

Process Guidance Note 6/33 (11)

Statutory Guidance for Wood Coating

Revised March 2011



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Llywodraeth Cynulliad Cymru
Welsh Assembly Government



**The Scottish
Government**



defra
Department for Environment
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Department for Environment, Food and Rural Affairs
Nobel House
17 Smith Square
London SW1P 3JR

Tel: 020 7238 6000

Website: www.defra.gov.uk

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Information about this publication and copies are available from:

Atmosphere and Local Environment
Defra
Area 5F
Ergon House
Horseferry Road
London
SW1P 2AL

Email: Control.Pollution@defra.gsi.gov.uk

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Revision of the Guidance

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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 Assembly Government, the Scottish Government and the Department of the Environment in Northern Ireland to give guidance on the conditions appropriate for the control of emissions into the air from Wood Coating. It is published only in electronic form and can be found on the [Defra website](#). It supersedes PG6/33 (04) & NIPG6/33(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 ¹ giving guidance on the Best Available Techniques (BAT)². 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.
- 1.4 In general terms, what is BAT for one installation in a sector is 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 is 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 Solvent Emissions Directive. The Regulations referenced in paragraph 1.3 put the Directive requirements into UK law.

¹ this and other notes in the series are issued as statutory guidance in England and Wales under regulation 64(2) of the Environmental Permitting Regulations. The notes are also issued as statutory guidance in Northern Ireland and guidance in Scotland.

² 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).

1.6 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 the 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.
- **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 constitutes 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 Solvent Emissions Directive (SED).

- 1.12 Most of the activities covered by this note come under [the SED](#). To be a SED activity, it must:
- a) be a wood coating activity listed in Section 7 of the relevant LAPPC Regulations
- AND**
- b) consume more than 15 tonnes of solvent in any 12 month period.

Which paragraphs of this note apply to SED activities?

- 1.13 Everything in boxes labelled "SED box" is mandatory, because it repeats what is required by the SED. The rest of the note is guidance on Best Available Techniques for the sector.
- 1.14 The SED offers two ways of compliance for wood coating activities:
- complying with SED emission limits for waste gases and fugitive emissions,
 - applying the SED reduction scheme (with or without abatement).
- 1.15 The SED also 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 risk phrases: R45, R46, R49, R60, and R61³. Additional requirements also apply to the use of halogenated VOCs assigned risk phrase R40 and R68.
- 1.16 The SED boxes in this note are:
- 1 - new VOC abatement plant
 - 2 - new installations

³ The [CLP Directive](#) requires that Risk phrases classifications in SED will be replaced in June 2015 by "hazard statements". From December 2010 to June 2015 both classifications apply. (See Section 7). For further information on the Globally Harmonized System of Classification and Labelling of Chemicals (GHS), visit the [United Nations Economic Commission for Europe website](#) .

- 3 - substantially changed 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 1A, 1B and 1C** pick out the paragraphs and SED boxes that apply depending on which of these ways an operator chooses to comply

- complying with SED emission limits and fugitive emission limits (see **Table 1A**)
- complying with SED total emissions limits (see **Table 1B**)
- applying the SED reduction scheme (see **Table 1C**)

Table 1A: Activities Applying Emission and Fugitive Limits

Installation	Paragraphs of Guidance Note which apply
Single SED activity. Solvent consumption of the coating activity more than 15 tonnes	All of Sections, except: <ul style="list-style-type: none"> • 4.29 with regard to abated VOC releases • 4.5, 4.6, Table 6, 4.7 and 4.9 • SED Box 10 • Table 6
More than one SED Activity. Solvent consumption of the coating activity more than 15 tonnes plus another SED activity	All of Sections, except: <ul style="list-style-type: none"> • 4.29 with regard to abated VOC releases • 4.5, 4.6 , Table 6, 4.7 and 4.9 • Table 6
No SED activity, but LAPPC activity Solvent consumption of 5 -15 tonnes	All of Sections, except: <ul style="list-style-type: none"> • 1.12, 1.13, 1.14, 1.15, 1.16, 1.17, 1.18, • SED Boxes 1, 2, 3 and Table 4 SED requirements • 4.5, 4.6, Table 7, 4.7 and 4.9 • SED Boxes 4 - 11
<p>A SED activity is an activity falling within the scope of the Solvent Emission Directive (i.e. activity as defined in Annex I, and which exceeds the thresholds in Annex II of the Directive).</p> <p>Consumption is the organic solvent consumption of the activity, (see Annex IIA of the Directive). The determination of consumption is described in paragraph 4.10 of this Note).</p>	

Table 1B: Activities Applying Total Emission Limit

This compliance option is not available for this activity.

Table 1C: Activities Applying Reduction Scheme

Installation	Paragraphs of Guidance Note which apply	
	Without VOC Abatement	With VOC Abatement
Single SED activity. Solvent consumption of the coating activity more than 5 tonnes	All of Sections, except: <ul style="list-style-type: none"> • SED Box 1 • Table 5 • SED Boxes 5, 8, 9, and 10 	All of Sections, except: <ul style="list-style-type: none"> • SED Box 1 • Table 5 • 4.29 with regard to abated VOC releases • SED Boxes 5, 9, and 10
More than one SED activity. Solvent consumption of the coating activity more than 5 tonnes plus another SED activity	All of Sections, except: <ul style="list-style-type: none"> • SED Box 1 • Table 5 • SED Boxes 5, 9 and 10 	All of Sections, except: <ul style="list-style-type: none"> • SED Box 1 • Table 5 • 4.29 with regard to abated VOC releases • SED Boxes 5 and 10
No SED activity, but LAPPC activity. Solvent consumption of 5 -15 tonnes	All of Sections, except: <ul style="list-style-type: none"> • 1.12, 1.13, 1.14, 1.15, 1.16, 1.17, 1.18 • SED Boxes 1, 2, 3 and • Table 4 SED requirements • SED Boxes 4 - 11 	Not available
<p>A SED activity is an activity falling within the scope of the Solvent Emission Directive (i.e. activity as defined in Annex I, and which exceeds the thresholds in Annex II of the Directive).</p> <p>Consumption is the organic solvent consumption of the activity, (see Annex IIA of the Directive). The determination of consumption is described in paragraph 4.10 of this Note).</p> <p>NB: If a SED activity does not apply solids, the Reduction Scheme cannot be used.</p>		

Which provisions in this note apply to non-SED activities?

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

General guidance on SED

- 1.19 The general guidance mentioned in paragraph 1.11 contains an outline of the SED requirements, advice on derogations (i.e. 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 SED compliance.

Substitution (photochemical ozone creation potential – POCP)

- 1.20 Consideration will be given to the availability of lower-POCP solvents which can serve as suitable substitutes for those currently used (eg toluene and trimethyl benzenes). Amendments may be proposed during the lifetime of this guidance note if such solvents become available.

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 amended or removed. 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 the table below, together with the paragraph number where the provision is to be found. Compliance with the new provisions, which apply to both SED and non-SED 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: Compliance timetable

Guidance	Relevant Paragraph/Row in this Note	Compliance Date
Light coloured painting of outdoor tanks containing VOC*	Paragraph 5.7	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 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 or 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 process that have been substantially changed and any part of the process 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 appropriate Regulations⁴. Further guidance on permit reviews is contained in the appropriate Guidance Manual for England and Wales, Scotland and Northern Ireland. 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 SED requirements

- 2.9 Since 31st October 2007 the full requirements of the Solvent Emissions Directive have applied. . All requirements, as set out in the SED boxes below and in Section 4, ought to have been complied with by that date.

SED Box 1 New VOC abatement plant

(Article 5) All activities not using the Reduction Scheme

All installations with any VOC abatement equipment installed after 1 April 2001 must:

- meet the emission limit requirements for New Installations of SED Box 5 (but not the fugitive limits) and SED Box 6

SED Box 2 New Installations

(Article 3) All Activities

For new installations the permit must have regard to the full standards of the Directive as from 1 April 2001.

⁴ For details see [England and Wales, GGM](#) chapter 26, [Scotland, Practical guide](#) section 10, Northern Ireland [Part B Guidance](#) page 9, [Northern Ireland Part C Guidance](#) chapter 17.

SED Box 3 Substantially changed installations

(articles 2,4 & 9) All Activities

For substantially changed (as defined in Article 2 of SED (**Appendix 1**)) installations the permit must have regard to the full standards of the Directive as from the first day of April 2001.

Where an installation:

- undergoes a substantial change; or
- comes 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 as new installation.

However, if the following condition is met, then the change should not be considered substantial and an application for a non-substantial variation should be made:-

The total mass emission of VOC from the SED installation after the substantial change is less than:

- the total mass emission of the installation prior to the change (which would have been described as substantial);

PLUS

- the calculated additional mass emission of the changed part (which would have been described as substantial) of the installation if it had complied with the appropriate 31 October 2007 VOC requirements (i.e. those requirements being either emission and fugitive limits, or total emission limits, or the reduction scheme, as appropriate).

When determining a substantial change for SED installations, consideration must be given to the fact that:

- an increase in VOC emissions is required above the percentages set out below, and
- that increase in emissions must have resulted from a change in nominal capacity of the installation

Under the SED a substantial change means:

- For a small installation*, a change of the nominal capacity leading to an increase of emissions of VOC of more than 25%. Any change that may have, in the opinion of the competent authority, significant negative effects on human health or the environment is also a substantial change.
- For all other installations a change of the nominal capacity leading to an increase of emissions of VOC of more than 10%. Any change that may have, in the opinion of the competent authority, significant negative effects on human health or the environment is also a substantial change.

* A small wood coating installation has a solvent consumption of more than 15 tonnes but less 25 tonnes pa.

Following a substantial change, compliance must be re-verified.

3 Activity description

Regulations

3.1 This Note applies to LAPPC installations for Wood Coating. The activities are listed for regulation as follows.

Table 3: Regulations listing activities

LAPPC	Solvent Consumption of activity	England and Wales	Scotland	Northern Ireland
		EPR Schedule 1 reference	PPC Schedule 1 reference	PPC Schedule 1 reference
Part A	More than 150kg/hr or more than 200te in any 12 month period	Section 6.4 Part A2	Section 6.4 Part A	Section 6.4 Part A
Part B	More than 15te in any 12 month period but less than Part A 5 – 15te in any 12 month period	Section 7 Part B Section 6.4 Part B	Section 7 Part B Section 6.4, Part B	n/a
Part C	More than 15te in any 12 month period but less than Part A 5 – 15te in any 12 month period	n/a	n/a	Section 7 Part C Section 6.4 Part C

3.2 This note refers to the coating of wood where the process is likely to involve the use of over 5 tonnes of organic solvent in any 12 month period.

3.3 In the rest of **this section only** “process” should be understood to describe the various stages involved in the coating operations. It does not necessarily have the same meaning as elsewhere in this note.

3.4 In the context of this note, "process" or “activity” comprises the whole process from receipt of raw materials via production of intermediates to dispatch of finished products, including the treating, handling and storage of all materials and wastes relating to the process.

3.5 Examples of coated wood products include

- furniture, including solid, board and reproduction
- joinery including doors, windows, mouldings and wall panels
- veneer trim for cars
- pencils
- flooring

3.6 Wood coating techniques in use in the sector include

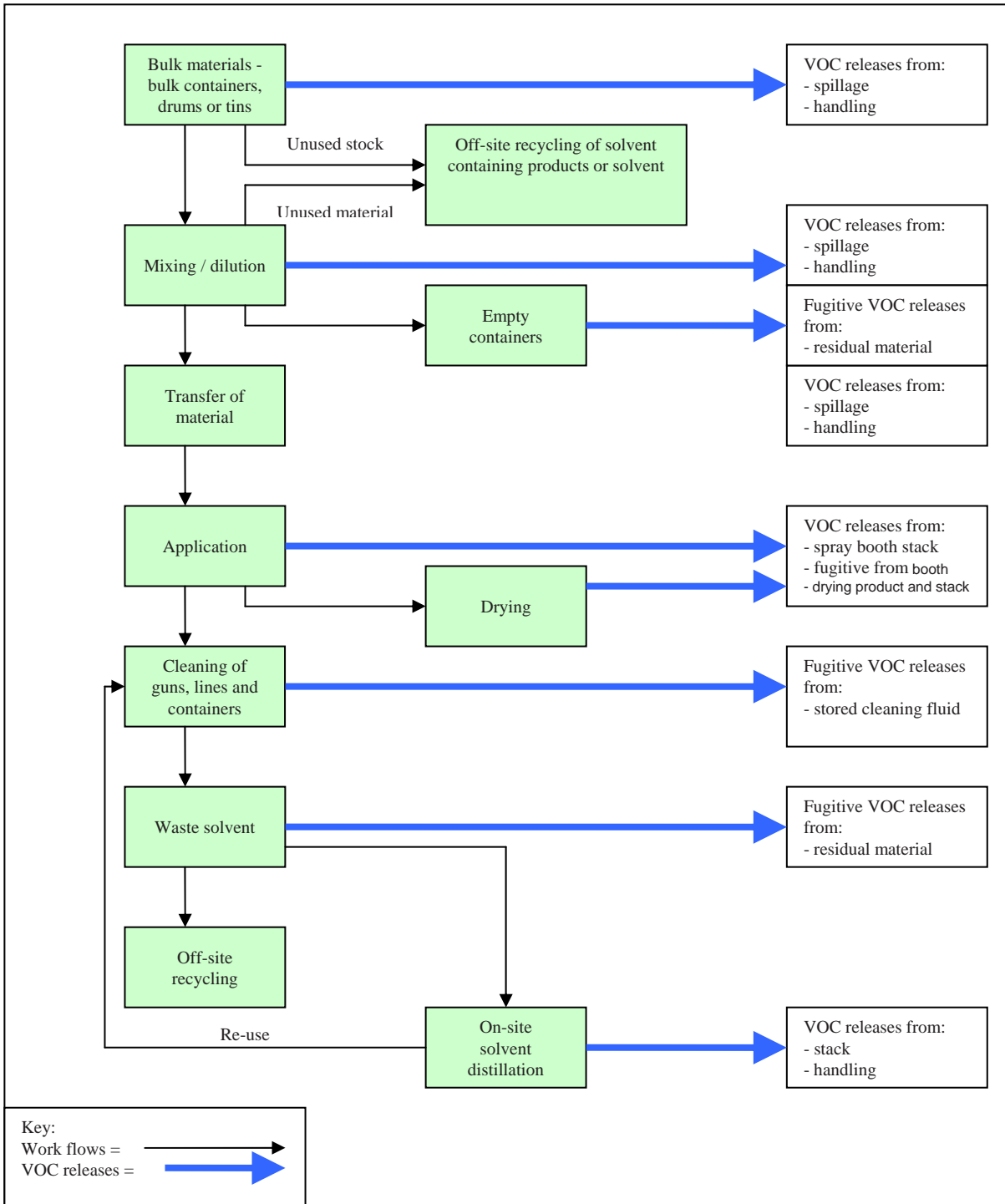
- manual and automated spraying
- roller coating
- hand, e.g. brush, rag or pad
- dip coating
- electrostatic powder coating
- curtain coating
- vacuum coating

3.7 The process varies widely with the product e.g. joinery often has a single dip stage and drying. Flatpack office furniture might be as simple as a single roller coat of UV lacquer. In contrast, reproduction furniture often has many stages, some of which are repeated, such as:

Bleaching	Sometimes undertaken to lighten veneers and solid timbers
Stain	Pigmented coat which provides the desired colour, evens out natural colour variations and accentuates the wood grain
Grain filler	Highly pigmented coating with an oil base which is mainly used on open pore wood. Designed to set hard and reduce the degree of absorption of subsequent coating layers by the wood fibres
Sealer	Designed to seal the wood, provide adhesion for subsequent layers and enable de-nibbing. Also known as base coat
De-nibbing	Staining and sealing will frequently raise the wood grain, especially if water borne products are used. De-nibbing is the fine sanding stage which removes the raised grain
Distressing	A used appearance may be imparted through the use of lava rock, chains or other hand tools which lead to scratches and small indents
Colour coat	May be applied to accent areas and to correct patches of poor colouration. Only a very light dusting of colour coat is generally used
Stipple	Comprising goldsize, turpentine and earth powders, is applied by hand to further enhance an aged look
Lacquer	Designed to protect the colour coats, enhance the final appearance and provide a durable surface. Lacquer may be tinted to remove the need for a separate staining process. Also known as top coat

Pullover	Thinners applied to a surface by hand to soften the top layer of lacquer and make it receptive to hand polishing
Hand polishing	Various methods may be used to provide a hand polished appearance, e.g. pullover with the application of burnishing cream, fine grade sand paper with a white spirit lubricant or bees wax applied using fine grade steel wool.

Figure 3.1: Potential VOC releases from a typical wood coating activity



4 Emission limits, monitoring and other Provisions

- 4.1 Emissions of the substances listed in the Tables and SED Boxes below should be controlled.
- 4.2 Guidance on techniques to achieve compliance with SED/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. Where reference is made to a British, European, or International standard (BS, CEN or ISO) in this Section, the standards referred to are correct at the date of publication. (Users of this Note should bear in mind that the standards are periodically amended, updated or replaced). 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**. The reference conditions for limits in **Section 4** are: 273.1K, 101.3kPa, without correction for water vapour content, unless stated otherwise.

Table 4: Emission limits, monitoring and other provisions for non-VOC releases

All Activities					
Row	Substance	Source	Emission limit/ provisions	Type of monitoring	Monitoring frequency
1	Carbon Monoxide	Oxidation plant	100mg/Nm ³ as a 15 minute mean for contained sources.	Catalytic oxidiser	Continuous
				Monitoring and recording	
		Plus	Plus		
		Manual extractive testing	Annual		
		From turbines, reciprocating engines or boilers used as VOC abatement equipment.	500 mg/Nm ³ at 5% oxygen dry gas, as 15 minute mean for contained sources.	All other types of abatement. Manual extractive testing	Annual
2	Particulate matter	All processes / activities	50mg/Nm ³ as 30 minute mean for contained sources	Manual extractive testing	Annual
3	Oxides of Nitrogen (measured as nitrogen dioxide)	Oxidation plant	100mg/Nm ³ as a 15 minute mean for contained sources.	Manual extractive testing	Annual
		From turbines, reciprocating engines or boilers used as VOC abatement equipment.	500 mg/Nm ³ as 15 minute mean for contained sources		
4	Sulphur dioxide	All activities using heavy fuel oil	1% wt/wt sulphur in fuel	Sulphur content of fuel is regulated by other arms of government.	
		All activities using gas oil	0.1% wt/wt sulphur in fuel		
5	Isocyanates	All processes / activities using isocyanates	0.1mg/Nm ³ as a 15 minute mean for contained sources excluding particulate and expressed as NCO.	Manual extractive testing	Annual

Table 5: Emission limits, monitoring and other provisions for non SED activity VOC releases

Row	VOC	Emission limit/ provisions	Type of monitoring	Monitoring frequency
1	All processes/ activities Except from mixing vessels where the total mass emission of VOC from an individual source is less than 1kg in any 8 hour period.	VOC expressed as total carbon excluding particulate matter. 100mg/Nm ³ as 15 minute mean for contained sources.	Abated releases monitoring and recording Plus Manual extractive testing	Abated releases Continuous monitoring Plus Annual Manual extractive
2	Non Methane VOC From turbines reciprocating engines or boilers used as VOC abatement equipment.	VOC expressed as total carbon excluding particulate matter. 150mg/Nm ³ as 15 minute mean for contained sources	Non abated releases Manual extractive testing	Non abated releases Annual Manual extractive
3	The emission limit value for VOC in rows 1 and 2 above do not apply in relation to the specified use of compliant coatings in Appendix 2 of this note.			

4.4 For VOC [the SED](#) gives three compliance options (not all options are available to all activities and **Option b** (below) is not available to activities covered by this note).

SED Box 4 VOC compliance

(Article 5) All activities

All installations must comply with

Either:

- a. The emission limit in waste gases and the fugitive emission values in SED Box 5 **or**
- b. The requirements of the total emission limit values in SED Box 6 **or**
- c. The requirements of the Reduction Scheme (paragraph 4.6)

Also, all installations must comply with the emission limits for designated materials in SED Box 7.

Waste Gas and Fugitive Emission Limits and Requirements

SED Box 5 Waste Gas and Fugitive Emission Limits and Requirements (Articles 5,8,9 & Annex IIA)				
For all activities using the Waste Gas and Fugitive Emission Limits and Requirements				
Row	VOC in waste gases	Emission Limits / Requirement	Fugitive Emission Values	Monitoring
1	All Installations Organic solvent consumption 15 tonnes or more and less than 25 tonnes	VOC expressed as total mass of organic carbon	25% of organic solvent input	Abated releases Continuous monitoring and recording Plus Annual manual extractive testing Unabated releases Annual manual extractive testing
	Waste gases from oxidation plant used as abatement	50 mg Carbon/Nm ³		
	Waste gases from turbines, reciprocating engines or boilers used as abatement plant	Until 1 April 2013 but see SED Box 5 note 1 150 mg Carbon/Nm ³		
		100 mg Carbon/Nm ³		
Any other Waste gases	100 mg Carbon/Nm ³			
2	All Installations Organic solvent consumption 25 tonnes or more	VOC expressed as total mass of organic carbon	20% of organic solvent input	Unabated releases Annual manual extractive testing
	Waste gases from oxidation plant used as abatement	50 mg Carbon/Nm ³		
	Waste gases from turbines, reciprocating engines or boilers used as abatement plant	Until 1 April 2013 but see SED Box 5 note 1 150 mg Carbon/Nm ³		
		50 mg Carbon/Nm ³ as abatement for drying processes		
		75 mg Carbon/Nm ³ as abatement for other processes		
	Waste gases from drying processes	50 mg Carbon/Nm ³		
Any other waste gases	75 mg Carbon/Nm ³			
Note 1 - For abatement plant existing prior to 1 April 2001, the higher contained emission figure may be used until 1 April 2013 if: The total emissions of the whole installation (Fugitive + contained emission) does not exceed the total emission allowed after 1 April 2013 (Fugitive and contained emission after 1 April 2013). Operators permitted to use the higher contained emission figure until 1 April 2013 may find that using the reduction scheme is the best way of achieving compliance thereafter.				

SED Box 6 Total Emission Limit Values SED activities

Total emission limit values are not a valid route to SED compliance for this sector

Solvent Reduction Scheme

4.5 The Reduction Scheme is the preferred method of preventing and minimising emissions of VOC, using non-abatement techniques such as:

- water borne coatings (low organic solvent content)
- higher solids content coatings
- powder coatings
- organic solvent free liquid coatings
- radiation cured coatings (for example, ultra violet and electron beam).

4.6 An operator may choose to use the Reduction Scheme for an installation to achieve emission reductions to a **“Target Emission”** equivalent to those which would have been achieved if the concentration emission limits had been applied.

The following scheme should operate for installations for which a constant solid content of product can be assumed and used to define the reference point for emission reductions.

The operator should forward an emission reduction plan, which includes in particular:

- mechanisms to decrease in the average solvent content of the total input; and/or
- systems to increase efficiency in the use of solids to achieve a reduction of the total emissions from the installation.

The Target Emission from an installation should be calculated by multiplying the total mass of solids in the quantity of coatings used in a year with the relevant figure given in Table 6 below. In determining the total mass of solids:

- solids are all materials in coatings that become solid as a result of curing, polymerisation, or the evaporation of the water or solvent (usually available from the supplier in g/l or non-volatile % mass by weight*), and
- all ingredients other than water and organic solvents should be assumed to form part of the solid coating.
- in cases of doubt, the reference standard for the determination of non-volatile % mass by weight is BS EN ISO 3251 (also numbered BS 3900: B18). The test conditions may need to be adjusted for the particular conditions of use or when assessing chemically or radiation cured coatings, where otherwise volatile components react to form part of the dry solid coating.

Table 6 Reduction scheme: Target emission figures

Coating activity	Wood coating 5-15 tonnes	Total mass of solids x 1.6
	Woodcoating Over 15 tonnes	Total mass of solids x 1.0

4.7 Compliance with Reduction Scheme is achieved if the annual actual solvent emission determined from the Solvent Management Plan is less than or equal to the Target Emission.

Where the annual actual solvent emission is:

annual actual solvent emission = I₁-O₈-O₇-O₆ (-O₅ if abatement has been used) - (see Definitions below)

4.8 The flexibility inherent in this compliance route should not be taken to encourage

- the replacement of a low or no organic solvent coating system with a conventional high organic solvent coating system, or
- the introduction of such a conventional high organic solvent coating system into a process/activity or
- the introduction of such a conventional high organic solvent coating system onto a product where it was not in use before, or
- the introduction of high solids formulations which have no beneficial effect on the product but increase the solids used, except where a reduction in the overall VOC emissions can be demonstrated.

Regulators should seek prior notification of any proposal to introduce such systems, which should include reasons why lower organic solvent systems are not considered technically appropriate or practicable.

Determination of Solvent Consumption

4.9 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)

4.10 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 below)

Solvent Management Plan

- 4.11 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 Solvent Emissions Directive requires an SMP to be produced to determine fugitive emissions (SED Box 5), identify future reduction options and give the public access to information about solvent consumption etc.

The SED provides guidance on what constitutes a solvent input and an output (see paragraph 4.12 below). 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

There is guidance on the [Business Link website about solvent management](#).

- 4.12 The definitions in Annex III of the SED 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)

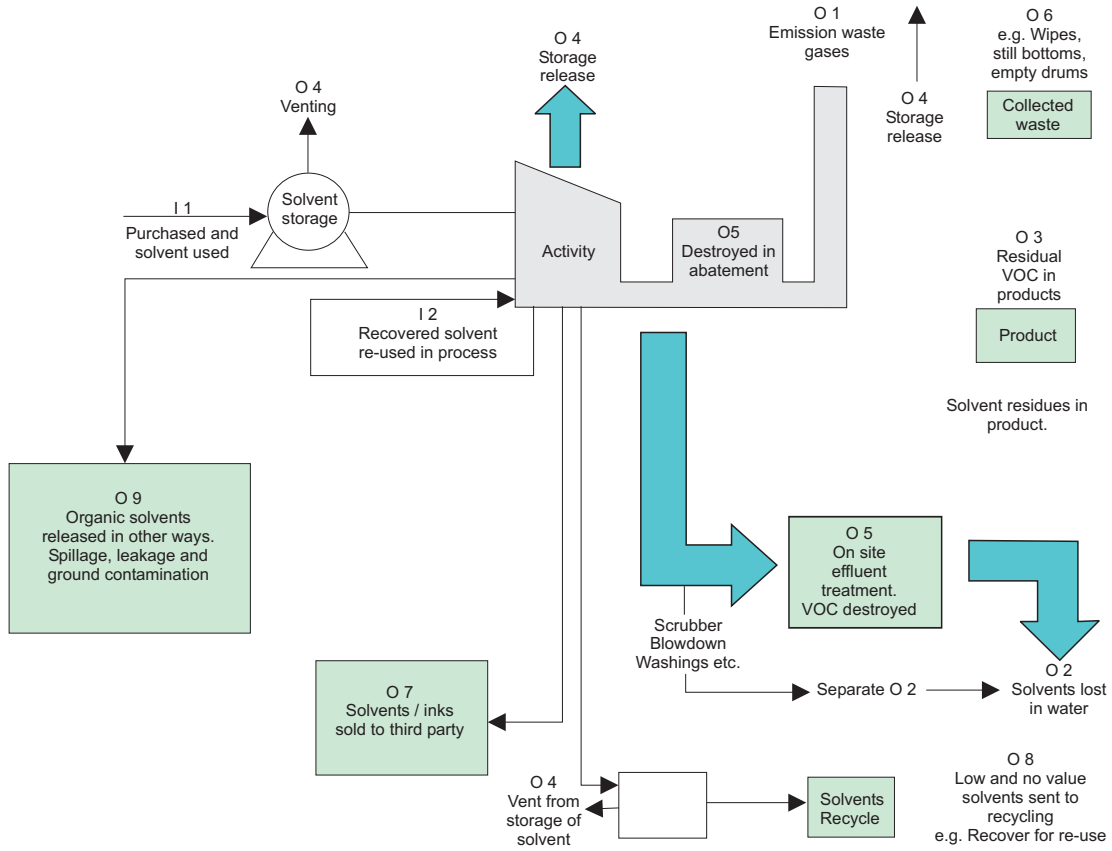
I₁ The quantity of organic solvents or their quantity in mixtures purchased which are used as input into the process/activity (including organic solvents used in the cleaning of equipment, but not those used for the cleaning of the products).

I₂ 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)

- O₁** Emissions in waste gases.
- O₂** Organic solvents lost in water, if appropriate taking into account waste water treatment when calculating O₅.
- O₃** The quantity of organic solvents which remains as contamination or residue in products output from the process/activity.
- O₄** 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



<p>Solvent Management Plan</p> <p>Consumption = I 1 - O 8 Actual solvent emission = I 1 - O 5 - O 6 - O 7 - O 8 Fugitive emission (F) = I 1 - O 1 - O 5 - O 6 - O 7 - O 8 OR Fugitive emission (F) = O 2 + O 3 + O 4 + O 9</p>	<p>Solvent Emissions Directive Activities Fugitive Emission Value =</p> $\frac{F}{I 1 + I 2} \times 100\%$ <p>Total emission = O 1 + Fugitive emission (F)</p>
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Designated Materials, Emission Limits and Conditions

<p>SED Box 7 SED requirements for Designated Materials (Articles 5,7,8,9) All Activities using Designated Materials Designated Materials used in SED installations must either be replaced, or controlled and limited, as set out below.</p>	
<p>All SED Installations. i.e. existing, new and substantially changed</p>	
<p>Materials Designated, because of their VOC content: Until 1 Jun 2015: risk phrase R45, R46, R49, R60, or R61 From 1 Dec 2010: hazard statement H340, H350, H350i, H360D, or H360F</p>	
<p>Requirements:</p> <ul style="list-style-type: none"> • Replace as far as possible (taking into account guidance under article 7(1) of the SED. See Appendix 1) by less harmful substances or mixtures 	<p>Timescale:</p> <ul style="list-style-type: none"> • installations must comply within the shortest possible time
<ul style="list-style-type: none"> • 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 	<p>Timescale:</p> <p>Immediately (and see note below)</p>
<ul style="list-style-type: none"> • 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 10 g/h, a limit value of 2 mg/Nm³ for the mass sum of the individual compounds must apply 	<p>Monitoring:</p> <p>Annual Manual extractive testing</p>
<p>Materials Designated, because of their Halogenated VOC content: Until 1 Jun 2015 : risk phrase R40, or from 1 Dec 2010 until 1 Jun 2015, risk phrase R68 From 1 Dec 2010: hazard statements H341 or H351</p>	
<p>Requirements:</p> <ul style="list-style-type: none"> • 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 	<p>Timescale:</p> <p>Immediately (and see note below)</p>
<ul style="list-style-type: none"> • 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 100 g/h, a limit value of 20 mg/Nm³ for the mass sum of the individual compounds must apply 	<p>Monitoring:</p> <p>Annual Manual extractive testing</p>
<p>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.</p> <p>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.</p> <p>Note 2 – As from 1st December 2010 “risk phrase” materials will, broadly, also be known as “hazard statement” materials. Either term will apply until 1st June 2015, when only the term “hazard statement” materials will apply. (See section 7 for further details).</p>	

Monitoring, investigating and reporting

- 4.13 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.
- 4.14 The operator should keep records of inspections, tests and monitoring, including all non-continuous monitoring, inspections and visual assessments. The 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

- 4.15 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 the 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

- 4.16 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

- 4.17 Emissions from combustion processes should in normal operation 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: 2009

- 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 transported off the site, the operator should inspect in order to find out which operation(s) is the cause.

If this inspection does not lead to correction of the problem then the operator should inform the regulator in order to 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 once per day 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

- 4.18 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 for local meteorological conditions which 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.

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 transported off the site, the operator should inspect in order to find out which operation(s) is the cause.

Whilst problems are ongoing, a boundary check should also be made once per day 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.

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.

SED Box 8 Non compliance causing immediate danger

(Article 10) All Activities

In cases of non-compliance causing immediate danger to human health, 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 meter of air, (mg/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 numerical 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 CEM 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 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, and
 - For all activities the sampling period should be sufficient such that at least 3 results are obtained.
- 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 5 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

Continuous monitoring of VOC abated releases

- 4.27 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.

SED Box 9 VOC Monitoring

(Article 9) 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.

4.28 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

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/m³, against an emission limit of 50 mg/m³ 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/m³ when the limit is 50 mg/m³ might not qualify for a reduction in monitoring.

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

- three or more monitoring exercises within two years or;
- two or more monitoring exercises in one year 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 Where continuous quantitative or indicative monitoring is required it is not appropriate that reduced monitoring be applied as the monitoring is required to demonstrate either compliance with emission limits on an ongoing basis or to demonstrate correct functioning of arrestment equipment.

Monitoring of unabated releases

- 4.32 Where emission limit values for VOC 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.
- 4.33 Care is needed in the design and location of sampling systems in order to obtain representative samples for all release points. The operator should ensure that adequate facilities for sampling are provided on vents or ducts. Sampling points on new plant should be designed to comply with the British or equivalent standards. Where monitoring is not in accordance with the main procedural requirements of the relevant standard, deviations should be reported as well as an estimation of any error invoked.

Sampling provisions

- 4.34 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.
 - Where monitoring is not in accordance with the main procedural requirements of the relevant standard, deviations should be reported as well as an estimation of the likely error.

Start-up and shut-down

- 4.35 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.

SED Box 10 All Installations with Two or More Activities

(Article 5 and Annex III)

Installations with two or more activities

Installations where two or more of the activities in Annex I of the Solvents Emissions Directive are carried out, each of which exceeds the threshold in Annex IIA of the Solvents Emissions Directive must:

- (1) as regards to Designated Risk Phrase Materials, meet the requirements specified in SED 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 II of the SED been met for each activity separately

SED Box 11 Start up and shutdown

(Article 5.10)

All appropriate precautions must be taken to minimise emissions during start-up and shutdown

5 Control techniques

Summary of Best Available Techniques

- 5.1 The following table provides a summary of BAT 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 7: 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, capture and disposal or capture and destruction
Coating and surface preparation operations	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
UV lamps and corona discharge	Ozone	Dispersion
Preparation and use of isocyanate coatings	Isocyanate	As for VOC

Non VOC Releases Control Techniques

Particulate matter

- 5.2 Emissions of particulate matter should be abated if necessary to meet the emission limit.

Sulphur dioxide

- 5.3 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.

Nitrogen oxides

- 5.4 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 NOx burners should be installed.

Ozone

5.5 Where ozone is emitted from equipment and is currently only vented to the external atmosphere it should in future be ducted to stacks to ensure adequate dispersion.

- This is in relation to significant releases i.e. uv and corona discharges. Emissions of ozone should be dispersed.

VOC Control Techniques

VOC and odour control storage

5.6 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.

VOC control handling

- The receipt, handling, use and storage of organic solvents and organic solvent containing liquids will give rise to fugitive releases of VOC.
- Coatings 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.
- Mixing of coatings containing VOC should be carried out in covered or enclosed mixing vessels, except for small tins (e.g. 25 litres) mixed by hand.

VOC control cleaning

5.7 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.
- Application of cleaning solvents should be:

- from a contained device or automatic system when applied directly on to machine rollers; and
 - 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.
 - Residual coating materials contained in parts of the application equipment should be removed prior to cleaning.

VOC control operational

5.8 Organic solvent losses can be identified and minimised by operational controls and good operational practice.

- A programme to monitor and record the consumption of coatings/ organic solvent against product produced should be used to minimise the amount of excess organic solvent / coating used.
- Spray coatings should be applied using one of the following methods:
 - air-assisted airless
 - centrifugal
 - High Volume Low-Pressure (HVLP)
 - hot airless
 - electrostatic systems; or
 - alternatively, a system capable of achieving a transfer efficiency of at least 65%

(For information prEN 13966-1 October 2000 is a draft European standard for the determination of the transfer efficiency of liquid coating materials Part 1 concerns flat panels and should be sufficient for evaluating transfer efficiency for this provision).

- Emissions from ovens should be adequately contained – for example, by the use of end zone exhaust ventilation or air curtains. Emissions from flash-off zones and coating application areas should be adequately contained by local exhaust ventilation.
- Curing ovens, flash-off and coating application areas (including dip tanks) should be exhausted to suitable arrestment equipment where necessary to meet the requirements of this Note. Dip tanks should be covered when not in use.
- All ovens, ductwork and ancillary equipment should be made and maintained in a condition which does not allow leakage of exhaust gases from flanges, joints or areas of corrosion.

VOC control waste

5.9 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 that 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

- 5.10 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.

Air Quality

Dispersion & Dilution

- 5.11 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 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.

- 5.12 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.

Ambient air quality management

- 5.13 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

- 5.14 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 effect 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/sec under normal operating conditions, (but see 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 above 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 9 m/sec.

To reduce the potential of droplet emissions a mist eliminator should be used. Where a linear velocity of 9m/sec 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

- 5.15 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

- 5.16 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.

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. Authorities are urged to encourage wider adoption of EMS by operators, 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 on EMS

refer to the appropriate chapter of the appropriate Guidance Manual for [England and Wales](#), [Scotland](#) and [Northern Ireland](#).

Training

- 5.17 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 shut down
 - 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

- 5.18 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 below in Table 8. Minor changes that will not impact on the permit conditions, e.g. slight alterations to the Process Description, have not been recorded.

Table 8: Summary of changes

Section / Paragraph / Row	Change	Reason	Comment
Introduction			
	Simplification of text	Make Note clearer	
	Addition of links	Change to electronic format	Removes need for extensive footnotes/references
Emission limits, monitoring and other provisions			
	Removal of redundant paragraphs	SED now fully in force	
	Removal of Section 9	Now incorporated fully into reviewed note	Removes need for additional sections
Control techniques			
Air Quality	Clarification of exhaust velocity requirements		

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. Local authority regulators may be willing to provide assistance and ideas, although cannot be expected to act as unpaid consultants.

Health and safety

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

- requirements of a permit or authorisation should not put at risk the health, safety or welfare of people at work
- equally, the permit or authorisation 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 regulations 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.

Risk Phrase Classifications

As from 1st December 2010 “risk phrase” materials will also be known as “hazard statement” materials. Both terms will apply until 1st June 2015, when only the term “hazard statement” materials will apply. This change will not have an impact on the regulatory position under SED, all requirements regarding risk phrase materials still applying for hazard statement materials. However, as the identifier for the risk categories will change Table 9 below 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

Table 9 Classification of hazardous materials

			SED only catches halogenated VOC with the phrases/statements in this column
Risk Phrases	class 1 'known to'	class 2 'treat as'	class 3 'cause concern'
Hazard statements categories They are NOT exact equivalents to risk phrase classes	category 1a known from human evidence	category 1b presumed from animal evidence	category 2 suspected human carcinogens
	H340, H350, H350i, H360D or H360F		H341 H351
Carcinogens	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
Mutagens	R46 May cause heritable genetic damage H340 May cause genetic defects	R46 May cause heritable genetic damage H340 May cause genetic defects	new to SED R68 possible risk of irreversible effects H341 Suspected of causing genetic defects
Carcinogen by inhalation	R49 May cause cancer by inhalation H350i May cause cancer by inhalation	R49 May cause cancer by inhalation H350i May cause cancer by inhalation	(Covered by R40 and H351 above)
Toxic to reproduction,	R60 May impair fertility - and R61 May cause harm to the unborn child H360D or H360F May damage fertility	R60 May impair fertility - and R61 May cause harm to the unborn child H360D or H360F May damage fertility or	Outside SED - R62 and R63 for the suspecteds R phrases say "possible risk to".

	or the unborn child	the unborn child	
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Appendix 1: SED

[A consolidated version of the SED](#) is available, and convenient, but is not authoritative.

It consists of:

Preamble

Articles

Annex 1: *Scope (which lists the categories of activities covered by SED)*

Annex IIA: I Thresholds and emission control limits

Annex IIA: II The vehicle coating industry

Annex IIB: Reduction scheme

Annex III: Solvent management plan

[Directive 2010/75](#) on industrial emissions (integrated pollution prevention and control) (Recast), requires transposition into UK legislation by 6 January 2013. It incorporates the Solvent Emissions Directive with minimal changes. Both Directives can also be found on the European Commission [website](#).

Appendix 2: Compliant Coatings

VOC emission limits in Table 5 Rows 1 & 2 do not apply in relation to each coating where the coating applied contains less than the following where, in relation to each of the following coatings, coating as applied contains less VOC than specified in the table.

Table 10 Compliant Coatings

Coating	Grammes of VOC per litre of coating (less water)
(a) fillers	370
(b) clear coating applied by vacuum or roller coating methods	200
(c) pigmented coating applied by vacuum or roller coating methods	265
(d) pigmented coating applied by spray, curtain or dip techniques (except (g) below)	520
(e) clear coating applied by spray, curtain or dip techniques (except (g) below)	475
(f) clear coating applied by spray, curtain or dip techniques where all other coats are water-borne coatings containing no more than 10% by weight of VOC	600
(g) pencil end dipping lacquers	650

where, in the case of stains, the VOC content in the coating as applied is less than 10% by weight. (The VOC content should be determined by measuring the volatile content in accordance with the method below and subtracting the water content of the coating); **or** where the organic solvent loss during each cleaning of curtain and roller coating equipment is less than 10% of the organic solvent cleaning solution usage in each individual cleaning operation.

should also not apply to emissions from the use of "matching colours" and stains, where:

- the operation only uses coatings which comply with the requirements of paragraphs (i), (ii) and (iv) of this provision, and
- the total VOC content of the matching colours and stains used in any 12 month period is less than the larger of;5 tonnes

- 5% by weight of the total annual coating use

1. This Appendix includes general guidance on a method of measuring VOC contents of coatings as applied to demonstrate compliance with Appendix 2 of the note.
2. It will normally prove very difficult to calculate VOC content of coatings from coating formulation data. Coating formulation information may be used to establish water content of paint (although this can not make allowance for condensation reactions which produce water in the resin system during stoving) and for total solids content. It is preferable to determine solids content by measurement its detailed below rather than from calculation based upon coating formulation.
3. The test method should be based upon the following:
 - (i) prepare the coating to achieve a formulation typical of the coating applied in the particular process concerned (this may involve tile addition of organic solvents or water for viscosity adjustment),
 - (ii) the sample should be thoroughly mixed,
 - (iii) the sample should first be weighed into a graduated syringe or weighing bottle (WA) and sufficient material should be weighed depending upon the anticipated volatile content of the coating for example, assuming a balance accuracy of 0.1mg, it should be sufficient to use 500mg of coating,
 - (iv) precondition an aluminium foil dish, typically about 60mm diameter, in all oven at 353K +/- 5K (80°C +/- 5°C) for 30 minutes and cool and store in a desiccator prior to use,
 - (v) weigh the foil dish (Wc) and discharge the syringe contents into the dish,
 - (vi) the volume of coating used should be determined either by measuring the difference between the initial volume iii the syringe and the volume remaining after discharge or by metering the coating as it is discharged into the foil dish. The volume of coating used is Vc measured in micro litres,
 - (vii)place the dish into a preheated forced draught oven for 2 hours at 353K +/- 5K 80°C +/- 5°C),
 - (viii)determine the weight of coating applied by re - weighing the syringe after discharge to correct for any residual coating in the syringe (Wb)

(ix) remove dish from oven and place immediately into a desiccator to cool and weigh to 0.1 mg (WB).

4. The volatile content of the coating is:

$(WA - WB) - (WD - WC)$ mg.....(1)

5. It is necessary to make allowance for the weight of water if press (Ww). This can be derived either from formulation data or by determining water content by analysis, for example using gas chromatography. Therefore, the coating VOC content is:

$$\frac{[(WA - WB) - (WD - WC) Ww] \text{ grams}}{1,000,000} \dots\dots\dots(2)$$

6. In order to calculate the VOC content of the coating in accordance with this note, it is necessary to establish the volume of coating less water in which the measured VOC are present. The volume of water in the sample (Vw) can be derived from the weight of water present as calculated in paragraph 5 above, and converting to volume using the density of water. This figure should be expressed in micro litres.

7. Therefore, the volume of coating less water in which the measured VOC content is present is:

$$\frac{Vc - Vw \text{ litres}}{1,000,000} \dots\dots\dots(3)$$

8. The VOC content of the coating in grams per litre as expressed in Appendix 2 of this note is obtained by dividing the result of equation number (2) in paragraph 5 above by the result equation (3) in paragraph 7 above. In some circumstances it may be necessary to make minor amendments to the above method taking account of coating characteristics. For example, the temperature of the test oven may need to be increased to reflect the typical stoving temperature that the coating will be raised to in the process oven, but the temperature should be not be less than that specified in paragraph 3 vii) of this Appendix. The 2 hour period given in paragraph 3 vii) of this Appendix may need to be reduced to coincide with the actual stoving schedule of the coating concerned.

9. This method may not be suitable for determining the solids and VOC content of air drying, UV or chemically cured coatings where the coating is not cured by heat in an oven and in these circumstances should be determined by simulating the actual coating curing method.