

Specific Environmental Release Categories (SPERCs) for the widespread use of household care and professional cleaning and hygiene products

Background Document

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1 Statement of purpose

To carry out an environmental exposure assessment, the quantification of the rates of substances released to the environment is key. While the ECHA Guidance R16 provides a generic set of release factors, they are less meaningful for several industry sectors, among them A.I.S.E., that have refined the Environmental Release Categories (ERCs) by detailed analysis of the sector specific typical operational conditions to build 'SPecific Environmental Release Categories' (SPERCs).

Thus, the A.I.S.E. SPERCs refine and specify emission scenario information (ERCs) for the use of substances throughout their life cycle (Reihlen et al., 2016) in the detergent and maintenance products industry.

The SPERCs described in this document are specific to the widespread use of household care and professional cleaning and hygiene products. These SPERCs refine the single set of generic release factors provided in ECHA Guidance document R16 Appendix A.16-1 for environmental release category (ERC) 8a (Widespread use of non-reactive processing aid (no inclusion into or onto article, indoor)) (ECHA 2016).

For each SPERC, specific information is given as regards the operational conditions of use relevant to environmental exposure (chapter 2 and 3), the risk management measures (chapter 4), as well as the derivation method and justification of release factors and indicative use rates (chapter 5). As outlined below, the SPERCs described in this document are conservative for use in lower tier REACH safety assessments (chapter 6).

This document provides the background information to three SPERC factsheets that refine ERC8a. The SPERC factsheets covered in this document are shown in Table 1.

Table 1: Factsheets covered in this document

AISE SPERC Code	Type of ingredient	Product characteristic
AISE SPERC 8a.1.a v3	Solid and Liquid substances	Widespread use in 'down the drain' laundry detergents, cleaning and maintenance products
AISE SPERC 8a.1.b v3	Non-volatile substances (Non-Propellants)	Widespread use in aerosol products for cleaning and maintenance (non-volatile)
AISE SPERC 8a.1.c v3	Volatile substances (incl. Propellants)	Widespread use of aerosol products for cleaning and maintenance products (volatile, incl. propellants)

2 Scope

2.1 Ingredients and product types

These SPERCs are intended to cover household care products and professional cleaning and hygiene products which fall within the AISE product portfolio; the categories covered and the SPERCs recommended as most relevant for the assessment of their exposure are shown in table 2. Products for professional cleaning are covered in this document. It is important to clarify that these are different to products in industrial application which are covered by the A.I.S.E. SPERC document covering ERC 4 on *Specific Environmental Release Categories (SPERCs) for the Industrial use of Water-borne Processing Aids*. The distinction between professional applications and industrial applications is based on various aspects. Generally, industrial application occurs in a supervised area and one site usually serves larger areas (no correlation with local infrastructure). More details to clarify this distinction, for both industrial cleaning and industrial laundry application, are delineated in the ERC 4 document.

Three SPERC scenarios have been used to cover the environmental release of substances within the portfolio. SPERC 8a.1.a is designed to cover products that are applied to aqueous solution directly from the package e.g. products used in laundry care, dishwashing or bleach. SPERCs 8a.1.b and 8a.1.c are designed to cover products that release substances to the air when used e.g. air fresheners, scented candles, surface cleaners applied by an aerosol can (including a propellant) or via pump spray. Note that these SPERCs do not cover substances intended for release, for example, the SPERCs would cover the substances used to fragrance an in-car air freshener, but not the absorbent material the fragrance is embedded in. For substances that react during application some considerations were made. In scented candles fragrance released to air when the candle is both lit and unlit. Substances released as a candle is lit are technically 'reacted' and assessment of the release of the initial substances to air before transformation using these SPERCs is highly conservative. This thought process also applies to chlorine-based bleach products whereby a significant proportion of the substances being assessed will immediately react upon application.

SPERCs 8a.1.b and 8a.1.c representing the aerosol products are separated to cover both, non-volatile substances (8a.1.b) that are expected to immediately deposit from the air, or volatile substances (including those used as propellants), that will remain in the air compartment (8a.1.c). Volatile substances are defined as those with a boiling point threshold of <250°C, substances with a boiling point of ≤250°C (WHO 1989, USEPA 2017). Generally, this will cover propellants, however is also applicable to other volatile substances. As shown in table 2, all three SPERCs might be appropriate for substances used in surface care products at different modes of delivery. Hence, the appropriate SPERC should be chosen based on the mode of delivery of the product and the volatility of the substance.

It should be noted that the detergents industry is highly regulated and detergent and maintenance products are subject to an array of regulatory requirements including the CLP No 1272/2008, Biocides No 528/2012, REACH No 1907/2006 and Detergents Regulation No 648/2004. These regulations restrict the use of certain ingredients in detergent and maintenance products. For ingredients used in widespread consumer products the Detergent Regulation enforces biodegradability of surfactants and limitations on the use of phosphates and other phosphorus compounds. REACH Annex XVII (29-30) restricts the use of substances with specific hazards (CARC 1A, 1B, MUT. 1A, 1B, REPROTOX. 1A, 1B) in use to the general public. Beyond complying with binding legislation, many cleaning products are subject to an additional voluntary sustainability assessment via the [A.I.S.E. Charter for Sustainable Cleaning](#). The Advanced Sustainability Profile (ASP) status under the A.I.S.E. Charter is achieved when

all ingredients of products' formulations are verified with the Environmental Safety Check (ESC), a conservative assessment scheme that projects environmental concentrations below the predicted no-effect concentration for aquatic toxicity.¹ This adds some context on the additional requirements in place beyond the SPERCs, to mitigate risk of the emissions coming from detergent and maintenance products.

Within the A.I.S.E. product categories there are a number of different ingredients, e.g. surfactants, fragrances, builders. Each factsheet has a different scope with regards to the products and ingredient types covered. The SPERCs provided here are not differentiated by the role of the ingredient in the formulation, because this will not impact their emission pattern. Therefore, all ingredients used in the products as identified in table 2 are considered within scope.

Table 2: AISE product portfolio categories and corresponding relevant SPERCs.

Category	AISE SPERC		
	8a.1.a v3 - Wide spread use in 'down the drain' laundry detergents, cleaning and maintenance products	8a.1.b v3 - Wide spread use in aerosol products for cleaning and maintenance (non-volatile)	8a.1.c v3 - Wide spread use of aerosol products for cleaning and maintenance products (volatile, incl. propellants)
Laundry care – Laundry detergents (powders, tabs, liquids), softeners and laundry aids.	✓		
Surface Care (incl. toilet care) – multi-purpose, bathroom, oven, kitchen, window/glass and floor cleaners, descalers, drain openers, scouring agents, household antiseptics and wipes, in-cistern devices, in the bowl systems (ITBS) and liquids / powders, mousses, carpet cleaners, tablets and toilet cleaning systems, shoe, floor, furniture and metal polish.	✓	✓	✓
Dishwashing – Hand and machine dishwashing products and dishwashing additives.	✓		
Maintenance products (covering air care, aerosol spray polishes and home insecticides) - Spray / aerosol air fresheners, electric air fresheners, gel air fresheners, liquid air			

¹ Detailed explanations and examples of the ESC Tool key concepts and methodology are available in the peer-reviewed scientific article published in the journal Integrated Environmental Assessment and Management [Article by Pickup et al. \(2016\)](#).

fresheners, scented candles (as described in section 2.1), , car air fresheners and other air care, spray / aerosol insecticides, electric insecticides, coils, baits and other consumer good insecticides.		✓	✓
Bleaches - Chlorine based products (as described in section 2.1), that are designed for general domestic cleaning purposes -only products that are clearly labelled as bleach are included. (Bleach-based cleaners, primarily marketed as surface or toilet cleaning products, are included in surface care and toilet care sectors). This sector also includes chlorine-based laundry bleach (but colour-safe laundry bleach is included in laundry aids subsector).	✓		

3 Emission relevance of operational conditions

The widespread use of household care and professional cleaning and hygiene products is described by two process steps as detailed in Table 3. All products considered within the scope of SPERC 8a.1.a v3 and SPERC 8a.1.b have contact with water, either directly or indirectly, and will therefore be disposed of with wastewater. Substances assessed under SPERC 8a.1.a are expected to be applied to aqueous solution directly from the package, allowing only negligible volatilization during transfer. SPERC 8a.1.b covers non-volatile substances that are expected to immediately deposit on the surface of application. The deposited constituents are expected to be picked up in subsequent wiping or in the next cleaning event and disposed of with waste water (assuming a re-useable cleaning cloth is used and rinsed afterwards), or domestic waste (in the case of wiping with a disposable cloth or cleaning wipe). SPERC 8a.1.c covers volatile substances, or those used as propellants. These substances are expected to remain in the air immediately after release to the air compartment from their respective product.

Table 3: Overview of the processing steps involved for the SPERCs for the widespread use of household care and professional cleaning and hygiene products.

Processing Step		Widespread Use in 'Down the Drain' laundry detergents, cleaning and maintenance products	Widespread Use in Aerosol products for cleaning and maintenance products (Non-volatile)	Widespread Use of Aerosol products for cleaning and maintenance products (Volatile, incl. propellants)
		AISE SPERC 8a.1.a v3	AISE SPERC 8a.1.b v3	AISE SPERC 8a.1.c v3
a	Consumer application of products (including air care, washing and cleaning, polish and wax	Substance applied to aqueous solution with negligible volatilization. After cleaning of substrate, the washing/cleaning solution is disposed of with the waste water. Product residues remaining on the	Application (including spraying) of non-volatile substances to indoor surfaces for cleaning and maintenance purposes. Deposited constituents are expected to be picked up in the next	Application (including spraying) of volatile substances (expected to fully volatilise during application) for indoor cleaning and maintenance purposes.

	blends, laundry, biocidal)	substrate are likely to be washed off in the next cleaning event.	cleaning event and disposed of with domestic waste or wastewater (depending on type of cleaning).	
b	Direct disposal of empty containers	Disposal of leftover packaging with domestic waste or recycling.	Disposal of leftover packaging with domestic waste or recycling.	Disposal of leftover packaging with domestic waste or recycling.

4 Application of risk reduction measures

As per ECHA Guidance document R16, chapter R.16.2.2 'Conditions of Use' no additional risk reduction measures are applicable for widespread uses by consumers other than municipal sewage treatment set as default for releases to wastewater.

5 SPERC Information sources and justification

5.1 Justification of use rates

The default procedure for the estimation of tonnages for widespread uses is given in the ERCs contained within R.16.2.2.1.2 of ECHA Guidance document R16 (ECHA 2016). Herein the default 'fraction of EU tonnage used in region' ($F_{\text{prodregion}}$) is 0.1, or 10%. The default 'fraction of regional tonnage used locally' ($F_{\text{mainsource}}$) is 0.002, or 0.2%. This default is calculated by the following equation:

$$F_{\text{mainsource}} = \frac{\text{Population connected average sized STP}}{\text{Population in hypothetical region}} \times AF.$$

Where the population connected to an average sized STP is 10,000 and the population in a hypothetical region is 20,000,000. In addition, a default assessment factor (AF) of 4 is applied to take account of potential local variations in widespread uses in time and space. Table R.16-6 in ECHA Guidance document R16 (ECHA 2016) states; 'Registrants can overwrite this value, for example, if they have sufficient information to demonstrate that the use of the substance is evenly distributed in space and time throughout the region (e.g. for detergents)' Both, $F_{\text{prodregion}}$ and the AF, are matter of refinement in these SPERCs.

5.1.1 Refinement of $F_{\text{prodregion}}$

Within all three SPERCs defined here, the fraction of EU tonnage used in a region is set to 0.04 (4%) as opposed to the default of 0.1 (10%) set within ECHA Guidance document R16 (ECHA 2016). This revision is based on an empirical/statistical work performed by (Price et al. 2010b). Price et al. (2010b) presented a novel approach that allows the coupling of population density and country-specific usage statistics for a range of home and personal care products. Spatially explicit usage estimates were generated for hypothetical EU regions (200 × 200-km grid). Recent sales and population density data were combined to assess the relevance of the default assumption that 10% of a product will be used in an EU hypothetical region that is inhabited by 20 million people. The results of this analysis suggest that environmental exposure estimates conducted for regulatory risk assessments under REACH, for ingredients used in home and personal care products, are not a "representative worst-case". $F_{\text{prodregion}}$ is usually lower than 10%.

For the study, five large cleaning and maintenance product categories representing ERC 8a were included in the assessment (laundry care, surface care, toilet care, dish washing, bleach). The average per capita use values for the default region containing 20 million people, as a proportion of the total EU27 (+ Croatia, Norway and Switzerland) product usage, were derived for each product type (see Table 4). An inter-country analysis was performed that identified two primary regions in the EU27+3 with maximum use of home and personal care products (the UK and a transboundary region). EU regions containing 20 million people had maximum product usage (99.5th percentile) ranging from 3.6

to 5.11% (of the total EU product usage) for the sub categories (as shown in Table 4) with the mean PCC (per capita consumption) typically less than a factor of three lower than the maximum country PCC. It is important to note that whilst the maximum usage of products such as bleach within the homecare category are much higher than their mean, these products make up a relatively small percentage of the overall usage of the homecare product category. For example, the usage of bleach in Spain is 6.3 times greater than the mean usage of bleach across the EU, however bleach makes up only 10.04% of the home care product category usage i.e. the volume of bleach used across the EU is a factor of 6 smaller than the laundry care sub-category. In addition, the 99.5thile results in just 5.11% of the total EU tonnage. A weighted average over all analyzed home care product categories is therefore deemed sufficiently conservative and appropriate to provide a generic refinement to ERC8a for chemicals used over all cleaning and maintenance product categories. The weighted average $F_{prodregion}$ was calculated to be 0.0402 (as shown in Table 4). This value is considered conservative as it is based on product usage per category and not per substance usage. In other words, the assumption is made that all products are similar and the same ingredient would always be used in every product across the home care category and each product sub category e.g. the same ingredient would be used across every laundry care product and every bleach product. It is considered that this fact inherently includes a large conservative safety factor for the home care category.

Table 4. Estimating “worst-case” usage statistics for exposure estimates under REACH for ingredients used in home and personal care products (Price et al. 2010a).

Product type	Mean PCC (mL/cap/yr)	Maximum	<i>Max Product usage in Region</i> $F_{prodregion}$ (99.5 th ile)	% Home care PCC	Weighted Contribution
Laundry Care	8837	16714 (Italy)	0.0385	59.77	0.0230
Surface Care	1749	4113 (Portugal)	0.0362	11.83	0.0043
Toilet Care	474	1337 (Luxembourg)	0.0492	3.21	0.0016
Dish Washing	2240	5048 (Italy)	0.0410	15.15	0.0062
Bleach	1485	9363 (Spain)	0.0511	10.04	0.0051
Weighted average for home care products ($F_{prodregion}$)					0.0402

5.1.2 Refinement of the local variation AF

For a local risk assessment, a factor of 4 is generally applied to the per capita consumption to take into account temporal peaks (e.g. night-day, behavioral). For high production chemicals in detergents and cosmetics the EU TGD (2003; cf. B-Table B4#) already diminished this variability completely to a factor of one by realizing wide-spread uses of these products occur with much less variability, this would result in a less conservative $F_{mainsource}$ of 0.0005 Here a more conservative approach is taken based on the work by Fox et al. (2002) who measured influent concentrations of boron from 48 sewage treatment plants (STP) within the UK, Germany, Italy and the Netherlands. As a common ingredient in detergents at that time, boron was chosen as a representative marker for environmental monitoring, due to its lack of absorption or biodegradation in the sewer system. Freights of boron indicated that 90% of the STPs never received more than 1.5 times of the average predicted boron input by using regional detergent sales volumes. As discussed further in Price et al. (2010), the default assessment factor of 4 is considered overly conservative and it has been deemed appropriate that an assessment factor of 1.5 provides a ‘reasonable worst case’ for all uses of this category. Moreover, Fox et al. could

not draw correlations between the local and regional variations of product usage. Hence, the factor of 1.5 appears to be applicable to local situations of all regions in the EU.

Using an assessment factor of 1.5 instead of 4 means $F_{\text{mainsource}} = 10,000 / 20,000,000 * 1.5 = 0.00075$.

Therefore, for the purpose of the SPERCs defined in this document the 'fraction of regional tonnage used locally' ($F_{\text{mainsource}}$) has been set to 0.00075.

5.2 Justification of days emitting

The days emitting for each SPERC are set to 365 as per ECHA Guidance document R16, chapter R.16.2.2.1.2, 'Estimation of tonnage for widespread uses'. For widespread uses, the assumption is that products could be used by consumers all year round, 365 days a year.

5.3 Justification of release factors

5.3.1 Water, sediment and soil

The release factors presented in Table 6 are based on the generic release factors provided in the ECHA Guidance document R16 Appendix A.16-1 for ERC 8a (Widespread use of non-reactive processing aid (no inclusion into or onto article, indoor)) (ECHA 2016). The default ERC values for 8a assume a 200% release; 100% into water and 100% into air. Here, three SPERCs have been provided to offer a greater degree of specificity depending on the use and physical-chemical properties of an individual ingredient. SPERCs 8a.1.a and 8a.1.b for 'down-the-drain' products and non-volatile/ non-propellant substances assume 100% release to water only. SPERC 8a.1.c, on the other hand, was created to account for products emitting ingredients to air, covering volatile substances that will not deposit immediately. SPERC 8a.1.c therefore assumes 100% will be released to the air compartment only.

5.3.2 Waste

The percentage of a product released to waste is required as part of the SPERC factsheet format published in 2016 and may have implications for lifecycle assessment and legislation around the handling of waste but not on the risk assessment of the substance. In this context, waste is defined as the amount of product that remains in packaging at the end of typical consumer product use, for example, product residue left in a spray bottle. The percentage of material remaining in each package after the use phase can be calculated as follows:

% product waste residue = $((W1 - W2)/W3) \times 100$

- W1 = average weight of emptied package (emptied package = package + cap/nozzle + residual product) (g)
- W2 = average net-weight of the "unused" empty package + cap/nozzle (g).
- W3 = average net weight of content. The net weight of content is the quantity of product poured into the empty package, as declared on the label (g).

An exercise was performed to define a representative range of waste values appropriate for the majority of the (e.g. excl. candles) products covered in these SPERCs. The waste residue values cited in this document are based on data collection carried out by three large companies in the A.I.S.E. network that represented approximately 43% of the EU detergents and cleansers market in 2019. This figure is considered representative as key product properties in the respective categories (e.g. viscosity) are not considered to significantly differ between producers. Products available on the market were

collected and the residual waste left in the container was measured and averaged. The overall approach was inspired by the free online “Recyclclass tool” from Plastics Recyclers Europe and its “easy-to-empty/easy to access” indexes (Plastics Recyclers Europe, 2019). No generic SOP was followed as the experiment aimed to replicate a real-life context for wide-spread use of detergents, where consumers would also not follow one specific methodology. Thus, some bottles were emptied, weighed, rinsed, dried and weighed again to establish a waste residue value. While for others, clean bottles were weighed, then filled with the quantity of product that is declared on the label (in case of volume it was converted to weight), totally emptied and then weighed once more. Each company repeated the measurement between 3 to 5 times for each sample. The differences in values between the amount of product wasted for each sample was dependent on various factors including product viscosity and container shape. It is known that many consumers rinse out used products; the values here were generated by emptying products without rinsing, they are therefore considered to be conservative values.

Depending on the product and bottle type and its phys-chem properties the values for the waste value ranged from 0.004-3.118%, thus the following range of **0.004-3.2%** is cited generically for all products in the SPERC factsheets.

In Table 5, more detail is provided by product category, including the product categories that were tested. The ranges represent the values cited by the three companies. However, values are only stated in cases where data was obtained from at least three companies for competition law reasons. A.I.S.E. has other values archived in case they can be used with the addition of further companies’ data.

It is stated in ECHA guidance R.18 section “R.18.2.3.1 Assessment of the relevance of the waste life cycle stage”, that it may not be relevant to assess waste stage exposure if:

“Only small fractions of the mass flow of the substance end up in the waste stage. This consideration should take into account the initial quantities of the substance placed on the market and the outcome of the assessment for the previous life stages.

The conditions in the waste stage are already covered in the exposure assessment for other life cycle stages, and it can be concluded that the expected releases to the environment from the waste stage are significantly lower than those from the previous life cycle stages.” (ECHA 2012).

Hence, if not incinerated, the default scenario when calculating emissions from landfill is that 100% of leachate is collected and treated under municipal treatment plant-like conditions. Therefore, it is expected that for these uses, assuming 100% for release to water or air at this life cycle stage covers the exposure assessment of any subsequent waste stage.

Table 5. Summary of waste residues based on product type.

Product type tested	Products included in product type	Range of Waste residue values cited by 3 companies
Laundry Detergents (powder and liquid, excluding tablets)	Laundry detergent	0.004-3.118%
Liquid Detergents	Fabric finisher, fabric conditioner, liquid detergents, liquid detergent gels, detergent paste (hand detergents), cleaner gels (WC, bathroom, etc.) and hand dishwash	0.91-2.6%
Hand Dishwash		Values only from 2 companies

		values compare with liquid detergents
Insect Repellent	Lotion bottles	Value only from 1 company
Cleaners Trigger Sprays	Floor cleaner, all-purpose cleaner, bathroom cleaner, kitchen cleaner, window cleaner, liquid WC-rim, limescale removers	0.13 - 0.952%
Cleaners Liquid		0.26 - 2.83%
Biocidal Products	WC Disinfectants	Value only from 1 company
Insecticides	Electric refill Insecticide	Value only from 1 company
	Insecticide diffuser	
	Aerosol Insecticide	

5.3.3 Summary of release factors

Table 6 summarizes all release factors of the AISE SPERCs on widespread uses.

Table 6. Summary of release factors for the SPERCs for the widespread use of household care and professional cleaning and hygiene products.

Release factors	Widespread Use in 'Down the Drain' laundry detergents, cleaning and maintenance products	Widespread Use in Aerosol products for cleaning and maintenance products (Non-volatile)	Widespread Use of Aerosol products for cleaning and maintenance products (Volatile substances incl. propellants)
AISE SPERC	AISE SPERC 8a.1.a v3	AISE SPERC 8a.1.b v3	AISE SPERC 8a.1.c v3
To air	0%	0%	100%
To water	100%	100%	0%
To soil	0%	0%	0%
To waste	0.004-3.2%	0.004-3.2%	0.004-3.2%

5.4 Justification of Risk Management Measures

No RMMs are applicable for this SPERC.

6 Applicability of SPERCs

6.1 Conservatism

The use rates identified in this background document and reported in the relevant SPERC factsheets are based on the subject matter expertise of AISE members in addition to peer reviewed scientific publications. Release factors were chosen in a conservative manner (100% release), since the product uses are intended for its release into the environment after use.

The $F_{\text{prodregion}}$ and $F_{\text{mainsource}}$ for the regional and local exposure assessment have been revised in a conservative manner. For the $F_{\text{prodregion}}$ this was done by using the weighted average of maximum regional use rates (99.5%iles) of laundry and home care products to derive a reasonable worst case figure. The $F_{\text{mainsource}}$ was altered by the adjustment of the AF based on representative monitoring data which accounts for temporal fluctuations of home care product use found by Fox et al. (2002). Moreover, for high production chemicals the resulting assessment factor is more conservative as the default. By these approaches a two-fold worst-case representation of the widespread emissions of household care and professional cleaning and hygiene products is reached.

In combination, the values provided are considered to be a reasonable worst-case scenario for input into exposure assessments.

7 Applicability of SPERCs

7.1 Tiered assessment

Due to the characteristics described above, we consider the widespread use of household care and professional cleaning and hygiene products SPERCs to be suitable for use in standardised, 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 very limited regional variation in the widespread use of household care and professional cleaning and hygiene products, SPERCs may be applicable for emission estimation of the widespread use of household care and professional cleaning and hygiene products across the EU.

8 References

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