

Convention on Long-Range Transboundary Air Pollution

45<sup>th</sup> Working Group on Strategies and Review – 31 August 2009 to 4 September 2009

Technical Annex prepared by EGTEI

## **Suggested Technical Annex VI to the Gothenburg Protocol**

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

UNECE GP : Gothenburg Protocol

BREF STS : reference document on BAT for Surface Treatment using Organic Solvents

BREF OFC : reference document on BAT for the manufacture of organic fine chemicals - August 2006

BREF TMP : reference document on BAT for the surface treatment of metals and plastics – August 2006

Annex VI

LIMIT VALUES FOR EMISSIONS OF VOLATILE ORGANIC COMPOUNDS  
FROM STATIONARY SOURCES

1. Section A applies to Parties other than Canada and the United States of America, section B applies to Canada and section C applies to the United States of America.

A. Parties other than Canada and the United States of America

2. This section of the present annex covers the stationary sources of VOC emissions listed in paragraphs 8 to 22 below. Installations or parts of installations for research, development and testing of new products and processes are not covered. Threshold values are given in the sector-specific tables below. They generally refer to solvent consumption or emission mass flow. Where one operator carries out several activities falling under the same subheading at the same installation on the same site, the solvent consumption or emission mass flow of such activities are added together. If no threshold value is indicated, the given limit value applies to all the installations concerned.

3. For the purpose of section A of the present annex:

(a) "Storage and distribution of petrol" means the loading of trucks, railway wagons, barges and seagoing ships at depots and mineral oil refinery dispatch stations, excluding vehicle refuelling at service stations covered by relevant documents on mobile sources;

(b) "Adhesive coating" means any process in which an adhesive is applied to a surface, with the exception of adhesive coating and laminating associated with printing processes and wood and plastic lamination;

(c) "Wood and plastic lamination" means any process to adhere together wood and/or plastic to produce laminated products;

(d) "Coating processes" means the application of metal and plastic surfaces to: passenger cars, truck cabins, trucks, buses or wooden surfaces and covers any process in which a single or multiple application of a continuous film of coating is laid onto:

(i) New vehicles defined (see below) as vehicles of category M1 and of category N1 insofar as they are coated at the same installation as M1 vehicles;

(ii) Truck cabins, defined as the housing for the driver, and all integrated housing for the technical equipment of category N2 and N3 vehicles;

(iii) Vans and trucks defined as category N1, N2 and N3 vehicles, but excluding truck cabins;

(iv) Buses defined as category M2 and M3 vehicles; and

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(v) Other metallic and plastic surfaces including those of aeroplanes, ships, trains, etc., wooden surfaces, textile, fabric, film and paper surfaces.

This source category does not include the coating of substrates with metals by electrophoretic or chemical spraying techniques. If the coating process includes a step in which the same article is printed, that printing step is considered part of the coating process. However, printing processes operated as a separate activity are not included. In this definition:

- M1 vehicles are those used for the carriage of passengers and comprising not more than eight seats in addition to the driver's seat;
- M2 vehicles are those used for the carriage of passengers and comprising more than eight seats in addition to the driver's seat, and having a maximum mass not exceeding 5 Mg;
- M3 vehicles are those used for the carriage of passengers and comprising more than eight seats in addition to the driver's seat, and having a maximum mass exceeding 5 Mg;
- N1 vehicles are those used for the carriage of goods and having a maximum mass not exceeding 3.5 Mg;
- N2 vehicles are those used for the carriage of goods and having a maximum mass exceeding 3.5 Mg but not exceeding 12 Mg;
- N3 vehicles are those used for the carriage of goods and having a maximum mass exceeding 12 Mg.

(e) "Coil coating" means any processes where coiled steel, stainless steel, coated steel, copper alloys or aluminium strip is coated with either a film-forming or laminate coating in a continuous process;

(f) "Dry cleaning" means any industrial or commercial process using VOCs in an installation to clean garments, furnishings and similar consumer goods with the exception of the manual removal of stains and spots in the textile and clothing industry;

(g) "Manufacturing of coatings, varnishes, inks and adhesives" means the manufacture of coating preparations, varnishes, inks and adhesives, and of intermediates as far as they are produced in the same installation by mixing pigments, resins and adhesive materials with organic solvents or other carriers. This category also includes dispersion, predispersion, realization of a certain viscosity or colour and packing the final products in containers;

(h) "Printing" means any process of reproduction of text and/or images in which, with the use of an image carrier, ink is transferred onto a surface and applies to the following subprocesses:

- (i) Flexography: a printing process using an image carrier of rubber or elastic photopolymers on which the printing inks are above the non-printing areas, using liquid inks that dry through evaporation;
- (ii) Heat set web offset: a web-fed printing process using an image carrier in which the printing and non-printing areas are in the same plane, where web-fed means that the material to be printed is fed to the machine from a reel as distinct from separate sheets. The non-printing area is treated to attract water and thus reject ink. The printing area is treated to receive and transmit ink to the surface to be printed. Evaporation takes place in an oven where hot air is used to heat the printed material;

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(iii) Publication rotogravure: rotogravure used for printing paper for magazines, brochures, catalogues or similar products, using toluene-based inks;

(iv) Rotogravure: a printing process using a cylindrical image carrier in which the printing area is below the non-printing area, using liquid inks that dry through evaporation. The recesses are filled with ink and the surplus is cleaned off the non-printing area before the surface to be printed contacts the cylinder and lifts the ink from the recesses;

(v) Rotary screen printing: a web-fed printing process in which the ink is passed onto the surface to be printed by forcing it through a porous image carrier, in which the printing area is open and the non-printing area is sealed off, using liquid inks that dry only through evaporation. Web-fed means that the material to be printed is fed to the machine from a reel as distinct from separate sheets;

(vi) Laminating associated to a printing process: the adhering of two or more flexible materials to produce laminates; and

(vii) Varnishing: a process by which a varnish or an adhesive coating is applied to a flexible material for the purpose of later sealing the packaging material;

(i) "Manufacturing of pharmaceutical products" means chemical synthesis, fermentation, extraction, formulation and finishing of pharmaceutical products and, where carried out at the same site, the manufacture of intermediate products;

(j) "Conversion of natural or synthetic rubber" means any process of mixing, crushing, blending, calendering, extruding and vulcanization of natural or synthetic rubber and additionally processes for the processing of natural or synthetic rubber to derive an end product;

(k) "Surface cleaning" means any process except dry cleaning using organic solvents to remove contamination from the surface of material, including degreasing; a cleaning process consisting of more than one step before or after any other processing step is considered as one surface-cleaning process. The process refers to the cleaning of the surface of products and not to the cleaning of process equipment;

(l) "Extraction of vegetable oil and animal fat and refining of vegetable oil" means the extraction of vegetable oil from seeds and other vegetable matter, the processing of dry residues to produce animal feed, and the purification of fats and vegetable oils derived from seeds, vegetable matter and/or animal matter;

(m) "Vehicle refinishing" means any industrial or commercial coating activity and associated degreasing activities performing:

(i) The original coating of road vehicles, or part of them, with refinishing-type materials, where this is carried out away from the original manufacturing line, or

(ii) The coating of trailers (including semi-trailers);

These activities are studied together with the coating of cars.

Vehicle refinishing, defined as the coating of road vehicles, or part of them, carried out as part of vehicle repair, conservation or decoration outside manufacturing installations, is considered in Annex XI.

(n) "Impregnation of wooden surfaces" means any process impregnating timber with preservative;

(o) "Winding wire coating" means any coating activity of metallic conductors used for winding the coils in transformers and motors, etc;

(p) "Standard conditions" means a temperature of 273.15 K and a pressure of 101.3 kPa;

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(q) "Volatile organic compound" (VOC) means any organic compound as well as the fraction of creosote, having at 293.15 K a vapour pressure of 0.01 kPa or more, or having a corresponding volatility under the particular conditions of use;

(r) "Organic solvent" means any VOC which is used alone or in combination with other agents, and without undergoing a chemical change, to dissolve raw material, products or waste materials, or is used as a cleaning agent to dissolve contaminants, or as a dissolver, or as a dispersion medium, or as a viscosity adjuster, or as a surface tension adjuster, or a plasticizer, or as a preservative;

(s) "Waste gas" means the final gaseous discharge containing VOCs or other pollutants from a stack or from emission abatement equipment into air. The volumetric flow rates shall be expressed in m<sup>3</sup>/h at standard conditions;

(t) "Fugitive emission of VOCs" means any emission, not in waste gases, of VOC into air, soil and water as well as, unless otherwise stated, solvents contained in any product and includes uncaptured emissions of VOCs released to the outside environment via windows, doors, vents and similar openings. Fugitive limit values are calculated on the basis of a solvent management plan (see appendix I to the present annex);

(u) "Total emission of VOCs" means the sum of fugitive emission of VOCs and emission of VOCs in waste gases;

(v) "Input" means the quantity of organic solvents and their quantity in preparations used when carrying out a process, including the solvents recycled inside and outside the installation, and which are counted every time they are used to carry out the activity;

(w) "Limit value" means the maximum quantity of a gaseous substance contained in the waste gases from an installation which is not to be exceeded during normal operation. Unless otherwise specified, it shall be calculated in terms of mass of pollutant per volume of the waste gases (expressed as mg C/Nm<sup>3</sup> unless specified otherwise), assuming standard conditions for temperature and pressure for dry gas. For solvent-using installations, limit values are given as mass unit per characteristic unit of the respective activity. Gas volumes that are added to the waste gas for cooling or dilution purposes shall not be considered when determining the mass concentration of the pollutant in the waste gas. Limit values generally address all volatile organic compounds except methane (no further distinction is made, e.g. in terms of reactivity or toxicity);

(x) "Normal operation" means all periods of operation except start-up and shutdown operations and maintenance of equipment;

(y) "Substances harmful to human health" are subdivided into two categories:

- (i) Halogenated VOCs that have possible risk of irreversible effects; or
- (ii) Hazardous substances that are carcinogens, mutagens or toxic to reproduction or that may cause cancer, may cause heritable genetic damage, may cause cancer by inhalation, may impair fertility or may cause harm to the unborn child.

4. The following requirements shall be satisfied:

(a) Emissions shall be monitored<sup>a</sup> in all cases. Compliance with limit values shall be verified. The methods of verification can include continuous or discontinuous measurements, type approval, or any other technically sound method. In case of continuous measurements, compliance with the emission standards is achieved if the validated daily emission average does not exceed the limit values. In case of discontinuous measurements or other appropriate determination procedures, compliance with the emission standards is achieved if the average of all the readings or other procedures does not exceed the limit values. The inaccuracy of the continuous and discontinuous measurement methods may be taken into account for verification purposes;

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<sup>a</sup> Monitoring is to be understood as an overall activity, comprising measuring or calculating of emissions, mass balancing, etc. It can be carried out continuously or discontinuously.

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(b) The concentrations of air pollutants in gas-carrying ducts shall be measured in a representative way. Sampling and analysis of relevant polluting substances and measurements of process parameters, as well as the quality assurance of automated systems and the reference measurement methods to calibrate those systems, shall be carried out in accordance with CEN standards. If CEN standards are not available, ISO standards, national or international standards which will ensure the provision of data of an equivalent scientific quality shall apply;

5. The following limit values should be applied for waste gases, unless stated otherwise below:

(a) 20 mg substance/Nm<sup>3</sup> for discharges of halogenated volatile organic compounds (which are assigned the following risk phrases: suspected of causing cancer and/or suspected of causing genetic defects), where the mass flow of the sum of the considered compounds is greater than or equal to 100 g/h; and

(b) 2 mg/Nm<sup>3</sup> (expressed as the mass sum of individual compounds) for discharges of volatile organic compounds (which are assigned the following risk phrases: may cause cancer, may cause genetic defects, may cause cancer by inhalation, may damage fertility, may damage the unborn child), where the mass flow of the sum of the considered compounds is greater than or equal to 10 g/h.

6. For the source categories listed in paragraphs 8 to 22 below, the following revisions are relevant:

(a) Instead of applying the canalized and fugitive emission limit values (respectively ELVc and ELVf), operators may be allowed to comply with total emission limit values<sup>b</sup>. The purpose is to allow the operator the possibility to achieve by other means emission reductions, equivalent to those achieved if given limit values were to be applied; and

(b) For fugitive emissions of VOCs, the values set out below shall be applied as a limit value. However, where it is demonstrated to the satisfaction of the competent authority that for an individual installation this value is not technically and economically feasible, the competent authority may exempt that installation provided that significant risks to human health or the environment are not expected. For each derogation, the operator must demonstrate to the satisfaction of the competent authority that the best available technique is used.

7. The limit values for VOC emissions for the source categories defined in paragraph 3 shall be as specified in paragraphs 8 to 22 below.

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<sup>b</sup> Total emission limit values defined in this annex are consistent with the implementation of a reduction scheme.

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8. Storage and distribution of petrol:

**Table 1: Suggested options for limit values for VOC emissions from the storage and distribution of petrol, excluding the loading of seagoing ships (stage I)**

Activity	Threshold value	Option 1			Option 2			Option 3	
		Option 1	Lower BAT AEL	Technique	Option 2	Upper BAT AEL	Technique	Option 3	Legislation
		ELV in g/Nm <sup>3</sup> or reduction efficiency in % or ELV in % w/w							
Loading and unloading of mobile container at terminals	5000 m <sup>3</sup> petrol throughput annually	As option 3			As option 3			10 g VOC/Nm <sup>3</sup> including methane <sup>a/</sup>	UNECE-GP
Storage installations at terminals	Existing terminals or tank farms with a petrol throughput of 10000 t/year New terminals without thresholds except for terminals located in small remote islands with a throughput less than 5000 tonnes/year	98.5 % (compared to a fixed roof tank without measures)	99.5 % [BREF on emissions from storage - 2003]	Internal or external floating roof with liquid mounted primary seals and rim mounted secondary seals	97% (compared to a fixed roof tank without measures)	97% [BREF on emissions from storage - 2003]	Internal or external floating roof with liquid mounted primary seals or mechanical seals	95 % (compared to a fixed roof tank without measures)	Directive 94/63/EC See [A]
Service stations	Petrol throughput larger than 100 m <sup>3</sup> /year	As option 3			As option 3			0.01 % w/w of the throughput <sup>b/</sup>	See [A]

a/ The vapour displaced by the filling of petrol storage tanks shall be displaced either into other storage tanks or into abatement equipment meeting the limit values in the table above.

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b/ Vapours displaced by the delivery of petrol into storage installations at service stations and in fixed-roof tanks used for the intermediate storage of vapours must be returned through a vapour-tight connection line to the mobile container delivering the petrol. Loading operations may not take place unless the arrangements are in place and properly functioning."

[A] European Parliament and Council Directive 94/63/EC of 20 December 1994 on the control of volatile organic compound (VOC) emissions resulting from the storage of petrol and its distribution from terminals to service stations

"Tanks with external floating roofs must be equipped with a primary seal to cover the annular space between the tank wall and the outer periphery of the floating roof and with a secondary seal fitted above the primary seal. The seals should be designed to achieve an overall containment of vapours of 95 % or more as compared to a comparable fixed-roof tank with no vapour-containment controls (that is a fixed-roof tank with only vacuum/pressure relief valve"

**Table 1 bis. Suggested options for limit values for VOC emissions for car refueling at service station (stage II)**

Threshold values	Option 1 [ yearly average]			Option 2 [ yearly average]			Option 3 [ yearly average]
	Option 1 [ yearly average] Minimum vapour capture efficiency % w/w	Lower BAT AEL	Technique	Option 2 [ yearly average] Minimum vapour capture efficiency % w/w	Upper BAT AEL	Technique	
<p>New service station if its actual or intended throughput is greater than 500 m<sup>3</sup> per annum</p> <p>Existing service station if its actual or intended throughput is greater than 3,000 m<sup>3</sup> per annum</p> <p>Existing service station if its actual or intended throughput is greater than 500 m<sup>3</sup> per annum and which undergoes a major refurbishment</p>	<p>Equal to or greater than 85% w/w with a vapour/petrol ratio equal to or greater than 0.95 but less than or equal to 1.05 (v/v)</p> <p>Option based on [A] See under the table</p>	<p>No BAT AEL available in BREFs</p>	<p>Vapour recovery system' aimed at recovering the petrol vapour displaced from the fuel tank of a motor vehicle during refuelling at a service station and which transfers that petrol vapour to an underground storage tank at the service station or back to the petrol dispenser for resale</p>	<p>Equal to or greater than 85% w/w with a vapour/petrol ratio equal to or greater than 0.95 but less than or equal to 1.05 (v/v)</p> <p>Option based on [A] See under the table</p>	<p>No BAT AEL Available in BREFs</p>	<p>Vapour recovery system' aimed at recovering the petrol vapour displaced from the fuel tank of a motor vehicle during refuelling at a service station and which transfers that petrol vapour to an underground storage tank at the service station or back to the petrol dispenser for resale</p>	<p>No ELVs</p>

[A] Proposal for a Directive of the European Parliament and of the Council on Stage II petrol vapour recovery during refuelling of passenger cars at service stations {SEC(2008) 2937} {SEC(2008) 2938} /\* COM/2008/0812 final - COD 2008/0229

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9. Adhesive coating:

**Table 2: Suggested options for limit values for adhesive coating**

Activity and threshold		Suggested ELV for VOC [daily for ELVc and yearly for ELVf and total ELV]		
		Option 1 <sup>1/</sup>	Option 2 <sup>1/</sup>	Option 3 <sup>1/</sup>
Shoe industry (solvent consumption > 5 t/y)	Option	As option 3	As option 3	25 <sup>a/</sup> g VOC / pair of shoes
	BAT AELs or legislation	Activity not covered by the BREF STS	Activity not covered by the BREF STS	UNECE GP Directive 99/13/EC
	Techniques			
Other adhesive coating, except footwear; new and existing installations (solvent consumption > 15 t/y)	Option	ELVc = 50 mg <sup>d</sup> C/Nm <sup>3</sup> ELVf = 10 wt-% or less of the solvent input <b>Or</b> total ELV of 0.6 kg or less of VOC/kg of solid input	ELVc = 50 mg <sup>c/</sup> C/Nm <sup>3</sup> ELVf = 15 wt-% or less of the solvent input <b>Or</b> total ELV of 0.8 kg or less of VOC/kg of solid input	ELVc = 50 mg <sup>b/</sup> C/Nm <sup>3</sup> ELVf = 20 wt-% or less of the solvent input <b>Or</b> total ELV of 1 kg or less of VOC/kg of solid input
	BAT AELs or legislation	BAT AEL for adhesive tape manufacturing only, lower than 5 % of solvent input (BREF STS) No BAT AEL provided for other processes in the BREF STS Based on a consensus of the EGTEI group considering all activities potentially covered	BAT AEL for adhesive tape manufacturing only, lower than 5 % of solvent input (BREF STS) No BAT AEL provided for other processes in the BREF STS Based on a consensus of the EGTEI group considering all activities potentially covered	UNECE GP Directive 99/13/EC
	Techniques	Minimisation of solvent emissions through selection of adhesives and dryer systems in conjunction with waste gas treatment techniques	Minimisation of solvent emissions through selection of adhesives and dryer systems in conjunction with waste gas treatment techniques	

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Other adhesive coating, except footwear; new and existing installations (solvent consumption 5 - 15 t/y)	Option	As option 3	As option 3	ELVc = 50 mg <sup>b/</sup> C/Nm <sup>3</sup> ELVf = 25 wt-% or less of the solvent input <b>Or</b> total ELV of 1.2 kg or less of VOC/kg of solid input
	BAT AELs or legislation	Based on a consensus of the EGTEI group	Based on a consensus of the EGTEI group	UNECE GP Directive 99/13/EC
	Techniques			

1/ Refers to the note at the end of the annex

a/ Total emission limit values are expressed in grams of solvent emitted per pair of complete footwear produced.

b/ If techniques are used which allow reuse of recovered solvent, the limit value shall be 150 mg C/Nm<sup>3</sup>.

c/ If techniques are used which allow reuse of recovered solvent, the limit value shall be 100 mg C/Nm<sup>3</sup>.

d/ If techniques are used which allow reuse of recovered solvent, the limit value shall be 75 mg C/Nm<sup>3</sup>.

10. Wood and plastic lamination:

**Table 3: Suggested options for VOC emission ELV for wood and plastic lamination**

Activity and threshold		Suggested ELV for VOC [yearly for total ELV] Options 1, 2 and 3 <sup>1/</sup>
		Option
Wood and plastic laminating; new and existing installations (solvent consumption > 5 t/y)	BAT AELs or legislation	UNECE GP Directive 99/13/EC No information in the BREF STS available for developing option 1 and 2
	Techniques	

1/ Refers to the note at the end of the annex

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11. Coating processes (vehicle coating industry):

**Table 4: Suggested options limit values for coating processes in the vehicle industry**

Activity and threshold		Suggested ELV for VOC [yearly for total ELV]		
		Option 1 <sup>a/ 1/</sup>	Option 2 <sup>a/ 1/</sup>	Option 3 <sup>a/ 1/</sup>
Manufacture of cars (M1, M2) (solvent consumption > 15 tonnes/y and ≤ 5,000 coated items/y or > 3,500 chassis-built)	Option	As option 3	As option 3	90 g VOC/m <sup>2</sup> or 1.5 kg/body + 70 g/m <sup>2</sup>
	BAT AELs or legislation	Based on a consensus of the EGTEI group	Based on a consensus of the EGTEI group	UNECE GP Directive 99/13/EC
	Techniques			
Manufacture of cars (M1, M2) (solvent consumption > 15 tonnes/y and > 5,000 coated items/y)	Option	25 g VOC/m <sup>2</sup> or 0.7 kg/body + 17 g/m <sup>2</sup>	35 g VOC/m <sup>2</sup> or 1 kg/body + 26 g/m <sup>2</sup>	<i>Existing installations:</i> 60 g VOC/m <sup>2</sup> or 1.9 kg/body + 41 g/m <sup>2</sup> <i>New installations:</i> 45 g VOC/m <sup>2</sup> or 1.3 kg/body + 33 g/m <sup>2</sup>
	BAT AELs or legislation	Lower BAT AEL (BREF STS) 10 g VOC/m <sup>2</sup> or 0.3 kg/body + 8 g/m <sup>2</sup>	Upper BAT AEL (BREF STS) 35 g VOC/m <sup>2</sup> or 1 kg/body + 26 g/m <sup>2</sup>	UNECE GP Directive 99/13/EC
	Techniques	Minimisation of solvent emissions through selection of paint and dryer systems in conjunction with waste gas treatment techniques	Minimisation of solvent emissions through selection of paint and dryer systems in conjunction with waste gas treatment techniques	

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<p>Manufacture of truck cabins (N1, N2, N3) (solvent consumption &gt; 15 tonnes/y and ≤ 5,000 coated items/y)</p>	Option	As option 3	As option 3	<p><i>Existing installations:</i> 85 g VOC/m<sup>2</sup></p>
				<p><i>New installations:</i> 65 g VOC/m<sup>2</sup></p>
	BAT AELs or legislation	Based on a consensus of the EGTEI group	Based on a consensus of the EGTEI group	<p>UNECE GP Directive 99/13/EC</p>
	Techniques			
<p>Manufacture of truck cabins (N1, N2, N3) (solvent consumption &gt; 15 tonnes/y and &gt; 5,000 coated items/y)</p>	Option	35 g VOC/m <sup>2</sup>	55 g VOC/m <sup>2</sup>	<p><i>Existing installations:</i> 75 g VOC/m<sup>2</sup></p>
				<p><i>New installations:</i> 55 g VOC/m<sup>2</sup></p>
	BAT AELs or legislation	Lower BAT AEL (BREF STS) 10 g VOC/m <sup>2</sup>	Upper BAT AEL (BREF STS) 55 g VOC/m <sup>2</sup>	<p>UNECE GP Directive 99/13/EC</p>
	Techniques	Minimisation of solvent emissions through selection of paint and dryer systems in conjunction with waste gas treatment techniques	Minimisation of solvent emissions through selection of paint and dryer systems in conjunction with waste gas treatment techniques	
<p>Manufacture of trucks and vans (solvent consumption &gt; 15 tonnes/y and ≤ 2,500 coated items/y)</p>	Option	As option 3	As option 3	<p><i>Existing installations:</i> 120 g VOC/m<sup>2</sup></p>
				<p><i>New installations:</i> 90 g VOC/m<sup>2</sup></p>
	BAT AELs or legislation	Based on a consensus of the EGTEI group	Based on a consensus of the EGTEI group	<p>UNECE GP Directive 99/13/EC</p>
	Techniques			

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Manufacture of trucks and vans (solvent consumption > 15 tonnes/y and > 2,500 coated items/y)	Option	35 g VOC/m <sup>2</sup>	50 g VOC/m <sup>2</sup>	<i>Existing installations:</i> 90 g VOC/m <sup>2</sup> <i>New installations:</i> 70 g VOC/m <sup>2</sup>
	BAT AELs or legislation	Lower BAT AEL (BREF STS) 15 g VOC/m <sup>2</sup>	Upper BAT AEL (BREF STS) 50 g VOC/m <sup>2</sup>	UNECE GP Directive 99/13/EC
	Techniques	Minimisation of solvent emissions through selection of paint and dryer systems in conjunction with waste gas treatment techniques	Minimisation of solvent emissions through selection of paint and dryer systems in conjunction with waste gas treatment techniques	
Manufacture of buses (solvent consumption > 15 tonnes/y and ≤ 2,000 coated items/y)	Option	As option 3	As option 3	<i>Existing installations:</i> 290 g VOC/m <sup>2</sup> <i>New installations:</i> 210 g VOC/m <sup>2</sup>
	BAT AELs or legislation	Based on a consensus of the EGTEI group	Based on a consensus of the EGTEI group	UNECE GP Directive 99/13/EC
	Techniques			
Manufacture of buses (solvent consumption > 15 tonnes/y and > 2,000 coated items/y)	Option	120 g VOC/m <sup>2</sup>	150 g VOC/m <sup>2</sup>	<i>Existing installations:</i> 225 g VOC/m <sup>2</sup> <i>New installations:</i> 150 g VOC/m <sup>2</sup>
	BAT AELs or legislation	Lower BAT AEL (BREF STS) 92 g VOC/m <sup>2</sup>	Upper BAT AEL (BREF STS) 150 g VOC/m <sup>2</sup>	UNECE GP Directive 99/13/EC
	Techniques	Minimisation of solvent emissions through selection of paints and dryer systems in conjunction with waste gas	Minimisation of solvent emissions through selection of paint s and dryer systems in conjunction with waste gas	

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		treatment techniques	treatment techniques	
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1/ Refers to the note at the end of the annex

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a/ The total limit values are expressed in terms of mass of solvent (g) emitted in relation to the surface area of product (m<sup>2</sup>). The surface area of the product is defined as the surface area calculated from the total electrophoretic coating area and the surface area of any parts that might be added in successive phases of the coating process which are coated with the same coatings. The surface of the electrophoretic coating area is calculated using the formula:  $(2 \times \text{total weight of product shell}) / (\text{average thickness of metal sheet} \times \text{density of metal sheet})$ . The total ELVs defined in the table above refer to all process stages carried out at the same installation from electrophoretic coating, or any other kind of coating process through the final wax and polish of topcoating inclusive, as well as solvent used in cleaning of process equipment, including spray booths and other fixed equipment, both during and outside of production time.

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12. Coating processes (metal, plastic, textile, fabric, film, plastic, leather and wooden surfaces coating):

**Table 5: Suggested options limit values for coating processes in various industrial sectors**

Activity and threshold		Suggested ELV for VOC [daily for ELVc and yearly for ELVf and total ELV]		
		Option 1 <sup>1/</sup>	Option 2 <sup>1/</sup>	Option 3 <sup>1/</sup>
New and existing installations: wood coating (solvent consumption 15 - 25 tonnes/y)	Option	As option 3	As option 3	ELVc = 100 <sup>a/</sup> mg C/Nm <sup>3</sup> ELVf = 25 wt-% or less of the solvent input <b>Or</b> total ELV of 1.6 kg or less of VOC / kg of solid input
	BAT AELs or legislation	Based on a consensus of the EGTEI group	Based on a consensus of the EGTEI group	UNECE GP Directive 99/13/EC
	Techniques			
New and existing installations: wood coating (solvent consumption > 25 tonnes/y)	Option	ELVc = 50 mg C/Nm <sup>3</sup> for drying and 75 mg C/Nm <sup>3</sup> for coating ELVf = 10 wt-% or less of the solvent input <b>Or</b> total ELV of 0.50 kg or less of VOC / kg of solid input	ELVc = 50 mg C/Nm <sup>3</sup> for drying and 75 mg C/Nm <sup>3</sup> for coating ELVf = 15 wt-% or less of the solvent input <b>Or</b> total ELV of 0.75 kg or less of VOC / kg of solid input	ELVc = 50 mg C/Nm <sup>3</sup> for drying and 75 mg C/Nm <sup>3</sup> for coating ELVf = 20 wt-% or less of the solvent input <b>Or</b> total ELV of 1 kg or less of VOC / kg of solid input
	BAT AELs or legislation	BAT AEL (BREF STS) 0.25 kg or less of VOC / kg of solid input Or 2-5 g/m <sup>2</sup> with paints with solvent content of 5% w/w 10-20 g/m <sup>2</sup> with paints with solvent content of 20% w/w 40-60 g/m <sup>2</sup> with paints with solvent content of 65% w/w	BAT AEL (BREF STS) 0.25 kg or less of VOC / kg of solid input Or 2-5 g/m <sup>2</sup> with paints with solvent content of 5% w/w 10-20 g/m <sup>2</sup> with paints with solvent content of 20% w/w 40-60 g/m <sup>2</sup> with paints with solvent content of 65% w/w	UNECE GP Directive 99/13/EC

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		ELVc and ELVf based on a consensus of the EGTEI group to have ELVs expressed with the same units as in option 3	ELVc and ELVf based on a consensus of the EGTEI group to have ELVs expressed with the same units as in option 3	
	Techniques	Minimisation of solvent emissions through selection of paints and dryer systems in conjunction with waste gas treatment techniques	Minimisation of solvent emissions through selection of paints and dryer systems in conjunction with waste gas treatment techniques	

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New and existing installations: coating of metal and plastics, (solvent consumption 5 - 15 tonnes/y)	Option	As option 3	As option 3	ELVc = 100 <sup>a/ b/</sup> mg C/Nm <sup>3</sup> ELVf = 20 <sup>b/</sup> wt-% or less of the solvent input <b>Or</b> total ELV of 0.525 kg or less of VOC / kg of solid input
	BAT AELs or legislation	Based on a consensus of the EGTEI group	Based on a consensus of the EGTEI group	UNECE GP Directive 99/13/EC
	Techniques			

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New and existing installations: other coating, incl. textile, fabric, foil and paper (excl. web screen printing for textiles, see printing) (solvent consumption 5 - 15 tonnes/y)	Option	As option 3	As option 3	ELVc = 100 <sup>a/ b/</sup> mg C/Nm <sup>3</sup> ELVf = 20 <sup>b/</sup> wt-% or less of the solvent input <b>Or</b> total ELV of 1.4 kg or less of VOC / kg of solid input
	BAT AELs or legislation	Based on a consensus of the EGTEI group	Based on a consensus of the EGTEI group	UNECE GP Directive 99/13/EC
	Techniques			
New and existing installations: textile, fabric, foil and paper coating, incl. (excl. web screen printing for textiles, see printing) (solvent consumption > 15 tonnes/y)	Option	As option 3	As option 3	ELVc = 50 mg C/Nm <sup>3</sup> for drying and 75 mg C/Nm <sup>3</sup> for coating <sup>b/ c/</sup> ELVf = 20 <sup>b/</sup> wt-% or less of the solvent input <b>Or</b> total ELV of 1 kg or less of VOC / kg of solid input
	BAT AELs or legislation	Based on a consensus of the EGTEI group	Based on a consensus of the EGTEI group	UNECE GP Directive 99/13/EC
	Techniques			

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New and existing installations: coating of plastic workpieces (solvent consumption > 15 tonnes/y)	Option	ELVc = 50 mg C/Nm <sup>3</sup> for drying and 75 mg C/Nm <sup>3</sup> for coating <sup>b/</sup> ELVf = 10 <sup>b/</sup> wt-% or less of the solvent input <b>Or</b> total ELV of 0.30 kg or less of VOC / kg of solid input	ELVc = 50 mg C/Nm <sup>3</sup> for drying and 75 mg C/Nm <sup>3</sup> for coating <sup>b/</sup> ELVf = 15 <sup>b/</sup> wt-% or less of the solvent input <b>Or</b> total ELV of 0.35 kg or less of VOC / kg of solid input	ELVc = 50 mg C/Nm <sup>3</sup> for drying and 75 mg C/Nm <sup>3</sup> for coating <sup>b/</sup> ELVf = 20 <sup>b/</sup> wt-% or less of the solvent input <b>Or</b> total ELV of 0.375 kg or less of VOC / kg of solid input
	BAT AELs or legislation	Lower BAT AEL (BREF STS) 0.25 kg or less of VOC / kg of solid input	Upper BAT AEL (BREF STS) 0.35 kg or less of VOC / kg of solid input	UNECE GP Directive 99/13/EC
	Techniques	Reduction of solvent consumption and emissions, maximize efficiency of paint application, in conjunction of waste gas treatment techniques	Reduction of solvent consumption and emissions, maximize efficiency of paint application, in conjunction of waste gas treatment techniques	
New and existing installations: coating of metal surfaces (solvent consumption > 15 tonnes/y)	Option	ELVc = 50 mg C/Nm <sup>3</sup> for drying and 75 mg C/Nm <sup>3</sup> for coating <sup>b/</sup> ELVf = 10 <sup>b/</sup> wt-% or less of the solvent input <b>Or</b> total ELV of 0.20 kg or less of VOC / kg of solid input	ELVc = 50 mg C/Nm <sup>3</sup> for drying and 75 mg C/Nm <sup>3</sup> for coating <sup>b/</sup> ELVf = 15 <sup>b/</sup> wt-% or less of the solvent input <b>Or</b> total ELV of 0.33 kg or less of VOC / kg of solid input	ELVc = 50 mg C/Nm <sup>3</sup> for drying and 75 mg C/Nm <sup>3</sup> for coating <sup>b/</sup> ELVf = 20 <sup>b/</sup> wt-% or less of the solvent input <b>Or</b> total ELV of 0.375 kg or less of VOC / kg of solid input
	BAT AELs or legislation	Lower BAT AEL (BREF STS) 0.10 kg or less of VOC / kg of solid input	Upper BAT AEL (BREF STS) 0.33 kg or less of VOC / kg of solid input	UNECE GP Directive 99/13/EC
	Techniques	Reduction of solvent consumption and emissions, maximize efficiency of paint application, in conjunction of waste gas treatment techniques	Reduction of solvent consumption and emissions, maximize efficiency of paint application, in conjunction of waste gas treatment techniques	

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	Option	As option 3	As option 3	<b>Exception for coatings in contact with food:</b> Total ELV of 0.5825 kg or less of VOC / kg of solid input
	BAT AELs or legislation	Based on a consensus of the EGTEI group	Based on a consensus of the EGTEI group	UNECE GP Directive 99/13/EC
	Techniques			

<sup>1</sup>/Refers to the note at the end of the annex

a/ Limit value applies to coating applications and drying processes operated under contained conditions.

b/ If contained coating conditions are not possible (boat construction, aircraft coating, etc.), installations may be granted exemption from these values. The reduction scheme is then to be used, unless it is demonstrated to the satisfaction of the competent authority that this option is not technically and economically feasible. In this case, the operator must demonstrate to the satisfaction of the competent authority that the best available technique is used.

c/ If, for textile coating, techniques are used which allow reuse of recovered solvents, the limit value shall be 150 mg C/Nm<sup>3</sup> for drying and coating together.

## 13. Coating processes (leather and winding wire coating):

**Table 6: Suggested options limit values for VOC for leather and winding wire coating**

Activity and threshold		Suggested ELV for VOC [yearly for total ELV]
		Options 1, 2 and 3 <sup>1/</sup>
New and existing installations: leather coating (solvent consumption > 10 tonnes/y)	Option	Total ELV of 150 g/m <sup>2</sup> <sup>a/</sup>
New and existing installations: leather coating (solvent consumption 10 - 25 tonnes/y)	Option	Total ELV of 85 g/m <sup>2</sup>
New and existing installations: leather coating (solvent consumption > 25 tonnes/y)	Option	Total ELV of 75 g/m <sup>2</sup>
	BAT AELs Or legislation	Directive 99/13/EC
	Techniques	
New and existing installations: winding wire coating (solvent consumption > 5 tonnes/y)	Option	Total ELV of 10 g/kg applies for installations where average diameter of wire ≤ 0,1 mm
	Option	Total ELV of 5 g/kg applies for all other installations
	BAT AELs or legislation	BAT AEL s (BREF STS) For non fine wires (<0.1 mm) : 5 kg VOC/kg product or less For fine wires (0.01 to 0.1 mm) : 10 kg VOC/kg product or less  Directive 99/13/EC
	Techniques	Using low solvent based materials or processes, using a suitable combination of waste gas treatment techniques

<sup>1/</sup> Refers to the note at the end of the annex

<sup>a/</sup> For leather coating activities in furnishing and particular leather goods used as small consumer goods like bags, belts, wallets, etc.

## 14. Coil coating:

**Table 7: Suggested options limit values for coil coating**

Activity and threshold		Suggested ELV for VOC [daily for ELVc and yearly for ELVf and total ELV]		
		Option 1 <sup>1/</sup>	Option 2 <sup>1/</sup>	Option 3 <sup>1/</sup>
Existing installation (solvent consumption > 25 tonnes/y)	Option	ELVc = 30mg <sup>c/</sup> C/Nm <sup>3</sup> ELVf = 5 wt-% or less of the solvent input <b>Or</b> total ELV of 0.225 kg or less of VOC/kg of solid input	ELVc = 50 mg <sup>b/</sup> C/Nm <sup>3</sup> ELVf = 5 wt-% or less of the solvent input <b>Or</b> total ELV of 0.3 kg or less of VOC/kg of solid input	ELVc = 50mg <sup>a/</sup> C/Nm <sup>3</sup> ELVf = 10 wt-% or less of the solvent input <b>Or</b> total ELV of 0.45 kg or less of VOC/kg of solid input
	BAT AELs or legislation	Lower BAT AEL (BREF STS) 0.73 g/m <sup>2</sup> and 3 % fugitive emissions	Upper BAT AEL (BREF STS) 0.84 g/m <sup>2</sup> and 10% fugitive emissions	UNECE GP Directive 99/13/EC
	Techniques	Selection of techniques such as substitution, coating techniques, waste gas collection and treatment	Selection of techniques such as substitution, coating techniques, waste gas collection and treatment	
New installation (solvent consumption > 25 tonnes/y)	Option	ELVc = 30mg <sup>c/</sup> C/Nm <sup>3</sup> ELVf = 3 wt-% or less of the solvent input <b>Or</b> total ELV of 0.15 kg or less of VOC/kg of solid input	ELVc = 30mg <sup>b/</sup> C/Nm <sup>3</sup> ELVf = 5 wt-% or less of the solvent input <b>Or</b> total ELV of 0.18 kg or less of VOC/kg of solid input	ELVc = 50 mg <sup>a/</sup> C/Nm <sup>3</sup> ELVf = 5 wt-% or less of the solvent input <b>Or</b> total ELV of 0.3 kg or less of VOC/kg of solid input
	BAT AELs or legislation	Lower BAT AEL (BREF STS) 0.73 g/m <sup>2</sup> and 3 % fugitive emissions ELVc and ELVf based on a consensus of the EGTEI group to have ELVs expressed with the same units as in option 3	Upper BAT AEL (BREF STS) 0.84 g/m <sup>2</sup> and 5 % fugitive emissions ELVc and ELVf based on a consensus of the EGTEI group to have ELVs expressed with the same units as in option 3	UNECE GP Directive 99/13/EC
	Techniques	Selection of techniques such as substitution, coating techniques, waste gas collection and treatment	Selection of techniques such as substitution, coating techniques, waste gas collection and treatment	

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1/ Refers to the note at the end of the annex

a/ If techniques are used which allow reuse of recovered solvent, the limit value shall be 150 mg C/Nm<sup>3</sup>.

b/ If techniques are used which allow reuse of recovered solvent, the limit value shall be 100 mg C/Nm<sup>3</sup>.

c/ If techniques are used which allow reuse of recovered solvent, the limit value shall be 75 mg C/Nm<sup>3</sup>.

15. Dry cleaning:

**Table 8: Suggested options limit values for dry cleaning**

Activity and threshold		<sup>2</sup> Suggested ELV for VOC [yearly for total ELV]		
		Option 1 <sup>1/</sup>	Option 2 <sup>1/</sup>	Option 3 <sup>1/</sup>
New and existing installations (no threshold, all machines are concerned whatever the consumption is)	Option	Total ELV of 5 g VOC/kg (mass of cleaned and dried product) <sup>a/</sup>		Total ELV of 20 g VOC/kg (mass of cleaned and dried product) <sup>a/</sup>
	BAT AELs or legislation	Not covered by BREF documents Total ELV based on a consensus of the EGTEI group – refer to the revised guidance document		UNECE GP Directive 99/13/EC
	Techniques	Machine type IV: this type is totally closed with a closed drying cycle. The air stream for drying cycles, circulates through the refrigeration cooling unit and the activated carbon, until the concentration of solvent in the turning cage is below 2 mg/m <sup>3</sup> . The solvent from the adsorption phase of the activated carbon adsorber is returned into the machine.		

1/ Refers to the note at the end of the annex

a/ Limit value for total emissions of VOCs calculated as mass of emitted solvent per mass of cleaned and dried product.

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16. Manufacturing of coatings, varnishes, inks and adhesives:

**Table 9: Suggested options limit values for manufacturing of coatings, varnishes, inks and adhesives**

Activity and threshold		Suggested ELV for VOC [daily for ELVc and yearly for ELVf and total ELV]		
		Option 1 <sup>1/</sup>	Options 2 <sup>1/</sup>	Option 3 <sup>1/</sup>
New and existing installations with an annual organic solvent consumption between 100 and 1000 t	Option	Total ELV of 3 wt-% of solvent input		ELVc = 150mg C/Nm <sup>3</sup> ELVf <sup>a/</sup> = 5 wt-% or less of the solvent input <b>Or</b> total ELV of 5 wt-% or less of the solvent input
	BAT AELs or legislation	BAT AEL 1.75 to 2.5 % Revised Guidance Document prepared by EGTEI		UNECE GP Directive 99/13/EC
	Techniques	Good practices and condensation or carbon adsorption units and solvent recovery		
New and existing installations with an annual organic solvent consumption > 1000 t	Option	Total ELV of 1 wt-% of solvent input		ELVc = 150mg C/Nm <sup>3</sup> ELVf <sup>a/</sup> = 3 wt-% or less of the solvent input <b>Or</b> total ELV of 3 wt-% or less of the solvent input
	BAT AELs or legislation	BAT AEL 1 % Revised Guidance Document prepared by EGTEI		UNECE GP Directive 99/13/EC
	Techniques	Good practices and condensation or carbon adsorption units and solvent recovery		

<sup>1/</sup> Refers to the note at the end of the annex

<sup>a/</sup> The fugitive limit value does not include solvents sold as part of a preparation in a sealed container.

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17. Printing (flexography, heat set web offset, publication rotogravure etc.):

**Table 10: Suggested options limit values for printing processes**

Activity and threshold	Suggested ELV for VOC [daily for ELVc and yearly for ELVf and total ELV]			
		Option 1 <sup>1/</sup>	Option 2 <sup>1/</sup>	Option 3 <sup>1/</sup>
Heatset offset (solvent consumption 15 – 25 tonnes/y)	Option	As option 3	As option 3	ELVc = 100 mg C/Nm <sup>3</sup> ELVf = 30 wt-% or less of the solvent input <sup>a/</sup>
	BAT AELs or legislation	Based on a consensus of the EGTEI group	Based on a consensus of the EGTEI group	UNECE GP Directive 99/13/EC
	Techniques			
Heatset offset (solvent consumption > 25 tonnes/y)		For new and upgraded presses		New and existing installations
	Option	Total ELV = 5 wt-% or less of the ink consumption <sup>a/</sup>	Total ELV = 10 wt-% or less of the ink consumption <sup>a/</sup>	ELVc = 20 mg C/Nm <sup>3</sup> ELVf = 30 wt-% or less of the solvent input <sup>a/</sup>
	BAT AELs or legislation	Lower BAT AEL (BREF STS) 2.5 wt-% or less of the ink consumption	Upper BAT AEL (BREF STS) 10 wt-% or less of the ink consumption	UNECE GP Directive 99/13/EC
	Techniques	Combination of lower concentration of IPA in dampening solution or replacement and waste gas treatment by oxidation	Combination of lower concentration of IPA in dampening solution or replacement and waste gas treatment by oxidation	

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Heatset offset (solvent consumption > 25 tonnes/y)		For existing presses		
	Option	Total ELV = 10 wt-% or less of the ink consumption <sup>a/</sup>	Total ELV = 15 wt-% or less of the ink consumption <sup>a/</sup>	ELVc = 20 mg C/Nm <sup>3</sup> ELVf = 30 wt-% or less of the solvent input <sup>a/</sup>
	BAT AELs or legislation	Lower BAT AEL (BREF STS) 5 wt-% or less of the ink consumption	Upper BAT AEL (BREF STS) 15 wt-% or less of the ink consumption	UNECE GP Directive 99/13/EC
	Techniques	Combination of lower concentration of IPA in dampening solution or replacement and waste gas treatment by oxidation	Combination of lower concentration of IPA in dampening solution or replacement and waste gas treatment by oxidation	

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Publication gravure (solvent consumption > 25 tonnes/y)		For new installations		
	Option	Total ELV = 4 wt-% or less of the solvent input	Total ELV = 5 wt-% or less of the solvent input	ELV <sub>c</sub> = 75 mg C/Nm <sup>3</sup> ELV <sub>f</sub> = 10 wt-% or less of the solvent input <b>Or</b> total ELV of 0.6 kg or less of VOC/kg of solid input
	BAT AELs or legislation	Lower BAT AEL (BREF STS) 4 wt-% or less of the solvent input	Upper BAT AEL (BREF STS) 5 wt-% or less of the solvent input	UNECE GP Directive 99/13/EC
	Techniques	Reduction of fugitive emissions and the VOC remaining after gas treatment	Reduction of fugitive emissions and the VOC remaining after gas treatment	
		For existing installations		
	Option	Total ELV = 5 wt-% or less of the solvent input	Total ELV = 7 wt-% or less of the solvent input	ELV <sub>c</sub> = 75 mg C/Nm <sup>3</sup> ELV <sub>f</sub> = 15 wt-% or less of the solvent input <b>Or</b> total ELV of 0.8 kg or less of VOC/kg of solid input
	BAT AELs or legislation	Lower BAT AEL (BREF STS) 5 wt-% or less of the solvent input	Upper BAT AEL (BREF STS) 7 wt-% or less of the solvent input	UNECE GP Directive 99/13/EC
	Techniques	Reduction of fugitive emissions and the VOC remaining after gas treatment	Reduction of fugitive emissions and the VOC remaining after gas treatment	

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Packaging rotogravure and flexography (solvent consumption 15 – 25 tonnes/y)	Option	As option 3	As option 3	ELVc = 100 mg C/Nm <sup>3</sup> ELVf = 25 wt-% or less of the solvent input <b>Or</b> total ELV of 1.2 kg or less of VOC/kg of solid input
	BAT AELs or legislation	Based on a consensus of the EGTEI group	Based on a consensus of the EGTEI group	UNECE GP Directive 99/13/EC
	Techniques			
Packaging rotogravure and flexography (solvent consumption 25 - 200 tonnes/y) and rotary screen printing (solvent consumption > 30 tonnes/y)	Option	As option 3	As option 3	ELVc = 100 mg C/Nm <sup>3</sup> ELVf = 20 wt-% or less of the solvent input <b>Or</b> total ELV of 1.0 kg or less of VOC/kg of solid input
	BAT AELs or legislation	Based on a consensus of the EGTEI group	Based on a consensus of the EGTEI group	UNECE GP Directive 99/13/EC
	Techniques			

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Packaging rotogravure and flexography (solvent consumption > 200 tonnes/y)	Option	<p><b>For plants with all machines connected to oxidation:</b> Total ELV = 10% of the reference emission <sup>a/</sup></p> <p><b>For plants with all machines connected to carbon adsorption:</b> Total ELV = 12.5% of the reference emission <sup>a/</sup></p> <p><b>For existing mixed plants where some existing machines may not be attached to an incinerator or solvent recovery:</b> Emissions from <i>the machines connected</i> to oxidisers or carbon adsorption are below the emission limits of 10% or 12.5% respectively.</p> <p><i>For machines not connected to gas treatment:</i> use of low solvent or solvent free products, connection to waste gas treatment when there is spare capacity and preferentially run high solvent content work on machines connected to waste gas treatment. Total emissions below 25% of reference emission (as defined in annex IIb of the Solvent Directive <sup>b/</sup>)</p>	<p>ELVc = 100 mg C/Nm<sup>3</sup></p> <p>ELVf = 20 wt-% or less of the solvent input</p> <p><b>Or</b> total ELV = 25% of reference emission <sup>b/</sup></p>
	BAT AELs or legislation	<p><b>BREF STS</b></p> <p><b>For plants with all machines connected to oxidation:</b> Lower and upper BAT AEL = 7.25 – 12.5 % of the reference emission <sup>a/</sup></p> <p><b>For plants with all machines connected to oxidation:</b> Lower and upper BAT AEL = 10 – 15 % of the reference emission <sup>a/</sup></p>	<p>UNECE GP Directive 99/13/EC</p>
	Techniques	<p>Substitution with water based inks, UV curing inks; high solids, UV curing, solvent free adhesives or varnishes;</p> <p>Optimization of extraction and waste gas treatment.</p>	

<sup>1/</sup> Refers to the note at the end of the annex

<sup>a/</sup> Residual solvent in the finished product are not taken into account in the calculation of the fugitive emission

<sup>b/</sup> Annual reference emissions are calculated by multiplying the total mass of solids in the quantity of coating, ink, varnish and/or adhesive consumed in a year by an appropriate factor (which is 4 for rotogravure and flexography printing). Competent authorities may adjust this factor for individual installations to reflect documented increased efficiency in the use of solids.

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18. Manufacturing of pharmaceutical products:

**Table 11: Suggested options limit values for manufacturing of pharmaceutical products**

Activity and threshold	Suggested ELV for VOC [daily for ELVc and yearly for ELVf and total ELV]				
		Options 1 <sup>1/</sup>		Option 2 <sup>1/</sup>	
New installations (solvent consumption > 50 tonnes/y)	Option	ELVc: For non oxidating techniques : 0.1 kg C/hour <sup>f</sup> or 20 mg C/Nm <sup>3 g/ d/</sup> for thermal oxidation/incineration or catalytic oxidation < 0.05 kg C/hour or < 5 mg C/ Nm <sup>3 g/ e/</sup>	ELVf = 3 wt-% or less of the solvent input <sup>d/</sup>	ELVc: For non oxidating techniques : 0.1 kg C/hour <sup>f</sup> or 20 mg C/Nm <sup>3 g/ d/</sup> for thermal oxidation/incineration or catalytic oxidation < 0.05 kg C/hour or < 5 mg C/ Nm <sup>3 g/ e/</sup>	ELVf = 3 wt-% or less of the solvent input <sup>d/</sup>
	BAT AELs or legislation	BAT AEL (BREF OFC) For non oxidating techniques : 0.1 kg C/hour <sup>f</sup> or 20 mg C/Nm <sup>3 g/ d/</sup> for thermal oxidation/incineration or catalytic oxidation < 0.05 kg C/hour or < 5 mg C/ Nm <sup>3 g/ e/</sup>	Revised guidance document prepared by EGTEI	BAT AEL (BREF OFC) For non oxidating techniques : 0.1 kg C/hour <sup>f</sup> or 20 mg C/Nm <sup>3 g/ d/</sup> for thermal oxidation/incineration or catalytic oxidation < 0.05 kg C/hour or < 5 mg C/ Nm <sup>3 g/ e/</sup>	Revised guidance document prepared by EGTEI
	Techniques	Mix of BAT defined above (primary measures and use of secondary measures (both oxidation, adsorption and / or condensation)) – refer to chapter 7.24 of the guidance document			
Existing installations (solvent consumption > 50 tonnes/y)	Option	ELVc: For non oxidating techniques : 0.1 kg C/hour <sup>f</sup> or 20 mg C/Nm <sup>3 g/ d/</sup> for thermal oxidation/incineration or catalytic oxidation < 0.05 kg C/hour or < 5 mg C/ Nm <sup>3 g/ e/</sup>	ELVf = 5 wt-% or less of the solvent input <sup>e/</sup>	ELVc: For non oxidating techniques : 0.1 kg C/hour <sup>f</sup> or 20 mg C/Nm <sup>3 g/ d/</sup> for thermal oxidation/incineration or catalytic oxidation < 0.05 kg C/hour or < 5 mg C/ Nm <sup>3 g/ e/</sup>	ELVf = 5 wt-% or less of the solvent input <sup>e/</sup>
	BAT AELs or legislation	BAT AEL (BREF OFC) For non oxidating techniques : 0.1 kg C/hour <sup>f</sup> or 20 mg C/Nm <sup>3 g/ d/</sup>	Revised guidance document prepared by EGTEI	BAT AEL (BREF OFC) For non oxidating techniques : 0.1 kg C/hour <sup>f</sup> or 20 mg C/Nm <sup>3 g/ d/</sup>	Revised guidance document prepared by EGTEI

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		for thermal oxidation/incineration or catalytic oxidation < 0.05 kg C/hour or < 5 mg C/ Nm <sup>3</sup> g <sup>f/e/</sup>		for thermal oxidation/incineration or catalytic oxidation < 0.05 kg C/hour or < 5 mg C/ Nm <sup>3</sup> g <sup>f/e/</sup>	
	Techniques	Mix of BAT defined above (primary measures and use of secondary measures (both oxidation, adsorption and / or condensation)) – refer to chapter 7.24 of the guidance document			

Activity and threshold	Suggested ELV for VOC [daily for ELVc and yearly for ELVf and total ELV]		
	Option 3 <sup>1/</sup>		
New installations (solvent consumption > 50 tonnes/y)	Option	ELVc = 20 mg C/Nm <sup>3 a/ b/</sup>	ELVf = 5 wt-% or less of the solvent input <sup>b/</sup>
	BAT AELs or legislation	UNECE GP Directive 99/13/EC	UNECE GP Directive 99/13/EC
	Techniques		
Existing installations (solvent consumption > 50 tonnes/y)	Option	ELVc = 20 mg C/Nm <sup>3 a/ c/</sup>	ELVf = 15 wt-% or less of the solvent input <sup>c/</sup>
	BAT AELs or legislation	UNECE GP Directive 99/13/EC	UNECE GP Directive 99/13/EC
	Techniques		

1/ Refers to the note at the end of the annex

a/ If techniques are used which allow reuse of recovered solvents, the limit value shall be 150 mg C/Nm<sup>3</sup>.

b/ A total limit value of 5 % of solvent input may be applied instead of applying ELVc and ELVf.

c/ A total limit value of 15 % of solvent input may be applied instead of applying ELVc and ELVf.

d/ A total limit value of 3 % of solvent input may be applied instead of applying ELVc and ELVf.

e/ A total limit value of 5 % of solvent input may be applied instead of applying ELVc and ELVf.

f/ The averaging time relates to the emission profile, the levels relate to dry gas and Nm<sup>3</sup>

g/ The concentration level relates to volume flows without dilution by, e.g. volume flows from room or building ventilation

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19. Conversion of natural or synthetic rubber:

**Table 12: Suggested options limit values for conversion of natural or synthetic rubber**

Activity and threshold		Suggested ELV for VOC [daily for ELVc and yearly for ELVf and total ELV] Options 1, 2 and 3 <sup>1/</sup>
New and existing installations: conversion of natural or synthetic rubber (solvent consumption > 15 tonnes/y)	Option	ELVc = 20 <sup>a/ b/</sup> ELVf = 25 <sup>a/ c/</sup> <b>Or total ELV = 25% of solvent input</b>
	BAT AELs or legislation	UNECE GP Directive 99/13/EC
	Techniques	

<sup>1/</sup> Refers to the note at the end of the annex

a/ A total limit value of 25% of solvent input may be applied instead of using the waste gas concentration limit and the limit value for fugitive emissions of VOCs.

b/ If techniques are used which allow reuse of recovered solvent, the limit value shall be 150 mg C/Nm<sup>3</sup>.

c/ The fugitive limit does not include solvents sold as part of a preparation in a sealed container.

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20. Surface cleaning:

**Table 13: Suggested options limit values for surface cleaning**

Activity and threshold	Threshold value for solvent consumption (Mg/year)		Suggested ELV for VOC [daily for ELVc and yearly for ELVf and total ELV]			
			Options 1 and 2 <sup>1/</sup>		Option 3 <sup>1/</sup>	
New and existing installations: surface cleaning using halogenated solvent H351 and H341	1 - 5	Option	ELVc = 10 mg compound/Nm <sup>3</sup>	ELVf = 1% of solvent input	ELVc = 20 mg compound/Nm <sup>3</sup>	ELVf = 15 % of solvent input
		BAT AELs or legislation	No BAT AEL available in the BREF TMP ELVc and ELVf based on a consensus of the EGTEI group (refer to the revised guidance document prepared by EGTEI)		UNECE GP Directive 99/13/EC	
		Techniques	Substitution or hermetically sealed machines			
	> 5	Option	ELVc = 10 mg compound/Nm <sup>3</sup>	ELVf = 0.5 % of solvent input	ELVc = 20 mg compound/Nm <sup>3</sup>	ELVf = 10 % of solvent input
		BAT AELs or legislation	No BAT AEL available in the BREF TMP ELVc and ELVf based on a consensus of the EGTEI group (refer to the revised guidance document prepared by EGTEI)		UNECE GP Directive 99/13/EC	
		Techniques	Substitution or hermetically sealed machines			
New and existing installations: other surface cleaning	2 - 10	Option	As option 3	As option 3	ELVc = 75 mg C/Nm <sup>3 a/</sup>	ELVf = 20 % <sup>a/</sup> of solvent input
		BAT AELs or legislation	Based on a consensus of the EGTEI group	Based on a consensus of the EGTEI group	UNECE GP Directive 99/13/EC	
		Techniques				
	> 10	Option	As option 3	As option 3	ELVc = 75 mg C/Nm <sup>3 a/</sup>	ELVf = 15 % <sup>a/</sup> of solvent input
		BAT AELs or legislation	Based on a consensus of the EGTEI group	Based on a consensus of the EGTEI group	UNECE GP Directive 99/13/EC	
		Techniques				

<sup>1/</sup> Refers to the note at the end of the annex

a/ Installations which demonstrate to the competent authority that the average organic solvent content of all cleaning material used does not exceed 30% w/w are exempt from applying these values.

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21. Vegetable oil and animal fat extraction and vegetable oil refining processes:

**Table 14: Suggested options limit values for extraction of vegetable and animal fat and refining of vegetable oil**

Activity and threshold		Suggested ELV for VOC [yearly for total ELV] Options 1, 2 and 3 <sup>1/</sup>
New and existing installations (solvent consumption > 10 tonnes/y)	Option	Total ELV (kg VOC/Mg product) Animal fat: 1.5 Castor: 3.0 Rape seed: 1.0 Sunflower seed: 1.0 Soya beans (normal crush): 0.8 Soya beans (white flakes): 1.2 Other seeds and vegetable material: 3.0 <sup>a/</sup> All fractionation processes, excl. degumming <sup>b/</sup> : 1.5 Degumming: 4.0
	BAT AELs or legislation	UNECE GP Directive 99/13/EC
	Techniques	

<sup>1/</sup> Refers to the note at the end of the annex

a/ Limit values for total emissions of VOCs from installations treating single batches of seeds or other vegetable material shall be set case by case by the competent authorities on the basis of the best available technologies.

b/ The removal of gum from the oil.

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22. Impregnation of wooden surfaces:

**Table 15: Suggested options limit values for impregnation of wooden surfaces**

Activity and threshold		Suggested ELV for VOC [daily for ELVc and yearly for ELVf and total ELV]		
		Option 1 <sup>1/</sup>	Option 2 <sup>1/</sup>	Option 3 <sup>1/</sup>
Wood preservation (solvent consumption > 25 tonnes/y)	Option	ELVc = 100 <sup>a/</sup> mg C/Nm <sup>3</sup> ELVf = 25 wt-% or less of the solvent input <b>Or</b> 7 kg or less of VOC / m <sup>3</sup>	ELVc = 100 <sup>a/</sup> mg C/Nm <sup>3</sup> ELVf = 35 wt-% or less of the solvent input <b>Or</b> 9 kg or less of VOC / m <sup>3</sup>	ELVc = 100 <sup>a/</sup> mg C/Nm <sup>3</sup> ELVf = 45 wt-% or less of the solvent input <b>Or</b> 11 kg or less of VOC / m <sup>3</sup>
	BAT AELs or legislation	BREF STS 99 % of reduction achieved using water based systems 70 % using solvent based systems with waste gas treatment ELVc and ELVf based on a consensus of the EGTEI group (refer to the revised guidance document prepared by EGTEI)		UNECE GP Directive 99/13/EC
	Techniques			

<sup>1/</sup> Refers to the note at the end of the annex

<sup>a/</sup> Does not apply to impregnation with creosote

B. Canada <sup>2</sup>

23. Limit values for controlling emissions of volatile organic compounds (VOCs) from new stationary sources in the following stationary source categories will be determined on the basis of available information on control technology and levels, including limit values applied in other countries, and the following documents:

(a) Canadian Council of Ministers of the Environment (CCME). Environmental Code of Practice for the Reduction of Solvent Emissions from Dry Cleaning Facilities. December 1992. PN1053;

(b) CCME. Environmental Guideline for the Control of Volatile Organic Compounds Process Emissions from New Organic Chemical Operations. September 1993. PN1108;

(c) CCME. Environmental Code of Practice for the Measurement and Control of Fugitive VOC Emissions from Equipment Leaks. October 1993. PN1106;

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- (d) CCME. A Program to Reduce Volatile Organic Compound Emissions by 40 Percent from Adhesives and Sealants. March 1994. PN1116;
- (e) CCME. A Plan to Reduce Volatile Organic Compound Emissions by 20 Percent from Consumer Surface Coatings. March 1994. PN1114;
- (f) CCME. Environmental Guidelines for Controlling Emissions of Volatile Organic Compounds from Aboveground Storage Tanks. June 1995. PN1180;
- (g) CCME. Environmental Code of Practice for Vapour Recovery during Vehicle Refueling at Service Stations and Other Gasoline Dispensing Facilities. (Stage II) April 1995. PN1184;
- (h) CCME. Environmental Code of Practice for the Reduction of Solvent Emissions from Commercial and Industrial Degreasing Facilities. June 1995. PN1182;
- (i) CCME. New Source Performance Standards and Guidelines for the Reduction of Volatile Organic Compound Emissions from Canadian Automotive Original Equipment Manufacturer (OEM) Coating Facilities. August 1995. PN1234;
- (j) CCME. Environmental Guideline for the Reduction of Volatile Organic Compound Emissions from the Plastics Processing Industry. July 1997. PN1276; and
- (k) CCME. National Standards for the Volatile Organic Compound Content of Canadian Commercial/Industrial Surface Coating Products - Automotive Refinishing. August 1997. PN1288.

### C. United States of America<sup>2</sup>

24. Limit values for controlling emissions of VOCs from new stationary sources in the following stationary source categories are specified in the following documents:

- (a) Storage Vessels for Petroleum Liquids - 40 Code of Federal Regulations (C.F.R.) Part 60, Subpart K, and Subpart Ka;
- (b) Storage Vessels for Volatile Organic Liquids - 40 C.F.R. Part 60, Subpart Kb;
- (c) Petroleum Refineries - 40 C.F.R. Part 60, Subpart J;
- (d) Surface Coating of Metal Furniture -40 C.F.R. Part 60, Subpart EE;
- (e) Surface Coating for Automobile and Light Duty Trucks - 40 C.F.R. Part 60, Subpart MM;
- (f) Publication Rotogravure Printing - 40 C.F.R. Part 60, Subpart QQ;
- (g) Pressure Sensitive Tape and Label Surface Coating Operations - 40 C.F.R. Part 60, Subpart RR;
- (h) Large Appliance, Metal Coil and Beverage Can Surface Coating - 40 C.F.R. Part 60, Subpart SS, Subpart TT and Subpart WW;
- (i) Bulk Gasoline Terminals - 40 C.F.R. Part 60, Subpart XX;
- (j) Rubber Tire Manufacturing - 40 C.F.R. Part 60, Subpart BBB;
- (k) Polymer Manufacturing - 40 C.F.R. Part 60, Subpart DDD;
- (l) Flexible Vinyl and Urethane Coating and Printing - 40 C.F.R. Part 60, Subpart FFF;

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- (m) Petroleum Refinery Equipment Leaks and Wastewater Systems - 40 C.F.R. Part 60, Subpart GGG and Subpart QQQ;
- (n) Synthetic Fiber Production - 40 C.F.R. Part 60, Subpart HHH;
- (o) Petroleum Dry Cleaners - 40 C.F.R. Part 60, Subpart JJJ;
- (p) Onshore Natural Gas Processing Plants - 40 C.F.R. Part 60, Subpart KKK;
- (q) SOCOMI Equipment Leaks, Air Oxidation Units, Distillation Operations and Reactor Processes - 40 C.F.R. Part 60, Subpart VV, Subpart III, Subpart NNN and Subpart RRR;
- (r) Magnetic Tape Coating - 40 C.F.R. Part 60, Subpart SSS;
- (s) Industrial Surface Coatings - 40 C.F.R. Part 60, Subpart TTT; and
- (t) Polymeric Coatings of Supporting Substrates Facilities - 40 C.F.R. Part 60, Subpart VVV.

### Note

- 1/ The definitions of option 1, option 2 and option 3 are as follows. These options were designed to leave maximum flexibility for discussion at the WGSR. Options for ELVs are as follows:
- Option 1: ELV1 is a demanding but technically feasible option with the objective of achieving a high level of reduction. The ELV1 is based on a value between the lower and upper BAT AEL, (where it is available),
  - Option 2: ELV2, while technically demanding, pays greater attention to the costs of the measures for achieving reduction. The ELV2 is a value based on the upper BAT AEL (where it is available),
  - Option 3: ELV 3 represents current [good] practices based on the legislation of a number of Parties to the Convention.

2/ Up to now, no information has been provided by North America, then part B and C of the annex have not been modified yet.

## Appendix I

### SOLVENT MANAGEMENT PLAN

#### Introduction

## ANNEX VI

1. This appendix to the annex on limit values for emissions of non-methane volatile organic compounds (NMVOCs) from stationary sources provides guidance on carrying out a solvent management plan. It identifies the principles to be applied (para. 2), provides a framework for the mass balance (para. 3) and provides an indication of the requirements for verification of compliance (para. 4).

### Principles

2. The solvent management plan serves the following purposes:  
(a) Verification of compliance, as specified in the annex; and  
(b) Identification of future reduction options.

### Definitions

3. The following definitions provide a framework for the mass balance exercise:

(a) Inputs of organic solvents:

I1. The quantity of organic solvents or their quantity in preparations purchased that are used as input into the process in the time frame over which the mass balance is being calculated.

I2. The quantity of organic solvents or their quantity in preparations recovered and reused as solvent input into the process. (The recycled solvent is counted every time it is used to carry out the activity.)

(b) Outputs of organic solvents:

O1. Emission of NMVOCs in waste gases.

O2. Organic solvents lost in water, if appropriate taking into account waste-water treatment when calculating O5.

O3. The quantity of organic solvents that remains as contamination or residue in output of products from the process.

O4. Uncaptured emissions of organic solvents to air. This includes the general ventilation of rooms, where air is released to the outside environment via windows, doors, vents and similar openings.

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

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- O6. Organic solvents contained in collected waste.
- O7. Organic solvents, or organic solvents contained in preparations, that are sold or are intended to be sold as a commercially valuable product.
- O8. Organic solvents contained in preparations recovered for reuse but not as input into the process, as long as they are not counted under O7.
- O9. Organic solvents released in other ways.

### Guidance on use of the solvent management plan for verification of compliance

4. The use of the solvent management plan will be determined by the particular requirement which is to be verified, as follows:
- (a) Verification of compliance with the reduction option mentioned in paragraph 6 (a) of the annex, with a total limit value expressed in solvent emissions per unit product, or as otherwise stated in the annex.
- (i) For all activities using the reduction option mentioned in paragraph 6 (a) of the annex, the solvent management plan should be put into effect annually to determine consumption. Consumption can be calculated by means of the following equation:
- $$C = I1 - O8$$
- A parallel exercise should also be undertaken to determine solids used in coating in order to derive the annual reference emission and the target emission each year;
- (ii) For assessing compliance with a total limit value expressed in solvent emissions per unit product or as otherwise stated in the annex, the solvent management plan should be put into effect annually to determine emission of NMVOCs. Emission of NMVOCs can be calculated by means of the following equation:
- $$E = F + O1$$
- Where F is the fugitive emission of NMVOC as defined in subparagraph (b) (i) below. The emission figure should be divided by the relevant product parameter;
- (b) Determination of fugitive emission of NMVOCs for comparison with fugitive emission values in the annex:
- (i) Methodology: The fugitive emission of NMVOC can be calculated by means of the following equation:

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$$F = I1 - O1 - O5 - O6 - O7 - O8$$

or

$$F = O2 + O3 + O4 + O9$$

This quantity can be determined by direct measurement of the quantities. Alternatively, an equivalent calculation can be made by other means, for instance by using the capture efficiency of the process.

The fugitive emission value is expressed as a proportion of the input, which can be calculated by means of the following equation:

$$I = I1 + I2$$

(ii) Frequency: Fugitive emission of NMVOCs can be determined by a short but comprehensive set of measurements. This need not to be done again until the equipment is modified.