Department for Environment Food & Rural Affairs

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Process Guidance Note 6/16(11)

Statutory guidance for printworks

Revised: June 2014

Llywodraeth Cymru
Welsh Government

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The Scottish 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&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 Boxes 5, 6 and 7	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 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
	Table 4.3	For non-Directive printing, reinserted explicit target emission for reduction scheme of 1.6

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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 printworks. It is published only in electronic form and can be found on the Defra website. It supersedes PG6/16(04) and NIPG6/16(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 printing or coating activity listed as a solvent emission activity in the LAPPC Regulations (see **Table 3.1**); **and**

b) consume more solvent in any 12 month period than the LAPPC threshold for that activity (see **Table 3.1**).

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 printing or coating activities:

- complying with the Directive emission limits for waste gases and fugitive emissions;
- applying the Directive reduction scheme (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 For those activities/processes covered, not all paragraphs of the note will apply in every case.

Table 1.1, 1.3, 1.4 and **Table 1.2, 1.3** and **1.5** set out which paragraphs apply in specific circumstances, as follows:

For activities (i) - (iii), use **Table 1.1, 1.3** and **1.4** (coating activities) as a guide to the applicable paragraphs:

i. where an article/substrate is being coated and the solvent consumption is 5 tonnes or more

ii. where an article/substrate is being coated and the same article/substrate is being printed and the solvent consumption is 5 tonnes or more

iii. where (i) or (ii) above are being undertaken together with an additional Directive solvent emission activity

For activities (iv) - (vi), use **Table 1.2, 1.3** and **1.5** (printing activities) as a guide to the applicable paragraphs:

iv. an article/substrate is being printed; and

v. there is no coating of the same article/substrate, or any coating operations have a solvent consumption of less than 5 tonnes; and

vi. the solvent consumption of the printing operations and any additional coating operations which make up the printing activity/process have a solvent consumption of 15 tonnes or more

For installations involving coating and printing activities/processes on different articles/substrates, it will be necessary to consult both **Table 1.1**, **1.3**, **1.4** and **Table 1.2**, **1.3** and **1.5**.

1.18 **Table 1.1, 1.3, 1.4** and **Table 1.2, 1.3** and **1.5** pick out the paragraphs and SE boxes that apply depending on which of these ways an operator chooses to comply

- complying with Directive emission limits and fugitive emission limits, (See **Table 1.1 & 1.2**)
- applying the Directive reduction scheme.(See **Table 1.4 & 1.5**)

Table 1.1 - Coating activities applying emission and fugitive limits	
Installation	**Paragraphs of guidance note which apply**
Single SE activity: Solvent consumption of the coating activity more than 5 tonnes	**All of sections except:** 4.5, 4.6, Table 4.3, 4.7 and 4.8 Table 4.2 SE Box 10
More than one SE activity: Solvent consumption of the coating activity more than 5 tonnes plus another SE activity	**All of sections except:** 4.5, 4.6, Table 4.3, 4.7 and 4.8 Table 4.2
No SE activity: Solvent consumption of the coating activity less than 5 tonnes, solvent consumption of the coating installation more than 5 tonnes	**All of sections except:** 1.12, 1.13, 1.14, 1.15, 1.16, and 1.20 SE boxes 1,2, 3 and Table 3.1 SE provisions 4.5, 4.6, Table 4.3, 4.7 and 4.8 SE boxes 4 - 11
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 & 3 of the Directive). Consumption is the organic solvent consumption of the activity (see Article 57(9) of the Directive). The determination of consumption is described in paragraph 4.10 of this note.	

Table 1.2 - Printing activities applying emission and fugitive limits

Installation	Paragraphs of guidance note which apply
Single SE activity: Printing with: • solvent consumption of the activity more than 15 tonnes and • using the following techniques: - heatset web offset - rotogravure - flexography - rotary screen printing - laminating or varnishing (as defined in Annex VII of the Directive) Printing with: • solvent consumption of the activity more than 30 tonnes and • rotary or screen printing on textile and cardboard	**All of sections except:** 4.5, 4.6, Table 4.3, 4.7 and 4.8 Table 4.2 SE Box 10
More than one SE activity: Printing with a single SE printing activity plus • another SE activity	**All of sections except:** 4.5, 4.6, Table 4.3, 4.7 and 4.8 Table 4.2
No SE activity:	**All of sections except:** 1.12, 1.13, 1.14, 1.15, 1.16, and 1.20 SE boxes 1,2, 3 and Table 3.1 SE provisions 4.5, 4.6, Table 4.3, 4.7 and 4.8 SE boxes 4 - 11
Printing techniques • cold set web offset printing and/or • sheet fed off set litho printing - solvent consumption 25 tonnes or more:	
Printing technique **other than**: • cold set web offset printing and/or • sheet fed off set litho printing - solvent consumption of the installation 5 – 15 tonnes	
Any other printing techniques • not subject to Directive - solvent consumption 15 tonnes or more	
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 & 3 of the Directive). Consumption is the organic solvent consumption of the activity (see Article 57(9) of the Directive). The determination of consumption is described in paragraph 4.10 of this note.	

Table 1.3 - Activities applying total emission limit

This compliance option is not available for this activity.

Table 1.4 - Coating activities applying reduction scheme	
Installation	**Paragraphs of guidance note which apply**
	With or without VOC abatement
Single SE activity: Solvent consumption of the coating activity more than 5 tonnes	All of Sections **except**: Table 4.2 SE boxes 5, 9 and 10
More than one SE activity: Solvent consumption of the coating activity more than 5 tonnes plus another SE activity	All of Sections **except:** Table 4.2 SE boxes 5, and 9
No SE activity: Solvent consumption of the coating activity less than 5 tonnes, solvent consumption of the coating installation more than 5 tonnes	All of Sections **except:** 1.12, 1.13, 1.14, 1.15, 1.16, and 1.20 SE boxes 1,2, 3 and Table 3.1 SE provisions SE boxes 4 - 11
A solvent emissions activity (SE) is an activity 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, Part 2 of the Directive). Consumption is the organic solvent consumption of the activity, (see Article 57(9) of the Directive). The determination of consumption is described in paragraph 4.10 of this note. NB: If a SE activity does not apply solids, the reduction scheme cannot be used.	

Table 1.5 - Printing activities applying reduction scheme	
Installation	**Paragraphs of guidance note which apply** **With or without VOC abatement**
Single SE activity: Printing with: • solvent consumption of the activity more than 15 tonnes • and using the following techniques: - heatset web offset - rotogravure - flexography - rotary screen printing - laminating or varnishing (as defined in Annex VII of the Directive) Printing with • solvent consumption of the activity more than 30 tonnes • and with rotary or screen printing on textile and cardboard	All of Sections **except**: Table 4.2 SE boxes 5, 9 and 10
More than one SE activity: Printing with a single SE printing activity plus • another SE activity	All of Sections **except:** Table 4.2 SE boxes 5, and 9
No SE activity:	All of Sections **except:** 1.12, 1.13, 1.14, 1.15, 1.16, and 1.20 SE boxes 1,2, 3 and Table 3.1 SE requirements SE boxes 4 - 11
Printing techniques • cold set web offset printing and/or • sheet fed off set litho printing - solvent consumption 25 tonnes or more:	
Printing technique **other than**: • cold set web offset printing and/or • sheet fed off set litho printing - solvent consumption of the installation 5 – 15 tonnes	
Any other printing techniques • not subject to Directive - solvent consumption 15 tonnes or more	
A solvent emissions activity (SE) is an activity 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, Part 2 of the Directive). Consumption is the organic solvent consumption of the activity, (see Article 57(9) of the Directive). The determination of consumption is described in paragraph 4.10 of this note. NB: If a SE activity does not apply solids, the reduction scheme cannot be used.	

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

1.19 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

1.20 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.

Activities including surface cleaning using solvents

1.21 Some printing installations may also undertake surface cleaning using solvents, however directly associated and technically connected activities are included in the activity and must meet the provisions for that activity.

If the surface cleaning activity consumes more than **1 tonne** a year of solvents with the hazard statement listed in paragraph 1.14, or **2 tonnes** a year of any solvents, the provisions of PG6/45(11) should be used.

If the surface cleaning activity consumes less than these amounts, **Section 6** of this note should be applied.

The Directive definition of 'surface cleaning' includes "This activity does not refer to the cleaning of the equipment but to the cleaning of the surface of products".

Coating and printing together

1.22 If 5 tonnes or more of organic solvent is consumed in the application of a continuous film of coating on a substrate, the coating and any associated printing on the same article should be regarded as a coating activity.

If additional printing is carried out within the same installation which is technically connected to the coating activity and does not involve the application of a continuous film of coating:

- if its consumption is less than 15 tonnes of organic solvent then that additional printing should be regarded as part of the coating activity
- otherwise, if its consumption is 15 tonnes or more, it should be regarded as a separate printing activity as defined within the Directive

If additional printing is carried out within the same installation, which is not technically connected to the coating activity, that additional printing should be regarded as a separate activity:

- if the organic solvent consumption of that additional printing activity is more than 5 tonnes but less than 15 tonnes per annum, the non-Directive requirements of this note should apply to that additional printing activity;

- if the organic solvent consumption of that additional printing activity is 15 tonnes or more per annum, it should be regarded as a separate printing activity as defined within the Directive.

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 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/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 heat set web offset, rotogravure, flexography some rotary screen printing, laminating varnishing activities with a solvent consumption of less than 25 tonnes per year;

b) 10 % for all other installations (including rotary screen printing on textile / cardboard.

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 carrying out of printing activities. The activities for regulation are listed in **Table 3.1**.

Table 3.1 - Regulations listing activities

LAPPC	Solvent consumption of activity	England and Wales	Scotland	Northern Ireland
		EPR reference	PPC reference	PPC reference
Part A	More than 150kg/hr or more than 200te in any 12 month period	Schedule 1 section 6.4 Part A2	Schedule section 6.4 Part A	Schedule 1 section 6.4 Part A
Solvent emission activity	Heatset web offset printing – More than 15 tonnes in any 12 month period Publication Rotagravure – More than 25 tonnes in any 12 month period Other rotogravure, flexography, rotary screen printing, laminating or varnishing units. – More than 15 tonnes in any 12 month period Rotary Screen printing on textile/cardboard. – More than 30 tonnes in any 12 month period	Reg 2 EPR as amended in 2013 refers to industrial emissions Directive Annex VII Parts 1 and 2	Schedule 2	Schedule 1 section 7 Part C
Part B or Part C	Cold set web offset or sheet fed offset litho printing –25 tonnes or more in any 12 month period Any other coating or printing activity 5 tonnes or more in any 12 month period	Schedule 1 section 6.4 Part B	Schedule 1 section 6.4 Part B	Schedule 1 section 6.4 Part C

The links are to the original version of the Regulations. A consolidated version is not available on 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.

Offset Lithographic

3.3 Offset lithographic is the most widely used printing process. The printing and non-printing surfaces of the lithographic printing plate are almost in the same plane. The different print areas of the plate are treated to accept ‘oily’ printing ink, the image area, or reject the printing ink the hydrophilic non-image areas. Before inking the printing plate it is dampened with a dampening solution (normally water and propan-2-ol plus additives). A thin film of ink is then applied via a roller to the image areas. The image to be printed is then transferred from the printing plate on to a rubber blanket cylinder and then on to the printing substrate, the film of ink is then dried. Offset is the term used to describe the double transfer of the image from the plate to the blanket roller to the substrate. Periodic cleaning of the blanket roller is required to remove build up of debris such as paper, dust and printing ink constituents. Cleaning is carried out using various organic solvents, either manually or automatically. At the end of each print run, cleaning of the inking rollers and ink ducts is carried out. The rollers are cleaned using various organic solvents whilst the inking ducts are usually cleaned using solutions similar to the blanket wash.

Heatset Web Offset

3.4 Heatset web offset printing is from a continuous reel ‘web’, it is typically used for magazines and coated papers when printing large numbers of copies, it gives richer colours than cold set printing. In heat set web offset printing the ink dries in an oven. The exhaust gases from the heat set drying process contain VOC from inks, cleaning agents and propan-2-ol. The exhaust gases are generally abated using thermal oxidation.

Coldset Web Offset

3.5 Coldset web offset printing is from a continuous reel ‘web’ and is typically used for newspapers printed on absorbent uncoated paper The inks dry as a result of absorption by the substrate or oxidation. Cleaning of blanket rollers and print rollers is a more frequent requirement in coldset web offset.

Sheet Fed Offset

3.6 Sheet fed is the most common printing process used by small/medium size printers. Printing is carried out on single sheets. The inks dry as a result of absorption by the substrate or oxidation. UV curing inks are used for some applications. However these are harder to remove from blanket rollers than conventional inks and require stronger solvents to remove them.

Waterless Lithographic Printing

3.7 Is similar to cold web offset lithographic but without the use of any damping water. The printing plate used is coated with an ink repellent silicone surface and following exposure to the image the unwanted silicone is removed by development to reveal the ink attractive layer below. Ink is readily accepted where the silicone has been removed and as a result no water is needed to keep the non-image areas free of ink. However, solvent blanket washes are still required.

Letterpress

3.8 Letterpress is a relief form of printing process that uses similar inks to those used for offset litho printing. Printing can be in sheet or web form. Cleaning solvents are used to automatically clean the ink rollers when required. However, printing plates are predominantly cleaned by hand.

Gravure

3.9 Gravure is an operation where the image lies recessed in the surface of the printing cylinder. The cylinder is flooded with ink and the surface scraped clean (using a doctor blade) to leave ink in only the recessed image areas only. Low viscosity inks are mostly used in order to fill the recesses, the image is then transferred to the substrate. Dryers are used to fix the inks as a result of their high organic solvent content. As a wide variety of organic solvents are used, it is common for the exhaust gases from the operation to be abated using a thermal oxidiser or bio-reactor. Water borne inks for gravure printing which do not give rise to VOC are used in some applications.

Publication Gravure

3.10 Publication gravure is essentially the same as gravure printing, except it is carried out on a substantially larger scale e.g. long runs such as magazines. The scale of the process means that a single solvent (toluene) system is employed to enable solvent recovery and reuse. The toluene-laden air from the ovens and often from the print line is passed through activated carbon beds where it is adsorbed. The toluene is then recovered from the activated carbon and either reused or sold back to the supplier.

Flexography

3.11 Flexographic printing involves sheet or web fed printing from a raised image on a printing plate made from either rubber or photo-polymers. Highly fluid quick drying (high organic solvent) inks are generally used. Ink is applied to the raised area of the printing plate from an engraved (anilox) roller, it is then transferred directly to the substrate. The ink must be heat dried prior to the printing of another colour. After the addition of the last colour all the residual organic solvents are removed in a final drying section. After finishing a printing run it is necessary to clean the printing plates, anilox roller etc. with organic solvent similar to those within the ink. As a result of the high organic solvent content and the variety of organic solvents used, abatement of the exhaust gases from the process, using an incinerator or bio-reactor, is common. Alternatively, low organic solvent UV curing inks (UV ink curing systems may give rise to ozone releases), or water borne flexographic inks (for absorbent substrates) can be used.

Screen Printing

3.12 Screen-printing is a form of stencilling where ink is forced through the clear elements of the stencil. Screen-printing is capable of putting down a heavier ink film than other processes, this enables printing on almost any surface or material. The material to be printed on is positioned under the stencil screen in close contact, the frame supporting the screen is then loaded with ink which is forced through the clear parts of the screen by a squeegee. Organic solvent, water borne and UV curing inks are used in screen-printing. The use of organic solvent inks give rise to VOC during printing, cleaning and drying operations. When oven drying is carried out the exhausted VOC can be collected. Water borne inks (most containing between 5-15% organic solvent) give rise to lower levels of VOC. However, they have inferior adhesion to some substrates. UV curing inks avoid the use of organic solvent except for cleaning purposes, however they are currently only suitable for certain substrates.

Rotary Screen Printing

3.13 Rotary screen-printing is continuous web fed form of screen-printing.

Roll Label Printing

3.14 This is a product rather than a printing process. However, it may be dealt with separately as it may incorporate one or more of the different printing processes outlined above in the same press.

Digital Printing

3.15 Digital printing relies on ink jet technology, data is down loaded directly to the printer from the computer. Digital printers vary from 1 to 10 meters in width using inks containing up to 70% organic solvent. Smaller (1 metre) machines have no extraction, whilst larger units are extracted to atmosphere. Additional organic solvent is used for cleaning the print heads of the machines. UV curing inks can be used on digital printing machines.

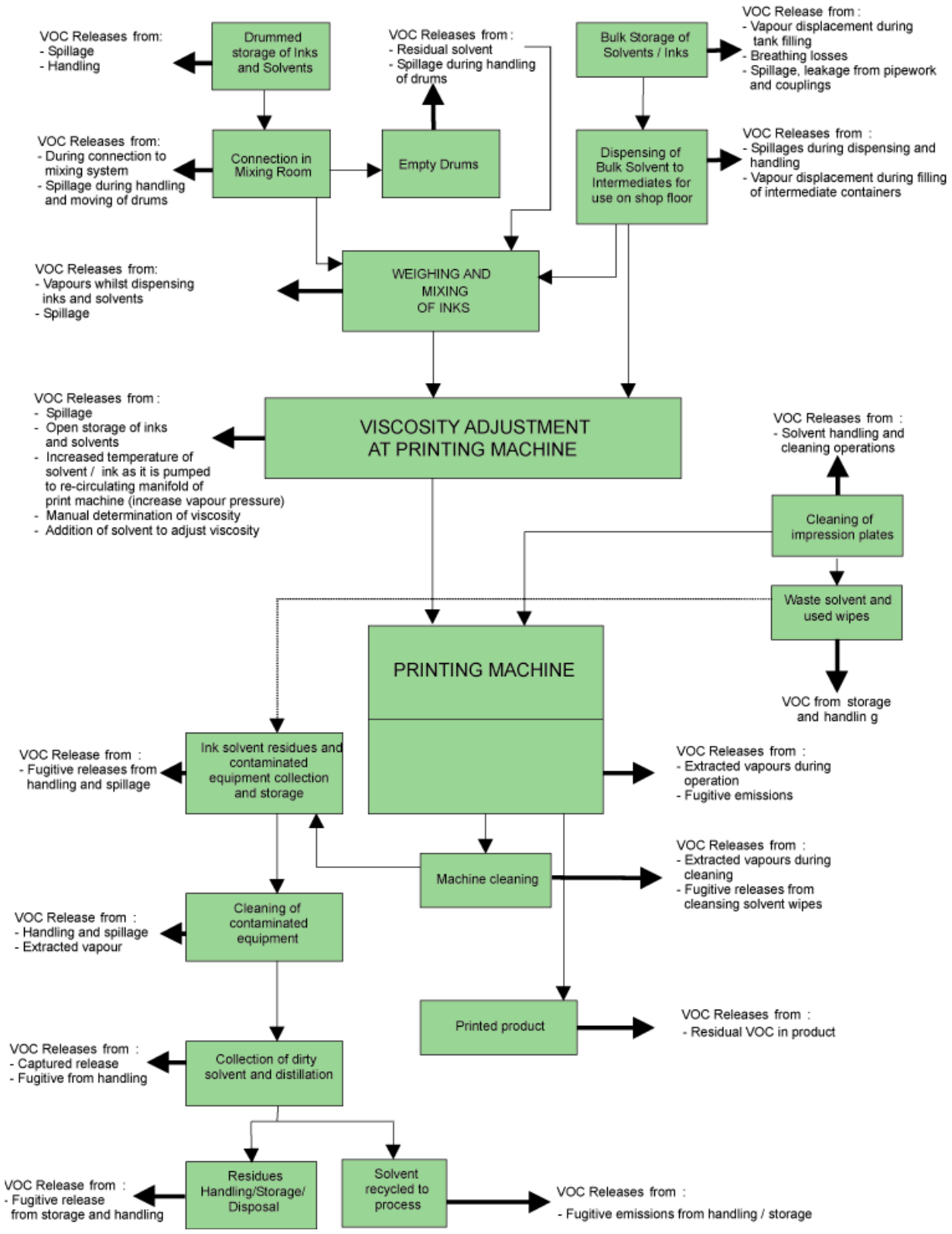
Finishing Processes

3.16 Finishing processes such as cutting trimming and spine buffing can give rise to particulate releases in the form of paper dust. These processes are normally enclosed, where the enclosure is extracted; the air with dust is filtered using bag filters or cyclones before being discharged.

Cleaning Processes

3.17 Generally cleaning of equipment takes place at the beginning and/or end of each print run or in some cases during runs, to remove debris and ink build up. Enclosed cleaning machines are used for detachable equipment such as screens, plates, drums, rollers and ink trays. Emissions from these machines may be contained or vented via suitable abatement equipment.

Figure 3.1 - Potential VOC releases from a printworks printing operation



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	100mg/Nm^3 as a 15 minute mean for contained sources	Catalytic oxidiser Monitoring and recording PLUS Manual extractive testing	Continuous PLUS Annual
		From turbines, reciprocating engines or boilers used as VOC abatement equipment.	500mg/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.	500mg/Nm^3 as 15 minute mean for contained sources		
4	Isocyanates	All processes / activities using isocycanates	0.1mg/Nm^3 as a 15 minute mean for contained sources excluding particulate and expressed as NCO.	Manual extractive testing	Annual
5	Sulphur dioxide	All activities using heavy fuel oil or other residual type /comparable Quality Protocol Processed Fuel Oil	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 Quality Protocol Processed Fuel Oil	0.1% wt/wt sulphur in fuel		

Table 4.2 - Emission limits, monitoring and other provisions for non-Directive activity VOC releases				
Row	**VOC**	**Emission limits/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 PLUS Annual
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
3	The emission limit value for VOC in rows 1 and 2 above do not apply where all of the inks and cleaning materials used in the process contain less than15% by weight of organic solvents.			

4.4 For VOC compliance, the Directive 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).

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 paragraphs 4.6 and 4.7

All installations must report on compliance and the regulator requests the information needed. See paragraph 4.10 for consumption and for the solvent management plan, see paragraph 4.12.

Annual data is required for the reduction scheme, see paragraph 4.6, excluding the 'list point b'.

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 4.30 on varying monitoring frequency.

If compliance is breached, it should be restored within the shortest possible time (see also paragraphs 4.14 and 4..20).

For accidents and incidents significantly affecting the environment, paragraph 4.14 and 4.20 apply. In addition, further possible incidents or accidents should be prevented.

SE Box 5 - Waste gas and fugitive emission limits and requirements (Article 59 and Annex VII, Parts 2 & 3)				Monitoring
For all activities using the waste gas and fugitive emission limits and requirements				
	VOC in waste gases	**Emission limits / requirement**	**Fugitive emission values**	
1	**Coating** installations Organic solvent consumption 5 – 15 tonnes	VOC expressed as total mass of organic carbon	25% of organic solvent input	**Abated releases:** Continuous monitoring and recording **PLUS** Manual extractive testing **Unabated releases:** Manual extractive testing
	Waste gases from oxidation plant used as abatement	50mg C/Nm^3		
	Waste gases from turbines, reciprocating engines or boilers used as abatement plant. Any other waste gases	100mg C/Nm^3		
2	**Coating** installations Organic solvent consumption 15 tonnes or more	VOC expressed as total mass of organic carbon	20% of organic solvent input	
	Waste gases from oxidation plant used as abatement	50mg C/Nm^3		
	Waste gases from turbines, reciprocating engines or boilers used as abatement plant.	50mg C/Nm^3 as abatement for drying processes		
		75mg C/Nm^3 as abatement for other processes		
	Waste gases from any other type of abatement plant	50mg C/Nm^3 as abatement for drying processes		
		75mg C/Nm^3 as abatement for other processes		
	Waste gases from unabated drying processes	50mg C/Nm^3		
	Any other unabated waste gases	75mg C/Nm^3		

3	All heatset web offset **printing** Installations Organic solvent consumption more than 15 tonnes and less than 25 tonnes	VOC expressed as total mass of organic carbon	30% of organic solvent input – See Note 1	**Abated releases:** Continuous monitoring and recording **PLUS** Manual extractive testing **Unabated releases:** Manual extractive testing
	Waste gases from oxidation plant used as abatement	50mg C/Nm^3		
	Waste gases from turbines, reciprocating engines or boilers used as abatement plant. Any other Waste gases	100mg C/Nm^3		
4	All heatset web offset **printing** Installations Organic solvent consumption 25 tonnes or more	VOC expressed as total mass of organic carbon	30% of organic solvent input -See Note 1	
	Waste gases : from oxidation plant used as abatement from turbines, reciprocating engines or boilers used as abatement plant from any other type of abatement plant and any other waste gases	20mg C/Nm^3		

5	**Printing**: All publication rotagravure Installations Organic solvent consumption 25 tonnes or more	VOC expressed as total mass of organic carbon	Existing installation 15% of organic solvent input – See Note 3 New installation 10% of organic solvent input – See Note 3	**Abated releases:** Continuous monitoring and recording **PLUS** Manual extractive testing **Unabated releases:** Manual extractive testing
	Waste gases from turbines, reciprocating engines or boilers used as abatement plant. from any other type of abatement plant Any other Waste gases	75mg C/Nm^3		
6	**Printing**: All other rotogravure, flexography, rotary screen printing (not rotary screen printing on textile and card board), laminating or varnishing units 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	
	Waste gases from oxidation plant used as abatement	50mg C/Nm^3		
	Waste gases from turbines, reciprocating engines or boilers used as abatement plant. Any other Waste gases	100mg C/Nm^3		
7	**Printing**: All other rotogravure, flexography, rotary screen printing (not rotary screen printing on textile and card board), laminating or varnishing units Installations Organic solvent consumption 25 tonnes or more	VOC expressed as total mass of organic carbon	20% of organic solvent input	
	Waste gases from oxidation plant used as abatement	50mg C/Nm^3		
	Waste gases from turbines, reciprocating engines or boilers used as abatement plant. Any other Waste gases	100mg C/Nm^3		

8	All rotary screen **printing** on textile and card board Installations Organic solvent consumption 30 tonnes or more	VOC expressed as total mass of organic carbon	20% of organic solvent input
	Waste gases from oxidation plant used as abatement	50mg C/Nm^3	
	Waste gases from turbines, reciprocating engines or boilers used as abatement plant. Any other Waste gases	100mg C/Nm^3	

Note 1 For heat set web offset printing, solvent residue in finished product is not to be considered as part of fugitive emissions.

Note 2 - Operators who were permitted to use an emission figure of 150mg/Nm^3 until 1 April 2013 may find that using the reduction scheme is the best way of achieving compliance thereafter.

Note 3 - the definition of 'existing installation' is in SE Box 3B, and the definition of 'new installation' too

Abated releases:

Continuous monitoring and recording

PLUS

Manual extractive testing

Unabated releases:

Manual extractive testing

SE Box 6 - Total emission limit values industrial emissions Directive activities
Total emission limit values are not a valid route to industrial emissions Directive 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:

a) mechanisms to decrease in the average solvent content of the total input; **and/or**

b) 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 4.3** below. In determining the total mass of solids:

- all ingredients other than water and organic solvents should be assumed to form part of the solid coating; **and**
- 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.
- 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 4.3 - Reduction scheme: target emission figures		
SE Coating activity		
Food coating 5-15 tonnes		Total mass of solids x 0.93
Food coating Over 15 tonnes		Total mass of solids x 0.58
Coating of paper textiles or film 5 -15 tonnes		Total mass of solids x 1.6
Coating of paper textiles or film Over 15 tonnes		Total mass of solids x 1.0
Coating other substrates 5 -15 tonnes		Total mass of solids x 0.6
Coating other substrates Over 15 tonnes		Total mass of solids x 0.37
SE Printing activity		
Publication Rotagravure	Reduction scheme not available to this activity.	
Other rotogravure, flexography, laminating or varnishing units.	15 – 25 tonnes	Total mass of solids x 1.2
	Over 25 tonnes	Total mass of solids x 1.0
Rotary screen printing	15 -25 tonnes	Total mass of solids x 0.45
	Over 25 tonnes	Total mass of solids x 0.37
Rotary screen printing on textile/cardboard	Over 30 tonnes	Total mass of solids x 0.37
Non-Directive activity		
Non Directive activity		Total mass of solids x 1.6

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 = I_1-O_8-O_7-O_6 (-O_5 if abatement has been used). See paragraph 4.12.

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, paragraph 4.12).

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 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.

4.12 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)**

$\mathbf{I_1}$ 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).

$\mathbf{I_2}$ 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_1 Emissions in waste gases.

O_2 Organic solvents lost in water, if appropriate taking into account waste water treatment when calculating O_5.

O_3 The quantity of organic solvents which remains as contamination or residue in products output from the process/activity. (But for heatset web offset, also see SE Box 5 Note 1)

O_4 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.

O_5 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 O_6, O_7 or O_8).

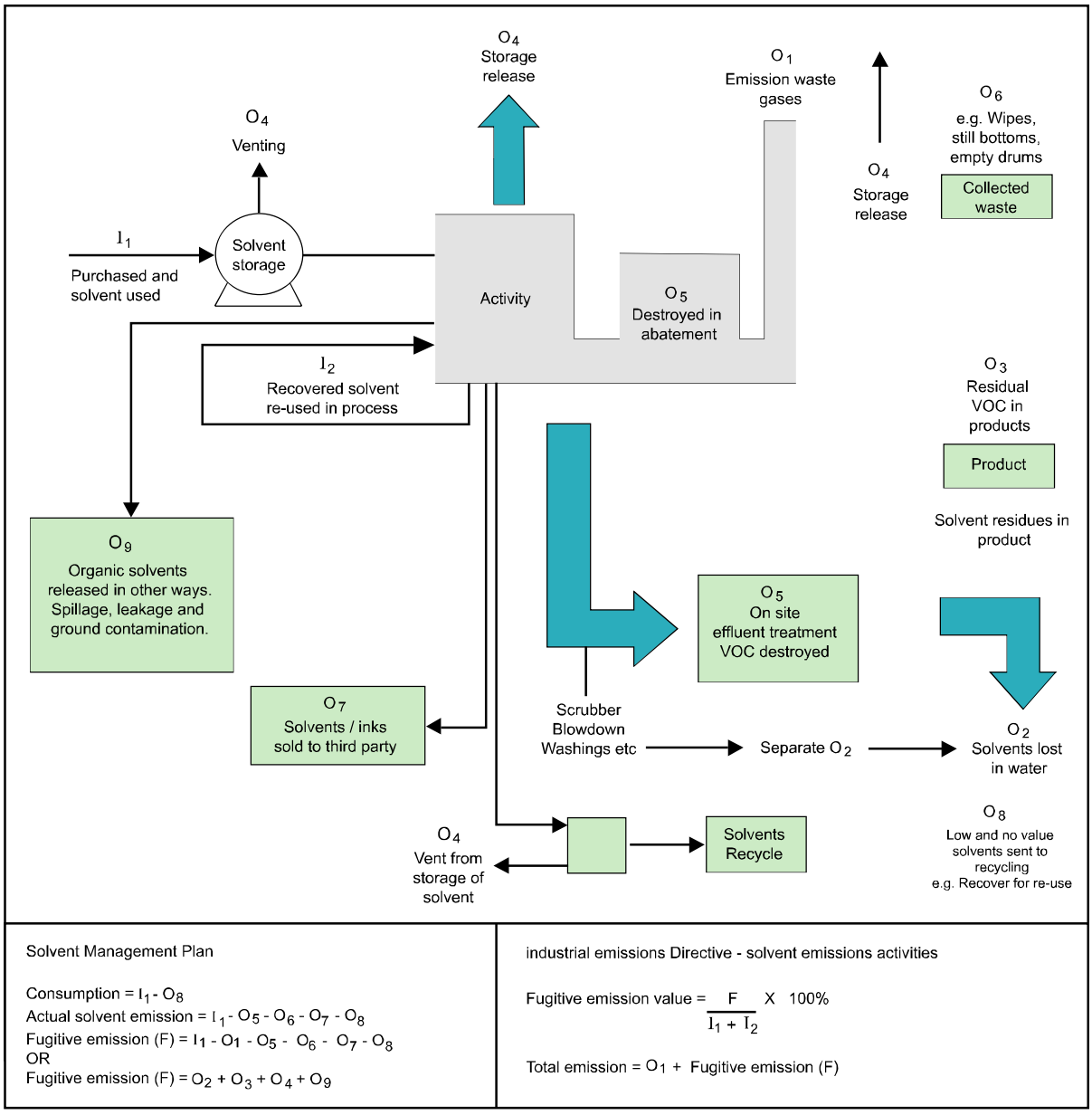
O_6 Organic solvents contained in collected waste.

O_7 Organic solvents, or organic solvents contained in mixtures, which are sold or are intended to be sold as a commercially valuable product.

O_8 Organic solvents contained in mixtures recovered for reuse but not as input into the process/activity, as long as not counted under O_7.

O_9 Organic solvents released in other ways.

Figure 4.1 - Solvent management plan inputs and outputs



Solvent Management Plan

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) = $O_2 + O_3 + O_4 + O_9$

industrial emissions Directive - solvent emissions activities

Fugitive emission value = $\frac{F}{I_1 + I_2} \times 100\%$

Total emission = O_1 + Fugitive emission (F)

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:	Timescale:
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.	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^3 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:	Timescale:
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.	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^3 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

4.13 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.

- 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

4.14 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

4.15 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.

4.16 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

4.17 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.

4.18 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.

4.19 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.

Abnormal events

4.20 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

4.21 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 (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 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.

4.22 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.

4.23 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

4.24 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.

4.25 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.

4.26 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.

4.27 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.

4.28 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.

Continuous monitoring of VOC abated releases

4.29 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 4.28

Varying of monitoring frequency

4.30 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.

4.31 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^3 , against an emission limit of 50 mg/m^3 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^3 when the limit is 50 mg/m^3 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.

4.32 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 arrestment equipment is functioning correctly.

Monitoring of unabated releases

4.33 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

4.34 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.

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

4.35 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.

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, 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

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 as specified in **Table 4.1**.

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 in accordance in the provisions of paragraph 5.17.

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. 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.

5.7 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^{o}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.

5.8 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

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

- Inks/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.

VOC control cleaning

5.10 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 (such as screens, plates, drums, rollers and coating / ink trays) 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 ink / coating contained in parts of the application equipment should be removed prior to cleaning.

VOC control operational

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

- Programmable scales should be used during the mixing and preparation of inks/coatings to reduce organic solvent usage.

- A programme to monitor and record the consumption of inks/coatings/ organic solvent against product produced should be used to minimise the amount of excess organic solvent / coating / ink used.

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.

Sheet fed offset printing

5.13 For sheet fed offset, the composite vapour pressure at 20oC (293K) of the cleaning solvents used should be no greater than:

- 0.8kPa for low odour processes (e.g. food packaging, to avoid taint of the product);
- 1.6kPa for ultra violet curing processes;
- 0.2 kPa for all other processes.

Specialist cleaning solvent products such as blanket reviver, which have a vapour pressure of greater than 0.1kPa should not contain more than 5% of cleaning organic solvent by weight.

Offset printing

5.14 For all offset printing, where technically feasible non-dampening printing methods or physical or inorganic dampening aids should be used instead of propan-2-ol and other organic compounds

- Where organic compounds are present in dampening:

The proportion of organic compounds in dampening solutions should not exceed

- 10% (by weight) in the case of existing presses, except where these are incapable of running at that level
- 5% (by weight) in the case of new presses

- Cooling in order to reduce the evaporation of dampening solutions containing organic compounds should be installed.

Publication gravure

5.15 For publication gravure, monthly solvent balances should be carried out. Discrepancies between the sum of the monthly solvent balance and the annual solvent balance should be investigated.

General control techniques

Dust and spillage control

5.16 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

5.17 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.

5.18 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

5.19 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

5.20 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

5.21 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

5.22 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.

5.23 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

5.24 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

5.25 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.

Table 6.1 - 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	The solvent emissions Directive is fully in force (and is now replaced by the industrial emissions Directive.)	
Control techniques			
	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, 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

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**
Risk Phrases	class 1 ‘known to’	class 2 ‘treat as’	class 3 ‘cause concern’
Hazard statements categories They are NOT exact equivalents	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	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	R40 Limited evidence of a carcinogenic effect H351 Suspected of causing cancer
Toxic to reproduction	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	**Outside** the Directive - R62 and R63 for the suspected R phrases say “possible risk to”.

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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