

**Guidance on VOC Substitution and Reduction  
for Activities Covered by the  
VOC Solvents Emissions Directive  
(Directive 1999/13/EC)**

**Introduction chapter**

European Commission - DG Environment

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## Background

The main instrument for the reduction of VOC emissions from industrial installations using organic solvents in the European Union is Council Directive 1999/13/EC<sup>1</sup> of 11 March 1999 on the limitation of emissions of volatile organic compounds due to the use of organic solvents in certain activities and installations (SE Directive).

Article 7 ("Substitution") of the SE Directive requires the Commission to ensure "that an exchange of information between Member States and the activities concerned on the use of organic substances and their potential substitutes takes place".

The present guidance documents are the result of a Commission project to provide sector specific information on VOC substitution and reduction measures for each of the activities covered by the SE Directive and listed in its Annexes I and II(A). This project was carried out by a consortium of consultants including BiPRO and ÖKOPOL under the management of AEA Technology.

The guidance documents contain detailed information on the use of substances and techniques that have the least potential effects on air, water, soil, ecosystems and human health. Each guidance document gives a short overview on the activity and the related industry sector covered, describing the solvents used, the related VOC emissions and their possible impact on the environment and on human health. Subsequently, they give a comprehensive overview of VOC-free alternatives to conventional systems, of systems with a reduced VOC use, and of other VOC emission prevention measures and abatement techniques. Particular attention is given to substitution of VOCs classified as CMR substances and halogenated VOCs carrying risk phrases R40/R68. Some practical "good practice" examples are discussed to show opportunities and barriers to the successful implementation of VOC prevention and reduction measures. Finally, relevant emerging techniques and promising research approaches are presented.

The information in the guidance documents draws on the STS BREF<sup>2</sup> (Best Available Techniques Reference document on Surface Treatment using Solvents) developed under the IPPC Directive (2008/1/EC) as adopted by the European Commission in 2007. In addition, numerous publications and web sites have been reviewed, interviews have been conducted with experts of the industries concerned, researchers and industry suppliers have also been contacted. Several stakeholders and competent authorities have been consulted and given the opportunity to provide inputs to the project. All of their contributions have been of outstanding value for the project and are very much appreciated.

1 OJ L 85, 29.3.1999, p.1

2 <http://eippcb.jrc.es/reference/>

## How to use the guidance documents

These documents are intended to:

- Provide information for operators and permitting authorities of activities under the scope of the SE Directive;
- Give a short, and easy to use overview of VOC reduction and VOC substitution measures;
- Raise awareness and interest in recent developments that provide further opportunities to reduce the use of organic solvents and their associated VOC emissions.

It should be noted, however, that:

- These documents do not have the status of a BREF document and do not define BAT;
- By focussing on VOC relevant issues, the guidance is equally applicable to large and small installations and the documents are thus not restricted to IPPC installations;
- The documents aim to avoid undue detail, their description of technologies has been limited to a level suitable for a general readership;
- The documents do not aim to reflect a full life cycle assessment and cost-benefit analysis of the options presented or to contain exhaustive assessment of all cross-media effects as these will be situation specific.

## General issues to be considered when implementing VOC reduction and substitution measures

It is important, when selecting VOC emission prevention/reduction measures, to consider the impacts on the environment as a whole on a case-by-case basis. Options should be selected on the basis of a balanced assessment of cross-media effects (water, soil, energy use, waste). Life Cycle Assessment can be a useful tool for such decision-making process<sup>3</sup>.

When considering substitution options, it should be remembered that REACH<sup>4</sup> requires that harmful substances are not substituted by more harmful substances (see Articles 60(5) and Article 64(4)).

## Selection of good practice examples

The information provided seeks to reflect practical experience. The good practice examples have been collected from actual companies to illustrate particular substitution/prevention/abatement techniques applied. Their selection does however not imply that the techniques cited are necessarily the best with respect to the minimisation of all possible environmental impacts.

<sup>3</sup> For more information about life cycle assessment see: <http://ca.jrc.ec.europa.eu/EPLCA/deliverables.htm> or <http://ca.jrc.ec.europa.eu/>.

<sup>4</sup> OJ L 396, 30.12.2006, p. 1–849, <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2006:396:0001:0849:EN:PDF>

## Overview of guidance documents and good practice examples

No	Topic of Guidance	Good practice examples for VOC reduction and substitution
0	Introduction chapter	
1	Heatset web offset printing	<ul style="list-style-type: none"> <li>a) Printing without isopropanol in the dampening solution</li> <li>b) Waterless heatset offset printing</li> </ul>
2	Publication rotogravure	a) Achieving a low toluene emission using a closed loop system and high frequency toluene recovery with steam from a CHP gas turbine
3	Other rotogravure, flexography, rotary screen printing, and laminating or varnishing units	<ul style="list-style-type: none"> <li>a) High efficiency waste gas treatment by adsorption wheel</li> <li>b) Use of VOC emissions to fuel engines for electricity production</li> </ul>
4/5	Surface cleaning	<ul style="list-style-type: none"> <li>a) Sealed single chamber installation using perchloroethylene as cleaning agent</li> <li>b) Vacuum system to reduce VOC losses</li> <li>c) Plasma cleaning technology for degreasing and surface activation of plastic parts</li> </ul>
6.1	Vehicle coating (< 15 t/y) and vehicle refinishing	<ul style="list-style-type: none"> <li>a) Coating of aluminium wheel rims: Changing to water-based metallic-effect base coat and a powder coating top coat</li> <li>b) Coating of trailers: Changing to a high-solid product. Reduced cleaning with shorter material supply ducts</li> <li>c) Trailer coating: Use of automatic washing machines for equipment cleaning</li> <li>d) Coating of brake pads: Reduced overspray from optimized arrangement of work pieces for spray coating</li> </ul>
6.2	Vehicle coating (large series)	a) Increased use of powder coating
7	Coil coating	<ul style="list-style-type: none"> <li>a) Use of Reduced Solvent Polyester Paints</li> <li>b) Use of Water Reducible Epoxy Baker</li> </ul>
8.1	Other metal coating	<ul style="list-style-type: none"> <li>a) Changing from solvent based to water based systems; change of application and drying techniques</li> <li>b) Use of automatic washing machines for cleaning of equipment</li> </ul>
8.2	Other coating - plastic, textile, fabric, film and paper coating	<ul style="list-style-type: none"> <li>a) Changing from solvent based system to water based systems</li> <li>b) Use of water based coatings - drying with dehumidified air</li> <li>c) Use of Plastic extrusion coating</li> </ul>
9	Winding wire coating	No examples available
10	Coating of wooden surfaces	<ul style="list-style-type: none"> <li>a) Replacing solvent borne polyurethane paint with water-borne paint</li> <li>b) Substituting solvent based paints with water based paints</li> <li>c) VOC reduction: Results of an overview study on furniture producing companies</li> </ul>
11	Dry cleaning	<ul style="list-style-type: none"> <li>a) Liquid silicone cleaning</li> <li>b) Liquid CO2 cleaning</li> <li>c) Perchloroethylene cleaning with a refrigerated condenser</li> </ul>

No	Topic of Guidance	Good practice examples for VOC reduction and substitution
12	Wood impregnation	<ul style="list-style-type: none"> <li>a) Use of EN 13991 Grade C creosote</li> <li>b) Thermal treatment of wood</li> <li>c) Water based preservatives</li> </ul>
13	Coating of leather	<ul style="list-style-type: none"> <li>a) Change to water based systems</li> <li>b) Improvement of spraying technique</li> </ul>
14	Footwear manufacture	<ul style="list-style-type: none"> <li>a) Increased use of high-solid products, water based systems, reactive coatings and adhesive systems; installation of a waste gas scrubber.</li> <li>b) Improved handling of VOC containing products</li> </ul>
15	Wood and plastic lamination	No examples available
16	Adhesive coating	<ul style="list-style-type: none"> <li>a) Solvent/water based coating machines</li> <li>b) Abatement technologies: Refrigerated cooling, Regenerative thermal oxidation and Recuperative thermal oxidation</li> <li>c) Hot melt coating</li> </ul>
17	Manufacturing of coatings, varnishes, inks and adhesives	<ul style="list-style-type: none"> <li>a) Improved housekeeping and enclosed manufacturing process</li> <li>b) Enclosed production and improved cleaning technique</li> </ul>
18	Rubber conversion	<ul style="list-style-type: none"> <li>a) Automotive tyre production: Overview on measures to reduce VOC emissions</li> <li>b) Agricultural tyre production: Overview on measures to reduce VOC emissions</li> </ul>
19	Vegetable oil and animal fat extraction and vegetable oil refining activities	No examples available
20	Manufacturing of pharmaceutical products	<ul style="list-style-type: none"> <li>a) Use of effective abatement technologies for VOC emission reduction</li> </ul>

