ESIG/ESVOC SpERC
Background Document

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Specific Environmental Release Categories (SpERCs) for the professional use of solvents and solvent-borne substances for agrochemical use, polymer processing, and water treatment chemicals

European Solvents Industry Group (ESIG)
European Solvents Downstream Users Coordination Group (ESVOC)
Avenue E. van Nieuwenhuyse 4
1160 – Brussels Belgium
esig@cefic.be

Introduction

Many solvent-containing products are suitable for routine use in a wide variety of professional applications. The professional use of these products requires the employment of trained personnel with the requisite knowledge and expertise needed to safely and sensibly operate under a range of work conditions. In this context, professional product applications are generally carried out by seasoned personnel who have undergone an apprenticeship or other similar intensive training program to acquaint them with functional skills and situational knowledge needed to perform a particular task safely. Automotive mechanics, painters, machinists, and construction/maintenance specialists are all examples of professional occupations that may use solvent-containing products on a regular basis.

The use of many professionally formulated products may result in the widespread release of substances into the environment (ECHA, 2016). Widespread uses of a product may either be indoors or outdoors and are characterized by small point-source releases at many different locations spread over a large area. Engineering controls to prevent or reduce the environmental release of product components are generally absent or ineffective when the uses are widespread. Administrative and procedural controls may be in place to minimize releases in professional operations where the task is repetitively performed on a regular schedule. These measures include rigorous training and adherence to operational guidelines that reduce the potential for environmental release by guarding against overuse and unabated emissions to air, water, and soil.

Professional product users are accustomed to the routine handling of a wide variety of solvent-containing coatings, cleaners, lubricants, and treatment solutions. Specific techniques and practices for minimizing environmental release and reducing waste generation are routinely implemented by professional applicators who are accustomed to working with a product under a variety of circumstances. These include measures for the proper storage, cautious dispensing, and conscientious disposal of the product regardless of the task or work conditions.

The following guidance document provides a description of the logic and reasoning used to create three Specific Environmental Release Categories (SpERCs) covering the professional use of solvent-containing products. The air, water, and soil release factors associated with these SpERCs and sub-SpERCs provide an alternative to the default release factors associated with the environmental release categories (ERCs) promulgated by ECHA. The following sections of this background document have been aligned with those of the SpERC Factsheet and provide additional descriptive details on the genesis and informational resources used to generate each SpERC.

1. Title

The enclosed background information corresponds with the information provided in the following three factsheets:

1. ESVOC SPERC 8.11a.v3 – Agrochemical uses
2. ESVOC SPERC 8.21b.v3 – Polymer processing
3. ESVOC SPERC 8.22b.v3 – Water treatment chemical use

Since these newly released SpERC factsheets include some corrections and or modifications, the version number has been changed to reflect the updates.

2. Scope

The applicability domain for a particular SpERC includes an initial determination of the life cycle stage (LCS) that best describes the industrial operation involved and the intended use of the substance being evaluated. The relevant life cycle stages and their interrelationships are depicted in Figure 1 (ECHA, 2015). The three SpERCs highlighted in this guidance document are all associated with a single life cycle stage: widespread use by professional workers. This assignment is consistent with ECHA guidelines for distinguishing solvent uses in industrial applications versus their widespread use in professional or consumer applications.

Other use descriptors such as the sector of use (SU) and the chemical product category (PC) have been assigned in accordance with the naming conventions outlined by ECHA (ECHA, 2015). These have been summarized in Table 1 along with the use descriptions characterizing the three SpERCs. The terminology used to describe the individual applications is consistent with the list of standard phrases associated with the Generic Exposure Scenarios (GESs) that have been created to describe the exposures associated with the industrial production and use of solvents (ESIG/ESVOC, 2017). Use of standard phrases in these SpERC descriptions provides consistency and harmonization, and avoids confusion among potential SpERC users.

Figure 1. ECHA identified life cycle stages and their interrelationship

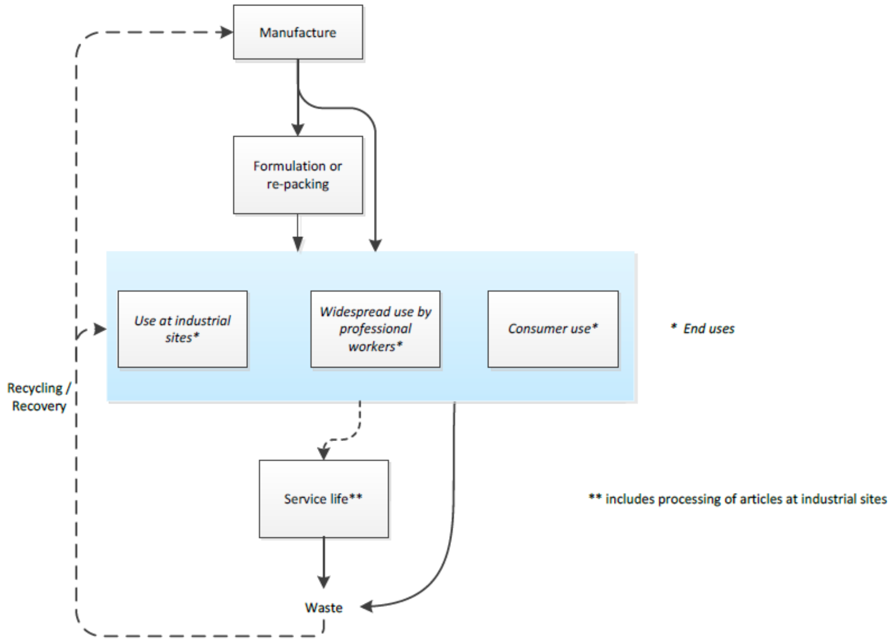

Table 1. SpERC background information

SpERC Code	Title	Life Cycle Stage (LCS)	Sector of Use (SU)	Chemical Products Category (PC)	Use Description
ESVOC SPERC 8.11a.v3	Agrochemical use	Widespread use by professional workers	SU1 Agriculture, forestry, fishery	PC8 Biocidal products	Covers the professional use as an agrochemical excipient for application by manual or machine spraying, smokes and fogging; including equipment clean-downs and disposal; and consumer use in agrochemicals in liquid and solid forms.
ESVOC SPERC 8.21b.v3	Polymer processing	Widespread use by professional workers	SU12 Manufacture of plastics products, including compounding and conversion	PC32 Polymer preparations and compounds	Processing of formulated polymers including material transfers, moulding and forming activities, material re-works and associated maintenance.
ESVOC SPERC 8.22b.v3	Water treatment chemical use	Widespread use by professional workers	SU0 Other	PC20 Processing aids such as pH-regulators, flocculants, precipitants, neutralization agents	Covers the use of the substance for the treatment of water in open and closed systems.

3. Operational conditions

The operating conditions for a particular professional application define a set of procedures and use conditions that limit the potential for environmental release. The professional use of solvent-containing products in small businesses are not associated with a specific group of mandatory requirements or constraints to minimize the likelihood of an environmental release. There are, however, recommended procedures that are typically implemented as standards of practice to reduce the potential for air, water, and soil release.**Conditions of use**

The three SpERCs described in this background document are associated with indoor and outdoor professional operations typically undertaken by experts with detailed knowledge of the best handling practices for the products in use. The widespread use of these products can occur at various locations employing skilled and appropriately trained personnel. Construction, agriculture, custodial cleaning, wastewater treatment, and trucking/transport operations exemplify the types of small businesses where professional product use may occur (ECHA, 2015).

Several use conditions characterize the professional use of a product in a widespread manner. These include i) the potential use and handling at a large number of broadly found sites whose distribution density is roughly proportional to the number of local inhabitants; ii) unimpeded usage that does not need to conform with local, regional, or national permitting requirements; iii) basic and simplified pollution control equipment for controlling environmental release; iv) tasks and workflows that limit the product use volumes and the overall emissions potential; and v) access to a municipal sanitary sewer system capable of handling any extraneous waste streams from the site.

A sanitary drainage system connected to a standard municipal wastewater treatment facility (WWTP) is presumed to exist when these solvent-containing products are used in widespread applications. A standard municipal facility uses both mechanical and biological treatment stages and has an effluent discharge rate of 2,000 m^3/day, which is equivalent to a wastewater generation rate of 200 L/person/day for a community with 10,000 inhabitants (ECHA, 2016). At the regional scale, ECHA assumes that 80% of the generated wastewater is funnelled through a standard municipal WWTP, with the remaining 20% released directly to surface waters. Further, stormwater drainage systems are not connected to a standard WWTP and the effluents are discharge untreated to local surface waters. The sludge resulting from the municipal wastewater treatment is also recognized to be suitable for direct application to agricultural soil.

Rigorous containment is not a necessary prerequisite for the application of these SpERCs to an environmental exposure analysis. The European Chemical Agency (ECHA) has outlined the technical and operational requirements necessary to demonstrate that a volatile organic compound (VOC) has been rigorously contained and these conditions are not applicable to the regional widespread use of a product in a professional setting (ECHA, 2010).

3.2. Waste handling and disposal

Every effort should be made to minimize the generation of waste at every point in a products' life cycle including professional uses. This necessitates the implementation of sensible waste minimization practices that stress the importance of recycling and/or reuse at the professional level. Many professional operations institute waste avoidance and minimization practices that are aimed at reducing the environmental impact of the products being handled. These include regular training sessions that focus on a range of topics such as waste reduction, recycling, and reuse. In addition to training, other management practices include the creation of standard operating procedures for the labelling, collection, storage and disposal of unused or spent products.

Under most circumstances, the residual waste generated during the professional use of a solvent-containing product is handled as a liquid or solid hazardous waste (EEA, 2016). Small and medium sized enterprises often put into place environmental management plans that describe an employee's responsibilities for ensuring the conscientious processing of both hazardous and non-hazardous wastes (EC, 2012). Available guidance for small businesses provide a detailed blueprint for storing, transporting, and disposing the hazardous waste generated by professional users (CIPS, 2007, Editions Ruffec, 2003). An important aspect of these plans is the need to reduce, recycle, and reuse any accumulated hazardous to the extent possible. Regardless of their degree of implementation, all waste handling practices must conform with the provisions cited in all applicable waste directives issued by local, regional, and national authorities.

4. Obligatory risk management measures onsite

There are few obligatory risk management measures associated with the widespread professional use of a solvent-containing product. All discharges to a local sanitary sewer system need to be treated at a municipal WWTP capable biologically degrading wastewater contaminants before surface water release. The operating conditions for this facility are expected to conform with the standard default specifications outlined by ECHA (ECHA, 2016). This includes meeting or exceeding effluent discharge rate for a standard municipal WWTP and the creation of sludge that is suitable for release onto agricultural land.

There are, however, a number of voluntary initiatives that may be undertaken to control environmental releases during the professional use of a product. These include the institution of several different types of technical and administrative programs that are described in more detail below.

4.1. Optional risk management measures limiting release to air

Pollution prevention initiatives provide a reasonable and cost-effective means of reducing the atmospheric release of volatile substances during the use or application of professional products. These initiatives usually take the form of chemical management plans that describe a set of standard operating procedures (SOPs) to be used when a product is being handled in a professional setting (EEA, 1998). These SOPs can cover a range of topics from product procurement to disposal and contain a precise description of the procedures to be followed when handling a product under actual field conditions.

Sound practices for reducing the widespread atmospheric release of a substance include specific storage, handling, and spill containment strategies (USEPA, 2016). Storage examples include the correct handling of damaged containers susceptible to spillage, the proper closure and sealing of containers following use, and the use of drip pans or trays to contain any spills that may occur during storage. Similar examples describe basic handling procedures to circumvent the unintended release of volatile constituents. These include procedures for the onsite transport, transfer, and container storage of products and wastes. SOPs may also be created that govern spill prevention and remediation. These are particularly effective at minimizing the impact of an accidental release on the levels of air, water, and soil contamination that may ensue. **Optional risk management measures limiting release to water**

Wastewaters generated in the course of products' professional use need to be treated in a biological wastewater treatment plant that is capable of biodegrading any water-soluble substances discharged to the local sanitary sewer system. The primary source of treatable wastewater results from the cleaning of containers, tanks, and transfer equipment. Small releases may also result from unintentional spills and leaks, which need to be guarded against at all junctures.

Special attention should be given to the professional use and application of products that may come into contact with local water sources. Contaminated water should not be released to the storm sewers used to collect rainwater for direct release to local surface waters. Other cleanup practices that may reduce the generation of wastewater include the recovery of any unused material in transfer lines rather than washing it down the drain, the application of dry cleaning practices for leaks and spills rather than area hosing with water, and the washing of floors, equipment, and surfaces only when needed rather than on a regular schedule (NSEL, 2003).

4.3. Optional risk management measures limiting release to soil

Many of the same pollution prevention practices exercised to reduce releases to air and water will also be effective in containing emissions to soil. Procedures and protocols for housekeeping and spill removal are perhaps the most effective at reducing any releases to soil (GTZ, 2008). The creation and wide dissemination of a spill plan is a highly effective pollution prevention initiative. Ideally, the plan would include a detailed description for handling accidental releases rapidly and in an efficient manner. The location and correct use of spill kits can also provide an added benefit as does the storage of products in dedicated spaces that have a floor made of impervious concrete. Aside from these discretionary measures, there are no mandatory risk management measures for controlling the soil release potential.

5. Exposure assessment input

The SpERCs described in this background document are associated with a specific set of use conditions that have been directly adopted from ECHAs appraisal of the factors influencing the widespread dispersive use of a substance on a professional scale (ECHA, 2016). The derived default values are associated with the conditions that presumably exist within a "standard town" occupied by 10,000 inhabitants and serviced by a municipal WWTP with an effluent flow rate of 2000 m^3/day, which corresponds to a wastewater generation rate of 200 L/day/person for those residing in the "standard town". The number of individuals living in the "standard town" assumes that it is positioned within a densely populated "standard region" of Western Europe with 20 million inhabitants living within a land area measuring 200 km x 200 km (10% of the European land mass). The following paragraphs describe the underlying reasoning used to assign a numerical value to the parameters affecting the emissions resulting from the widespread professional use of solvent-containing products.

5.1. Substance use rate

The regional use tonnage for a professionally used substance contained in a product formulation is dependent on several key parameters that dictate the extent and magnitude of a product's use at the regional scale. Since product formulations may vary widely in composition, the use tonnage will be highly dependent on the product formulation and regional sales distribution. Registrants using these professional SpERCs are, therefore, in the best position to define the regional use rate based on detailed knowledge of their product portfolio, product compositions, and penetration. Specification of multiple putative regional tonnages based on available knowledge of the product types available to professional users is not a tenable option given the ambiguities it creates (OKOPOL, 2014).

The following equation describes the default calculation of a daily use rate of substance in a "standard town" using ECHA recognized default parameters. This calculation is applicable once an annual use rate is supplied by the registrant.

$$Daily\ use\left(\frac{tonnes}{day}\right) = \frac{annual\ use\left(\frac{tonnes}{year}\right) x\ adjustment\ factor\ x\ regional\ fraction\ used\ locally\ x\ annual\ fraction\ used\ regionally}{emission\ days\ (\frac{days}{year})} \quad (1)$$

The assessment factor of 4 used in this calculation adjusts for any spatial and temporal variability in the professional use of a substance within a region. The application of this factor accounts for any localized spikes in the usage rate within a confined geographical area or narrow span of time. The regional fraction used locally is proportional to the ratio of the number of inhabitants living in the "standard town" and the "standard region". This equates to a default value of 0.0005 or 0.05% assuming a "standard town" population of 10,000 and a "standard region" with 20 million residents. According to convention, the fraction of the annual EU tonnage used regionally has been assigned a default value of 0.1 or 10%. The preceding derivation outlined above describes the standard approach for determining the daily use rate using available default parameters along with the registrants' estimate of the annual tonnage associated with the production of particular professional product.

5.2. Days emitting

The number of emission days for each of the SpERCs described in this guidance document has been set at the ECHA default value of 365 days/year (ECHA, 2016). Since the substances described in these SpERCs may see widespread continuous use over a large geographical domain, the use frequency has been maximized to reflect the broad regional usage of these professional products.

5.3. Release factors

Although vapor pressure and water solubility may be important considerations when examining the environmental emission magnitudes from professional products, their impact is minimized in materials that are not formulated using a wide range of solvent types. The SpERC release factors highlighted in this background document have not been assigned to specific vapor pressure or water solubility categories. As such, the stated values apply to the entire range professional products included in the SpERC description.

The release factors to air were established following a thorough search of the scientific and technical literature for information pertaining to the volatile emissions accompanying the professional use of a particular product. When suitable information was located, it was often necessary to perform some mathematical corrections to ensure that the factor represented the fractional amount of a chemical substance released to an environmental compartment relative to the available chemical mass rather than the mass of product being produced or consumed. Detail regarding these numerical corrections are fully and transparently described in the passages below along with the application of adjustment factors to ensure an adequate degree of conservatism in the final value.

5.3.1. Release factors to air

1. Agrochemical use

A modeling study has been performed to assess the air release fraction for a range of volatile chemicals used to formulate pesticide emulsifiable concentrates (ECs) (Toose, et al., 2015). Using the results from laboratory chamber studies that mimicked a pesticide spray application, an environmental fate model was constructed that examined the volatilization occurring during each of three sequential stages: i) during spray application, ii) during evaporation from the soil surface, and iii) during desorption and volatilization from soil solids. The resulting model was used to predict an overall 14-day air emission factor for EC solvents with varying vapor pressures. The results showed substantial air emissions with carrier solvents having a vapor pressure of 5 Pa or greater. A representative value was obtained for the nine carrier solvents examined after they were shown to be normally distributed with an 95% upper limit value of 76%. This value has been rounded off to 75% to obtain a broadly justifiable air emission factor that captures the releases that would be expected for a wide range of professionally applied agricultural chemicals.

2. Polymer processing

Polymer processing at the professional scale is characterized by production at smaller facilities where environmental release permits are not necessarily required. In lieu of survey data, the air factors were derived from controlled laboratory investigations examining VOC emissions from the extrusion of five different polymer types (Adams, et al., 1999, Barlow, et al., 1996, Barlow, et al., 1997, Kriek, et al., 2001, Rhodes, et al., 2002). Multiple grades of plastic were examined for each of the five polymer types including polypropylene, polyethylene, polyamide, polycarbonate, and ethylene-vinyl acetate/ethylene-methylacrylate. The maximum emission factors per gram of plastic produced ranged from 118 to 819 ug/g. Following correction for the VOC content of the plastics, the air release factors were found to range has high as 0.1% for polypropylene (Guillemot, et al., 2017). These results are in good agreement with those from a second independent study showing that the maximum air release factor for the extrusion of plastic parts using four different types of polymers was 0.07% (Contos, et al., 1995). To compensate for the possible existence of a thermoplastic with appreciably higher emission characteristics, a 10-fold adjustment has been applied to the highest reported value. This adjustment yields a final recommended air release factor of 1% for polymer processing at the professional level.

3. Water treatment chemical use

The air release factor for the professional use of water treatment chemicals is based upon the use of neutralizing agents to treat the water used in steam boilers. These film forming agents include a number of aliphatic and cycloaliphatic amines that are categorized in terms of their neutralizing capacity, basicity, and distribution ratio. They are continually fed into the makeup water to offset the losses from system blowdowns and steam leakages at the various traps, flanges, pipes, valves used to transport the steam throughout a facility. The distribution ratio used to differentiate commercially available boiler amines describes the relative amounts of chemical in the steam vapor phase versus the liquid condensate. Since steam can be vented to ambient air and the boiler water drained to a sewer, the distribution ratio provides a measure of the air and water release factor that would be expected with the use of these water treatment chemicals. The most commonly used neutralizing amine, 2-diethyl-aminoethanol, has been shown to possess the highest air-water distribution ratio of 0.11:1.0 which is equivalent to an air and water release factor of 9.9% and 90.1% (air factor = 0.11/0.11+1.0 * 100), respectively (Hydro-Logic, 2012). These values have been modestly revised to preserve the overall mass balance in the system by adjusting for the small releases to soil and waste. The final recommended release factor for the professional use of water treatment chemicals is therefore set at 9.8% for air and 90.0% for water.

5.3.2. Release factors to water

1. Agrochemical use

Since the water solubility characteristics of the active and inactive ingredients of an agrochemical preparation are not expected to appreciably differ during professional use, the release of the active ingredient into surface water provides a suitable surrogate for predicting the degree of stormwater runoff for any inert substances used in a formulation. An early compilation of measured surface runoff losses from fields in the southwestern U.S. lists the individual results for three types of pesticides including: wettable powders, water insoluble emulsions, and organochlorine-based pesticides (Wauchope, 1978). The percentage of applied liquid pesticide that was lost long-term due to rain events was 1% or less for most of the water insoluble emulsions and 3% or less for the organochlorine pesticides. The results from these field studies provide a sound basis for establishing a water release factor of 3% for the professional use of agrochemicals.

2. Polymer processing

The cleaning of molded plastic polymers entails the removal of residual mold release agents, processing chemicals, and other matter prior to further processing or final shipping. The release of organic residues into the process water during final cleaning has been determined in several field surveys conducted by the USEPA (USEPA, 1984). A sampling program instituted in conjunction with the field surveys looked at the releases of a wide range of priority pollutants in the cleaning water from 13 different cleaning operations. Measurable amounts of benzene, 4-chloro-m-cresol, methylene chloride, N-nitroso-diphenylamine, phenol, bis(2-ethylhexyl) phthalate, and toluene were detected in the cleaning wastewater released directly without treatment or indirectly to a municipal WWTP. The average annual mass of these substances discharged directly or indirectly to cleaning wastewater was reported to be 69 kg/yr. Results from survey questionnaires received from 382 plastic parts producers revealed an average plastic production rate of 1,390 tons/yr for those facilities using cleaning water that was indirectly discharged to a WWTP. These values yield a water release factor of 0.005% which has been rounded upward to 1% to ensure an adequate degree of conservatism.

3. Water treatment chemical use

As discussed in the previous section, the air release factor for the professional use of water treatment chemicals was directly determined from the air-water distribution ratio for a neutralizing amine used to treat the water used in steam boilers. The most commonly used neutralizing amine, 2-diethyl-aminoethanol, has been shown to possess the highest air-water distribution ratio of 0.11:1.0 which is equivalent to an air and water release factor of 9.9% and 90.1% (air factor = 0.11/0.11+1.0 * 100), respectively (Hydro-Logic, 2012). These values have been modestly revised to preserve the overall mass balance in the system by adjusting for the small releases to soil and waste. The final recommended release factor for the professional use of water treatment chemicals is therefore set at 9.8% for air and 90.0% for water.

5.3.3. Release factors to soil

1. Agrochemical use

The fraction of a professionally applied agricultural chemical that irreversibly binds to soil has been determined using both modeling and experimental methods (Suddaby, 2012). Using isotope exchange techniques, the irreversible binding of three pesticides was investigated using each of three soil types found in the UK. The pesticides included one neutral, one basic, and one acidic herbicide or fungicide that were incubated with each soil type for a minimum of 56 days. Following the application of sequential extraction techniques to remove the reversibly bound pesticide, the residual sorption to soil was measured. The irreversible sorption to soil ranged from 0.14% to 2.27% percent for the nine combinations of pesticide brand and soil type. Using kinetic data collected during the investigation, a soil sorption model was developed showing average irreversible sorption values of 15.2%, 4.5%, and 2.8% for the three pesticides being examined. Assuming that the sorptive behavior of inert carrier solvents approximates the results observed with the three active ingredients used in this study, a conservative worst-case soil emission factor of 15% has been identified. This value has been revised and slightly increased to 17% to preserve the overall mass balance in the environmental release pattern.

2. Polymer processing

The soil release associated with polymer processing at the professional scale was identified using the A-Tables published by the European Commission and listed in Appendix 1 of the Technical Guidance Document (TGD) on Risk Assessment PART II (EC, 2003). Use of these A-Tables requires the proper identification of the use characteristics associated with a particular application. The proposed soil release factor of 0.001% for polymer processing was taken directly from A-table 3.11 and can be traced back to original source using the following identifiers.

Industry category	IC=11 (Polymers Industry)
Main category	III (Industrial processing)
Type of processing	A or B (Thermoplastics or Thermosetting)
Chemical category	III (Solvents)
A-table number	A3.11
Compartment	Soil

In essence, the listed value corresponds to the soil release expected for the use of solvents in a polymer processing operation (IC-11) and applies to the industrial and/or professional processing of thermoplastic or thermosetting resins. The value of 0.001% is consistent with expectations since the leaching of plastic volatiles to soil is not expected to be a major pathway for release into the environment.

3. Water treatment chemical use

A thorough examination of the literature found several instances where boiler blowdown water was reportedly released to a drainage ditch rather than a municipal sewer (ODEQ, 2006, UDWQ, 2012, USACE, 2008). These reports are generally confined to small or medium sized businesses seeking a discharge permit. Unfortunately, few details are provided regarding the presence of neutralizing amines in the boiler blowdown or on the volume of water discharged to nearby ditches. Since studies have shown that alkanolamines in contact with soil can persist for extended periods of time, any environmental release to soil will result in some sorption (Hawthorne, et al., 2005). The discharge of boiler blowdown to a drainage ditch is predicted to result in some soil or sediment contact with the neutralizing amines in the discharge. Although, the fractional release of amines via this pathway is expected to be minor, it may be measurable. In lieu of the general absence of emission measurements, a soil release factor of 0.1 % is recommended as a default value to account for the possibility of boiler water contact with soil.

Table 2 provides a listing of the air, water, and soil emission factors applicable to the three SpERCs described in this background document. The assigned release factors were reviewed and agreed upon by a broad group of knowledgeable specialists within the sector organization (CEFIC, 2012). All relevant Emissions Scenario Documents (ESDs) and Best Available Technology Reference Documents (BREF) were examined prior to assigning a release factor. In addition, a secondary literature search was performed to locate any complimentary qualitative information that could be beneficial. This included an examination of emission factors located in PRTR (Pollutant Release and Transfer Register) reports and life cycle inventories for products and processes (CONCAWE, 2017, Frischknecht, et al., 2005).

Table 2. SpERC release factors

Assignments	SpERC title		
	Agrochemical use	**Polymer processing**	**Water treatment chemical use**
ERC	8a 8b	8a 8d	8d
Air release factor (%)	75	1	9.8
Water release factor (%)	3	1	90
Soil release factor (%)	17	0.001	0.1

5.3.4. Release factor to waste

A thorough and detailed analysis accompanied the assignment of waste release factors for the three SpERCs outlined in this background document. Although a substantial amount of information is available documenting the total amount of different waste types associated with the various different professional operations, these data are often in a form that prevents the determination of a normalized release fraction as a function of the use volume. Life cycle studies often provide useful statistics on waste generation in different professional use sectors; however, these studies need to be individually examined to determine their relevance to a particular SpERC code.

In this context, waste refers to solvent-containing substances and materials that have no further use and need to be disposed of in a conscientious manner (Inglezakis and Zorpas, 2011). Professional operations are capable of generating hazardous wastes as a result of spill clean-up, routine maintenance, and equipment repairs. Waste volumes are dramatically affected by recovery and reuse practices that take advantage of any residual value following recycling. In many cases, the amount of waste generated is directly related to the degree of compliance with any agreed upon recovery and reuse programs.

All of the waste release factors cited in Table 3 have been derived from published life cycle assessments (LCAs) or surveys that inventoried the emissions and wastes generated during the use of a formulated professional product. The cited values may be supplanted if the actual hazardous waste generation factor is known for the operation described by the SpERC. To guarantee that an adequate margin of protection has been built into the determination, an adjustment factor has occasionally been applied when the reported value was judged to be unrepresentative of the entire range of potential use conditions within a particular operation.

Table 3. SpERC waste release factors and their literature source

Assignments	SpERC title		
	Agrochemical use	Polymer processing	Water treatment chemical use
Waste release factor (%)	5	3	0.1
Source	(FFCO, 2015)	(Plastics Europe, 2014)	(DEFRA, 2012)

1. Agrochemical use

The value was derived from survey data that documented the annual return of empty pesticide jugs, pails and drums to plastic recycling facilities in Ontario (WMCS, 2011). The annual collection of this packaging waste was determined to be 220 tonnes/year with a capture rate of 80%. The remaining 20% (55 tonnes/year) of plastic packaging represents uncollected waste containing residual amounts of pesticide. This unrecovered waste was divided by the sales volume of pesticides in Ontario (FFCO, 2015). The annual sales of all pesticides for application on fruit, vegetable, and field crops was 5403 tonnes/yr, which yielded an overall waste release factor of 1%. An uncertainty factor of 5 has been applied to this value since the survey did not account for the disposal of unused agricultural chemicals.

2. Polymer processing

The waste generation factor was established using information from a life cycle assessment involving the commercial production of three polyolefin plastics: high-density polyethylene, low-density polyethylene, and linear low density (Plastics Europe, 2014). The generation of hazardous waste during the creation of these plastics ranged from 0.05% to 0.3% and was highest for the low-density polyethylene. Much of this waste was either incinerated or landfilled; however, a portion was put through a recovery operation. To ensure that all possible waste sources are considered an adjustment factor of 10 has been applied to highest reported value. This correction ensures that all possible waste streams have been considered and adjusts for any deviations that may exist with the production of other types of polymers.

3. Water treatment chemical use

The waste factor associated with the use of paper chemicals was taken from an LCA describing the production of office paper from recycled supplies (DEFRA, 2012). The LCA focused on the reprocessing of closed-loop recycled paper sent back to the paper mill by businesses operating in Europe. The pulp generated from this recycled paper was initially treated with a variety of chemicals to aid in the toner removal and promote slurry formation. The operation resulted in the generation of 1.13 kg/tonne (0.013%) of unrecovered industrial waste that could contain residual amounts of paper-making chemicals. This factor was adopted without modification or the application of an uncertainty factor since the facility provides a representative example of the practices employed by other facilities using water treatment chemicals.

6. Scaling Principles

Scaling provides a means for downstream users (DUs) to confirm whether their combination of OCs and RMMs yield use conditions that are in overall agreement with those specified in a SpERC (ECHA, 2014). These adjustments are only applicable to industrial uses and cannot be employed with other life cycle stages where widespread uses take place.

7. References

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