ESIG/ESVOC SpERC
Background Document

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Specific Environmental Release Categories (SpERCs) for the professional use of solvents and solvent-borne substances in de-icing, construction, and laboratory applications

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 8.14a.v3 – De-icing applications
2. ESVOC SPERC 8.15.v3 – Construction applications
3. ESVOC SPERC 8.17.v3 – Laboratory 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

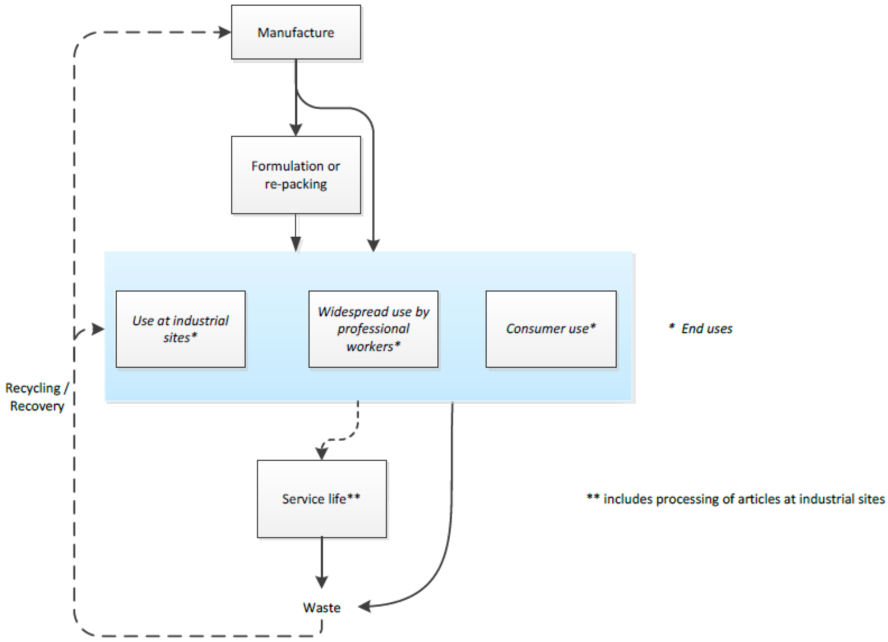

Table 1. SpERC background information

SpERC Code	Title	Life Cycle Stage (LCS)	Sector of Use (SU)	Chemical Products Category (PC)	Use Description
ESVOC SPERC 8.14a.v3	De-icing applications	Widespread use by professional workers	SU0 Other	PC4 Anti-freeze and de-icing products	Covers use for ice prevention and de-icing of vehicle, aircraft and other equipment by spraying.
ESVOC SPERC 8.15.v3	Construction applications	Widespread use by professional workers	SU19 Building and construction work	PC1 Adhesives and sealants	Application of surface coatings and binders in road and construction activities, including paving uses, manual mastic and in the application of roofing and water-proofing membranes.
ESVOC SPERC 8.17.v3	Laboratory use	Widespread use by professional workers	SU24 Scientific research and development	PC21 Laboratory chemicals	Covers the use of small quantities within laboratory settings, including material transfers and equipment cleaning.

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/or 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, 2000a, 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. De-icing application

The air release associated with the application of an aircraft deicing fluid has been examined by expert authorities within the EU. Four grades of deicing fluid are available for use at most airports, each with a different glycol concentration and application temperature. Type I are most commonly used in the US and Europe, and are typically applied as a hot solution at temperatures as high as 80 °C (Ritter, 2001). The glycol concentration in undiluted Type I fluid can be as high as about 90% (Dyer, 2007). Once applied, glycol-containing deicing fluids are not expected to volatilize to a substantial degree due to their low vapor pressure; however, spray application under windy conditions can result in vapor release as can the wind shear occurring during taxi and take-off (USEPA, 2012). The European Monitoring and Evaluation Programme (EMEP) and European Environment Agency (EEA) have jointly issued emission estimates for the use of aircraft deicing fluids (EEA, 2019a). The recommended factor for the release of non-methane VOCs during aircraft deicing is 53 kg/ton of applied deicer. This value was flanked by upper and lower 95% confidence limit values of 106 kg/tonne and 27 kg/tonne. The average value is equivalent to an air emission factor of 5.3%, which has been pragmatically rounded downward to an even 5.0%. Given the general acceptance of the EMEP emission factors by many European nations, they provide an easily justified SpERC value for the professional application of a deicing fluid.

2. Construction applications

Asphalt concrete, commonly known as bitumen, is composed of an 95% aggregate and 5% asphalt binder (USEPA, 2001). Three types of binders are commonly used on highways: i) a heated asphalt cement; ii) a liquified emulsified asphalt; and iii) a liquified cutback asphalt. Cutback asphalt contains the highest percentage of volatile hydrocarbons which can range from 25 to 45% depending on the grade. The three grades of cutback plasma available for use include fast, medium, and slow cure blends that use either gasoline (naphtha), kerosene, or fuel oil to control the viscosity and curing time (Ali, et al., 2017). A study conducted by the USEPA found that the average air release for rapid, medium, and slow varieties was 80%, 70%, and 25%, respectively (USEPA, 1977). These values have been adjusted for a purported petroleum diluent concentration of 35%. The USEPA values are consistent with those issued in the EMEP (European Monitoring and Evaluation Programme) (EEA, 2019b) The recommended unadjusted emission factors for use by EU Member States when constructing annual air emission inventories were 32%, 26%, and 10% for a rapid, medium, and slow cure cutback asphalt, respectively. When these factors are adjusted for the solvent content of 45%, the values increase to 71%, 58%, and 22% for the fast, medium and slow curing grades of cutback. When these reported values are considered in their entirety, an air release factor of 75% is deemed to suitably conservative and appropriate for the professional use of road and construction materials.

3. Laboratory use

A recent study examined the stack releases of 21 polar, nonpolar, and chlorinated solvent vapors from four large research laboratories located in the US. The laboratory solvents included groups of chlorinated hydrocarbons, aromatic and aliphatic hydrocarbons, alcohols, and ketones (Ballinger, et al., 2013). Laboratory stack measurements were used to calculate individual air release fractions based on the solvent usage in each laboratory. The resulting air release fractions ranged from 0.9% to 50.7% and averaged 17.1%. A fit test of the values showed that the release factors were normally distributed with a 90% upper limit value of 32%. This value provides a realistic and justifiable determination of the air releases that would be expected with the professional use of solvents in the laboratory. No adjustment to this number is necessary since it is based on an analysis of a reasonably large group of solvents.

5.3.2. Release factors to water

1. De-icing applications

The volume of aircraft deicing fluid needed to adequately deice a commercial aircraft is dependent on several factors including the plane size, the method of spray application, and the weather conditions. Most US airports assume worst-case cold weather conditions when applying the fluid and dilute the stock material to achieve a glycol concentration of 50% (USEPA, 2000b). Many airports have established procedures and techniques for collecting the deicer runoff following application (Switzenbaum, et al., 2001). A survey of US airports found that most were able to achieve an ADF recovery of 70% through the use of a suitable recovery technique (FAA, 2001, Switzenbaum, et al., 1999). This includes the deicing fluid that is deposited on the pavement below the aircraft as well as fluid that is lost due to overspray or drippage. On the basis of this analysis a water release factor of 70% is recommended for the professional use of deicing agents. This value is well justified and often used in regulatory discussions concerning airport pollution control options for deicing agents.

2. Construction applications

The petroleum hydrocarbon diluents used to prepare the cutback asphalt used in road construction are all sparingly soluble in water with limited ability to partition into rainwater and surface water runoff. The absence of reliable field or test data with a cutback asphalt of known composition prompted the use of surrogate water solubility data for the kerosene used to formulate medium curing formulations. This approach was taken because kerosene is the most commonly used carrier diluent used in the formulation of medium curing cutback asphalt. A study of the dissolution of kerosene in tap water reportedly found a 17-hr water solubility of 0.7% (Coleman, et al., 1984). This water solubility value can be used to calculate a water release factor if the volume of water coming into contact with the freshly applied cutback asphalt can be determined. Based on rainfall measurements, the British Building Research establishment has adopted a rainfall rate of 3 L/m^2-hr for 6 hr/day (18 L/m^2) when testing the rain resistance of building facades (Straube and Burnett, 1998). If the rainwater falling on freshly applied cutback asphalt were saturated with kerosene at the water solubility limit of 0.7% (7 g/L) the overall flux of hydrocarbons into the rainwater would be 21 g/m^2-hr or 126 g/m^2 for a 6-hour rainfall event. A water release factor can be obtained when this value is divided by the kerosene content in the cutback asphalt applied to a roadway. The Asphalt Institute recommends a maximum application rate 2.3 L/m^2 of cutback asphalt to an unprimed road surface (USDOT, 2005) Adjusting for the density of medium curing cutback asphalt (0.94 kg/L) and the kerosene content in the asphalt (45%) yields a carrier solvent application rate of 0.97 kg/m^2 (Aqua-Calc, 2019). The overall release fraction under these conditions of use would therefore be 13% (0.126/0.97) for the professional application of a kerosene-containing cutback asphalt to a road surface. This value has not be adjusted and is suitable for use with all construction applications involving the use of solvent hydrocarbons in a professional setting.

3. Laboratory use

The disposal of laboratory solvents down the drain is no longer a common practice even for highly biodegradable polar solvents such as acetone. Whereas, most professional laboratories discourage the indiscriminate disposal of any hazardous waste down the drain, the evidence suggests that some releases to the municipal sewage system can occur. Monitoring of the laboratory wastewater from six university campuses in Japan showed measurable levels of 17 common laboratory solvents at levels ranging from 0.2 to 110 ng/L (Dien, et al., 2019). Whereas, some of this is likely due to the incidental release to sinks or floor drains, some European universities and research institutes still allow a down the drain disposal of certain easily biodegradable solvents (Meyer, 2018, UT, 2021). Guidelines issued by one university allow methanol, ethanol, propanol, isopropanol, butanol, acetone, and acetonitrile to be washed down the sink at aqueous concentrations that do not exceed 10% and volumes that do not exceed 3 liters per day (UG, 2012). This equates to a daily disposal of 0.3 L/day of neat solvent. The solvent use rate for a typical professional laboratory was determined to be about 2 liters/day and takes into consideration published estimates of the amount of solvent used per day to operate chromatographic equipment and to clean various pieces of laboratory glassware (Scott, 2000, Welch, et al., 2015). The ratio of the solvent discharge rate to the solvent use rate yields a water release fraction of 15% for the solvents used in a professional laboratory. As before, no adjustments are needed since the value is reasonably conservative.

5.3.3. Release factors to soil

1. De-icing applications

Studies have shown that 15-20% of an applied aircraft deicing fluid may be lost on the airport apron during taxi and takeoff (FAA, 1998). The overall loss to soil and groundwater may be conservatively determined from the results from a study examining the amount of deicing fluid captured in snowbank and snowmelt water (Corsi, et al., 2006). The percentage of applied deicing fluid that appeared in the runoff to a nearby stream ranged from 1.7 to 24% over four measurement periods. The average value of 12.6 % provides a good approximation of the amount fluid that would be expected to reach the soil and/or groundwater at airports where there the surface water avoids capture and treatment. On the basis of this information a truncated soil release factor of 12% is recommended for the professional use of deicing agents.

2. Construction applications

One of the many uses of cutback asphalt is soil stabilization which is used to increase the strength of soils used in the construction of low volume rural roads (Samrat, et al., 2021). The cutback asphalt acts as a binder that holds the soil particles together thereby increasing its overall stability. A portion of the diluent found in freshly applied cutback asphalt may therefore partition into adjacent soil layers. Although information was not available on the distribution of cutback diluents into untreated soil, the behavior of a kerosene diluent has been examined in field studies examining temporal changes following application to plots of land (Dror, et al., 2001). The concentration of nine aliphatic and aromatic ingredients in kerosene were monitored at three soil depths for a period of 39 days. The total soil concentration of these kerosene components upon application was 15,990 µg/g, whereas the value at a soil depth of no more than 10 cm was 1584 µg/g after 39 days. These data indicate a kerosene soil persistence of 9.9%, which provides a reasonably reliable estimate of the distribution that would be expected with the use of cutback asphalt in road construction. This value has been rounded upward to obtain a soil release factor of 10% for the application of a surface coatings during road construction.

3. Laboratory use

A soil release factor for a mid-sized professional laboratory was developed assuming that a small amount of a liquid reagent will be spilled or leaked during storage or use at the site. Many small to medium-sized laboratories are equipped with outdoor storage areas where reagents and solvents are stowed in bulk quantities for later use (Eddy and Wood, 1997). Transport to and from these areas presents an opportunity for accidental ground spillage and release accompanied by an incomplete clean-up of the affected area. This possibility is supported by studies showing that a group of 64 university students spilled up 10% of the liquids handled in a chemistry lab (Tsokou, et al., 2019). Although published determinations of the chemical volumes lost to the soil surface are unavailable, it is highly probable that some releases will occur at professional laboratories using outdoor storage facilities. The amount released is estimated to be no greater than 1% for the vast majority of wet chemistry teaching laboratories located on college campuses. This value provides reasonable approximation of the soil release associated with the use of liquid solvents in a professional setting.

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**		
	De-icing applications	**Construction applications**	**Laboratory use**
ERC	8d	8d 8f	8a
Air release factor (%)	5	75	32

Water release factor (%)	70	13	15
Soil release factor (%)	12	10	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		
	De-icing applications	**Construction applications**	**Laboratory use**

Waste release factor (%)	10	2	50
Source	(Hunt, et al., 1996)	(ARMA, 2016)	(Zweckmair, et al., 2017)

1. De-icing applications

The waste generation factor was taken from a life cycle assessment of a commercial antifreeze solution suitable for use in automobiles (Hunt, et al., 1996). The stated value represents the amount of ethylene glycol waste that is generated as a result of improper disposal, which included dumping into a storm sewer or onto the ground and unremedied leaks and spills. A total of 1665 pounds of an aqueous antifreeze waste containing 50% ethylene glycol was generated per 8883 pounds (1000 gallons) of product. This yielded a waste generation factor of 9.4%, which was rounded up to 10% to ensure adequate accounting. An uncertainty factor has not been applied to this value since a portion of the waste includes the improper release to surface water and soil.

2. Construction applications

The quoted value was derived from a life cycle assessment covering the residential installation of asphalt shingles on a steep-slope roof (ARMA, 2016). The operation included the installation of shingles, underlayment, leak barriers, and starter strips. The amount of waste generated during the roofing operation was kg/m^2 of surface area. The quantity of asphalt-containing material used to complete the task was 12.7 kg/m^2, which yielded a waste release factor of 2%. An uncertainty factor has not been applied to this value since it provides a reasonable representation of the waste expected from the wide dispersive uses of many different types of construction products.

3. Laboratory use

The solvent waste generated in research, analytical, and clinical laboratories is generally accumulated and disposed of as hazardous waste. The most common method for disposing of this wate is through incineration in a roatary kiln. Under some circumstances a portion of the solvent waste stream many be recovered and reused espeially if a limited number of solvents are in use within the laboratory. Such is the case in commercial and industrial laboratories that perform routine analyses using standardized methodologies. Pollution prevention initiatives and cost considerations have prompted some laboaratories to install solvent recovery systems that reduce the generation of disposable waste. Solvent recoveries ranging from 50 to 95% have been attained for common laboartory solvents such as methanol, ethyl acetate, tolune, and acetonitrile (Stepnowski, et al., 2002, Zweckmair, et al., 2017). Since these recovery systems are not in widespread use, only a portion is currently reclaimed prior to incinerator. The waste release factor of 50% reflects the increasingly common implementation of recovery and reuse programs in many laboratories.

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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