Final Background Document
on the sector

Architectural and domestic use of paints

Prepared in the framework of EGTEI

Prepared by CITEPA, Paris

Summary

The European Commission is still working on this sector. If new information becomes available, it will be introduced into this document so that the most up to date data are used.

Architectural and domestic use of paints

SNAP: 06 01 03 and 06 01 04 or NFR 3 A Paint Application

These sectors can be defined differently : Construction & buildings and domestic use applications (SNAP definitions) or architectural and domestic (or do-it-yourself (DIY)) applications (RAINS model).
In this document, the same terminology as the one of reference [4] (i.e.: architectural and domestic use of paints) is used.

Paints used in these sectors are very similar. Consequently both sectors are considered together. VOC emissions during paint application are caused by evaporation of solvents used to modify the viscosity of the binder (thinners) and by the use of cleaning solvents.

ACTIVITY **:** total consumption of products (tonnes of paints ready to use consumed / year)
POLLUTANT CONSIDERED **:** VOC

1 Data in the bibliography

Following data are displayed for comparison reason

1.1 Data currently used in the RAINS model [4], [5]

In the present stage of development of the RAINS model, architectural and domestic use of paints are considered separately (under the sector “non-industrial use of paints”).

1.1.1 Control options

- Architectural use of paints

In the RAINS model, the following options are considered :

- NoC : Reference case (use of conventional solvent-based products containing 50% wt. solvent);
- EMU : Substitution with dispersion/emulsion (2-3% wt. solvent);
- WB : Substitution with water-based paints (efficiency : 80%);
- HS : Substitution with high solids paints (efficiency : 40 to 60%).

- Domestic use of paints

In this case, only brushing and rolling are used to applied the paints. The measures considered are similar to those for “architectural use of paint”.

1.1.2 Abatement costs

Examples for three countries are displayed below :

No comments are made on the figures displayed in the following tables because no further information is available.
Data on the other countries are downloadable on
http://www.iiasa.ac.at/~rains/voc_review/single.html

Table 1.1.2.1 : French situation

Measure	Emissions factor [kt VOC / kt of paint]	Efficiency [%]	Technical Eff. [%]	Applicability [%]	Unit cost [€$_{1990}$/ t VOC]
Activity level 1990 : 318,000 kt paint; 2010 : 362,339 kt paint **VOC emission scenario business as usual :** 1990 : 102,48 kt VOC; 2010 : 90,46 kt VOC.					
Architectural					
NoC	0,3614	0	0	0	0
EMU	0,2930	19	95	20	0
WB	0,2524	30	78	38	459
HS	0,3308	8	55	15	1 307
EMU + WB	0,1840	49	49	100	282
EMU + HS	0,2624	27	27	100	404
EMU+WB+HS	0,1534	58	58	100	43
Activity level 1990 : 20,000 kt paint; 2010 : 22,160 kt paint **VOC emission scenario business as usual :** 1990 : 48,34 kt VOC; 2010 : 38,53 kt VOC.					
Domestic					
NoC	0,3237	0	0	0	0
EMU	0,2703	16	95	17	0
WB	0,2127	34	79	44	405
HS	0,3080	5	56	9	1 210
EMU + WB	0,1593	51	51	100	274
EMU + HS	0,2546	21	21	100	275
EMU+WB+HS	0,1436	56	56	100	355

Table 1.1.2.2 : German situation (Old Laender)

Measure	Emissions factor [kt VOC / kt of paint]	Efficiency [%]	Technical Eff. [%]	Applicability [%]	Unit cost [€$_{1990}$/ t VOC]
Activity level 1990 : 459,600 kt paint; 2010 : 786,835 kt paint **VOC emission scenario business as usual :** 1990 : 59,89 kt VOC; 2010 : 50,37 kt VOC.					
Architectural					
NoC	0,138	0	0	0	0
EMU	0,0770	44	94	47	0
WB	0,1023	26	75	34	533
HS	0,1361	1	76	1	1 053
EMU + WB	0,0414	70	70	100	197
EMU + HS	0,0751	46	46	100	32
EMU+WB+HS	0,0395	71	71	100	213
Activity level 1990 : 230,300 kt paint; 2010 : 393,813 kt paint **VOC emission scenario business as usual :** 1990 : 40,90 kt VOC; 2010 : 25,20 kt VOC.					
Domestic					
NoC	0,1851	0	0	0	0
EMU	0,0770	58	94	62	0
WB	0,1495	19	75	26	480
HS	0,1832	1	76	1	1 000
EMU + WB	0,0414	78	78	100	119
EMU + HS	0,0751	59	59	100	17
EMU+WB+HS	0,0395	79	79	100	130

Table 1.1.2.2 : German situation (New laender)

Measure	Emissions factor [kt VOC / kt of paint]	Efficiency [%]	Technical Eff. [%]	Applicability [%]	Unit cost [€$_{1990}$/ t VOC]
Activity level 1990 : 100,000 kt paint; 2010 : 300,000 kt paint **VOC emission scenario business as usual :** 1990 : 27,63 kt VOC; 2010 : 19,20 kt VOC,					
Architectural					
NoC	0,2763	0	0	0	0
EMU	0,0770	72	94	77	0
WB	0,2407	13	75	17	533
HS	0,2744	1	76	1	1 053
EMU + WB	0,0414	85	85	100	81
EMU + HS	0,0751	73	73	100	10
EMU+WB+HS	0,0395	86	86	100	89
Activity level 1990 : 58,000 kt paint; 2010 : 157,180 kt paint **VOC emission scenario business as usual :** 1990 : 13,00 kt VOC; 2010 : 10,06 kt VOC,					
Domestic					
NoC	0,2241	0	0	0	0
EMU	0,0770	66	94	70	0
WB	0,1885	16	75	21	480
HS	0,2222	1	76	1	1 000
EMU + WB	0,0414	82	82	100	94
EMU + HS	0,0751	66	66	100	13
EMU+WB+HS	0,0395	82	82	100	103

Table 1.1.2.3 : Hungarian situation

Measure	Emissions factor [kt VOC / kt of paint]	Efficiency [%]	Technical Eff. [%]	Applicability [%]	Unit cost [€$_{1990}$/ t VOC]
Activity level 1990 : 20,000 kt paint; 2010 : 22,160 kt paint **VOC emission scenario business as usual :** 1990 : 3,86 kt VOC; 2010 : 4,28 kt VOC.					
Architectural					
NoC	0,1930	0	0	0	0
EMU	0,1420	26	93	28	0
WB	0,1500	22	78	28	465
HS	0,1780	8	55	14	1 333
EMU + WB	0,0990	49	49	100	213
EMU + HS	0,1270	34	34	100	303
EMU+WB+HS	0,0840	56	56	100	367
Activity level 1990 : 10,000 kt paint; 2010 : 11,080 kt paint **VOC emission scenario business as usual :** 1990 : 1,93 kt VOC; 2010 : 2,14 kt VOC.					
Domestic					
NoC	0,1930	0	0	0	0
EMU	0,1420	26	93	28	0
WB	0,1500	22	78	28	419
HS	0,1870	3	55	6	1 267
EMU + WB	0,0990	49	49	100	191
EMU + HS	0,1360	30	30	100	133
EMU+WB+HS	0,0930	52	52	100	256

1.2 Situation in Norway [5]

According to [5], NMVOC emissions from the use of paints and varnishes in domestic and professional contexts came to about 4 650 tonnes in 1993. Alkyd paints for outdoor use represents the biggest share of emissions.
Nowadays, about 80% of paints used are water-based products. Reference [5] estimates that the share of water-based products can be increased to 85%. As the share of solvent-based products is decreasing, the use of white spirit as cleaning agent will be also reduced.

These reductions are due to the general increase in the use of products with a lower solvent content. No costs are given in [5].

2 Short technology description [1]

Surface coating is the application of decorative and/or protective materials in liquid form to substrates. Liquid paints include solvent-based coatings, varnishes, lacquers and water-based coatings. Emissions of NMVOC in paint application are due to the evaporation of solvents used to thin coatings or used for equipment cleaning.
All unrecovered solvents can be considered as potential emissions. The major factor affecting these emissions is the amount of volatile matter contained in the paint. Conventional high solvent-based coatings contain approximately 50 % solids and 50 % organic solvents. In addition, other solvents may be added to the paint to thin the paints before application.
No large differences can be identified between architectural and domestic use of paints. In the first one, paint is supplied to professionals and used by painting contractors, local authorities, government departments, industrial and commercial companies etc. In the second one, paint is used principally by the "do-it-yourselfers" (DIY).

It is possible to distinguish the following main applications of paints for the whole architectural sector:

- walls, ceilings, floors in indoor applications;
- walls, floors in outdoor applications;
- wood substrates in indoor applications : floors, furniture, doors, window frames;
- wood substrates in outdoor applications : fences, garden sheds, gable boards, garden furniture, wooden chalets;
- metallic substrates in indoor applications : radiators, tanks;
- metallic substrates in outdoor applications : fences, portals, garden furniture.

For all of these cases, the application techniques are the same : while conventional spraying is certainly carried out by some commercial applicators, rolling for large flat areas and brushing for more complex shapes such as windows and door frames are the dominant application techniques. In the domestic use sector (decorative retail), application techniques are only brushing and rolling.

3 EU regulation

The replacement of high solvent-based coatings by low solvent-based and water-based coatings will considerably reduce emissions. These measures are currently studied by the European Commission to regulate VOC content of the different types of coatings. This regulation will be implemented in two phases (phase 1 in 2007 and phase 2 in 2010). Limit values are still under discussion [3].

Table 3.1 : Proposal of VOC content limit values for decorative paints and varnishes [3]

Coating categories	Type	Phase I (g/l)* (2007)	Phase II (g/l)* (2010)
Interior matt wall and ceilings	WB	55	30
	SB	350	30
Interior glossy walls and ceilings	WB	150	100
	SB	350	100
Exterior walls of mineral substrate	WB	60	40
	SB	450	430
Interior trim and cladding paints for wood and metal	WB	130	130
	SB	250	250
Exterior trim and cladding paints for wood and metal	WB	140	100
	SB	500	400
Interior/exterior trim varnishes and woodstains	WB	150	130
	SB	700	700
Primers	WB	50	30
	SB	450	350
Binding primers	WB	50	30
	SB	750	750
One pack performance coatings	WB	140	140
	SB	600	500
2 pack reactive performance coatings for specific end use	WB	140	140
	SB	550	500
Multi-coloured coatings	WB	150	100
	SB	400	100
Decorative effects coatings	WB	300	200
	SB	500	200

*g/l ready to use

4 Definition of Reference Installations

No reference installation is defined in this chapter. This sector is described by the total consumption of each type of products in each country (see Chapter 6).

5 Emission abatement techniques and costs

Definitions of measures to reduce VOC emissions

According to references [1] and [2], the only possibilities to reduce VOC emissions are :

- to reduce the consumption of coatings, varnishes, etc.;
- to reduce solvent content of products.

To increase the use of low solvent based paints, additional measures, such as labelling of products and economic incentives could be taken.

- *Switch to Low-Solvent Products*

The replacement of high solvent-based coatings by low solvent-based and water-based coatings will reduce VOC emissions. The efficiency of this replacement will depend on the present use of low solvent based paints. The European Commission is presently studying the possibility to regulate VOC content of the different types of coatings. This regulation will be implemented in two phases (phase 1 in 2007 and phase 2 in 2010) [3].

Reference [2] indicates an average share of 70% of water based coatings in EU but the situation might be very different from one country to another. VOC emissions depend on the share of solvent-based and water-based products used.

- *Process Modifications*

The only feasible process change in "buildings and construction coating sector" is the development of the use of pre-coated metal sheets, since secondary measures can then be applied at the production facility.

Table 5.1 : Products considered in the document

Types of products
Coatings (solvent based and water based paints)
Cleaning solvents

Average solvent content of each type of coatings can differ from one country to another (this information has to be provided in paragraph 6).

6 Data to be provided by national experts for the completion of the database for their own country

The following tasks are required :

6.1 Validation work

For representing costs in this sector, the national expert is invited to comment the methodology defined by the Secretariat.

- Validate the method of derivation of variable operating costs.

Or

- Provide other costs for the same combination of techniques and justify them.

Comments have to be sent to the Secretariat in the two weeks after having received the document.

6.2 Provision of country specific data

To be filled in by national experts

Table 6.2.1 : Country and sector specific costs

	Default value	Country specific value
Cost of cleaning solvents [€ / t]	450	

- Consumptions (t products consumed / y) in 2000, 2005, 2010, 2015, 2020. Some default values for the confidence interval are given. They can be used by the Party if no data are available.

Total activity corresponds to the consumption of coatings only (t of coatings ready to use / y).

Table 6.2.2 : Consumption of coatings and cleaning solvents [t of products / y]

Products	2000	CI%	2005	CI%	2010	CI%	2015	CI%	2020	CI%
Coatings										
Cleaning solvents										
Default values		10		20		50		100		100

Product consumption (t products consumed / y) have to be estimated from 2000 to 2020.

Table 6.2.3 : Average solvent content of the products (weight %)

This information depends on the types of products used at a country level. These concentrations will evolve in the future (with the implementation of national or European regulations) so the possibility is given to national experts to modify this parameter.
Cleaning products are considered to be pure solvents (100%). The solvent content is not assumed to differ in the future but their consumption should be reduced with the increased use of water based coatings.

Products	2000	CI%	2005	CI%	2010	CI%	2015	CI%	2020	CI%
Coatings										
Diluting/cleaning solvents	100		100		100		100		100	

Default values presented in table 6.2.4 for 1999 and 2000 are derived from the EC [2] and CEPE [7] documents respectively. They have been calculated with the default values for the shares of each sub-category of paints presented in table 6.2.6. Solvent contents differ from one source to the other because limit values considered for current practice (g VOC/l of paint) are not the same.

In 2010, average solvent contents are calculated with the limit values presented in [3] and with the default values for the shares of each sub-category of paints presented in table 6.2.6.

Solvent contents presented in table 6.2.4 represent the lower limit expected for each country from 2010 onward.

Table 6.2.4 : Average solvent content (weight %) of the coatings ready to use for different countries (DEFAULT VALUES) [2], [7]

Types of coatings / Countries	B	DK	D	GR	E	F	I	L	NL	N	A	P	CH	FIN	S	UK	Av.
Solvent content in 1999 [2]	17,9	16,3	13,6	18,3	20,4	20,5	17,9	17,9	17,9	22,3	17,9	18,3	18,7	17,3	19,1	17,9	17,3
Solvent content in 2000 [7]	13,2	11,1	6,9	13,1	17,3	18,4	12,6	13,2	13,4	17,4	12,6	13,1	13,6	11,7	13,9	11,7	12,1
Solvent content from 2010 onwards	9,2	7,8	5,7	8,9	10,8	10,1	8,7	9,2	9,0	13,2	8,7	8,9	9,3	8,4	10,8	9,0	8,4

Av. : Average

- For cost calculations, more detailed information about the types of products used is required. The consumption of each type of paints as defined in the proposition of Directive [3] has to be known.

If this parameter is not available in country statistics, data provided by CEPE [7] for 16 countries and European average figures from the EC [2] are available in table 6.2.6.

Table 6.2.5 : Share of each sub-category of paints (country specific)

Coating categories	Type	% of total consumption
Interior matt and glossy wall and ceilings	WB	
	SB	
Exterior walls of mineral substrate	WB	
	SB	
Interior/exterior trim and cladding paints for wood and metal	WB	
	SB	
Interior/exterior trim varnishes and woodstain	WB	
	SB	
Primers	WB	
	SB	
Binding primers	WB	
	SB	
One pack performance coatings	WB	
	SB	
2 pack reactive performance coatings for specific end use	WB	
	SB	
Multi-coloured coatings	WB	
	SB	
Decorative effects coatings	WB	
	SB	

Shares of each sub-category as defined in table 6.2.5 are assumed to remain the same from 2000 to 2020 [2]. This simplification is used for cost calculation (see Chapter 7).

Table 6.2.6 : Shares of each sub-category of paints (% of total consumption) (DEFAULT VALUES)[2], [7]

		Reference [7]																[2]
Types of coatings	**Countries**	**B**	**DK**	**D**	**GR**	**E**	**F**	**I**	**L**	**NL**	**N**	**A**	**P**	**CH**	**FIN**	**S**	**UK**	**EU_{15}**
Interior matt and glossy walls and ceilings	Water	37,0	52,9	61,4	52,9	40,4	24,9	52,9	37,0	46,0	52,9	52,9	52,9	52,9	52,9	52,9	54,5	53,5
	Solvent	1,5	3,4	0,0	3,4	1,3	22,4	3,4	1,5	1,4	3,4	3,4	3,4	3,4	3,4	3,4	2,9	5,9
Exterior walls of mineral substrates	Water	25,1	17,6	17,7	17,6	17,9	22,6	17,6	25,1	17,0	2,7	17,6	17,6	17,6	16,3	3,6	8,3	15,1
	Solvent	0,5	0,5	0,4	0,5	2,0	5,6	0,5	0,5	0,5	15,4	0,5	0,5	0,5	1,8	14,5	2,8	3,3
Interior/exterior trim and cladding paints for wood and metal	Water	3,8	4,8	2,0	1,0	3,9	0,3	1,9	3,9	7,3	1,0	1,9	1,0	1,0	4,8	4,8	2,2	2,3
	Solvent	12,2	4,8	4,7	8,7	28,8	3,5	7,7	12,2	15,4	8,7	7,7	8,7	8,7	4,8	4,8	12,4	8,9
Interior/exterior trim varnishes and woodstains	Water	1,2	4,4	4,1	0,4	0,4	1,2	0,9	1,2	4,4	1,8	0,9	0,4	0,9	1,8	5,3	9,8	2
	Solvent	5,7	4,4	2,7	8,4	5,3	5,5	8,0	5,7	5,4	7,1	8,0	8,4	8,0	7,1	3,5	4,2	3,2
Primers	Water	1,5	0,2	0,9	0,6	0,0	1,2	0,6	1,5	0,1	0,2	0,6	0,6	0,2	0,6	0,6	0,1	0,5
	Solvent	0,6	1,0	0,2	0,6	0,0	1,1	0,6	0,6	0,3	1,0	0,6	0,6	1,0	0,6	0,6	0,5	0,5
Binding primers	Water	1,5	0,2	0,9	0,6	0,0	1,2	0,6	1,5	0,1	0,2	0,6	0,6	0,2	0,6	0,6	0,1	0,5
	Solvent	0,6	1,0	0,2	0,6	0,0	1,1	0,6	0,6	0,3	1,0	0,6	0,6	1,0	0,6	0,6	0,5	0,5
One pack performance coatings	Water	1,5	0,2	0,9	0,6	0,0	1,2	0,6	1,5	0,1	0,2	0,6	0,6	0,2	0,6	0,6	0,1	0,5
	Solvent	0,6	1,0	0,2	0,6	0,0	1,1	0,6	0,6	0,3	1,0	0,6	0,6	1,0	0,6	0,6	0,5	0,5
Two pack performance Coatings for specific end	Water	1,5	0,2	0,9	0,6	0,0	1,2	0,6	1,5	0,1	0,2	0,6	0,6	0,2	0,6	0,6	0,1	0,5
	Solvent	0,6	1,0	0,2	0,6	0,0	1,1	0,6	0,6	0,3	1,0	0,6	0,6	1,0	0,6	0,6	0,5	0,5
Multi-coloured coatings	Water	1,5	0,2	0,9	0,6	0,0	1,2	0,6	1,5	0,1	0,2	0,6	0,6	0,2	0,6	0,6	0,1	0,5
	Solvent	0,6	1,0	0,2	0,6	0,0	1,1	0,6	0,6	0,3	1,0	0,6	0,6	1,0	0,6	0,6	0,5	0,5
Decorative effect coatings	Water	1,5	0,2	0,9	0,6	0,0	1,2	0,6	1,5	0,1	0,2	0,6	0,6	0,2	0,6	0,6	0,1	0,5
	Solvent	0,6	1,0	0,2	0,6	0,0	1,1	0,6	0,6	0,3	1,0	0,6	0,6	1,0	0,6	0,6	0,5	0,5
	Total	**100,0**	**100,0**	**100,0**	**100,0**	**100,0**	**100,0**	**100,0**	**100,0**	**100,0**	**100,0**	**100,0**	**100,0**	**100,0**	**100,0**	**100,0**	**100,0**	**100,0**

7 Explanatory notes

7.1 Derivation of Emission Factors

Emission factors at a country level (t VOC / t products consumed) depend on the shares of use of the different coatings (solvent based, water-based and high solid coatings).
Emission factors will be higher where solvent based product sales are more important.

Country specific emission factors will be calculated by the tool for the years 2000 to 2020 (from inputs of tables 6.2.2 and 6.2.3).

Table 7.1.1 : Emission factor calculations

Emission factor [t VOC / t paints ready to use]
(consumption of coatings [t / y] × % of solvents + consumption of cleaning solvents) / Total activity [t of coatings / y]

Basic assumption [1] :

- Application and drying processes are not enclosed and all solvents used are emitted into the air.

7.2 Derivation of cost data

Costs are derived from reference [2]

Switching from solvent based to water based paints will imply an increase in costs. This is mainly due to more expensive inputs for water based paints, but also due to some additional research and development and investment costs.
Usually, costs to reduce the solvent content of existing water based paints are rather low. However, in some cases the lowering of solvent content of paint requires a significant technological shift and the costs are then the same order of magnitude as in the case of shifting from solvent to water based paints.

Four parameters are studied hereafter :

- ✓ Increase in production costs;
- ✓ Research and development costs;
- ✓ Additional investment;
- ✓ Savings on cleaning solvent use.

7.2.1 Increase in production costs

When switching from solvent based to water based paints, the composition of the paints will change and the raw material costs will increase. In most water based paint categories, it is assumed that reducing VOC content will not incur additional raw material costs. This is the case for :

- ✓ Interior matt walls and ceilings,
- ✓ Interior/exterior trim varnishes and woodstains,
- ✓ Primers,
- ✓ One pack and two pack performance coatings.

The same is assumed for the following solvent-based paint categories :

- ✓ Interior/exterior trim varnishes and woodstains,
- ✓ Primers,
- ✓ One pack and two pack performance coatings.

Over costs for the other categories of paints are calculated from the following data provided in reference [2]. To make an accurate comparison, we have to take into account that the amount of dry matter in a water based paint is lower that the one of a solvent based paint.

Table 7.2.1.1 : Comparison of WB paint vs. SB paint costs [2]

Parameters	WB paints	SB paints	Comparison
Costs [€ / kg paint]	1,28	1,36	-
Solid content [kg of solid / kg paint]	0,5	0,7	-
Amount of WB paint necessary to obtain a solid content of 0,7 [kg]	1,4	-	-
Corresponding cost [€]	1,79	-	-
Cost increase [€ / kg of paint]	-	-	1,79 – 1,36 = 0,43

WB paint : water based paint
SB paint : solvent based paint

When this type of SB paint is substituted by WB paint, costs are increased by 0,43 €/kg. To use this method for all sub-categories of paints, this cost is compared to the corresponding reduction in VOC content. The ratio obtained is used for all the sub-categories of paints considered.

Table 7.2.1.2 : Determination of the costs of VOC abatement

Parameters	WB paints	SB paints	Comparison
VOC content [kg of VOC / kg paint]	0,085	0,303	-
Corresponding VOC content [kg] for 1,4 kg	0,119	-	-
VOC reduction [kg]	-	-	0,303 – 0,119 = 0,184
Ratio [€ / kg of VOC abated]	-	-	0,43 / 0,184 = 2,3

This ratio has been extended to all concerned sub-categories of paints. The expected VOC reduction [kg of VOC / kg of paint] for all categories (difference between the current situation and the future situation : annex 3 of reference [2]) has been calculated and multiplied by the ratio of 2,3 [€ / kg of VOC abated].

Additional costs per sub-category of paints are displayed in table 7.2.1.3.

As interior matt and glossy walls and ceilings paints are considered together, an average over-cost is used.

As in reference [2], two scenarios are considered for exterior walls of mineral substrate and exterior/exterior trim and cladding :

- The “optimistic scenario“ : it is assumed that no additional raw material costs are required for these two categories of paint.
- The “pessimistic scenario“ : it is assumed that additional raw material costs due to the technology shift are required.

In the present document, an “average scenario” is taken into account as no other information is available.

Table 7.2.1.3 : Cost increase due to the abatement of VOCs in paints [€ / kg of paints]

Coating categories	Type	Optimistic scenario	Pessimistic scenario	Average scenario
Interior matt and glossy wall and ceilings	WB to WB	0	0	0
	SB to WB	0,36	0,49	0,425
Exterior walls of mineral substrate	WB to WB	0	0,12	0,06
	SB to SB	0	0,09	0,045
Interior/exterior trim and cladding paints for wood and metal	WB to WB	0	0,09	0,045
	SB to SB	0	0,26	0,13
Interior/exterior trim varnishes and woodstain	WB to WB	0	0	0
	SB to SB	0	0	0
Primers	WB to WB	0,23	0,23	0,23
	SB to SB	0	0	0
Binding primers	WB to WB	0,16	0,16	0,16
	SB to SB	0	0	0
One pack performance coatings	WB to WB	0	0	0
	SB to SB	0	0	0
2 pack reactive performance coatings for specific end use	WB to WB	0,22	0,22	0,22
	SB to SB	0	0	0
Multi-coloured coatings	WB to WB	0,09	0,09	0,09
	SB to SB	0,52	0,52	0,52
Decorative effects coatings	WB to WB	0,17	0,17	0,17
	SB to SB	0,52	0,52	0,52

To link costs and emission reduction, costs per tonne of VOC abated (€ / t VOC) have been calculated for each country.

For a theoretical activity level (tonnes of paints / y) :

- ✓ Theoretical emission reduction (tonnes) are derived from the data of reference [2] (see average solvent contents of the "reference" coatings in table 6.2.4).
- ✓ Theoretical additional costs are derived from the shares of each sub-category of paints (table 6.2.6) and from the additional costs per category of paints shown in table 7.2.1.3.

Abatement costs (€ / t VOC abated) are calculated by dividing total theoretical additional costs (€/year) by theoretical emission reductions (t VOC / year). They are presented in table 7.2.1.4 below.

Table 7.2.1.4 : Abatement costs [€ / t VOC abated] to take into account 2010 onwards

Types of coatings / Countries	B	DK	D	GR	E	F	I	L	NL	N	A	P	CH	FIN	S	UK
Abatement costs [€ / t VOC]	673	539	350	515	587	1 325	517	673	491	515	517	515	523	504	518	469

All abatement costs are more or less in the same range but for France.

For France, high costs come from the replacement of “solvent based interior walls and ceilings paints” which represent 28,8% of the total consumption of paints.

Increase in production cost :
VOC reduction (t VOC/y) will be calculated by the tool from the country specific data provided in tables 6.2.2 and 6.2.3 (i.e. paint consumption and solvent content).
This amount will be multiplied for each country by the ratios (€/t VOC) given in table 7.2.1.4.
This cost has to be considered as of 2010.

7.2.2 Cost increase due to additional research and development

According to reference [2], total research and development costs for the reformulation of paints and resins are estimated to be €6,5 million per annum. If we consider a total consumption of around 3 000 kt of paints for the EU, this leads to a R&D cost of 2,15 €/tonne of paints used.

R&D cost = Total activity [t of paints/year] × 2,15 [€ / tonne]
This cost has to be considered from 2010 onwards for the first 10 years (until 2020).

7.2.3 Investment costs

According to [2], additional investment is required to switch from SB to WB paint production. This leads to cost increase for trim paint around 1 to 1,5%. The price increase of paint for interior matt and glossy walls and ceilings (when switching from SB to WB paints) is assumed to be 125 € / tonne.

Investment cost = Consumption of solvent based interior matt and glossy walls and ceilings[t / y] × 125 [€ / t]
This cost has to be considered from 2010 onward.

7.2.4 Savings

When WB paints are applied, cleaning solvents are not used. This leads to savings.

Table 7.2.4.1 : Default price for cleaning solvents [2]

Default price [€ / t]	450

Savings = Consumption of solvents [t / y] (table 6.2.2) × price of solvents [450 € / t]

7.2.5 Total costs per country

Total costs [€ / y] = Increase in production costs [€ / y] + R&D costs [€ / y] + Investment costs [€ / y] – Savings [€ / y]

8 References

[1] IFARE. Task force on the assessment of abatement options and techniques for VOC from stationary sources. Draft background document prepared for UN/ECE-May 1999.

[2] EC DG Environment Decopaint, Study on the Potential for Reducing Emissions of VOC Due To The Use Of Decorative Paints and Varnishes for Professional and Non-professional Use, Final report. Tender E1/ETU/980084. June 2000.

[3] Proposal for a Directive of the European Parliament and of the Council on the limitation of emissions of volatile organic compounds due to the use of organic solvents in decorative paints and varnishes and vehicle refinishing products and amending Directive 1999/13/EC COM/2002/0750 final.

[4] Z. KLIMONT; M. AMANN; J. COFALA. Estimating costs for Controlling Emissions of Volatile Organic Compounds (VOC) from Stationary Sources in Europe. Interim Report IR-00-51. IIASA. August 1, 2000. http://www.iiasa.ac.at/~rains/voc_review/voc_ir-00-51.pdf

[5] Review of data used in RAINS-VOC model. http://www.iiasa.ac.at/~rains/voc_review/single.html

[6] Measures for Reducing NMVOC Emissions in Norway. Cost Estimate. SFT. 1997.

[7] CEPE statistics : Calculation of VOC emissions in Europe based on CEPA 2000 sales figures.

9 Modifications compared to the draft document

9.1 Modification of the introduction

It has been highlighted that activity is in consumption of paints ready to use as given in the statistics. According to CEPE, paints are almost always sold as ready to use products. Solvents are just used for cleaning purposes.

9.2 Modification of chapter 6

Solvent contents in 1999 have been recalculated and modified (table 6.2.4).

9.3 Modification of chapter 7

Table 7.2.1.3 : costs have been added for decorative effects coatings to be consistent with the hypothesis given in reference [2].

To be consistent, all hypothesis on costs and emissions are derived from reference [2]. As solvent contents in 1999 are used for the calculation of costs (table 7.2.1.4), abatement costs have also been modified. All costs are in the same range but for France (because of the use of a lot of solvent based interior walls and ceilings paints).

Statistics on the use of cleaning solvents are difficult to find but as the consumption of cleaning solvents will be reduced with the switch from SB to WB products, this is worth it to keep this parameter in this working document.

The European Commission is still working on this sector. If new information becomes available, it will be introduced into this document so that the most up to date data are used.