Specific Environmental Release Categories (SPERCs) for the application of liquid and powder coatings and inks

Background Document

CEPE

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General Disclaimer

SPERCs are specific environmental release categories and are meant to specify broad emission scenario information (ERCs) as suggested for the use of substances throughout their life cycles (Reihlen et al., 2016). Although specific, SPERCs still reflect emissions of a broad application area of a substance within an industry sector. For their purpose, SPERCs are conservative and, therefore, their emission estimates are not intended to reflect all regulatory requirements that may relate to environmental emissions.

1 Purpose of the document

This document provides background information to the CEPE SPERC factsheets for the application of liquid and powder coatings and inks. The REACH Guidance on Information Requirements and Chemical Safety Assessment, Chapters R12: Use description and R.16: Environmental exposure assessment, introduce Environmental Release Categories (ERC) as conditions for initial tier assessment. These provide default generic emission scenarios and define emission factors for certain processes. SPERCs are refined emission estimates compared to ERCs.

The ECHA Guidance provides one set of release factors each for the industrial use of a substance. This document focusses on:

- Industrial use of processing aids in processes and products, not becoming part of articles (ERC4);
- Industrial use resulting in inclusion into or onto a matrix (ERC5);
- Wide dispersive indoor use of processing aids in open systems (ERC 8a);
- Wide dispersive indoor use resulting in inclusion into or onto a matrix (ERC8c);
- Wide dispersive outdoor use of processing aids in open systems (ERC8d);
- Wide dispersive outdoor use resulting in inclusion into or onto a matrix (ERC8f).

As processes that have integrated risk management measures with impacts on the fate of volatile and non-volatile compounds, the CEPE SPERCs refer to ERCs 4, 5, 8a, 8c, 8d, 8f. Thus, specific information is provided on exposure relevant operational conditions/risk management measures for product formulation/manufacture and application (Ch. 3), on the application of risk management measures, including non-obligatory ones (Ch. 4), on the information sources on the derivation method and justification of release factors, days emitting and indicative use rates (Ch.5).

The SPERC Factsheets covered by this document, which comprise a number of (sub-)SPERCs are:

CEPE SPERC Code	Type of ingredient	Application area
CEPE SPERC 4.1a.v2	volatile ingredients	Application - industrial - spraying - indoor use - incineration
CEPE SPERC 4.1b.v2	volatile ingredients	Application - industrial - spraying - indoor use
CEPE SPERC 5.1a.v2	non-volatile ingredients	Application - industrial - spraying - indoor use – non-volatiles
CEPE SPERC 5.2a.v2	non-volatile ingredients	Application - industrial - spraying - indoor use - powder
CEPE SPERC 4.2a.v2	volatile ingredients	Application - industrial – non-spray - indoor use - incineration
CEPE SPERC 4.2b.v2	volatile ingredients	Application - industrial -non-spray - indoor use
CEPE SPERC 5.3a.v2	non-volatile ingredients	Application - industrial - non-spray - indoor use
CEPE SPERC 5.4a.v2	non-volatile ingredients	Application - industrial - non-spray - indoor use – powder
CEPE SpERC 8a.1a.v2	volatile ingredients	Application – consumer bush/roller - indoor use
CEPE SpERC 8c.1a.v2	non-volatile ingredients	Application - consumer - bush/roller - indoor use
CEPE SpERC 8d.1a.v2	volatile ingredients	Application - consumer - bush/roller - outdoor use
CEPE SpERC 8f.1a.v2	non-volatile ingredients	Application - consumer - bush/roller - outdoor use
CEPE SpERC 8a.2a.v2	volatile ingredients	Application - professional - brush/roller - indoor use

CEPE SpERC 8c.2a.v2	non-volatile ingredients	Application - professional - brush/roller - indoor use
CEPE SpERC 8d.2a.v2	volatile ingredients	Application - professional - brush/roller - outdoor use
CEPE SpERC 8f.2a.v2	non-volatile ingredients	Application - professional - brush/roller - outdoor use
CEPE SpERC 8a.3a.v2	volatile ingredients	Application - professional - spraying - indoor use
CEPE SpERC 8c.3a.v2	non-volatile ingredients	Application - professional - spraying - indoor use
CEPE SpERC 8d.3a.v2	volatile ingredients	Application - professional - spraying - outdoor use
CEPE SpERC 8f.3a.v2	non-volatile ingredients	Application - professional - spraying - outdoor use

2 Scope

The SPERCs in this area are valid for refinement of release factors for substances used in an industrial, professional or consumer setting in applying coatings, comprising solvent-borne, water-borne, liquid solvent-free and powder paints, coatings and printing inks.

Short title:
Use at industrial sites; various (SU 7, 11, 12, 15, 16, 17, 18, 19)
Use by professional workers; various products (PC 9a, 9b, 18)
Consumer use; various products (PC 9a, 9b, 18)

This document does not include the industrial use of coatings in installations with wet scrubbers for collection of overspray. A separate SPERC Background document and factsheet is available from ACEA [https://www.acea.be/publications/article/reach-extended-safety-data-sheets].

A separate Background Document[1] is available for the formulation of coatings (ERC2).

2.1 Uses of coatings - General

Decorative coatings (sometimes referred to as architectural coatings) are those applied to buildings and associated structures for decoration and protection. The sector is split into the following main categories:

- DIY Paints - these are the coatings found in shops and superstores for application by homeowners etc.
- Trade Paints - coatings that are supplied to the professional decorating sector and companies that carry out new build or refurbishment of buildings, not generally available to the general public
- Woodcare - term used to cover a wide range of products that decorate and protect wooden substrates. These include, for example, fence and shed paints, decking paints and varnishes, floor varnishes and wood stains
- Special effect paints and specialist finishes - a range of coatings that provide two-tone effects and special aesthetic finishes often requiring special application techniques.

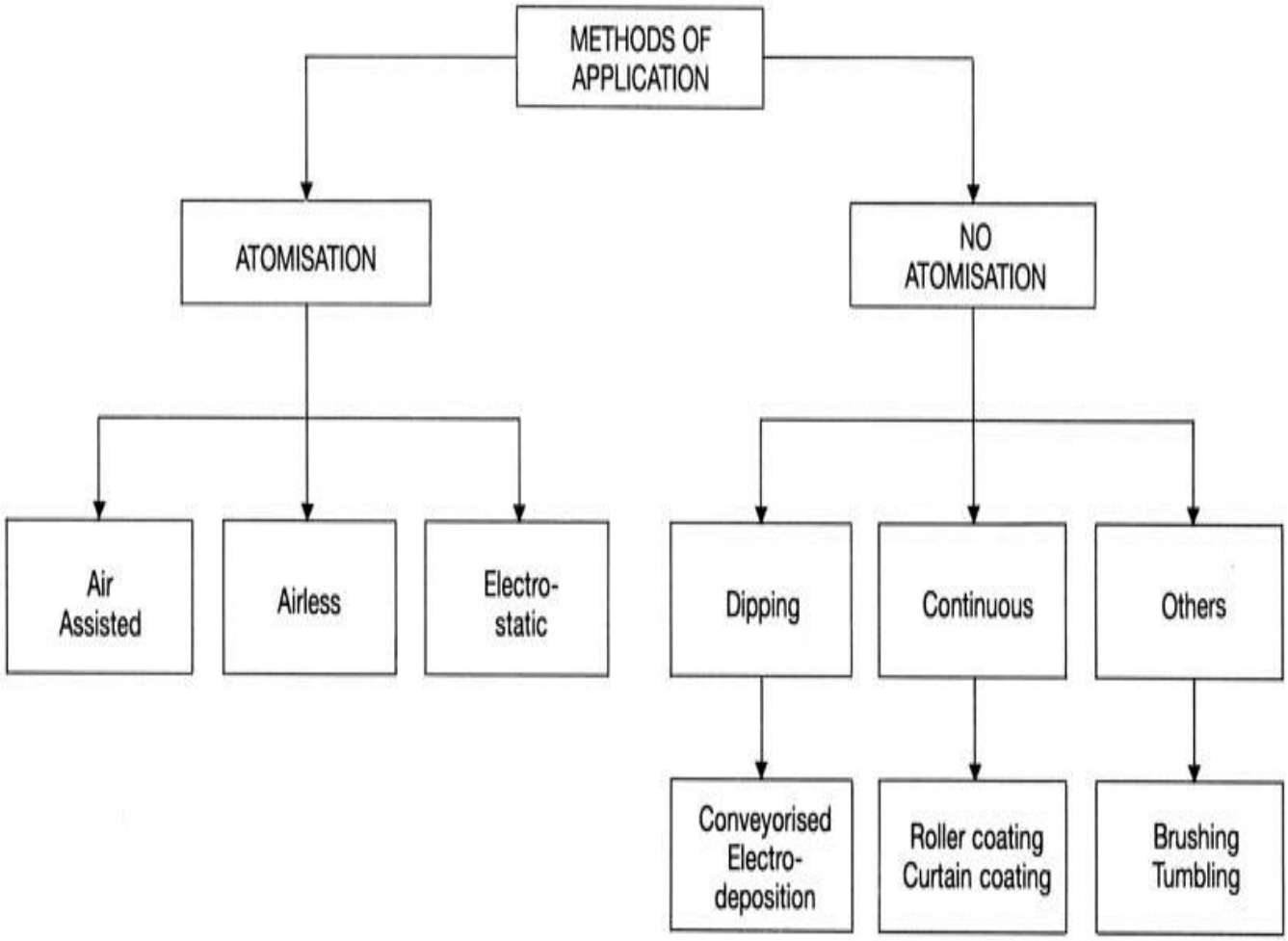
Industrial coatings are paints or coatings defined by their protective, rather than aesthetic properties, although they can provide both. The most common use of industrial coatings is for corrosion control of steel or concrete. Industrial coatings cover a very large range of diverse uses for coatings with many differing requirements and functions, for example: Aircraft and aerospace coatings; Automotive and Vehicle Refinishes; Can coatings; Coatings for plastics; Coil coatings; General Industrial coatings; High Performance coatings; Intumescent Coatings; Marine coatings; and Wood Finishes.

Printing inks are applied at industrial sites by several different processes such as flexography, gravure, offset, screen, letterpress and roller coating. Digital inks and toners are applied by non-impact methods such as ink-jet and xerography. Depending on the process, inks can be solvent-borne, water-borne, oleo-

[1] CEPE Background Document on SpERCs for the formulation of liquid and powder coatings, 2019

resinous or energy-curing (UV or electron beam) mixtures. The main uses of printing inks are for packaging and publications with other uses such as screen and textile printing.

2.2 Application technologies



2.2.1 Spray application

Spray coatings are used, when complex three-dimensional objects need to be coated with a protective, functional or decorative layer and when other coating technologies (e.g. pre-coated substrates, rolling, brushing, powder coatings, adhesive films) are not suitable for technical or economic reasons.

2.2.1.1 Industrial spraying application

Spraying of coatings at industrial sites may occur manually or automatically, by means of spray-guns or high-rotation bells, with or without support of pressurized air, with or without electrostatic charging, continuously or discontinuously.

Due to limited transfer efficiency of spraying techniques, a part (10 to 70 %) of the constituents is not deposited on objects, but forms so-called overspray. Per coating job, transfer efficiency may range between 30 and 90 % depending on geometrical and electrostatic substrate properties, atomization technology and desired effect formation.

Retention of overspray by process-integrated risk management measures is standard. This is achieved by either dry filtering systems, dry precipitation systems or by wet scrubbers. Techniques other than the use of a wet scrubber do not have the potential transfer to a waste water stream.

2.2.1.2 Spraying powder coatings

Powder coatings are typically fed as a powder/air mixture from a feed hopper to the spray gun, which imparts an electrostatic charge on each powder particle by the application of a high voltage. The charged powder particles are attracted to the earthed workpiece to be coated and are deposited onto any conductive object within the spray area. However, some of the particles do not deposit on the workpiece and the so-called overspray is recovered to the feed hopper for re-use, which can result in recovery efficiencies of up to 99%. The coated workpiece is then conveyed to the curing oven.

Another method of charging in some spray gun designs is Tribo Charging. Tribo Charging does not use high voltage, but instead uses the principal of high velocity friction to give the powder particles a static charge.

2.2.1.3 Non-industrial spraying application

There are very limited activities involving professional and consumer spraying...

2.2.2 Non-spray applications

Application by non-spray methods are very efficient for transferring product to the substrate.

2.2.2.1 Industrial non-spray application

There are some methods of application not dependent on atomisation and often referred to as “Non-spray ” methods. Non-spray methods are very efficient application techniques. These include:

- dipping, including electrodeposition
- roller coating in which a train of rollers conveys the paint from a feed duct or tray to the surface, which is to be coated. There may be a series of individual sheets or thin boards or a continuous metal strip
- curtain coating (or flood coating) in which flat sheets pass through a falling film or curtain of liquid paint
- most printing processes
- powder coatings applied by dipping into a fluidised bed of powder.

2.2.2.2 Non-industrial non-spray application

There are miscellaneous methods which include the use of paint brush and paint roller, which dominate the do-it-yourself and professional decorator field.

2.3 Emission relevance of operational conditions

2.3.1 Spraying

2.3.1.1 Industrial spraying application

Volatile compounds are considered to be released to air in the vast majority of cases. Abatement for oven exhaust air only captures between 5 and 30 % of releases. Abatement for spray booth exhaust air is rarely used. Transfer of volatiles to waste and transfer to water only have minor relevance.

All released volatile compounds are photochemically reactive and easily biodegradable, so there is no relevant impact on humans via environment, neither to soil or groundwater via deposition or precipitation.

Non-volatile compounds are retained from air by filters or scrubbers with high efficiency. Overspray collected on dryback filters and equipment washings will be sent to waste.

2.3.1.2 Non-industrial spraying application

There are very limited activities involving professional and consumer spraying...

2.3.1.3 Industrial powder coatings spraying application

Oversprayed powder is collected by a reclaim system which separates the air from the powder. The most common primary filter methods are: filter belts, bag filters, cartridge filters, cyclones. There are no volatile components and minor emissions to air, of non-volatile materials, after filtration.

Emission to soil is not expected.

Due to reclamation of overspray, there is limited emission as waste.

2.3.2 Non-spray application

2.3.2.1 Industrial non-spray application

Volatile compounds are considered to be released to air in the vast majority of cases. Abatement for oven exhaust air only captures between 5 and 30 % of releases. Abatement has a high efficiency c.99%. Transfer to waste and transfer to water only have minor relevance.

All released volatile compounds are photochemically reactive and easily biodegradable, so there is no relevant impact on humans via environment, neither to soil or groundwater via deposition or precipitation.

Non-volatile compounds are retained from air by filters or scrubbers with high efficiency. Equipment washings will be sent to waste.

Emission to soil is not expected.

Other techniques may lead to a release of paint compounds to water (e.g. via ultrafiltrate dumping from electrocoat installations or from wet sanding).

2.3.2.2 Non-industrial non-spray application

In non-industrial application e.g. by brush/roller, almost all of the volatile compounds are considered to be released to air. Non-volatile components are not emitted to air. A small amount of volatile and non-volatile component will be lost in washing in domestic sinks, discharged, via the public sewer, to municipal sewage treatment plant. There is no release to soil. Unused paint may be re-used, recycled or discharged as municipal waste.

2.3.2.3 Industrial powder coatings non-spray application

Powder released during the fluidized bed process is collected by a reclaim system. The most common primary filter methods are: filter belts, bag filters, cartridge filters, cyclones. There are no volatile components and minor emissions to air, of non-volatile materials, after filtration.

Emission to soil is not expected.

Due to efficiency of application, there is limited emission as waste.

2.4 Application of risk reduction measures

2.4.1 Risk reduction measures - spraying

Volatile compounds are released from coatings in spray-booths, flash-off zone and drying ovens. For larger users, final release to environmental air depends on the required abatement to comply with the Industrial Emissions Directive 2010/75/EC and its national or local implementation (controls on VOC contents of coatings in the VOC Paint Directive reduce emissions for vehicle refinish products). Best practice is given in the Best Available techniques reference document (BREF) on Surface Treatment Using Solvents (2007).

Abatement is not considered as an obligatory RMM in this SPERC, as in practice the range of site specific requirements varies between no abatement and full abatement of exhaust air from spray-booths and ovens in larger users.

Industrial spraying

	Air	***Wastewater***	***Soil***	***Waste***
	Typical Efficiency			
CEPE SPERC 4.1a.v2: Thermal oxidiser (incinerator)	99%	Municipal STP	None expected from indoor processes	
CEPE SPERC 4.1b.v2 and	95%			
CEPE SPERC 5.1a.v2: Wet scrubber or filtration	95%			Waste from spray-booth filters disposed of under national waste regulations
CEPE SPERC 5.2a.v2: Cyclone and/or filter	95%			

Non-industrial spraying

	Air	***Wastewater***	***Soil***	***Waste***
CEPE SPERC 8a.3a.v2 and CEPE SPERC 8c.3a.v2: Indoor	None – for a coating film to form, the volatile phase of organic solvent-borne and water-borne coatings must evaporate into the atmosphere. The solid phase is not emitted to air.	Not applicable	None expected from indoor processes	
CEPE SPERC 8d.3a.v2 and CEPE SPERC 8f.3a.v2: Outdoor	None – for a coating film to form, the volatile phase of organic solvent-borne and water-borne coatings must evaporate into the atmosphere. The solid phase is not emitted to air.	Not applicable	where practicable, physical methods, such as impervious sheeting	Waste disposed of under national waste regulations

2.4.2 Risk reduction measures – non-spraying

Industrial non-spray application

	Air Typical Efficiency	***Wastewater***	***Soil***	***Waste***
CEPE SPERC 4.2a.v2 Application - industrial – non-spray - indoor use - incineration - volatiles	99%		None expected from indoor processes	
CEPE SPERC 4.2b.v2 Application - industrial – non-spray - indoor use - volatiles	None – for a coating film to form, the volatile phase of organic solvent-borne and water-borne coatings must evaporate into the atmosphere. The solid phase is not emitted to air.	Municipal STP		
CEPE SPERC 5.3.v2 Application - industrial - non-spray - indoor use – non-volatiles	95%			Waste disposed of under national waste regulations
CEPE SPERC 5.4.v2 Application - industrial - Non-spray - indoor use – powder	95%			Waste disposed of under national waste regulations

Volatile compounds are released from coatings during application, flash-off and drying. Final release to environmental air depends on the required abatement to comply with the Industrial Emissions Directive 2010/75/EC and its national or local implementation. Best practice is given in the Best Available techniques reference document (BREF) on Surface Treatment Using Solvents (2007).

Abatement is not considered as an obligatory RMM in this SPERC. Notwithstanding this, many industrial low-energy applications such as coil coating, use abatement equipment to capture and treat volatile emissions.

Consumer brush/roller application

	Air	***Wastewater***	***Soil***	***Waste***
CEPE SPERC 8a.1a.v2 Application - consumer - brush/roller - indoor use - volatiles	For a coating film to form, the volatile phase of organic solvent borne and water borne coatings must evaporate into the atmosphere.	Application equipment can be washed in domestic sinks discharged to municipal STP	None expected from indoor processes	
CEPE SPERC 8c.1a.v2 Application - consumer - brush/roller - indoor use – non-volatiles	None – for a coating film to form, the volatile phase of organic solvent-borne and water-borne coatings must evaporate into the atmosphere. The non-volatile phase is not emitted to air.	Application equipment can be washed in domestic sinks discharged to municipal STP	None expected from indoor processes	Waste disposed of under national waste regulations
CEPE SPERC 8d.1a.v2 Application - consumer - brush/roller - outdoor use - volatiles	For a coating film to form, the volatile phase of organic solvent borne and water borne coatings must evaporate into the atmosphere.	Application equipment can be washed in domestic sinks discharged to municipal STP		
CEPE SPERC 8f.1a.v2 Application - consumer - brush/roller - outdoor use – non-volatiles	None – for a coating film to form, the volatile phase of organic solvent-borne and water-borne coatings must evaporate into the atmosphere. The non-volatile phase is not emitted to air.	Application equipment can be washed in domestic sinks discharged to municipal STP	Where practicable, physical methods, such as impervious sheeting	Waste disposed of under national waste regulations

Volatile compounds are released from coatings during application, flash-off and drying. Final release to environmental air depends on the compliant coating VOC limit to comply with the Paints Directive 2004/42/EC (Directive 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 its national or local implementation.

On-pack information gives advice to avoid release to water or uncontrolled waste stream.

Professional brush/roller application

	Air	***Wastewater***	***Soil***	***Waste***
CEPE SPERC 8a.2a.v2 Application - professional - brush/roller - indoor use - volatiles	For a coating film to form, the volatile phase of organic solvent borne and water borne coatings must evaporate into the atmosphere.	Professionals not expected to wash application equipment domestic sinks	None expected from indoor processes	
CEPE SPERC 8c.2a.v2 Application - professional - brush/roller - indoor use – non-volatiles	None – for a coating film to form, the volatile phase of organic solvent-borne and water-borne coatings must evaporate into the atmosphere. The non-volatile phase is not emitted to air.	Professionals not expected to wash application equipment domestic sinks	None expected from indoor processes	Waste disposed of under national waste regulations
CEPE SPERC 8d.2a.v2 Application - professional - brush/roller - outdoor use - volatiles	For a coating film to form, the volatile phase of organic solvent borne and water borne coatings must evaporate into the atmosphere.	Professionals not expected to wash application equipment domestic sinks		
CEPE SPERC 8f.2a.v2 Application - professional - brush/roller - outdoor use – non-volatile	None – for a coating film to form, the volatile phase of organic solvent-borne and water-borne coatings must evaporate into the atmosphere. The non-volatile phase is not emitted to air.	Professionals not expected to wash application equipment domestic sinks	Where practicable, physical methods, such as impervious sheeting	Waste disposed of under national waste regulations

Volatile compounds are released from coatings during application, flash-off and drying. Final release to environmental air depends on the compliant coating VOC limit to comply with the Paints Directive 2004/42/EC (Directive 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 its national or local implementation.

Training and on-pack information aims to avoid release to water or uncontrolled waste stream.

2.5 Application of coatings: Ingredients and product types

2.5.1 Liquid coatings and inks

Liquid coatings comprise solvent-borne coatings (5 to 85 % non-volatile content), water-borne coatings (5 to 60 % non-volatile content including between 5 and 20 % organic solvents), oleo-resinous coatings (100% non-volatile content) or solvent-free liquid coatings such as UV curing materials volatiles (close to 100 % non-volatile content).

Coatings contain solvents and other volatile organic compounds as processing aids which do not become part of coated objects. Coatings also contain liquid and solid compounds which are meant to form a durable solid coating (polymer matrix) on objects.

The major constituents of coatings are binders, activators, pigments, extenders, and solvents including water. In addition, additives such as catalysts, initiators, UV absorbers, neutralizing compounds and sagging control agents are used as typical minor ingredients.

2.5.2 Powder coatings

Powder coatings may be described as 100% solid paint which comprises a homogeneous blend of polymers, pigments and additives produced in the form of a fine powder. The powder is applied, most commonly, by means of a spray gun that imparts an electrical charge on the powder particles and directs them towards the object to be coated. The object is then subjected to heat which causes the powder to melt and flow out to form a tough, coherent film.

There are three categories of coating powder:

- Thermoset coatings: typically particle sizes are in the range 30 - 50 micrometres
- Thermoplastic toners: commonly most particle sizes are in the range 5 – 20 micrometres
- Thermoplastic coatings: for electrostatic grade many particles are around 100 microns and for fluidised bed grades they are significantly larger.

Some powders (especially some thermoplastic powders) have mostly large particles and have no potential to emit particulate matter to the air.

Thermosetting powder coatings are available in various chemistries: epoxy, polyester, epoxy/polyester (hybrid), polyurethane and acrylic. These undergo a chemical change when heated and will not re-melt to a plastic state once cured.

Thermoplastic powder coating chemistries include nylon, polyolefins, polyvinylidene fluoride, polyamides, polyvinyl chloride and polyester.

3 SPERC information Sources

The OECD Emission Scenario Document (ESD) for coatings contains a number of assumptions on release factors. In context with this SPERC, whilst the coating ESD focuses on emissions to air, figures for substance release to water (and soil) are also included. The ESD has been supplemented by industry knowledge.

4 Justification of release factors

Release factors for Formulation of water- and solvent-borne coatings and inks are given in "EMISSION SCENARIO DOCUMENT ON COATINGS INDUSTRY (PAINTS, LACQUERS AND VARNISHES)", OECD, July 2009. The release factors obtained from the OECD ESD on coatings and paints have been confirmed by expert sector knowledge.

5 Justification of use rates

Based on sector knowledge.

5.1 Justification of days emitting

Consumer: Widespread dispersive use, but individually DIY painting is carried out only for 6 days p.a. - based on CEPE study[2].

Industrial: Based on sector knowledge: typical industry situation – 5 working days per week, 45 weeks per year.

6 Applicability of SPERC

6.1 Conservatism

The conservatism in the emission estimation of the SPERCs is ensured by assuming a worst case release factors. The estimates are based on data from the OECD ESD on coatings and paints (OECD 2009b). This OECD ESD is based on two reference documents from 2000 and 2002. The latest information, which was included in the derivation of the release factors dates from 2003. Hence, the release factors used in the SPERCs for the application of coatings reflect technology that is more than ten years old.
Given the need for continuous efficiency gains in industrial processes and the concurrent technological advancement it is fair to assume that processes have become more efficient with consequent lower emissions to air, water, and waste. With regard to emissions of volatile substances, there have been significant improvements on low VOC products, which have often been adopted voluntarily or to meet industry green standards.

[2] A market survey study on DIY Paint Use Frequencies, CEPE, 2015

6.2 Tiered assessment

Due to this set of characteristics we consider the coating SPERCs 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, additional efforts can be focused on assessments of situations beyond the defined scope.

6.2 Regional assessment

This SPERC is meant for local sources.

7 References

OECD 2009b, OECD Environment, Health and Safety Publications Series on Emission Scenario Documents No. 22, EMISSION SCENARIO DOCUMENTS ON COATING INDUSTRY (Paints, Lacquers and Varnishes), Paris 2009.

European Commission, Reference document on Best available techniques on Surface treatment using organic solvents, (2007)