniques;
  - suitable organic solvent containment and spillage equipment should be readily available in all organic solvent handling areas;
  - a high standard of housekeeping should be maintained.

In the paint manufacturing sector, regulators should consider any specific case made by the operator to allow dry sweeping, in particular where organic pigments are used and it is made clear either that wet cleaning will merely spread the spillage, or that the value of the pigment is such that an alternative, careful method of collection is needed in order to re-used the spilled material.



## Air quality

### Dispersion & dilution

- 5.14 Pollutants that are emitted via a stack require sufficient dispersion and dilution in the atmosphere to ensure that they ground at concentrations that are deemed harmless. This is the basis upon which stack heights are calculated using HMIP Technical Guidance Note (Dispersion) D1. The stack height so obtained is adjusted to take into account local meteorological data, local topography, nearby emissions and the influence of plant structure.

The calculation procedure of D1 is usually used to calculate the required stack height but alternative dispersion models may be used in agreement with the regulator. An operator may choose to meet tighter emission limits in order to reduce the required stack height.

- 5.15 Where an emission consists purely of air and particulate matter, (i.e. no products of combustion or any other gaseous pollutants are emitted) the above provisions relating to stack height calculation for the purpose of dispersion and dilution should not normally be applied. Revised stack height calculations should not be required as a result of publication of this revision of the PG note, unless it is considered necessary because of a breach or serious risk of breach of an EC Directive limit value or because it is clear from the detailed review and assessment work that the permitted process itself is a significant contributor to the problem.
- 5.16 Where offensive odour is likely outside the process site boundary the assessment of stack or vent height should take into account the need to render harmless residual offensive odour.

### Ambient air quality management

- 5.17 In areas where air quality standards or objectives are being breached or are in serious risk of breach and it is clear from the detailed review and assessment work under Local Air Quality Management that the permitted process itself is a significant contributor to the problem, it may be necessary to impose tighter emission limits. If the standard that is in danger of being exceeded is not an EC Directive requirement, then industry is not expected to go beyond BAT to meet it. Decisions should be taken in the context of a local authority's Local Air Quality Management action plan. For example, where a permitted process is only responsible to a very small extent for an air quality problem, the authority should not unduly penalise the operator of the process by requiring disproportionate emissions reductions. Paragraph 59 of the [Air Quality Strategy 2007 \[Volume 1\]](#) gives the following advice:

“...In drawing up action plans, local authority environmental health/pollution teams are expected to engage local authority officers across different departments, particularly, land-use and transport planners to ensure the actions are supported by all parts of the authority. In addition, engagement with the wider panorama of relevant stakeholders, including the public, is required to ensure action plans are fit-for-purpose in addressing air quality issues. It is vital that all those organisations, groups and individuals that have an impact upon local air quality, buy-in and work towards objectives of an adopted action plan.”

## **Stacks, vents and process exhausts**

- 5.18 Liquid condensation on internal surfaces of stacks and exhaust ducts might lead to corrosion and ductwork failure or to droplet emission. Adequate insulation will minimise the cooling of waste gases and prevent liquid condensation by keeping the temperature of the exhaust gases above the dewpoint. A leak in a stack/vent and the associated ductwork, or a build up of material on the internal surfaces may affect dispersion:

Flues and ductwork should be cleaned to prevent accumulation of materials, as part of the routine maintenance programme.

When dispersion of pollutants discharged from the stack (or vent) is necessary, the target exit velocity should be 15m/s under normal operating conditions, however, lower velocities than 15m/s are acceptable provided adequate dispersion and dilution is achieved (see also the paragraph below regarding wet plumes). In order to ensure dispersion is not impaired by either low exit velocity at the point of discharge, or deflection of the discharge, a cap, or other restriction, should not be used at the stack exit. However, a cone may sometimes be useful to increase the exit velocity to achieve greater dispersion.

An exception to the previous paragraph is where wet arrestment is used as the abatement. Unacceptable emissions of droplets could occur from such plant where the linear velocity in the stack exceeds 9m/s. To reduce the potential of droplet emissions a mist eliminator should be used. Where a linear velocity of 9m/s is exceeded in existing plant consideration should be given to reducing this velocity as far as practicable to ensure such droplet entrainment and fall out does not happen.

# Management

## Management techniques

5.19 Important elements for effective control of emissions include:

- proper management, supervision and training for process operations;
- proper use of equipment;
- effective preventative maintenance on all plant and equipment concerned with the control of emissions to the air; **and**
- ensuring that spares and consumables - in particular, those subject to continual wear – are held on site, or available at short notice from guaranteed local suppliers, so that plant breakdowns can be rectified rapidly. This is important with respect to arrestment plant and other necessary environmental controls. It is useful to have an audited list of essential items.

## Appropriate management systems

5.20 Effective management is central to environmental performance; it is an important component of BAT and of achieving compliance with permit conditions. It requires a commitment to establishing objectives, setting targets, measuring progress and revising the objectives according to results. This includes managing risks under normal operating conditions and in accidents and emergencies.

It is therefore desirable that installations put in place some form of structured environmental management approach, whether by adopting published standards (ISO 14001 or the EU Eco Management and Audit Scheme [EMAS]) or by setting up an environmental management system (EMS) tailored to the nature and size of the particular process. Operators may also find that an EMS will help identify business savings.

5.21 Regulators should use their discretion, in consultation with individual operators, in agreeing the appropriate level of environmental management. Simple systems which ensure that LAPPC considerations are taken account of in the day-to-day running of a process may well suffice, especially for small and medium-sized enterprises. Regulators are urged to encourage operators to have an EMS for all their activities, but it is outside the legal scope of an LAPPC permit to require an EMS for purposes other than LAPPC compliance. For further information/advice refer to the appropriate chapter of the appropriate Guidance Manual for [England and Wales](#), [Scotland](#) and [Northern Ireland](#).

## Training

5.22 Staff at all levels need the necessary training and instruction in their duties relating to control of the process and emissions to air. In order to minimise risk of emissions, particular emphasis should be given to control procedures during start-up, shut down and abnormal conditions. Training may often sensibly be addressed in the EMS referred to above.

- All staff whose functions could impact on air emissions from the activity should receive appropriate training on those functions. This should include:
  - awareness of their responsibilities under the permit;
  - steps that are necessary to minimise emissions during start-up and shutdown;
  - actions to take when there are abnormal conditions, or accidents or spillages that could, if not controlled, result in emissions.
- The operator should maintain a statement of training requirements for each post with the above mentioned functions and keep a record of the training received by each person. These documents should be made available to the regulator on request.

## Maintenance

5.23 Effective preventative maintenance plays a key part in achieving compliance with emission limits and other provisions. All aspects of the process including all plant, buildings and the equipment concerned with the control of emissions to air should be properly maintained. In particular:

- The operator should have the following available for inspection by the regulator:
  - a written maintenance programme for all pollution control equipment;
  - and**
  - a record of maintenance that has been undertaken.

## 6. Summary of changes

The main changes to this note, with the reasons for the change, are summarised in **Table 6.1**. Minor changes that will not impact on the permit conditions e.g. slight alterations to the Process Description have not been recorded.

<b>Table 6.1 - Summary of changes</b>			
<b>Section/paragraph/row</b>	<b>Change</b>	<b>Reason</b>	<b>Comment</b>
<b>Introduction</b>			
	Simplification of text	Make note clearer	
	Addition of links	Change to electronic format	Removes need for extensive footnotes/references
<b>Emission limits, monitoring and other provisions</b>			
	Removal of redundant paragraphs	The solvent emissions Directive is fully in force (and is now replaced by the industrial emissions Directive.)	
	Used to be Section 5 in previous note	Section 4 in previous note deleted	
Emissions from silos	Clarification of requirements from all filtration plant	Make note clearer	
<b>Control techniques</b>			
	Used to be Section 6 in previous note	Section 4 in previous note deleted leading to renumbering of sections	
Para 4.12 Visible Emissions	Revised text describing approach to take to visible and odorous emissions.	Allows more flexibility in managing visible/odorous emissions	Conditions requiring boundary checks will normally only be appropriate where potential odour is particularly offensive (see chapter 17 of the GGM).
Para 4.14 Emissions of odour	Removal of arrowed condition suggesting inclusion of an odour boundary condition.		
Air Quality	Clarification of exhaust velocity requirements	Make note clearer	

## 7. Further information

### Sustainable consumption and production (SCP)

Both business and the environment can benefit from adopting sustainable consumption and production practices. Estimates of potential business savings include:

- £6.4 billion a year UK business savings from resource efficiency measures that cost little or nothing;
- 2% of annual profit lost through inefficient management of energy, water and waste;
- 4% of turnover is spent on waste.

When making arrangement to comply with permit conditions, operators are strongly advised to use the opportunity to look into what other steps they may be able to take, for example, having regard to the efficient use of auxiliary fuels, such as gas and electricity. Regulators may be willing to provide assistance and ideas, although cannot be expected to act as unpaid consultants.

### Health and safety

Operators of installations must protect people at work as well as the environment:

- requirements of a permit should not put at risk the health, safety or welfare of people at work or those who may be harmed by the work activity;
- equally, the permit must not contain conditions whose only purpose is to secure the health of people at work. That is the job of the health and safety enforcing authorities.

Where emission limits quoted in this guidance conflict with health and safety limits, the tighter limit should prevail because:

- emission limits under the relevant environmental legislation relate to the concentration of pollutant released into the air from prescribed activities;
- exposure limits under health and safety legislation relate to the concentration of pollutant in the air breathed by workers;
- these limits may differ since they are set according to different criteria. It will normally be quite appropriate to have different standards for the same pollutant, but in some cases they may be in conflict (for example, where air discharged from a process is breathed by workers). In such cases, the tighter limit should be applied to prevent a relaxation of control.

## Further advice on responding to incidents

The UK Environment Agencies have published [guidance](#) on producing an incident response plan to deal with environmental incidents. Only those aspects relating to air emissions can be subject to regulation via a Part B (Part C in NI) permit, but regulators may nonetheless wish to informally draw the attention of all appropriate operators to the guidance.

It is not envisaged that regulators will often want to include conditions, in addition to those advised in this PG note, specifying particular incident response arrangements aimed at minimising air emissions. Regulators should decide this on a case-by-case basis. In accordance with BAT, any such conditions should be proportionate to the risk, including the potential for harm from air emissions if an incident were to occur. Account should therefore be taken of matters such as the amount and type of materials held on site which might be affected by an incident, the likelihood of an incident occurring, the sensitivity of the location of the installation, and the cost of producing any plans and taking any additional measures.

## Hazard statement classifications

Until 1 June 2015 'hazard statement' materials might also be known as 'risk phrase' materials. From 1 June 2015, only the term 'hazard statement' materials will apply. This change is incorporated in the industrial emissions Directive, and all requirements regarding hazard statement materials still apply to risk phrase materials. Table 7.1 has been included to allow comparison between the two ways of labelling hazardous materials.

## Fluorinated Gas (F-gas) Regulations and Ozone Depleting Substances

Certain key obligations apply to the use of fluorinated (F-gas) and Ozone Depleting Substances (ODS) used as cleaning solvents. Designated Materials used in SED installations must either be replaced, controlled or limited and care should be taken to ensure that operators comply with the requirements of the F-gas and ODS Regulations for any replacement solvents that may contain F-gases or ODS.

At the time of publication of this guidance, further information was available at: <http://www.defra.gov.uk/environment/quality/air/fgas/>

or by contacting F Gas Support at [fgas-support@enviros.com](mailto:fgas-support@enviros.com)

**Table 7.1 - Classification of hazardous materials**

	The industrial emissions Directive catches materials which, because of their VOC content, are designated with the phrases/statements in these columns		Halogenated VOC is the trigger for the Directive in this column
<b>Risk Phrases</b>	class 1 'known to'	class 2 'treat as'	class 3 'cause concern'
<b>Hazard statements categories</b> They are NOT exact equivalents	category 1a <b>known</b> from human evidence	category 1b <b>presumed</b> from animal evidence	category 2 <b>suspected</b> human carcinogens
	H340, H350, H350i, H360D or H360F		H341 H351
<b>Carcinogens</b>	R45 May cause cancer H350 May cause cancer	R45 May cause cancer H350 May cause cancer	R40 Limited evidence of a carcinogenic effect H351 Suspected of causing cancer
<b>Mutagens</b>	R46 May cause heritable genetic damage H340 May cause genetic defects	R46 May cause heritable genetic damage H340 May cause genetic defects	R68 possible risk of irreversible effects H341 Suspected of causing genetic defects
<b>Carcinogen by inhalation</b>	R49 May cause cancer by inhalation H350i May cause cancer by inhalation	R49 May cause cancer by inhalation H350i May cause cancer by inhalation	R40 Limited evidence of a carcinogenic effect H351 Suspected of causing cancer
<b>Toxic to reproduction</b>	R60 May impair fertility - and R61 May cause harm to the unborn child H360D or H360F May damage fertility or the unborn child	R60 May impair fertility - and R61 May cause harm to the unborn child H360D or H360F May damage fertility or the unborn child	<b>Outside</b> the Directive - R62 and R63 for the suspected R phrases say "possible risk to".



# Appendix 1: Industrial emissions Directive

The [industrial emissions Directive 2010/75](#) recasts 7 Directives including the solvent emissions Directive, which is minimally changed.

In the industrial emissions Directive, Chapters I and V, and Annex VII, Parts 1 to 8 are most directly related to the solvent emissions Directive and this guidance note.

The Directive chapters are:

Chapter I - common provisions

Chapter II - provisions for activities listed in Annex I

Chapter III - special provisions for combustion plants

Chapter IV - special provisions for waste incineration plants and waste co-incineration plants

Chapter V - special provisions for installations and activities using organic solvents

Chapter VI - special provisions for installations producing titanium dioxide

Chapter VII - committee, transitional and final provisions

In the Directive, the Parts of Annex VII are:

Part 1 - activities

Part 2 - thresholds and emission limit values

Part 3 - emission limit values for installations of the vehicle coating industry

Part 4 - emission limit values relating to volatile organic compounds with specific risk phrases

Part 5 - reduction scheme

Part 6 - emission monitoring

Part 7 - solvent management plan

Part 8 - assessment of compliance with emission limit values in waste gases