

Specific Environmental Release Categories (SPERCs) for the widespread use of adhesives, sealants and construction chemical products

Background Document

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FEICA, the Association of the European Adhesive & Sealant Industry

Avenue E. van Nieuwenhuyse 2
B-1160 Brussels, Belgium
www.feica.eu

EFCC, the European Federation for Construction Chemicals

Avenue E. Van Nieuwenhuyse 6
B-1160 Brussels, Belgium
www.efcc.eu



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1 Statement of purpose

SPERCs are specific environmental release categories, and are meant to specify broad emission scenario information (ERCs) for the use of substances throughout their life cycle (Reihlen et al., 2016). The SPERCs described in this document are specific to the use of adhesives, sealants, and construction chemical products. In comparison with widespread use (i.e. use by consumers and by professionals), the industrial use of these chemicals is very low and the application processes are operated according to common good practices. Therefore, these both processing types are summarized as widespread use. Yet, they still reflect emission estimates of broadly defined use processes. The SPERCs for the widespread use of the mentioned products refine the single set of generic release factors for the widespread use of preparations provided in the ECHA Guidance R16.

This document provides the background information to the SPERC factsheets for the widespread indoor and outdoor use of solvent-borne and solvent-less adhesives/sealants and construction chemical products, as well as for water-borne adhesives and sealants, referring to ERC 8. Thus, for these products, specific information is given as regards the operational conditions of use relevant to exposure in use (chapter 2 and 3), the risk management measures (chapter 4), as well as the derivation method and justification of release factors plus indicative use rates (chapter 5).

The SPERC Factsheets covered in this document are:

FEICA SPERC Code	Type of ingredient	Product characteristic	Location of use
FEICA SPERC 8a.3.v3	volatile ingredients	Widespread Use of volatile Substances in Adhesives / Sealants - indoor	indoor
FEICA SPERC 8c.3.v3	non-volatile ingredients	Widespread Use of non-volatile Substances in Adhesives / Sealants - Indoor	
EFCC SPERC 8a.1a.v2	volatile ingredients	Widespread use of volatile substances in construction chemical products - indoor	Indoor
EFCC SPERC 8c.1a.v2	non- volatile ingredients	Widespread use of non-volatile substances in construction chemical products - indoor	
FEICA / EFCC SPERC 8d.1a.v2	volatile ingredients	Widespread use of volatile substances in adhesive/sealants and construction chemical products - outdoor	outdoor
FEICA / EFCC SPERC 8f.1a.v2	non- volatile ingredients	Widespread use of non-volatile substances in adhesives/sealants and construction chemical products - outdoor	

This background document provides information on the derivation of the relevant parameters of the above-mentioned factsheets. Some details refer to tertiary references, e.g. publications listed in chapter 8. As outlined below, the SPERCs described in this document are conservative for use in lower tier REACH safety assessments.

2 Scope

- **Adhesives and sealants** are products used to join and/or seal two or more substrates. Adhesives are used in bonding, facilitating the production of materials which are lightweight and/or flexible and which are used as components in aircraft and automobiles, in cell-phones, and in packaging materials. In addition, adhesives are used in the assembly of many products such as furniture, electronic devices, cars, etc.

Sealants allow the infilling of gaps between two or more substrates. They fulfil an important function in building and construction. Today, they are an essential element of modern engineering including, for instance, the automotive and aerospace industries.

Around 3,500,000 tonnes of adhesives and sealants are produced and used in Europe every year, for very diverse applications, most of which represents customised products (Tolls *et al.*, 2016).

- **Construction chemical products** and tile adhesives are mixtures used or applied by professional workers on the construction sites and/or do-it-yourself home applications. These products cover concrete and mortar admixtures, as well as cement and gypsum for building and repairing construction works. They include hydrophobing agents, modified bitumen-based emulsions and liquid applied membranes - e.g. to seal, preserve and/or waterproof the construction surfaces. In addition, construction chemical products also include reactive resins applied in injection, bonding and anchoring construction pieces, as well as flooring resins for park decks and industrial applications.

For the construction chemical products, there is no data available in the literature on the volumes produced in Europe. Therefore, to have European estimates on such volumes, the European Federation for Construction Chemicals (EFCC) has conducted an internal survey among their member companies and the results were extrapolated to the entire market. Based on this calculation, it is estimated that around 6,900,000 tonnes of construction chemical products were produced and used in Europe in 2016 for very diverse applications (cf. Annex 2), most of which represent products for wide dispersive use.

The SPERCs of this sector's applications are applied for refining the emissions of substances used in the widespread use of Water- or Solvent-borne and Solvent-less Adhesives / Sealants and Construction Chemical Products, e.g. by professionals and/or the general public, i.e. the Do-It-Yourself (DIY) user. Volatile and non-volatile ingredients are distinguished by the boiling point threshold of 250°C, according to the definition of volatile organic compounds given by the World Health Organization (WHO, 1989). Use operations of adhesives, sealants and construction chemical products are assumed for 365 working/emission days per year.

2.1.1 Adhesives and Sealants: ingredients and product types

The major constituents of adhesives and sealants (likewise for construction chemical products) are binders, fillers, and solvents. In addition, minor ingredients include additives such as catalysts and preservatives. Binders are typically natural or synthetic high molecular weight polymers. They may

alternatively contain reactive organic compounds (e.g. prepolymers, oligomers, monomers) that form polymers during the bonding process. The analysis of the production data for adhesives and sealants - resulting from a survey conducted by the Association of the European Adhesive and Sealant Industry (FEICA) - are detailed in Tolls *et al.* (2016). They have been used for the purpose of calculating indicative use rates for each ingredient type of these product categories (Annex 1).

Besides the differentiation among their ingredient classes the following three product-types have been distinguished that results in emission differences during the manufacturing phase of products: (1) Water-borne adhesives/sealants (2a) Basically Water-free, i.e. solvent-less adhesives/sealants and (2b) Solvent-borne adhesives/sealants. The latter two are usually combined to solvent-borne and solvent-less product categories. However, in view of obtaining a low number of scenarios for lower-tier emission assessment of widespread uses, the variety of uses were grouped without distinguishing according to application types. In consequence, a discrimination for “volatile” and “non-volatile” substance ingredients in the respective product categories was introduced in these SPERCs. The rationale for differentiating between volatiles and non-volatiles is that volatile substances will evaporate more or less quantitatively after the application of adhesives and sealants. Non-volatiles, in contrast, do not. The same differentiation is also used in the OECD ESDs for coatings and paints (OECD 2009, OECD 2013). The application of waterborne adhesives, sealants and construction chemical products may involve equipment cleaning with water and, hence, may result in emissions to the wastewater. However, the users of DIY and professional applications may not differentiate between these product types. Therefore, no difference was made between water- and solvent product types and, hence, the only differentiation remains with “volatile” and “non- volatile” substances.

2.1.2 Construction chemical products: ingredients and product types

Based on their ingredients and product properties, two main categories Construction Chemical Products can be distinguished:

1. Products with reactive ingredients. These products are produced in a relatively small amount – approx. around 600,000 tons/y. Their major constituents are binders, fillers, and solvents. Their specific properties involves the reaction of the ingredients (e.g. acrylates, epoxides, etc.) and therefore minor ingredients also include additives such as catalysts and in water based products preservatives. The binders are typically natural or synthetic high molecular weight polymers reactive organic compounds (e.g. prepolymers, oligomers, monomers) that form polymers during the bonding process.
2. Products with non-reactive ingredients are produced in high quantities – approx. around 6,300,000 tons/y. The products are generally not classified as dangerous to the environment. After use, the products become inert relatively quickly.

Products with non-reactive ingredients can be based on bitumen or polymer dispersions. Cementitious construction products are subsumed in this category as well. The latter also include tile adhesives and modified mineral mortars, concrete repair products, cementitious screeds, admixtures, floor levelling compounds, grouts, waterproofing slurries and pre-products for clinker manufacturing or products building concrete during use.

An analysis of typical ranges of ingredient types of construction chemical products is shown in Annex 2. This analysis is based on a survey conducted by the European Federation for Construction Chemicals (EFCC) in 2017 (data are for 2016). The data have been used for the purpose of calculating indicative use rates for manufacturing of each ingredient type within a product category. Since the

majority of construction chemical products are used by large and small professional companies and the general public (i.e. very little industrial uses), the manufacturing data have been applied for widespread uses as a worst case assumption. As with adhesives and sealants volatile and non-volatile ingredient substances are distinguished in the SPERCs for construction chemical products.

2.2 Activity/Process Technologies

Basically, during the use of adhesives, sealants and construction chemical products, the applications are more or less the same (OECD 2013):

Adhesives and sealants are applied between two substrates with the purpose to adhere, fill or seal the substrates. Upon application curing takes place either via a chemical reaction or via evaporation of a solvent. Construction chemical products are applied for sealing and filling to buildings, their trim and fittings and construction purposes.

Key processes in this SPERC may include: Mixing and transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities. Roller application or brushing, spraying (non-industrial), extrusion from a cartridge, dipping and pouring of articles. Equipment cleaning of brushes, rollers, buckets, etc. with solvents (organic or water) is included as part of the operation.

3 Emission relevance of operational conditions

The widespread use scenarios combines the uses of adhesives and sealants and construction chemical products by professionals and the general public, because both occur more or less continuously and are equally distributed within a region for which an exposure assessment is performed. In addition, the options for technical emission control are limited especially for DIY applications.

The widespread use of adhesives and sealants, as for this background document, is mainly described by three processes and subsequent disposals:

- a) transfer of product into a vessel. In case of more-component mixtures or cementitious products the components are mixed and/or diluted with a solvent (generally water) to get the ready to use product. One-component products are delivered ready to use. Very little exposure is expected during this phase.
- (b) the product is applied by brushing, rolling, non-industrial spraying, extrusion from a cartridge, dipping and pouring. Nearly total emission of volatile ingredients during and after use is expected
- (c) equipment cleaning with some emissions of volatile and non-volatile ingredients and
- (d) disposal of off- spec material.

Table 1 displays the process steps that potentially lead to emissions to the environment originating from the use of adhesives/sealants and construction chemical products. Main emissions to the air are expected to come from Volatile Organic Compounds (VOCs) such as solvents. The only origin of releases to water are cleaning operations. Equipment cleaning is producing some emission of volatile

and non-volatile substances as the entire product is rinsed-off the equipment. Some product residues will remain that are disposed-off as solid waste.

Table 1: Overview of the processing steps involved in widespread use of adhesives/sealants and construction chemical products, and their relevance with regard to the emission estimation and derivation of release factors.

Processing Step		Adhesives / sealants and construction chemical products – outdoor		Adhesives / sealants and construction chemical products – indoor	
		non-volatiles	volatiles	non-volatiles	volatiles
FEICA SPERC		FEICA / EFCC SPERC 8f.1a.v2	FEICA / EFCC SPERC 8d.1a.v2	FEICA SPERC 8c.3.v3 EFCC SPERC 8c.1a.v2	FEICA SPERC 8a.3.v3 EFCC SPERC 8a.1a.v2
a	Transfer and mixing	Transferring and mixing steps may be relevant depending on the type of product, no to little emissions are accounted for in release factors.			
b	Use	Dust losses to air during mixing operations accounted for in release factor.	Nearly total losses of volatile chemicals during use accounted for in release factor.	Dust losses to air during mixing operations accounted for in release factor.	Nearly total losses of volatile chemicals during use accounted for in release factor.
c	Equipment cleaning	Equipment cleaning, landfill. accounted for in release factor	Emissions predominantly to air. - accounted for in release factor.	Cleaning with water emissions to water, or dry cleaning to landfill. accounted for in release factor.	Emissions predominantly to air. - accounted for in release factor
		Cleaning with water as generally assumed for DIY applications and considered in analogy worst case for professional uses, emissions to water – or dry cleaning (for cementitious products before water is added), emissions to landfill - accounted for in release factor.			
d	Direct disposal of empty containers	Residues and empty containers disposed of as solid waste – little emissions to the environment (not considered in the SPERC)			

4 Application of risk reduction measures

Due to the application, i.e. widespread use, risk reduction measures are neither necessary nor possible.

5 SPERC Information sources and justification

Two relevant Emission Scenario Documents (ESD) were published by the Organization for Economic Cooperation and Development (OECD) on the industrial use of adhesives (OECD, 2013) and on the use of adhesives (OECD, 2015). These documents provide detailed descriptions of the use processes for adhesives and sealants, but they do not contain release factors. Consequently, the OECD ESD on paints and coatings (OECD 2009) was used as a source for the release factors. The derivation of the release factors for adhesives and sealants from these information sources is described in Tolls *et al.* (2016) (see also chapter 9).

A search of the open literature from 1999 to 2014 with the key words “estimation, emission, and chemical” did not yield references relevant to emissions of substances from using adhesives or sealants.

5.1 Justification of use rates

The rates of adhesives/sealants use and of construction chemical products by consumers and professionals are collectively addressed as use rates for wide spread uses. For adhesives and sealants they were obtained from data collected in the confidential FEICA report ‘The European Adhesive and Sealant Market’. For construction chemical products the German branch of construction chemical products (“Deutsche Bauchemie”) conducted a thorough market investigation between their members and extrapolated the data to the European market by market shares.

The following steps were taken in deriving the use rates for industrial and widespread uses:

- 1) Widespread use is the sum of professional and consumer use. Hence, the use figures for construction and for Do-It-Yourself applications were summed up.
- 2) A distinction is made between water-borne and solvent-borne/reactive products. To that end, the ‘Polymer dispersions and emulsions’ among the adhesives and as the ‘Acrylics’ among the sealants were identified as the water-borne adhesives and sealants, respectively. The amount of solvent-borne/reactive water-borne products was calculated as the sum of all product categories minus the ‘Polymer dispersions and emulsions’ or minus ‘Acrylics’, for adhesives and sealants, respectively.
- 3) The data for the EU are the sum of the data for Western Europe plus Eastern Europe (for FEICA only)
- 4) The data from Western Europe were taken as is (for FEICA only).
- 5) The data for Eastern Europe were calculated as the CEE data (in the report) minus Russia and Turkey (for FEICA only).

The resulting use rates amount to 600,000 tons/year and 640,000 tons/year of water-borne and solvent-borne/reactive adhesive and sealants being used in wide dispersive use, i.e. taking together the professional and consumer use. The total tonnage of construction chemical products sums up to 6,900,000 tonnes per year. The individual tonnages per ingredient category represents the 90th percentile of the typical range of the respecting ingredient type and therefore summing up well above 100% of the total tonnage. They can, therefore, be used as indicative use rates of individual tonnage considerations.

5.2 Justification of days emitting

The justification of the emission days is a reasonable worse case assumption for widespread use, operating at 365 days a year.

5.3 Justification of release factors

The release factors for the general public and the professional use of adhesive and sealants as well as for construction chemical products were taken in analogy to the releases from coatings and paints (OECD 2009). The rationale is given by their similar use pattern and product behaviour during mixing, application and drying/curing. Hence, the corresponding release factors are specified for the processing steps rolling and brushing (with direct losses due to evaporation), brush and roll cleaning,

and, finally, potential can residues. The worst-case release factors for the SPERC for solvents are 98% to air and 1.5% to water. These emissions originate from evaporation of solvent during and after paint rolling and brushing and from equipment cleaning. The release factor for the SPERC for non-volatiles is 0%. Equipment cleaning results in a worst-case release factor to water of 1.5% for both, volatile and non-volatile substances, respectively.

In total, especially in the professional use only a small fraction of the products end up in the waste stage. Any disposal leading to emissions is covered in the exposure assessment and is accounted for in the emission factor. However, during uses with the general public rather high residue values up to 25% are estimated. These are reported as fractions in the upper-range to waste (see table 2).

Table 2. Summary of release factors for the SPERCs for manufacturing of adhesives/sealants and construction chemical products.

Release factors	Adhesives / sealants and construction chemical products – outdoor		Adhesives / sealants and construction chemical products – indoor	
	non-volatiles	volatiles	non-volatiles	volatiles
	FEICA / EFCC SPERC 8f.1a.v2	FEICA / EFCC SPERC 8d.1a.v2	FEICA SPERC 8c.3.v3 EFCC SPERC 8c.1a.v2	FEICA SPERC 8a.3.v3 EFCC SPERC 8a.1a.v2
To air	0%	98%	0%	98%
To water	1.5%	1.5%	1.5%	1.5%
To soil	0%	0%	0%	0%
To waste	4-25%	2-6%	4-25%	2-6%

5.4 Justification of Risk Management Measures

Due to the application as indoor and outdoor widespread uses for professional as well as DIY applications risk management measures are not foreseen on this generic level.

6 Conservatism

The conservatism in the emission estimation of the SPERCs for the widespread use of adhesives/sealants and construction chemical products is warranted by assuming worst cases in both, the release factors and the use rates. The conservatism in the use rates is detailed in section 5.1.

The conservatism in the release rates is rooted in the worst-case selection of values of release factors reported for different related processes (DIY and professional), which have been selected in the read-across process (Tolls *et al.*, 2016).

The substance use rates are based on the 90th percentile of the typical use concentrations per category tonnage and therefore they indicate worst case use rates that sum up to well above 100%

of the respective product category tonnage. In this regard, they are indicative and may be iterated further once more detailed information on the substance tonnage for widespread uses is available (cf. Annex 1 and 2).

7 Applicability of SPERCs

7.1 Tiered assessment

Due to the characteristics described above, we consider the adhesives/sealants and construction chemical products SPERCs to be suitable for use in standardized, lower tier REACH assessments of the vast majority of their ingredient substances. Their envisaged use is for risk assessors to distinguish trivial substances and emission situations from problematic ones based on standardized emission estimates. Based on this distinction, efforts can be focused on further (higher tier) assessments and refinement of problematic issues.

7.2 Regional assessment

In view that there is a relatively homogenous regional distribution of the use of adhesives/sealants and construction chemical products, SPERCs may be applicable for emission estimation of the widespread use of adhesives / sealants and construction chemical products not only in the EU but also in other regions.

8 References

Best available techniques Reference document (BREF) 2013. Schorcht F., Kourti I., Scalet B-M, Roudier S., Sancho L-D., Best Available Techniques Reference Document for the Production of Cement, Lime and Magnesium Oxide - Industrial Emissions Directive 2010/75/EU (Integrated Pollution Prevention and Control) - <http://eippcb.jrc.ec.europa.eu>

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9 Annex

9.1 Annex 1:

Indicative use rates (M_{SPERC}) of adhesives and sealants and its main ingredients within its product categories. Percentages resulted from FEICA expert poll and evaluation in 2014 (Tolls *et al.*, 2015).

Product type	Ingredient type	Consensus Range	Indicative Value	Indicative use rate (M_{SPERC}) of Adhesive and Sealants in Europe for wide spread uses
		Typical range ^a	Indicative value ^b	(tons/y)
Overall Tonnage Adhesives and Sealants (widespread use)^c				1,240,000
solvent-borne / solvent-less adhesives/sealants	Overall			640,000
	Solvent / Volatile	40-90	<u>80</u>	512,000
	Binders/Fillers: Inorganic or polymeric*	20-60	<u>50</u>	320,000
	Reactive Resins*	20-60	<u>50</u>	320,000
	Fillers: Non-polymeric **	5 – 30	<u>25</u>	160,000
	Pigments***	<1	<u>1</u>	6,000
	Solvent / Volatile	<1	<u>1</u>	6,000
water-borne adhesives/sealants	Overall			600,000
	Water	20-60	30	Not relevant
	Solvent / Volatile / Emulsifier	5 – 10	10	60,000
	Binders/Fillers: Inorganic or polymeric*	20-60	50	300,000
	Reactive Resins*	20-50	40	240,000
	Fillers: Organic, non-polymeric **	5 – 10	10	60,000

Pigments ***	<1	1	6,000
Catalysts	<0.5	0.5	3,000
Preservatives	<0.3	0.3	2,000

Footnote a: The range covers more than 98% of the products in the market (according to the total volume)

Footnote b: The indicative value covers more than 90% of the products in the market (according to the total volume)

Footnote c: Addressed uses by professional (craftsmen) and consumers (DIY). Overall data on rate of manufacturing and use of adhesive and sealant from ChemResearch (2013).

9.2 Annex 2:

Indicative use rates (M_{SPERC}) of construction chemical products and its main ingredients within its product categories. Percentages for construction chemical products resulted from expert poll and evaluation in 2017 (EFCC, pers. comm).

Construction Chemicals Product category	Ingredient types	Concentration of ingredient type (%)		Indicative use rate (M_{SPERC}) of construction chemical products in Europe for wide spread uses
		Typical range ^a	Indicative value ^b	(tons/y)
Overall Tonnage Construction Chemical Products (wide spread use)				6,900,000
Construction chemical products based on reactive epoxy resins (e.g. products for surface protection of concrete, products for concrete injection, waterproofing, floor screeds, flooring, functional coatings, adhesives for tiles)	Overall			150,000
	Binder	10 - 80	35	53,000
	Hardener	5 - 80	20	30,000
	Filler	0 - 80	50	75,000
	Pigments	0 - 15	7	11,000
	Diluents	0 - 15	9	14,000
	Additives	0 - 10	3	4,500
Construction chemical products based on reactive polyurethane resins (e.g. products for surface protection of concrete, products for concrete injection, waterproofing, floor screeds, flooring, functional coatings, adhesives for tiles)	Overall			70,000
	Binder	5 - 80	30	21,000
	Hardener	8 - 50	30	21,000
	Filler	0 - 80	60	42,000
	Pigments	0 - 10	7	4,900
	Diluents	0 - 40	20	14,000
	Additives	0 - 5	2	1,400

Table 9.2 (cont.)

Construction Chemicals Product category	Ingredient types	Concentration of ingredient type (%)		Indicative use rate (M _{SPERC}) of construction chemical products in Europe for wide spread uses
		typical range ^a	typical range ^a	(tons/y)
<u>Construction chemical products based on other reactive resins</u> (e.g. products for surface protection of concrete, primers, bonding agents, waterproofing, floor screeds, flooring, functional coatings, adhesives for tiles)	Overall			45,000
	Binder	10-30	25	11,000
	Hardener	1-5	4	1,800
	Filler	0 - 70	50	23,000
	Pigments	0-5	4	1,800
	Diluents	0 - 10	7	3,200
Additives	0 - 10	5	2,300	
<u>Cementitious product</u> products (e.g. Modified mineral mortars, concrete repair products, tile adhesives, cementitious screeds, floor levelling compounds, grouts, waterproofing slurries)	Overall			5,000,000
	Cement	2 - 90	40	2,000,000
	inorganic binders	0 - 90	60	3,000,000
	Filler / aggregates	5 - 90	70	3,500,000
	Pigments	0 - 10	4	200,000
	Additives	0 -30	3	150,000
<u>Construction chemical products based on polymerdispersions</u> (e.g. products for surface protection of concrete, products for concrete injection, waterproofing, floor screeds, flooring, functional coatings, adhesives for tiles)	Overall			10,000
	Polymerdispersion	5 - 100	40	4,000
	Filler	0 - 90	50	5,000
	Pigment	0 - 40	25	2,500
	Additives	0 - 15	7	700
<u>Water-borne bituminous products</u> (e.g. polymer-modified bituminous thick coatings)	Overall			300,000
	Bitumen Emulsion	30 - 90	60	180,000
	Filler	0 - 40	25	75,000
	EPS	0 - 5	2	6,000
	Polymerdispersion	0 - 30	20	60,000
	Additive	0 - 5	3	9,000
<u>solvent-borne bituminous products</u>	Overall			13,000
	Bitumen	30 - 90	70	9,100
	Organic solvents	0 - 70	25	3,300
	Filler	0 - 50	25	3,300

	Additives	0 - 5	3	390
Table 9.2 (cont.)				
Construction Chemicals Product category	Ingredient types	Concentration of ingredient type (%)		Indicative use rate (M _{SPERC}) of construction chemical products in Europe for wide spread uses
		typical range ^a	typical range ^a	(tons/y)
<u>Concrete release agents</u>	Overall			82,200
	Oils	90 - 100	95	78,000
	Additives	0 - 10	8	6,600
<u>Concrete Admixtures</u>	Overall			1,200,000
	active agent	5 - 50	40	480,000
	water	50 - 95	90	1,100,000

Footnote a: The range covers more than 98% of the products in the market (according to the total volume)

Footnote b: The indicative value covers more than 90% of the products in the market (according to the total volume)

9.3 Annex 3:

Summary of the release factors for the emission from the general public and professional use of decorative paints compiled from the OECD ESD (OECD 2009). The values in bold specify the worst-case values that are used for the FEICA/EFCC SPERC derivation of release factors

Overview of release factors for volatiles and non-volatiles from OECD 2009 on pages 134-135

	Air [%]		Water [%]		Soil [%]		Disposal [%]	
	volatile	non-volatile	volatile	non-volatile	volatile	non-volatile	volatile	non-volatile
Emissions estimates for general public use of decorative paints	93	0	1.0^a	1.5^a	0	0	6	25
Emissions estimates for professional use of decorative paints	98	0	0	0	0	0	2	4
Worst case assigned to FEICA/EFCC SPERCs	98	0	1.5^b	1.5	0	0	0-6	0-25

Footnote ^a emissions result from brush residues (no direct losses are expected)

Footnote ^b original value (1%) assumes some solvent evaporation. However, because the emission scenario of the widespread SPERCs cover both, water borne and solvent borne products, an emission of 1.5% (as for non-volatile substances) will be assumed as a conservative estimate.

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