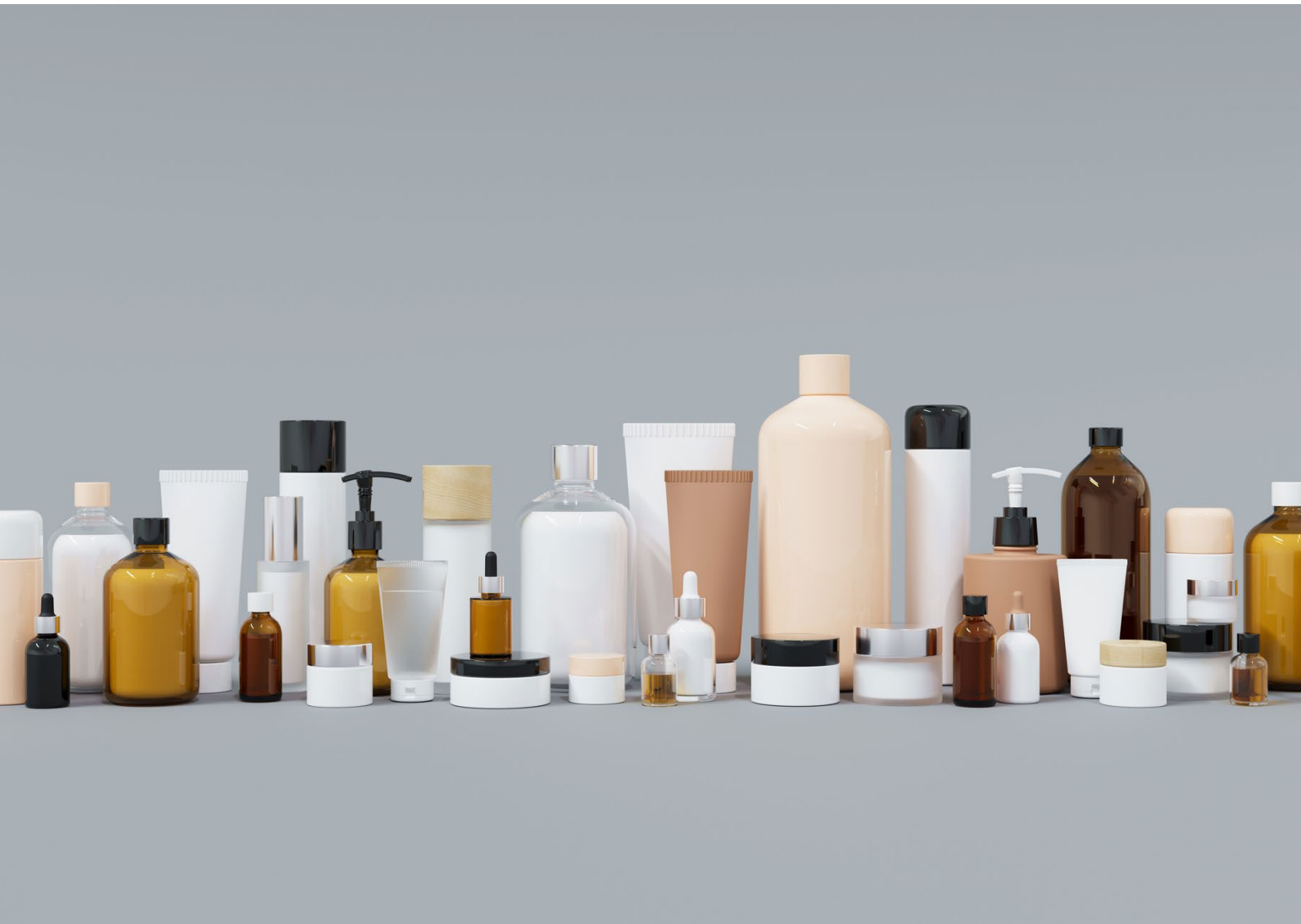
National Institute for Public Health
and the Environment
Ministry of Health, Welfare and Sport

Cosmetics Fact Sheet

Default parameters for estimating consumer exposure - updated version 2025

RIVM report 2025-0099



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Colophon

DOI 10.21945/RIVM-2025-0099

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This investigation has been performed by order and for the account of ConsExpo 2015 project. This project is financed by:

Netherlands Food and Consumer Product Safety Authority
Ministry of Economic Affairs

Ministry of Health, Welfare and Sport

anses
French agency for food, environmental and occupational health & safety
Investigate. evaluate. protect

Health Canada
www.hc-sc.gc.ca

German Federal Institute for Risk Assessment

Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

Swiss Confederation

Federal Department of Home Affairs FDHA
Federal Office of Public Health FOPH

Published by:
National Institute for Public Health and the Environment, RIVM
PO Box 1 | 3720 BA Bilthoven
The Netherlands
www.rivm.nl/en

Synopsis

Cosmetics Fact Sheet

Default parameters for estimating consumer exposure –
updated version 2025

To ensure consumer products are safe for use, it is estimated whether chemicals in these products could pose a health risk. This risk assessment requires an accurate estimate of the degree to which people are exposed to substances while using the product.

For this purpose, RIVM has developed the computer programme ConsExpo, for which a web application was developed in 2016 (ConsExpo Web). This can be used, for example, to calculate the exposure to certain chemicals at home when using, among other things, paint, cleaning products, or cosmetics.

Fact sheets have been written for ConsExpo Web users, in which default models and default values (defaults) are prescribed. By using these models and values, exposure estimates can be made in a transparent and standardised way.

There are several fact sheets, and the Cosmetics Fact Sheet has now been revised. This fact sheet sets out default values that can be used to estimate the exposure to a substance when using a cosmetic product. It contains information such as how often products are used, in what amounts and what body parts are being exposed. The revised version describes the latest available data sources and has assessed the new information. Default values have been amended where necessary.

Along with the publication of the revised Cosmetics Fact Sheet, the published default values in the ConsExpo database of, among other things, shampoo, body lotion and make-up have been updated.

Keywords: ConsExpo Web, Fact sheet, standardisation, estimate, consumer exposure, cosmetics

Publiekssamenvatting

Factsheet Cosmetica

Standaardparameters om de consumentenblootstelling te schatten – herziene versie 2025

Om consumentenproducten veilig te kunnen gebruiken, wordt beoordeeld of chemische stoffen in producten schadelijk kunnen zijn voor de gezondheid. Voor deze risicobeoordeling is een goede schatting nodig van de mate waarin mensen aan stoffen blootstaan terwijl zij het product gebruiken.

Voor deze schatting heeft het RIVM het computerprogramma ConsExpo ontwikkeld, waarvoor in 2016 een webapplicatie is gemaakt (ConsExpo Web). Hiermee kan bijvoorbeeld de blootstelling aan een bepaalde chemische stof in huis tijdens het gebruik van onder andere verf, schoonmaakmiddelen of cosmetica worden berekend.

Voor de gebruikers van ConsExpo Web zijn factsheets geschreven waarin standaardmodellen en standaardwaarden (defaults) staan beschreven. Door deze modellen en waarden te gebruiken, kan de blootstelling op een transparante en gestandaardiseerde manier worden geschat.

Er zijn verschillende factsheets, waarvan nu de factsheet over cosmetica is herzien. Hierin staan standaardwaarden die kunnen worden gebruikt om de blootstelling aan een stof in een cosmeticaproduct te schatten. Voorbeelden van die waarden zijn hoe vaak een product wordt gebruikt en in welke hoeveelheden. De herziene versie beschrijft de nieuwste beschikbare databronnen. Waar nodig zijn de standaardwaarden aangepast.

Tegelijk met de publicatie van de herziene Factsheet Cosmetica worden de gepubliceerde standaardwaarden in de ConsExpo-database van onder meer shampoo, bodylotion en make-up vernieuwd.

Kernwoorden: ConsExpo Web, factsheet, standaardisering, schatting consumentenblootstelling, cosmetica

Contents

Summary

The aim of the current report is to provide guidance for the assessment of consumer exposure to chemical substances in cosmetic products. The report describes the default scenarios and parameter values applied in the ConsExpo model. ConsExpo is used to calculate consumer exposure to chemicals in consumer products via various exposure routes. ConsExpo is now used by various (inter)national bodies and within several legal frameworks. An online version of ConsExpo (ConsExpo Web) was launched in 2016.

Product-specific default values are important for the consistent and harmonised estimation and assessment of consumer exposure to chemical substances contained in consumer products. These are developed for a wide range of product categories and are described in a series of specific fact sheets, which provide consumer exposure scenarios for the use of cleaning products, paint products, pest control products, disinfectant products, do-it-yourself products, and children's toys. In addition, the General Fact Sheet (of which the most recent update was published in 2014 by Te Biesebeek et al.) describes generic defaults for consumer exposure estimation, such as body weight, surface areas of body parts, room sizes, and ventilation rates.

The first version of the Cosmetics Fact Sheet was written in 2006 (Bremmer et al., 2006a). In the current version, new data has been taken into account and default values have been adjusted wherever necessary. Although ConsExpo was originally developed for the Dutch consumer market, the parameter values assigned are now aimed at consumers in general. Therefore, in the absence of suitable Dutch data, information from outside the Netherlands has been considered. The data supporting the prescribed defaults is explained and their quality and reliability are evaluated. In parallel to the publication of this fact sheet, the default values have been adjusted or, in the case of new scenarios, added to the ConsExpo database.
The current Cosmetics Fact Sheet explains standardised approaches in exposure estimation for cosmetic product use from which consumer exposure is anticipated. Scenarios have been drawn up explaining the anticipated consumer exposure on the basis of intentional product use. The most suitable consumer exposure models are assigned to each scenario, including default parameter values to input in the models. For each scenario, detailed information is provided for the selection of the default models and recommended input parameters. The quality of the supporting data is ranked and a rationale is provided for all of the selected defaults. The current fact sheet also describes new data sources that have become available since 2006. Finally, all changes to exposure scenarios, selected ConsExpo models, and default parameter values compared to the previous version, published in 2006, are shown in a single data table, available in an Appendix, so that they can be easily identified.

1 Introduction

1.1 Background

The ConsExpo software was developed in the early nineties at the request of the Keuringsdienst van Waren (currently Netherlands Food and Consumer Product Safety Authority; NVWA) and the Ministry of Health, Welfare and Sports (VWS) in the Netherlands as a model to calculate human exposure to chemicals from consumer products. ConsExpo is designed and used to estimate consumer exposure to chemical substances from non-food consumer products via all exposure routes (inhalation, dermal and oral exposure). Over the years, the ConsExpo project has been extended by means of the development of the fact sheets, which were incorporated into the ConsExpo software as a database.

The fact sheets are documents including exposure scenario descriptions and default values for various product categories (Bremmer & Van Veen, 2002; Bremmer et al., 2006a; 2006b; Bremmer & Van Engelen, 2007; Prud'homme de Lodder et al., 2006; Meesters et al., 2016, Cieszynski et al., 2022). In addition, there is a General Fact Sheet including default values for parameters such as body weight, skin surface area, room volume, ventilation rate, and activity patterns. This fact sheet was updated in 2014 (Te Biesebeek et al., 2014). The defaults described in the various fact sheets ensure that an exposure assessment is conducted in a harmonised and standardised way, provide reasonable worst-case estimates, and are fit for use in the ConsExpo Web software.

1.2 ConsExpo Web

In October 2016, ConsExpo Web was launched as an online web tool (www.consexpoweb.nl) for estimating exposure to substances in consumer products. ConsExpo Web is easily accessible via the internet and, in principle, is similar to ConsExpo 4.1. The online tool is open for any future updates that improve the model. ConsExpo Web already allows the user to include multiple scenarios within a single assessment. In addition, a new model has been added to assess the exposure due to emissions from solid products (or articles), and a first-tier screening level model for the exposure to non-volatile substances in sprays was added to the 'exposure to spray' model. Finally, the terminology for the outputs has been updated and the calculated exposure metrics have been adjusted. An updated manual describing how to use the ConsExpo Web version, as well as a description of the available models present in the software, is available (Delmaar & Schuur, 2017).

The use of ConsExpo is recommended for the consumer exposure assessment under REACH (EC, 2006) and the model is described in the updated REACH guidance (ECHA, 2016). Furthermore, it is also one of the models recommended to be used for the assessment of consumer exposure to biocides (EU, 2012; ECHA, 2015).

RIVM developed ConsExpo Web as an online software tool to assess the exposure to substances from consumer products. For this purpose, the

software contains a set of coherent general, mathematical models. Consumer exposure can be estimated by choosing the most suitable model and entering the required parameters of the product, such as the amount used or the concentration of the substance within a product, and subsequently the scenario.

ConsExpo is constructed to enable combining the product use data contained in fact sheets with mathematical models. The programme is based on relatively simple exposure models. The starting point for these models is the route of exposure, i.e. the inhalation, dermal, or oral route. The most appropriate exposure scenario and model is chosen for each route. Then, parameters needed for the exposure scenario and model, such as substance-specific data, frequency, and duration of use, are entered into the ConsExpo software to calculate the exposure. Further details on the mathematics behind ConsExpo are described in the manual (Delmaar & Schuur, 2016).

ConsExpo can be used for a screening assessment (first tier, often used in regulatory frameworks) or for an advanced (higher tier) assessment. For different exposure situations, different models are provided to calculate external exposure. ConsExpo also integrates the exposure through the various routes, resulting in a systemic dose. Different dosing regimens/exposure situations can be calculated (acute, daily, chronic exposure). ConsExpo can also run calculations using distributed input parameters and perform sensitivity analyses.
The models per route of exposure included in ConsExpo have different levels of detail and complexity.

The ConsExpo tool is publicly available via www.consexpoweb.nl. Default data is available via the database, which is an integral part of the online tool. The manual and the various fact sheets can be consulted on the website of the National Institute for Public Health and the Environment in the Netherlands (RIVM; www.rivm.nl/consexpo).

1.3 Fact sheets

Fact sheets are documents that present key information on consistent and harmonised estimation and assessment of the exposure to substances from consumer products. In the fact sheets, information about exposure to chemical substances is bundled into certain product or exposure categories, and default parameters are given. The main product categories comprising similar products have been defined. Examples of these categories are paint, cosmetics, toys, and pest control products, which are chosen in such a way that products with similar exposure are covered by one scenario. The choice of main product categories and subcategories is based on the product classifications used under REACH, by the United States Environmental Product Agency (US-EPA), and the Swedish Chemical Agency (KEMI), as described by the Organisation for Economic Co-operation and Development (OECD, 2012).

The fact sheets are developed for the purpose of characterising and standardising the exposure estimation in combination with the ConsExpo software, but they are also useful in any exposure estimation without the

use of the software. Products are categorised, and for each product category, the use of the type of products is described. To estimate the exposure, default models with default parameter values are determined for every product category, which are available via a database in ConsExpo Web. Using this data, standardised exposure calculations for consumers resulting from, for instance, the use of cleaning products can be performed. The fact sheets described in Table 1 are currently available. In the near future, more fact sheets may be generated to cover other categories of consumer products.

Table 1 Main categories of consumer products for which fact sheets are available.

Main categories of consumer products
Air fresheners
Children's toys
Cleaning Products
Cosmetics
Disinfectants
Do-it-yourself products
Paint
Pest control products

Main product categories are further divided into smaller product categories (subcategories). For example, the main product category Cosmetics includes the following product subcategories: shampoo, make-up, lipstick, toothpaste, and deodorant. The use of the type of products within the main category are examined for every product subcategory. To estimate the exposure to substances, default models with default parameter values are determined for every product subcategory.

Scoping literature reviews (e.g. Arksey & O'Malley, 2005) are performed in order to collect the most appropriate data available to include in the fact sheets. As such, the fact sheets provide general background information on exposure models. Furthermore, they describe various exposure scenarios for specific products and set defaults for relevant exposure parameters. The fact sheets present default values as deterministic values and also provide any available statistical information, which can be used in distributions of parameter values for conducting probabilistic (aggregate) exposure assessments.

In general, the following topics are dealt with in the fact sheets:

- Background information about the main category that is relevant for exposure;
- Delimitation of the main category and descriptions of the underlying product categories.

Furthermore, the fact sheets contain a general description of the product category and information on the way the products are used with regard to:

- Remarks about the product;
- Potentially problematic substances;
- Default scenarios and models;
- Default parameter values for the scenarios and models;
- Considerations that have led to the defaults.

The General Fact Sheet (Te Biesebeek et al., 2014) gives general information about the fact sheets and deals with overarching topics that are relevant for several other main product categories, providing further details about:

- The boundary conditions under which the defaults are estimated;
- The way in which the reliability of the data is shown;
- Parameters, such as the ventilation rate and room size;
- Anthropometric parameters, such as body weight and the surface area of the human body, or parts thereof, and inhalation rates and activity patterns.

The default values from the General Fact Sheet are used in the other fact sheets as long as there is no profound data to define individualised values for the separate scenarios.

2 Default setting and quality of the data

The underlying data is used to estimate consumer exposure in the default scenarios described in the fact sheets. This data is collected from scientific literature, product information, legislation documents, survey data on consumer habits, and experimental data on substance release from consumer products. Default exposure values are set according to the default exposure scenarios. The quality of the collected data is assessed in order to describe whether and where further improvements in consumer exposure estimation with ConsExpo can be achieved, i.e. by collecting more and better data. ConsExpo users are also informed about the uncertainty associated with the data underlying the default exposure parameter values and exposure estimates.

2.1 Default setting

Default parameter values are selected to represent a reasonable worst-case scenario, i.e. one that represents consumers who frequently use a certain product under unfavourable conditions. For example, in the case of cleaning products, parameter values are selected to represent a scenario in which frequency of use is above-average and the product is applied in large amounts, in a small room with a low ventilation rate, where the exposed person stays for a long time.

Although ConsExpo was originally developed for the Dutch consumer market, the parameter values are now aimed at consumers in general. When information is available, and if it is relevant, differences will be described between the European and the North American population.

The parameter values are chosen to generate a conservative estimate representing high-end users. To achieve this goal, the 75^{th} or the 25^{th} percentile is determined for each parameter. The 75^{th} percentile is normally used for proportional parameters. However, a decrease in, for example, room volume or ventilation rate results in an increase of the exposure estimate. In the case of such reverse proportional parameters, the 25^{th} percentile is used. For a significant number of parameters, there is actually too little data to calculate the 75^{th} or 25^{th} percentile. In such cases, an estimate is made that corresponds to these percentiles.

A probabilistic exposure assessment requires distributions of parameter values instead of deterministic point values. If available, they are provided in this update. If a distribution is not available, a reference may be provided.

2.2 Quality of the default

The availability of data is different for each exposure parameter. For a number of parameters, there is insufficient data to derive a reliable default. To indicate the reliability of a default value, a quality factor (Q-factor) is used. The quality factor ranges from 1 (low quality) to 4 (good quality), see Table 2.

Low Q-factors (Q=1 or 2) indicate that the default value is based on data that is not directly compatible with the exposure scenario or on data that comes from a limited data source and/or is solely based on expert judgment. If such a default is used in an exposure analysis, it should be used with caution. If more representative data is supplied by applicants or producers or is available from other sources, it should be weighted higher than the default value.

High Q-factors (Q=3 or 4), however, indicate that the defaults are based on sufficient data. High-quality defaults are generally associated with less uncertainty than those with low Q-factors. It is possible that some parameters will need to be adapted according to the exposure scenario. For example, if the exposure estimation is carried out for a room of a size that differs from the default scenario, the actual value should weigh more heavily than the default value.

Table 2 Value of quality factor Q

Q-factor	Description
4	Good-quality data, parameter value reliable. Applicable to the exposure scenario description.
3	Extent and quality of data satisfactory. Parameter value is applicable to the exposure scenario description.
2	Either: Extent and quality of the data are at least satisfactory. Default is subject to uncertainty on applicability to the specific exposure scenario. Or: data is considered to be limited, however applicable to the exposure scenario.
1	Educated guess, no relevant data available. Parameter value is solely based on expert judgment and/or high uncertainty on applicability to the specific exposure scenario prevails.

3 Cosmetics Fact Sheet

The first version of the Cosmetics Fact Sheet was written in 2006 (Bremmer et al., 2006a). Since this version, new data has become available, which has been evaluated and included, if appropriate, into this update. A summary table of updated defaults is presented in Appendix II.

3.1 Cosmetics

The Cosmetics Fact Sheet covers the major sources of exposure due to the use of cosmetics by consumers. This fact sheet covers products that are available on the consumer market to be used as cosmetics, including products used on hair, skin, and mucosal areas, for uses such as cleansing, beautification, care, and/or relaxation (Table 3.1). Please note that some products included in this fact sheet may be considered to be cosmetics in certain jurisdictions, but depending on label claims could be regulated as, for example, a natural health product or a non-prescription medication in other jurisdictions.

Table 3.1 Cosmetics described in this fact sheet

Chapter	Product type	Product categories
6	Hair care products	▪ Shampoo ▪ Conditioner ▪ Hair spray ▪ Hair styling gel ▪ Hair styling mousse ▪ Permanent hair dye ▪ Semi-permanent hair dye ▪ Temporary hair dye ▪ Hair bleach ▪ Permanent waves ▪ Permanent hair straightener
7	Bathing / showering products	▪ Hand soap (liquid & solid) ▪ Body soap (liquid & solid) ▪ Hand sanitiser ▪ Bubble / foam bath ▪ Bath salts ▪ Bath oils
8	Skin care products	▪ Face cream ▪ Hand cream ▪ Body lotion ▪ Face exfoliators ▪ Face packs ▪ Body packs
9	Make-up products	▪ Foundation (liquid & powder) ▪ Blush powder ▪ Facial cleanser ▪ Facial make-up remover

Chapter	Product type	Product categories
		▪ Eye shadow ▪ Mascara ▪ Eyeliner ▪ Eye make-up remover ▪ Lip make-up
10	Nail care products	▪ Nail polish, base coat, top coat ▪ Nail polish remover ▪ Other nail products
11	Deodorant	▪ Deodorant spray ▪ Deodorant stick
12	Oral hygiene products	▪ Toothpaste ▪ Mouthwash
13	Foot care products	▪ Foot cream / moisturiser ▪ Foot antiperspirant ▪ Foot anti-fungal cream ▪ Foot spray ▪ Foot powder
14	Fragrance products	▪ Fragrance spray
15	Hair removal products	▪ Shaving cream (face & body) ▪ After hair removal (face & body, spray & lotion) ▪ Hair removal cream / depilatory
16	Sun cosmetics	▪ Sun protection spray ▪ Sun protection cream/milk/lotion ▪ After sun spray ▪ After sun lotion
17	Baby care products	▪ Baby powder ▪ Diaper cream ▪ Baby oil ▪ Baby cleanser
18	Wipes	▪ Baby wipes ▪ Facial cleansing wipes ▪ Hand cleansing wipes ▪ Intimate hygiene wipes
19	Miscellaneous	▪ Massage oil ▪ Essential oils ▪ Face paint ▪ Douche

This fact sheet principally aims to predict exposure arising from the use of products as such, irrespective of the substance of interest. The default values that are presented serve to characterise consumer use of cosmetics. Information about specific substances within the cosmetic product, such as concentrations and physical-chemical properties, must be factored into the exposure assessment separately by the evaluator.

Exposure routes that are not realistic, such as the inhalation of non-volatile substances in hand wipes, are not considered in this fact sheet.

3.2 Ingredients in cosmetics

The major ingredients of cosmetics can be classified according to their function as surfactants, conditioning/moisturising agents, colorants, fragrances, or anti-microbial compounds (Bremmer 2006a; EU, 2013). Examples of other important ingredients are thickening agents, abrasives, and pH-adjusting agents.

Surfactants
The most important group of ingredients are surfactants, also called surface-active agents. These organic chemicals are used in cosmetics for cleansing, foaming, thickening, emulsifying, solubilising, and wetting effects. Surfactants can be classified by their ionic properties in water as anionic, non-ionic, amphoteric, or cationic surfactants (Bremmer 2006a; EU, 2013; Meesters et al., 2018; Romanowski, 2015).

- Anionic surfactants, such as sodium lauryl sulfate and ammonium lauryl sulfate, are used primarily in cleansing products such as shampoos, body cleansers, facial cleansers, and hand soap. They have excellent cleaning properties and produce high volumes of foam/suds, but can be irritating to the skin.
- Non-ionic surfactants, such as lauramide diethanolamine (DEA) and cocamide DEA, are used in products such as hand and body soap, hair styling products, and hair bleaching products. They produce low volumes of foam/suds, but are effective at enhancing foam when used with anionic surfactants and can reduce irritation. They are also the primary surfactants used to create emulsions, as they are effective at solubilising fragrances and natural oils.
- Amphoteric surfactants, such as cocamidopropyl betaine, cocoamphopropionate, and sodium lauraminopropionate, are used in cosmetic products where mildness, suds production and stability are required. They are less irritating than anionic surfactants, and help the product feel creamier and thicker. They are often used in combination with anionic surfactants in products such as shampoos, hand soaps, and body soaps.
- Cationic surfactants, such as behentrimonium chloride and dicetyldimonium chloride, are not primarily used in cleansing products, as they do not have efficient foaming and cleansing properties and are irritating to the skin. Cationic surfactants are typically used as a conditioning agent in products such as rinse-off hair conditioners, face packs, some facial cleansers, and liquid and powder facial makeup.

Mixtures of the above surfactants are possible, since many cosmetic products include two or more of them. Other products that may contain surfactants include deodorant, aftershave, chemical depilatory products, bath salts, bath oils, hair care products, make-up and make-up remover, exfoliation products, mouthwash, toothpaste, perfume, and shaving foam.

Conditioning/moisturising agents
Conditioning and moisturising agents are used to improve the feeling or condition of the skin or hair and to add or maintain moisture. The most common conditioning agents include cationic surfactants, occlusive agents, emollients, and humectants (Bremmer 2006a; EU, 2013; Romanowski, 2015).

- Occlusive agents, such as waxes, silicones, and oils, form a thin oily coating on the surface of the skin or hair. This coating is resistant to water, which helps prevent moisture loss from the skin and hair, while also protecting the skin from external irritants. Occlusive agents are used in cosmetics such as eye, lip, and face make-up, and hair styling products.
- Emollients, such as oils, butters, waxes, and esters, are similar to occlusive agents, but tend to be molecules with a lower molecular weight. Rather than forming a coating to block water, emollients improve the feeling and appearance of the hair or skin. They are used in cosmetics, such as lotions and creams, deodorants, shampoos, hair conditioners, skin cleansers, shaving gels, and make-up.
- Humectants, such as glycerin, aloe, and propylene glycol, are substances that attract and hold water, which is useful for bringing moisture from the air to the skin or hair. Unlike occlusive agents and emollients, humectants are easily rinsed off, so they are used more commonly in leave-on cosmetics such as lotions and creams, leave-on hair conditioner, make-up, and hair styling products.

Solvents
Solvents are added to cosmetics to dissolve or dilute other ingredients or to enhance the functionality or texture of the solution. In cosmetics, solvents may include water, oils, ethanol, or other alcohols. They are used in most types of cosmetic products.

Colourants
Colourants, or colouring agents, including opacifying (e.g. calcium carbonate, styrene, PVP copolymer, titanium dioxide) and pearlescent (e.g. glycol distearate, glycol stearate) agents, are added to cosmetics to provide colour, shine, sparkle, matte, and/or an opacifying appearance. Colourants are used in various cosmetic products, including make-up, nail care products, hair products, and skin cleansers, and in care products (Bremmer 2006a; EU, 2013).

Fragrances
Fragrance or parfum ingredients are added to cosmetic products to scent the product. They are used in most types of cosmetic products.

Anti-microbial compounds
Anti-microbial compounds or preservatives exterminate or inhibit the growth of microorganisms that cause diseases and/or odour and protect against product aging, discolouration, and oxidation (Meesters et al., 2018). They are used in most cosmetic product types.

Miscellaneous
Other ingredients added to cosmetics include abrasives, pH adjusters, processing aids, flavouring agents, propellants, and UV filters. Short descriptions of these groups of ingredients are provided below.

- Abrasives, such as polyethylene, walnuts, and silica, contain small particles that when used in a rubbing/scrubbing motion provide a smoothing or polishing effect. They are found in cosmetics such as skin exfoliators and toothpaste.
- pH adjusters include acids and alkalis, which neutralise or adjust the pH of the product to support the function of the product and prevent skin irritation.
- Processing aids, such as resins and polymers, bulking agents (e.g. talc, silica, nylon powder), thickening agents (e.g. stearalkonium hectorite, sodium chloride), and solvents (e.g. water, alcohols), provide cosmetic products with important physical characteristics, such as flow, viscosity, solubility, stability, and uniform density
- Flavouring agents, such as essential oils and sweeteners, are used to add flavour to products used near or in the mouth, such as lip care products, toothpaste, and mouthwash.
- Propellants, such as hydrocarbons, compressed gas, and dimethyl ether, are used in aerosol products such as hair spray, shaving foam, deodorant spray, and dry shampoo to help propel the product from the aerosol spray can.
- UV filters are used to protect the skin or hair from UV light, and are found in sunscreens, skin care products, make-up, nail care products, and hair products.

4 Generic scenarios and models for cosmetics

The use of cosmetic products can result in inhalation, dermal, and/or oral exposure to product ingredients. Exposure depends on the type of product and the way it is used. Because product formulation and use are often similar across different cosmetic products, exposure to these products can be comparable. Thus, the same model and scenario can be used to estimate exposure to several cosmetic products. Within this Cosmetics Fact Sheet, the generic scenarios describe the use of the products, exposure conditions, and the appropriate ConsExpo models to apply in relation to different product categories. The various scenarios include:

- Inhalation exposure (see 4.1)
  - Inhalation of substances evaporating from leave-on products;
  - Inhalation of substances evaporating from residues of rinse-off products;
  - Inhalation of volatile substances from sprays;
  - Inhalation of non-volatile substances from sprays ;
  - Inhalation of substances from powder particles.
- Dermal exposure (see 4.2)
  - Dermal exposure from leave-on products;
  - Dermal exposure from residues of rinse-off products;
  - Dermal exposure from diluted products;
  - Dermal exposure from sprays.
- Oral exposure (see 4.3)
  - Oral exposure to substances in ingested products.

The current chapter only addresses generic default parameters and scenarios that are applicable to products within this fact sheet. Chapters 6 to 19 provide the default scenarios, models, and parameter values to estimate exposure for relevant exposure routes for the product categories mentioned in Table 3.1 (including those set in this chapter). The models are described in detail in the help file and the user manual on ConsExpo Web (Delmaar & Schuur, 2017).

4.1 Inhalation exposure

4.1.1 Generic exposure scenario for inhalation of substances evaporating from leave-on products

Leave-on products are defined as cosmetic products that are intended to stay in prolonged contact with skin, hair, or mucous membranes (EU, 2015), i.e. not rinsed off. Following application, volatile or semi-volatile substances or ingredients may evaporate from the surface on which the product was applied (e.g. skin or hair) and become available for inhalation (Dudzina et al., 2015; Gentry et al., 2017; Franzen et al., 2016). The ***inhalation-exposure to vapour-evaporation-constant release area*** model is used to estimate inhalation exposure for scenarios in which substances in leave-on products evaporate from the surface to which the product was applied. It is unclear whether or for how long the product matrix remains intact on the consumer's skin, because product ingredients will eventually be evaporated, worn off, or dermally absorbed. In case the composition of the product matrix is not

entirely clear, the ***product is substance in pure form*** option of the model, which is the most conservative, is considered. In addition, it is conservatively assumed that substances evaporating from the skin to the room air are able to penetrate through clothing. This is based on the fact that volatile organic compounds have been demonstrated to be able to penetrate through clothing during the deposition from room air to human skin (Weschler and Nazaroff, 2014). Furthermore, the generic exposure scenario considers an unspecified room, because the room in which the consumer stays is not related to the used cosmetic product.

Exposure duration
The exposure duration is the time during which the leave-on product stays on the consumer's skin or hair. The exposure duration is the time between each application, which can be calculated from the product's use frequency (24 hours / frequency of use (per day) = exposure duration (hours)). The Q-factor assigned for the exposure duration is set to be equal to the Q-factor for frequency.

Some products may be assigned an exposure duration that is not calculated as described above. For example, since face paint is anticipated to be used only six times per year for adults, it is anticipated that the face paint will be washed off before the user goes to sleep, rather than worn for two months until the next application. For these cases, the exposure duration is expounded in the specific product sections.

Product amount
Here, the product amount is the amount of product available for inhalation and is equal to the amount of the product applied to the consumer's skin, hair, or mucous membrane per use. The product amount is dependent on the product type. This information is described in the specific exposure scenario for each product type, including the associated Q-factor.

Room volume
The default room volume is set to 20 m^3, which refers to an unspecified room as described in the General Fact Sheet (Te Biesebeek et al., 2014). Some products (such as hair bleach) may instead be used in the bathroom (10 m^3), while some products (such as massage oil) may be used in the bedroom (16 m^3) (Te Biesebeek et al., 2014). The Q-factor assigned is 4 or 3, for a bathroom/bedroom or an unspecified room, respectively, in accordance with the General Fact Sheet.

Ventilation rate
The default ventilation rate is set to 2 per hour or 0.6 per hour, which refers to the ventilation rate of a bathroom or an unspecified room, respectively, as described the General Fact Sheet (Te Biesebeek et al., 2014). The Q-factor assigned is 3, in accordance with the General Fact Sheet data.

Application temperature
The product is applied to the skin or hair, so the application temperature is interpreted as the temperature of the skin. The temperature is set to 32°C, which is in agreement with the derivation of the default mass

transfer coefficient (Gajjar et al., 2013; see below). The Q-factor assigned is 4, because there is sufficient available data on the temperature of human skin (Yosipovitch et al., 1998; Weschler and Nazaroff, 2014; Gajjar et al., 2013).

Mass transfer coefficient
A generic default value for the mass transfer coefficient of 10 m/h is proposed. This generic default is usable for a situation where specific properties of the substance, the product and the indoor environment are not considered. The Q-factor assigned is 2, because of the generic and conservative character of the calculation from which the default is derived.

For further information on the background of the default value suggested for the mass transfer coefficient, please check the overarching issues document provided by RIVM (RIVM, 2018; 2024).

Release area
The release area is set to be equal to the 'exposed area' described for dermal exposure estimation (the surface area of the skin to which a product is applied). Default values for surface area were derived from the US-EPA Exposure Factor Handbook (US-EPA, 2011), from the ConsExpo General Fact Sheet (Te Biesebeek et al., 2014), or derived from other relevant sources and based on professional judgment. This information is described in the specific exposure scenario for each product type, including the associated Q-factor.

Emission duration
The emission duration and associated Q-factor assigned is equal to the exposure duration.

4.1.2 *Generic exposure scenario for inhalation of substances evaporating from residues of rinse-off products*

Rinse-off products are defined as cosmetic products intended to be removed (for instance by washing, rinsing, or wiping off) following application on skin, hair or mucous membranes (EU, 2015). Following product removal, it is assumed that a small fraction of the product may remain on the skin. Substances in the remaining fraction of the product may evaporate and become available for inhalation (Dudzina et al., 2015; Gentry et al., 2017; Franzen et al., 2016). The ***inhalation-exposure to vapour-evaporation-constant release area*** model is used to estimate inhalation exposure to evaporated substances for scenarios in which the consumer has used a rinse-off product. Except for the product amount, the defaults for the generic exposure scenario for inhalation of substances evaporating from residues of rinse-off products are set equal to those for leave-on products (Section 4.1.1).

Product amount
Here, the product amount is the amount of product available for inhalation, which is equal to the amount of the product applied to the skin, hair, or mucous membrane per use. The product amount is dependent on the product type. This information is described in the specific exposure scenario for each product type, including the associated Q-factor. However, for rinse-off products, it is necessary to

apply a retention factor to the applied product amount in order to calculate the product amount retained on the skin or hair following removal.

Retention factor
The removal of a rinse-off product shortly after application may include rinsing with water (e.g. facial cleanser, mudpack, facial scrub, etc.) or wiping off (e.g. make-up remover, etc.). For these scenarios, a retention factor needs to be applied to reflect the amount of product remaining on the skin, hair, or mucous membrane after removing the product. Most of the retention factors described in the specific exposure scenarios are not derived from quantitative data, but are commonly accepted values for retention factors for cosmetic products. Generally, when a reliable source suggested ranges of retention factors for products (e.g. 0.01 to 0.1), the upper-end of the range was selected as the default value for these scenarios.

4.1.2.1 Generic exposure scenario for inhalation of substances evaporating from rinse-off product with a limited leave-on time

In order to be effective, some rinse-off cosmetic and personal care products need to be left on the consumers' skin or hair for a limited period of time. Examples of such products are hair dyes, bleaches, straighteners, and skin and face treatment products, such as permanent and semi-permanent hair dyes, hair bleaches, hair permanent waves, and straighteners. Such products are considered here to be rinse-off products with a limited leave-on time. The consumer can inhale substances evaporating from the pure product between the moments the product is being applied and rinsed off. The ***inhalation-exposure to vapour-evaporation-constant release area*** model is used to estimate inhalation exposure from these products. The **product is substance in pure form** option is selected, because this is the most conservative choice in case the composition of the product matrix is not entirely clear. The estimation of inhalation exposure to substances evaporating during the limited leave-on time of specific rinse-off products is quite similar to the estimation of inhalation of substances evaporating from leave-on products. The only differences are the (limited) exposure and emission durations. Also, the room volumes and ventilation rates are different; they refer to a bathroom where the product is applied. The other input fields (referring to product amount, application temperature, mass transfer coefficient and release area) are derived in the same manner as described in the generic scenario for leave-on products (see Section 4.1.1.).

Exposure duration
The exposure duration is set to be equal to the limited leave-on time during which the product needs be left on the skin or hair in order to be effective.

Product amount
The product amount in this scenario refers to the amount of product that is applied to the consumer's skin or hair before it is rinsed off.

Room volume
A default room volume of 10 m3 is set, because this corresponds to a bathroom (Te Biesebeek et al., 2014), which is considered to be the location where the product is being applied. As such, the Q-factor assigned is 4 (see Section 4.1.3.2).

Ventilation rate
A default ventilation rate of 2 per hour is set, corresponding to a bathroom (Te Biesebeek et al., 2014). As such, the Q-factor assigned is 4 (see Section 4.1.3.2).

Emission duration
Emission of substances is considered to occur between the moment of application and the moment of rinse-off. As such, the default emission durations are set equal to the respective exposure durations, and the same Q-factor is assigned.

4.1.3 Generic exposure scenarios for inhalation of substances from sprays

During the application of cosmetic and personal care products, which are available as aerosol spray cans, trigger sprays, or pump sprays, the consumer may inhale both volatile and non-volatile substances.

Inhalation exposure to non-volatile substances is anticipated via their presence in respirable aerosol particles generated during the spray event. In case of cosmetic spray products, the spray releases a cloud that travels directly towards the consumer. The inhalation exposure to non-volatile substances in sprays is estimated using the ***inhalation-exposure to spray-spraying-spraying towards person*** model.

Inhalation of volatile substances during the spray event is anticipated via direct release from the spray nozzle into the air that is inhaled by the consumer. Inhalation exposure to volatile substances during the spray event is estimated using the **inhalation-exposure to spray-instantaneous release** model. The inhalation of substances in the spray cloud is only considered for the duration of the spray event. This consideration is included in the 'spraying towards person' module for the estimation of inhalation exposure to non-volatile substances ConsExpo Web (Delmaar & Schuur, 2017).

An arbitrary designation of 0.01 Pa for the vapour pressure of the substance is considered to distinguish between volatile substances (>0.01 Pa) and non-volatile substances (<0.01 Pa) in sprays (Prud'homme de Lodder et al., 2006a).

4.1.3.1 Generic exposure scenario for inhalation of volatile substances from sprays

The ***inhalation-exposure to spray-instantaneous release*** model is most appropriate for estimating inhalation exposure to volatile substances released upon spraying. The spray is directed towards a person, so that for a short period, the air concentrations of volatile substances are higher close to the exposed individual compared to air concentrations throughout the bathroom. However, the appropriate model for volatile substance does not include the **spraying towards person** option, as described for the non-volatile substances. Therefore,

the approach to estimate inhalation exposure to volatile substances sprayed towards a person is different from the one for non-volatile substances.

Exposure duration
Here, the exposure duration is the short period of time in which the air concentration close to the exposed person is higher than the background concentration in the bathroom. It is assumed that this is the case for the entire duration of application of the cosmetic product, including non-spraying time in between multiple spraying activities. The duration of such an intermittent spray event is calculated as twice the time that is spent in actual spraying (Bremmer et al., 2006a). Hence, the default exposure duration is set to be equal to two times the spray duration. The Q-factor assigned is 1, because it is based on expert judgment.

Released mass
The released mass is the product amount that is sprayed from the container. This is set to be equal to the product amount described in the dermal exposure scenario, if available. Otherwise, the released mass (g) is calculated by multiplying the mass generation rate (g/s) by the spray duration (s). Then, the Q-factor for released mass is equal to the Q-factor for the dermal product amount or to the lowest Q-factor assigned for the respective mass generation rate or spray duration.

Room volume
The room volume is interpreted as the user's personal breathing zone, set to 1 m^3. The Q-factor assigned is 1, as the interpretation of the personal breathing zone is based on expert judgment.

Ventilation rate
The default ventilation rate of the air in the personal breathing zone is assumed to be equal to the ventilation in the entire room. The Q-factor assigned is 1, as this assumption is based on expert judgment.

4.1.3.2 Generic exposure scenario for inhalation of non-volatile substances from sprays

The inhalation exposure to non-volatile substances in sprays is estimated using the ***inhalation-exposure to spray-spraying-spraying towards person*** model.

Spray duration
In the current Cosmetics Fact Sheet, the spray duration of a spray product is defined as the *total spraying time between the start and finish of spraying, not counting time between sprays* (Delmaar & Schuur, 2017). This definition was updated from the previous Cosmetics Fact Sheet (Bremmer et al., 2006a) in which spray duration was defined as the *entire duration of applying the cosmetic product including non-spraying time in between multiple spraying activities.* The manual of ConsExpo Web (Delmaar & Schuur, 2017), however, describes spray duration as the time that is actually spent spraying during the spraying activity, thus excluding non-spraying time. The latter is preferred as explained in the Overarching issues document by RIVM (2018; 2024). A clear definition of 'spray duration' is important, because the amount of spray available for inhalation is simulated in ConsExpo Web from the

mass generation rate of the spray, the spray duration, and ventilation (Delmaar & Schuur, 2017). The spray duration (s) may be calculated by dividing the released mass (g) by the mass generation rate (g/s). Therefore, the Q-factor for spray duration is equal to the lowest Q-factor assigned for the respective released mass or mass generation rate. Default values for spray duration are described in the specific exposure scenario for each product type, including the associated Q-factor.

Exposure duration
The exposure duration in this case is the time the consumer spends in the room during and after the application of the spray product. Many cosmetic spray products are anticipated to be sprayed in the bathroom. The survey data reviewed by US-EPA (2011) for the time spent in the bathroom after a shower or bath shows a 75^{th} percentile of 10 min across all age groups and sexes (n = 1000+). It is expected that the consumer will not use cosmetic spray products immediately after the bath or shower, because it will take some time to towel off. The previous Cosmetics Fact Sheet (Bremmer et al., 2006a) describes a default exposure duration of 5 min to represent the time between the moment of product use and the moment the consumer leaves the bathroom. Since the previous default agrees quite well with the US-EPA (2011) review, the default exposure duration for spray products applied in the bathroom remains 5 min. The Q-factor assigned remains 2, as the actual time spent in the area after the use of specific spray cosmetics is unclear. Some products, such as foot spray and sun protection spray, may be used in any room. For these products, the exposure duration is described in the specific exposure scenario for each product type, including the associated Q-factor.

Room volume
The room volume refers to the room in which the consumer resides during and after the spray event. The room most commonly used for spraying hair spray, deodorant and perfume is the bathroom (EPHECT, 2012). Some products, such as foot spray and sun protection spray, may be used in any room. Therefore, the default room volume is 10 m^3 or 20 m^3, which refers to the volume of a bathroom or an unspecified room, respectively, according to the General Fact Sheet (Te Biesebeek et al., 2014). The Q-factor assigned is 4 or 3, for a bathroom or an unspecified room, respectively, in accordance with the General Fact Sheet.

Room height
The default value for room height is based on a standard room height of 2.5 m as explained in the General Fact Sheet (Te Biesebeek et al., 2014). The Q-factor assigned is 4, in accordance with the General Fact Sheet.

Ventilation rate
The default ventilation rate is set to 2 per hour or 0.6 per hour, which refers to the ventilation rate of a bathroom or an unspecified room, respectively, as described in the General Fact Sheet (Te Biesebeek et al., 2014). The Q-factor assigned is 3, in accordance with the General Fact Sheet.

Cloud volume
During the actual spraying of a cosmetic product towards a person, that person is exposed to an aerosol cloud with fine particles. In the ConsExpo Web spray model, the volume of the cloud after 1 second is assumed to further increase linearly in time until the spraying stops or the cloud volume equals the volume of the room. It is assumed that during the use of the spray (the actual spraying), the breathing zone of the exposed person is located inside this cloud volume. After spraying, the sprayed material is assumed to be homogeneously dispersed.
The default value for cloud volume is set to 1/16 m^3 or 0.0625 m^3. This cloud volume matches a cone measuring 1 m (length) and 0.5 m (diameter); in addition, it matches a sphere with a diameter of 0.5 m. The Q-factor assigned is 2 for spray cans and 1 for pump sprays, because the cone shaped dispersion pattern of a 1-m distance is less appropriate for pump sprays (Bremmer et al., 2006a).

Mass generation rate
In the current Cosmetics Fact Sheet, the mass generation rate of a spray product is defined as the *mass released per unit time of (net) spray duration* (Delmaar & Schuur, 2017). This definition was updated from the previous version (Bremmer et al., 2006a), in which mass generation rate was defined as the *average mass released per unit of time over the entire duration of the application.* This adjustment in the method for deriving mass generation rate has already been presented in the latest Cleaning Products Fact Sheet (Meesters et al., 2018) and will likewise be used in other relevant fact sheets that are due to be updated in the future. This is also described in the Overarching issues - ConsExpo Web and fact sheets document (RIVM, 2018). Delmaar & Bremmer (2009) experimentally determined mass generation rates for aerosol and trigger sprays, in addition to specific spray products (see also the section below). In the current fact sheet, these product-specific mass generation rates are used whenever possible. The mass generation rates are described in the specific exposure scenario for each product type, including the associated Q-factor.

Mass generation rate – aerosol spray cans
In the report by Delmaar & Bremmer (2009), mass generation rates were experimentally determined for aerosol spray cans by spraying for 10 seconds and determining the weight loss of the spray can. To account for the variation of the mass generation rate during the lifetime of the product, the weight loss was measured between a full spray container and a nearly empty container (Delmaar & Bremmer, 2009). The results of these experiments, performed on 17 aerosol spray cans, show that the mass generation rate ranged between 0.29 and 2.2 g/s. This is consistent with the data from a comparable series of experiments by Tuinman (2004; 2007), which shows a 75^{th} percentile of 1.2 g/s. Therefore, the default mass generation rate for aerosol spray cans is set to 1.2 g/s. The Q-factor assigned is 3, because the underlying dataset is large but does not refer to any specific exposure scenario.

Mass generation rate – trigger sprays
Delmaar & Bremmer (2009) also experimentally determined the mass generation rates for trigger sprays by squeezing 10 times (which approximately takes 6 seconds) and determining the weight loss in the

spray can afterwards. The obtained mass generation rates of 6 different trigger sprays ranged between 1.0 and 1.5 g/s. This is consistent with data from a comparable series of experiments by Tuinman (2004; 2007), which shows a 75th percentile of 1.6 g/s for trigger sprays. Therefore, the default mass generation rate for trigger sprays is set to 1.6 g/s. The Q-factor assigned is 3, because the underlying dataset is large but does not refer to any specific exposure scenario.

Airborne fraction
The 'airborne fraction' refers to the fraction of the sprayed respirable particles that becomes airborne and is thus available for inhalation (Delmaar & Schuur, 2017). However, the airborne fraction in this generic exposure scenario refers to a 'scaled' airborne fraction that is part of the correction in 'initial particle distribution' described below. The measured initial particle size distributions derived by Delmaar & Bremmer (2009) indicate that a log-normal distribution fitted for the entire initial particle size distribution of a spray may in fact result in a poor description of the smaller particles. For this reason, it was decided to fit the initial particle size distribution in the particle size range up to 22.5 µm (RIVM, 2010). To derive such a 'scaled airborne fraction', it is first required to derive a scaling factor (*fscale<22.5 µm*) that refers to the mass of all sprayed particles with a diameter < 22.5 µm as a fraction of the total mass sprayed of the product:

$$f_{scale<22.5\ \mu m} = \frac{g_{product\ sprayed<22.5\mu m}}{g_{total\ product\ sprayed}}$$

The scaling factor is then accommodated in a scaled airborne fraction that refers to the mass of the particles that are both airborne and smaller than 22.5 µm as a fraction of the total mass sprayed:

$$airborne\ fraction_{(scaled\ <22.5\ \mu m)} = f_{scale<22.5\ \mu m} \times \frac{g_{airborne}}{g_{total\ product\ sprayed}}$$

It should be noted that the default airborne fraction specifically links to the initial particle size distribution (in the range up to 22.5 µm) and must not be used when particle size distributions with other definitions are inserted by the ConsExpo Web user. Furthermore, ConsExpo Fact sheets that date before 2010 are due to be updated with respect to this *initial particle distribution* and *airborne fraction* (RIVM, 2018).

Aerosol diameter
In order to use ConsExpo Web's '***Inhalation-exposure to spray-spraying***' model to simulate the inhalation exposure to non-volatile substances in sprays, input values must be inserted that adequately represent the particle size distribution of spray droplets. More specifically, it is important that the particle sizes relevant for inhalation and oral exposure via secondary ingestion are represented. This means that the low particle size range should be properly described by the parameterisation of the particle size distribution. The method to derive a separate fit for smaller particles is described in detail in Delmaar & Bremmer (2009). In 2010, these newly derived defaults for the initial particle size distribution were included in the ConsExpo 4.1 software by updating the database (RIVM, 2010). By inputting the new defaults from

2010 for initial particle size distribution to the ConsExpo '***Inhalation-exposure to spray-spraying***' model, a correction is required to account for the fraction of particles above the 22.5 µm cut-off (RIVM, 2010). Otherwise, the exposure would be overestimated, as the model would assume that all airborne particles are in the range up to 22.5 µm. It was therefore decided to adjust the input value for the so-called 'airborne fraction' parameter in ConsExpo to the 22.5 µm cut-off.
The information required by the ConsExpo Web spray model does not allow using the ranges and <10 µm fraction as inputs for the model. The parameterisation needed describes a median and arithmetic coefficient of variation for the diameters of the particles/aerosols. This is the reason why a recent study by Berrada-Gomez et al. (2023) could not be used in ConsExpo Web. The data described in the research paper (Berrada-Gomez et al. 2023) is not compatible with the input fields of ConsExpo Web. They measured aerosol diameters of the droplets released from spraying 78 different cosmetic spray products from Pierre Fabre DermoCosmétique. The measurement study included propellant-based dry shampoo, hairspray, sunscreen, cosmetic powder, emulsions, oil, and lacquer, as well as sunscreens, hairspray, lotions, and oils available in pump spray product formats. The particle size distributions (PSDs) of the sprayed droplets was determined by using a laser diffraction system. The authors provided the results per unique product by presenting the lower and upper limit of the particle size range and the fraction of particles smaller than 10 µm within that range. This provides an indication of the inhalable fraction. On the basis of their results, it can be observed that certain product types are showing a variation in PSDs, while others appear to have similar PSDs. Unfortunately, the raw data was not yet available upon finalisation of this fact sheet and therefore, the information was utilised as supporting information in setting the defaults. It does present conflicting information on certain products, especially for those where assumptions have been made that one product can be used as a surrogate for another product. This data from Berrada-Gomez (2023) shows that in particular cases, the assumption is uncertain.

Density non-volatile
The density of the non-volatile substance is one of the parameters included in the spray model and is defined here as the density of the aerosol droplets that become airborne. Together with the droplet diameter, the aerosol density determines the time that the aerosol droplet is airborne and available for inhalation. Many non-volatile substances in cosmetics are made of large organic compounds with densities usually between 1.0 and 1.5 g/cm^3. For a complex mixture of (especially organic) compounds, the density is set to 1.8 g/cm^3. The density of salts generally varies between 1.5 and 3.0 g/cm^3. In Table 4.1, default values for solvents and non-volatile compounds are described. The Q-factor assigned is 3, because density is a physical-chemical property that is generally known for most substances but is presented here on a generic level.

Table 4.1 Default values for density of solvents and non-volatile compounds (Bremmer et al., 2006a)

Type	Main ingredient	Density [g/cm^3]	Q-factor
Solvents	Volatile organic solvents	0.7	3
	Water	1	4
Non-volatile compounds	Large organic compounds	1.5	3
	Salts	3.0	3
	Complex mixture of compounds, especially organic compounds	1.8	3

Inhalation cut-off diameter
The inhalation cut-off diameter is defined as the diameter below which the sprayed particles can be inhaled and reach the lower areas of the lungs, i.e. the alveolar region (Delmaar & Schuur, 2017). It is only an approximation of the complicated process of deposition of particles in the lungs, but in practice, its value is suggested to be set to 10-15 µm (Delmaar & Schuur, 2017). In order to be conservative, here, the default for the inhalation cut-off diameter is set to 15 µm. The Q-factor is considered to be 3, because the value is specifically but qualitatively derived for the parameter inhalation cut-off diameter.

4.1.4 Generic exposure scenario for inhalation of substances from powder particles

Cosmetic powders are generally applied by means of pads, brushes, or applied directly to the body. During application, the powders can disperse into air, and inhalation exposure occurs via respiration of airborne powder particles present in the consumer's breathing zone.

The extent to which powders are inhaled is related to the body area to which the powder is applied (location), the formulation and particle size distribution of the powder, and the behaviour of the individual using the product (Rasmussen et al., 2019; Steiling et al., 2018). Powders on the consumer market can be applied to the face (including blusher, finisher, eyebrow, eyeshadow), hair, full body, feet, and diaper area of infants (Ficheux et al., 2015; Steiling et al., 2018). In the scenarios where a powder is applied to an infant diaper area, both the infant and the person applying the powder can be exposed to the powder. A controlled laboratory experiment showed that the amount of powder mass inhaled by the consumer is influenced by the distance between the surface area on which the powder is applied and the consumer's nose and mouth (Rasmussen et al., 2019). This study was performed using four different talc-containing cosmetic powders, i.e. face, full body (2x), and diaper powder. It indicates that separate exposure scenarios are required for different cosmetic powders.

The various exposure scenarios, however, follow a generic approach to inhalation exposure. ConsExpo Web does not contain an exposure model that specifically describes the exposure to powders. Within the ConsExpo Web software, the **exposure to spray** model considers the exposure to sprayed aerosols and provides the best approximation of powder particle behaviour following application. Cosmetic powders are generally used only briefly and will not remain airborne long after application, thus

resulting in short exposure durations. Acknowledging the limitations, the ConsExpo Web ***inhalation exposure to spray - instantaneous release model*** is considered fit for purpose to determine the exposure to powders via inhalation. A similar approach was considered previously in the DIY fact sheet (RIVM report 2022-0208; Cieszynski et al., 2022). The defaults in the DIY fact sheet were based on information on powder exposure during mixing and loading of washing powder, which is not applicable to cosmetic powders.

The approach to deriving the default values from either the measured air concentrations or the inhaled mass as reported in the studies is described for the facial powders in detail and is considered applicable to the body powders as well. Since no data is available for cosmetic powders on other body areas, it is assumed that the exposure defaults derived for facial powder are applicable to hair powders; moreover, body powder defaults will apply to feet powders and diaper powders.

4.1.4.1 Face area

Typical facial powder cosmetics are blusher, finisher, eyeshadow and eyebrow products. They are often applied using pads or brushes. The application method may result in differences in exposure. However, there is no data that makes the distinction if there is any. Therefore, one generic exposure scenario, including associated defaults, has been derived for facial powders.

The potential for inhalation exposure to particulate matter from the use of powdered facial cosmetics was examined by Nazarenko et al. (2012a, b), Rasmussen et al. (2019), Oh and Kim (2020), and Oh et al. (2021). These five studies were used to derive the defaults for the facial powders. Summary data from four of these studies is available in Table 1, and more information on these studies is presented in Appendix I. (Nazarenko et al., 2012b was excluded because they did not present new data but showed how the inhaled dose was obtained.) Air concentrations of particulate matter in the personal breathing zone were measured in all of these studies while Nazarenko et al., Oh and Kim and Oh et al. also derived inhaled dose estimates from the following algorithm (adapted from Hansen et al. 2008) and a 60 kg body weight.

$$D_{inhalation} = C_{inhalation} \times Q_{inhalation} \times t_{inhalation} \times wf_{substance}$$

Here, the inhaled dose in *g* ($D_{inhalation}$) is calculated as the product of the concentration of the powder in the air inhaled in g/m^3 ($C_{inhalation}$), the consumer's inhalation rate in m^3/min ($Q_{inhalation}$), the time during which the consumer inhales the powder containing air in min ($t_{inhalation}$) and the weight fraction of the substance ($wf_{substance}$) in the powder product ($g_{substance}$ / g_{powder}). Nazarenko et al. used the US-EPA default inhalation rate for women aged 18-60 of 11 L/min to assess short-term exposure as a default in their calculations. This value was used to derive the released powder mass and room volume, as explained in the sections below.

Released mass

Here, the default released mass available for inhalation refers to the amount of mass inhaled by the consumer, or the total amount of powder

(*g*) inhaled during application of cosmetic powder to the face. Hence, the released mass is presented as equal to the inhaled dose derived from the four studies. This means that, in real life, the release of powder was higher but since the inhaled dose was used, that particular fraction not reaching the breathing zone/respiratory tract is already accounted for in this approach. The controlled experiments to measure the amount of cosmetic powder inhaled during application to the face area were performed by Oh and Kim (2020), Oh et al. (2021) Rasmussen et al. (2019) and Nazarenko et al. (2012a).

Nazarenko et al. (2012a) measured air concentrations around a mannequin head upon application of different cosmetic powders in the face area and calculated the amount of powder that would be inhaled. Particulate matter < 10 µm (PM10) air concentrations ranged from 0.13 to 170 mg/m^3 for the 6 facial cosmetics tested. Inhaled doses of PM10 of 1.5, 24.4, 24.0, 22.3, 50.2 and 1875 µg were calculated (Nazarenko 2012b, Nazarenko's personal communication).

In Rasmussen et al. (2019) one human subject wearing a personal monitor was asked to apply talc powder on the face. The data showed two peak concentrations of powder in the personal breathing zone. The mean concentration measured was 1.80 mg PM4/m^3. Using this air concentration, an inhalation rate of 11.0 L/min, and a 1-min exposure duration, the inhaled dose of particulate matter < 4 µm (PM4) would be 19.8 µg. Oh and Kim (2020) tested facial and eyeshadow powder on a mannequin head with two sampling devices mounted on the nose and mouth. The flow rate of the sampling devices was set up to resemble an inhalation rate of 11 L/min , and the test had repeat applications every 3 s for 5 minutes. The dosage of respirable powder (PM10) that could be inhaled ranged from 668 to 698 µg for the application of facial powder and from 582 to 817 µg for eyebrow powder (Oh and Kim 2020), with corresponding air concentrations ranging from 53 to 74 mg/m^3 based upon a 1-minute exposure.

In another publication on mannequin experiments with 5 eyebrow powder products performed by Oh et al. (2021), PM10 air concentrations in the personal breathing zone ranged from 0.056 to 0.21 mg/m^3. The related PM10 particle mass inhaled dose ranged from 1.4 to 3.3 µg.

Hence, the difference between the amounts of powder mass inhaled in the experiments from Oh et al. (2021), Oh and Kim (2020), Nazarenko et al. (2012a) and Rasmussen et al. (2019) is higher than a factor of 1000. Across these four studies, air concentrations ranged from 0.056 to 170 mg/m^3 and inhaled doses ranged from 1.4 to 1875 µg. It was decided to exclude the data by Rasmussen as it may have underestimated the inhaled dose of particles up to PM10. The impact of excluding this data is, however, limited. Here, the default release mass recommended is 668 ug (0.67 mg), which is the P75 of powder µg measured across the various experiments described. The Q-factor assigned is 2, because of the large difference in the measured amounts (> factor 1000).

Exposure duration
The exposure duration normally refers to the total time during which the exposed person is in the room where the substance is being released (Delmaar and Schuur 2017). Rasmussen et al. (2019) found that the exposure cloud in users' personal breathing zone lasted approximately 1 minute. Furthermore, they observed the formation of a secondary cloud in users' personal breathing zone following application of powdered cosmetics to the face. The secondary cloud is of lesser magnitude, but nonetheless contributes to the overall exposure. This suggests that users have the potential for inhalation exposure to particulates for the entire time they are present in the room.

However, as the inhaled dose was set as leading input to derive the released mass, and this value was linked to both fixed values for inhalation rate and exposure duration, these values should be kept the same. It remains unclear how the default values for the parameters mentioned above account for potential secondary cloud formations. However, the quantification by Rasmussen could not be used as explained above.

The default exposure duration is therefore set to 1 min. It is acknowledged that the exposure duration is less than the standard default value of 5 minutes in accordance with the time spent in a bathroom (RIVM 2006, US-EPA 2011). The Q-factor assigned is 1.

Room volume
In this scenario, the default room volume does not refer to the volume of the room in which the exposure scenario takes place, but to the volume of air inhaled by the consumer, in order to define the ConsExpo defaults in such a way that the outcome of the ***inhalation – exposure to spray – instant release*** would match the outcome of the equation by Nazarenko et al. (2012). The room volume is set to be equal to the volume of air that is inhaled by the consumer for the duration of the exposure event. The exposure duration is set to 1 min, while the default inhalation rate is 11 L/min. The default 'room volume' is thus set to $1 \times 11 = 11$ L = 0.011 m^3. The Q-factor assigned is 1, because 0.011 m^3 does not refer to the actual room volume, but to the volume of air inhaled.

Ventilation rate
The ventilation is set to 0 per hour, which best aligns with the equation used to estimate the released mass and the data presented in Nazarenko et al. (2012a, b).

4.1.4.2 Body area

The application of cosmetic body powders results in the release of powder particles into the user's personal breathing zone. The consumer activity consists of shaking and pouring a bottle, thus releasing the powder into the air and onto the palm of the consumer's hand. The hand then applies the powder to the targeted areas of the human body. Alternatively, the powder may be applied directly to the body and spread out using the hand. Although it is likely that the exposure to powder will differ between the two application techniques, no data is

available that distinguishes the anticipated difference. Therefore, only one scenario will be drafted for body powders.

Two studies were identified that have measured the air concentrations associated with the application of cosmetic powders to the body (Anderson et al. 2017, Rasmussen et al. 2019). Rasmussen et al. (2019) monitored powder concentrations (particulate matter with aerodynamic diameter < 4 µm; PM4) at different distances from one subject while they applied talc products over their body. The monitoring data measured one particle cloud at the breathing zone (distance 0 cm from face) with a mean concentration of 0.48 mg/m^3 (Rasmussen et al., 2019). Anderson et al. (2017) measured the average particle air concentrations of 1.46 mg/m^3 following the application of talcum powder to the body by 5 subjects. The ***inhalation – exposure to spray – instantaneous release*** was identified as the best available model within ConsExpo to estimate the inhalation exposure from cosmetic powders applied to the body.

Released mass
In this scenario, the default released mass that is available for inhalation refers to the amount of mass inhaled by the consumer, or to the total amount of powder (*g*) inhaled during the consumer activity of applying a cosmetic powder to the body.
Anderson et al. (2017) conducted activity-based sampling with cosmetic talcum powder in simulated-bathroom controlled chambers involving volunteers who applied the powder across their bodies. Air sampling filters were prepared by direct preparation techniques and analysed by phase contrast microscopy (PCM). The consumer activity consisted of shaking and pouring a bottle releasing the powder into the air and onto the palm of the consumer's hand. Per activity, Anderson et al. (2017) kept track of the number of shakes performed, the amount of talc powder used, the sampled volume of air, the duration of sampling, the duration of application and the respirable dust concentration in the sampled air. The application durations in Anderson et al. (2017) ranged from 13 to 47 seconds, whereas the sampling durations lasted for about 48 minutes covering 8 applications. Monitoring data from Rasmussen et al. (2019) indicates that cosmetic powder disperses into and out of the personal breathing zone within minutes.
Air concentrations measured in Anderson et al. 2017 and Rasmussen et al., 2019 (body powder replicate) ranged from 0.26 to 5.03 mg/m^3 with a P75 air concentration of 2.3 mg/m^3. This P75 value was only based on the Anderson data, as the Rasmussen data is based on PM4 measurements. The inhaled dose, as surrogate for the released mass, has been derived in a similar way as the one for the face powders. The main difference between the two approaches is the longer application duration for body powders, as it is often used on larger surface areas. In line with an approximation of the total application time in the Anderson et al., 2017 study, a duration of 5 minutes is assumed. An inhaled dose equivalent to 125.8 µg was calculated using the P75 air concentration and the algorithm adopted from Hansen et al. 2008 and Nazarenko et al. 2012(a, b), based on an inhalation rate of 11.0 L/min and a 5 min contact duration. The Q-factor assigned is 2, because measurements were obtained from 2 studies involving human subjects applying body powder.

Exposure duration
The default exposure duration refers to the time the exposed person spends in the room where the substance is being released (Delmaar and Schuur 2017). Resuspension of particles can contribute to airborne concentrations of inhalable particles. A secondary exposure cloud was observed in Rasmussen et al. (2019), Pooley (1972) and Dement et al. (1972) during application of body or baby powders, suggesting that users have the potential for inhalation exposure to particulate matter during the time they are present in the room (ECCC, HC 2020). However, as the released mass, exposure duration, and room volume (see below) are linked to each other to describe the available data on powders, the values are fixed to those used in the equation above. The exposure duration is set to 5 min. The Q-factor assigned is 2, equal to that for the inhaled dose/released mass since it relates to the same source of information.

Room volume
The default room volume for cosmetic body powder products is set to 0.055 m^3, which refers to the volume of air inhaled by the user personal breathing zone for the duration of exposure . The Q-factor assigned is 1.

Ventilation rate
The ventilation is set to 0 per hour, which best aligns with the equation used to estimate the released mass on the basis of air concentration data in Anderson et al. 2017.

4.1.4.3 Diaper area

Diaper powder is applied to an infant's perineal area. The consumer activity consists of shaking and pouring a bottle releasing the powder into the air and onto the infant's perineal area. There is a potential for inhalation exposure involving both the adult conducting the diapering activity and the infant. The ***inhalation – exposure to spray – instantaneous release*** model is used to estimate the inhalation exposure from diaper powders.

There are several relatively old studies that have examined exposure during diapering from which the data is outlined below. Overall, exposure during diapering activities resulted in variable air concentrations – in some studies, infants had lower exposure than the adult, in others infant exposure was higher or similar. However, since the equipment and quantification methods in these studies are outdated, the data is not useful for the current fact sheet.

Aylott et al. (1979) calculated mean concentrations for the infant ranging from 0.1 to 0.3 mg/m^3 (4 subjects up to a max of 0.9 mg/m^3, 8 repetitions per subject over 2 time periods), adult exposure during diapering was not measured. Russell et al. (1979) calculated mean concentrations of 0.19 mg/m^3 (n = 48), which was approximately 10 times lower than the adult diapering concentration. In addition, NIOSH (Dement et al. 1972) measured fibres around the mother and baby (doll) during diapering and talcum powder application. Overall, concentrations in the infant's breathing zone were at least equal to the mothers', and in many cases, they were higher. The Pooley 1972 study

(unpublished) demonstrated that infant and adult concentrations were similar.

Aylott et al. (1979) and Russell et al. (1979) used collection sampling equipment and quantification methods that were adequate at the time the study was conducted. However, forty years later, these methods are considered to be antiquated. A similar conclusion can be drawn for the Pooley (1972) and Dement et al. (1972) studies.

On the basis of this data, it is considered that the Anderson and Rasmussen studies are of higher quality. Moreover, it is considered that the use of body powder resembles the use of diaper powder to a certain extent and may be used as a surrogate. For that reason, it is considered appropriate to apply the same defaults for diaper powder as for body powders. Please, refer to the section above for information on body powders.

4.2 Dermal exposure

4.2.1 Generic exposure scenario for dermal exposure from leave-on products

Leave-on products are defined as cosmetic products that are intended to stay in prolonged contact with skin, hair, or mucous membranes (EU, 2015). During this prolonged contact, substances or ingredients in the products are available for dermal exposure. The ***dermal-direct product contact-instant application*** model is used to estimate dermal exposure to substances for scenarios in which the consumer has applied a leave-on product.

Exposed area

The exposed area is the surface area of the skin to which a product is applied. Default values for surface area were derived from the US-EPA Exposure Factor Handbook (US-EPA, 2011), from the ConsExpo General Fact Sheet (Te Biesebeek et al., 2014), or were derived from other relevant sources and based on professional judgment. This information is described in the specific exposure scenario for each product type, including the associated Q-factor.

Product amount

The product amount is the amount of the product applied to the consumer’s skin, hair, or mucous membrane per use. The product amount is dependent on the product type. This information is described in the specific exposure scenario for each product type, including the associated Q-factor.

4.2.2 Generic exposure scenario for dermal exposure from residues of rinse-off products

Rinse-off products are defined as cosmetic products that are intended to be removed (such as by washing, rinsing, or wiping off) after application on skin, hair or mucous membranes (EU, 2015). Following product removal, it is assumed that a small fraction of the product may remain on the skin. Substances in the remaining fraction of the product are available for dermal exposure. The ***dermal-direct product contact-instant application*** model is used to estimate dermal exposure to substances for scenarios in which the consumer has applied and

removed a rinse-off product. Except for the retention factor, the defaults for the generic exposure scenario for dermal exposure from residues of rinse-off products are set equal to those for leave-on products (see 4.2.1).

Retention factors
The use of certain cosmetic products involves removing the product shortly after application. Product removal may include rinsing with water (e.g. facial cleanser, mudpack, facial scrub, etc.) or wiping off (e.g. make-up remover, etc.). For these scenarios, a retention factor needs to be applied to reflect the amount of product remaining on the skin, hair, or mucous membrane after removing the product. Most of the retention factors described in the specific exposure scenarios are not derived from quantitative data, but are commonly accepted values for retention factors for cosmetic. Generally, when a reliable source suggested ranges of retention factors for products (e.g. 0.01 to 0.1), the upper-end of the range was selected as the default value for these scenarios.

4.2.3 Generic exposure scenario for dermal exposure from diluted products

Some cosmetic products involve dilution with water prior to use (e.g. bubble bath, bath oils, and bath salts). During this immersion, substances in the products are available for dermal exposure. The ***dermal-direct product contact-instant application*** model is used to estimate dermal exposure to substances for scenarios in which the consumer is immersed in a water container (e.g. bathtub or sink) with the diluted product. Except for the product amount and dilution factor, the defaults for the generic exposure scenario for dermal exposure from diluted products are set equal to those for leave-on products (see Section 4.2.1).

Product amount
The used product amount is the amount of product added to the bath water. Since the product is diluted in the bath water, not all of the used product amount is anticipated to make contact with the consumer's skin. Therefore, a dilution factor needs to be applied to the used product amount to calculate the amount of product that comes into contact with the skin.

Dilution factor
For immersion in diluted products, the product amount on the consumer's skin is based on the concentration of the diluted product in the water and the volume of water that comes into contact with the skin.

The concentration of product in the water is calculated by dividing the amount of product added to the bathtub by the volume of water in the bathtub. For adults and children, the volume of water in the bathtub is assumed to be 120 L (Bremmer et al., 2006a). For infants and toddlers, the volume of water in the bathtub is assumed to be 60 L (standard sized bathtub dimensions (76 cm x 152 cm) multiplied by a recommended water depth of 5 cm (AAP, 2019)).

(1) $$Concentration_{product\ in\ bath} = \frac{Amount_{product\ in\ container}}{Volume_{water\ in\ container}}$$

The volume of water that comes into contact with the skin is equal to the surface area of the entire body except for the head (Appendix III, Table AIII.1) multiplied by the layer thickness of liquid film on the skin (1 cm; Bremmer et al., 2006).

$$(2)\quad Volume_{water\ on\ skin} = \frac{Surface\ area_{skin\ in\ water} \times Layer\ thickness_{water\ on\ skin}}{1000\ \mathrm{cm^3/L}}$$

The product amount that comes into contact with the skin is then calculated by multiplying the concentration of the product in the water by the volume of water that comes into contact with the skin.

$$(3)\quad Amount_{product\ on\ skin} = Concentration_{product\ in\ bath} \times Volume_{water\ on\ skin}$$

Therefore, by rearranging the above equations, the dilution factor for bubble bath / foam for adults can be calculated as follows:

$$(4)\quad Dilution\ factor = \frac{Surface\ area_{skin\ in\ water} \times Layer\ thickness_{water\ on\ skin}}{Volume_{water\ in\ container} \times 1000\ \mathrm{cm^3/L}}$$

For example, the dilution factor for bubble / foam bath for adults can be calculated as follows:

$$\frac{17000\ \mathrm{cm^2} \times\ 1\ \mathrm{cm}}{120\ \mathrm{L} \times 1000\ \mathrm{cm^3/L}} =\ 0.14$$

The dilution factor for dermal exposure is dependent on the product type and age group. This information is described in the specific exposure scenario for each product type.

4.2.4 Generic exposure scenario for dermal exposure from sprays

The spray products in this fact sheet are leave-on products (intended to stay in prolonged contact with skin, hair, or mucous membranes) that are applied by spraying. During this prolonged contact, substances in the products are available for dermal exposure. The ***dermal-direct product contact-instant application*** model is used to estimate dermal exposure to substances for scenarios in which the consumer has applied a spray leave-on product. Except for the retention factor, the defaults for the generic exposure scenario for dermal exposure from sprayed leave-on products are set equal to those relating to leave-on products (see 4.2.1).

Retention factor

For spray products, it is assumed that only 85% of the sprayed product amount is on the consumer's skin or hair after spraying (Bremmer et al., 2006a). Therefore, a factor of 0.85 needs to be applied to reflect the amount of product actually on the consumer's skin or hair after spraying.

4.3 Oral exposure

4.3.1 Generic exposure scenario for oral exposure to substances in ingested products

Products that are used in the mouth area, such as lipstick or oral hygiene products, are available for oral exposure by ingestion. The ***oral-***

direct product contact-direct oral intake model is used to calculate oral exposure to substances in products used in the mouth area.

Amount ingested
The ingested product amount is dependent on the product type. Some product scenarios (such as lip make-up products) assume that the entire applied product amount may be ingested, while other product scenarios (such as oral hygiene products) assume that only a portion of the applied product amount may be ingested. This information is described in the specific exposure scenario for each product type, including the associated Q-factor (which reflects the quality of the information source (see Section 2.2)).

4.4 User population

The default values in the fact sheets have been derived for consumers (private or non-professional users). They are not aimed at describing exposure for people who professionally work with cosmetic products, for instance in salons or spas. Therefore, this fact sheet solely describes cosmetic products that are available to the consumer for private use.

Using the models in ConsExpo Web and the default values for consumers presented here as background data, it is nonetheless possible to calculate the exposure and uptake of cosmetic products by professional users. Of course, the differences in products and product use between the consumer and persons using cosmetic products professionally must be taken into account.

Groups to consider
In the exposure assessment, exposure is estimated for the person who is the user of the cosmetic product (for instance, an infant is considered to be the user when an adult is applying the cosmetic product to them). As users of cosmetic products can range from infants to adults, 8 relevant age groups are considered in this fact sheet (see Table 4.3). The default values for anthropometric parameters, such as body weight, inhalation rate and surface areas of body parts, for these age groups are provided in Appendix III.

Table 4.3 Age groups (Statistics Canada, 2004)

Age group name	Age range
Adults	19+ years
Children	14 - 18 years
Children	9 - 13 years
Children	4 - 8 years
Infants	2 - 3 years
Infants	12 - 24 months
Infants	6 - 11 months
Infants	0 - 5 months

In each section specific to a product type (e.g. Section 8.1.3 for body lotion), the age groups that are anticipated to use the product type are identified in the text. These age groups have been identified primarily on the basis of available data, including scientific literature, product

information labels, industrial and government reports and surveys. Occasionally, in the absence of data, professional judgment was used.

With respect to default parameters for each product type (e.g. Table 8.3 for body lotion), they are solely described for adults and for the age group that is expected to have the highest year-average exposure estimate (e.g. infants for body lotion in Table 8.3). In order to select the age groups for which defaults are presented, the expected year-average dermal exposure from the product was estimated for each age group that is anticipated to use the product, on the basis of the amount of product applied, retention factor, frequency of use of the product, and body weight of the user. The age group with the highest estimated year-average dermal exposure was then selected, along with the adult age group for the presentation of default parameters. If the highest estimated exposure is for adults, only adult parameters are described (e.g. for hand cream).

4.5 Adjustment of product amounts used per age group

In the absence of age-specific data, a general approach to estimating product amounts for younger age groups was to calculate the expected dermal load of the product (g/cm^2) for the age group for which data is available, and then apply that dermal load to the age group for which no data is available. The product amount for the age group without data can then be calculated by multiplying the expected dermal load by the exposed area. In this fact sheet, these surface area adjustments to quantify the unknown product amount were calculated using surface areas from Te Biesebeek et al. (2014) (Table AIII.2).

For example, for hand cream, the expected dermal load for adults (19+) is 2.78 x 10^{-3} g/cm^2, based on the ratio of the product amount used (2.5 g; Ficheux et al., 2016) and the surface areas of the hands (900 cm^2; Te Biesebeek et al., 2014):

$$Dermal\ load_{19+yrs} = \frac{Product\ Amount_{19+yrs}}{Surface\ Area_{19+yrs}} = \left(\frac{2.5\ g}{900\ cm^2}\right)$$
$$= 2.78\ x\ 10^{-3}\ g/cm^2$$

The product amount for the 14-18 age group can then be calculated on the basis of the dermal load for adults (19+) and the surface area of the hands for the 14-18 age group (750 cm^2; Te Biesebeek et al., 2014):

$$Product\ amount_{14-18\ yrs} = Dermal\ load_{19+yrs} \times Surface\ Area_{14-18\ yrs}$$
$$= (2.75\ x\ 10^{-3}\ g/cm^2) \times (750\ cm^2) = 2.1\ g$$

5 New information after 2006

By means of a scoping review, new information was collected from scientific literature, product information labels, industrial and government reports and surveys in order to reconsider the defaults of the previous Cosmetics Fact Sheet (Bremmer et al., 2006a). Important sources of new information published since 2006 resulting in reconsideration of the defaults are discussed below. Only the main sources of new information are presented in this section. Additional sources used in this fact sheet, such as Biesterbos et al. (2013), Statistics Canada (2012), Hall et al. (2007), SCCS (2023), and others, are described in the relevant sections.

5.1 Experimental evaluation of critical parameters of the ConsExpo spray model

A series of experiments on propellants and trigger sprays was performed in 2009 in order to validate and calibrate the spray models included in ConsExpo (Delmaar & Bremmer, 2009). Two critical exposure parameters for spray products are the mass generation rate of the product, and the size distribution of the generated particles. These parameters have been experimentally determined for 23 spray cans and trigger sprays. Mass generation rates were determined by spraying for 10 seconds (spray cans) or squeezing 10 times (trigger spray; squeezing 10 times takes approximately 6 seconds) and determining the weight loss of the spray.

Particle size distributions were determined by light scattering experiments using the Mastersizer S (Delmaar & Bremmer, 2009). The study included products from different product groups, including pest control products, personal care products, cleaning products, and paints. Information from the experiments is used to derive defaults for mass generation rates and particle size distributions for aerosol spray cans and trigger sprays for the different product categories.

The default mass generation rates described in the fact sheets generated in 2006 were updated in ConsExpo 4.1, on the basis of the experimental measurements by Delmaar & Bremmer (2009).

In the previous version of the Cosmetics Fact Sheet (Bremmer et al., 2006a), mass generation rates of sprays are defined as the *average mass released per unit of time over the entire duration of the application*. This required the mass generation rates of Delmaar & Bremmer (2009) to be adjusted by averaging over the total time span (RIVM, 2010). In the current version of the Cosmetics Fact Sheet, a different approach is adopted. In contrast to the 2006 version, the mass generation rate is defined as the *mass released per unit time of (net) spray duration* (Delmaar & Schuur, 2017). Using this definition, the mass generation corresponds directly to the generation rates determined in the experiments described by Delmaar & Bremmer (2009).

5.2 Surveys conducted by UEB-UBO on the use of cosmetic products

The Université Européenne de Bretagne - Université de Bretagne Occidentale (UEB-UBO) conducted two surveys on the use of cosmetic products by the French population including adults, children and infants (Ficheux et al., 2015; 2016). The first survey gathered information on the frequency of use, percentage of users and number of cosmetic products used at home by the French population (n= 5657; age 0-70) using a web questionnaire (Ficheux et al., 2015). The second survey evaluated the amount of cosmetic products used in the home by various age groups (n= 1078; age 0-70) for 106 cosmetic products in a laboratory setting (Ficheux et al., 2016). Study subjects were provided with cosmetic products and asked to use them as they would normally do at home. The products were weighed before and after use to determine how much was used (Ficheux et al., 2016). Additional surveys were conducted for wipes and hair dye products (Bernard et al., 2016). A separate survey was conducted on the use of nail care products (Ficheux et al., 2014).

5.3 The ETH survey on the use of different consumer products

The Federal Institute of Technology Zurich (ETH) conducted a survey in Switzerland to assess consumer usage patterns (Garcia-Hidalgo et al., 2017). The usage patterns of 12 household care products, 5 laundry products, and 22 personal care products were collected among the Swiss population (n =759; ages 0-91) by postal questionnaire. The survey was designed to collect data with respect to the use frequency, quantity, duration, habits, and co-uses of household and personal care products. On the basis of the summary data from this study, 75th percentiles were derived and used in the current fact sheet for the frequency and duration of consumer use of various cosmetic products. Examples are hand and body lotions, baby wipes, skin cleansers, toothpaste, hair products, and make-up. The 75th percentiles were derived from the data tables that express the percentages of the multiple-choice answers per sex and age group. The number of respondents for each subgroup is also presented, which enables the recalculation of the percentage and thus percentiles for the adults of the survey population (n=611). The 75th percentiles derived for the current fact sheet should be interpreted as the multiple-choice answer that the respondent reflecting the 75th percentile would declare. For some products, it is clear that there is a distinction between respondents that never use the product (non-users) and respondents that regularly use the product. For these products (body lotion, make-up and baby wipes) the non-users are excluded in the calculation of the 75th percentile.

5.4 The cosmetic use survey conducted by industry from the United States

Loretz et al. (2005; 2006; 2008) conducted a series of similar studies in 2000, 2001 and 2005, respectively, which examined the usage patterns of various cosmetics by adult women from the United States. All three studies were conducted in a similar manner with different products. Women were asked to use a diary and record their use of specific products (supplied) that they used on a regular basis over a 2-week period. The products were weighed at the start of the study and at the end of the 2-week period. Information on the frequency of use as well

as the product amount used is included in the studies. Information on the following cosmetics is available: lipstick, body lotion, and face cream (Loretz et al., 2005), hairspray, spray perfume, liquid foundation, shampoo, body wash, and solid antiperspirant (Loretz et al., 2006), and facial cleanser, hair conditioner, and eye shadow (Loretz et al., 2008).

5.5 The California cosmetic use survey

The University of California, in collaboration with the Seoul National University of South Korea, conducted a survey on the frequency of use of approximately 30 cosmetic products by adults and children living in California (n= 604; age 0-55+) using a phone questionnaire (Wu et al., 2010). The types of products covered in the questionnaire included those considered to be used most often, such as hand soaps, skin care, make-up, and hair styling products.

6 Hair care products

Hair care products are cosmetic products used on the hair of the scalp. The products can be distinguished on the basis of their function, e.g. to cleanse the hair, moisturise the hair, style the hair, change the shade or colour of the hair, change the texture of the hair, add a scent to the hair, etcetera.

Hair care products are available as creams, liquids, semi-solids, gels, foams, loose powders, aerosol sprays, and pump sprays. Exposure to substances in hair care products can occur through:

- Indirect and direct dermal contact;
- Inhalation of evaporated substances;
- Inhalation of non-volatile and volatile substances in sprays.

Some hair care products are intended to be left on the hair, while others are intended to be rinsed out. Since the products are applied to the hair rather than to the skin, dermal exposure is expected to occur mainly through transfer from the hair to the skin, rather than through direct application of the product to the skin. Therefore, a transfer factor is applied to the dermal exposure scenarios for hair care products. This is further explained in each product scenario.

6.1 Shampoo

Shampoo is used on the hair and scalp to remove oils, grease, dead skin cells, dirt, and/or product build-up. Shampoo is available as a rinse-off product or as a leave-on powder or spray product. These products are differentiated by use method and by function. Rinse-off shampoos are used on wet hair to cleanse the hair and scalp and they are rinsed out following application. In contrast, dry shampoo is applied to dry hair and the scalp to absorb oils and grease, is massaged in, and is left on the hair.

6.1.1 Shampoo (dry, spray)

Dry shampoo is a loose powder that is usually released using an aerosol spray can or by shaking the contents of a container onto the hair. It is assumed that the face powder inhalation exposure defaults will apply to loose hair powders (see Section 4.1.4). In this section, the dry shampoo in the form of aerosol spray is considered. It is used to absorb oils in the hair to give the appearance of clean hair, create volume for styling the hair, and often to add a scent to the hair. Dry shampoo is anticipated to be used by ages 14 and up. The values described in this section are for ages 14-18 and 19+, as dry shampoo is expected to be used in a similar manner by both age groups.

Scenario for consumer exposure

During application, the dry shampoo is directly sprayed onto the hair and scalp, the product is massaged in and left on for a prolonged duration. Therefore, the consumer exposure scenarios for dry shampoo are anticipated to run by inhalation of non-volatile substances in sprayed droplets, inhalation of volatile substances that remain in the air after

spraying, and by dermal contact after spraying. In this section, the exposure to dry shampoo is described in two separate scenarios: inhalation exposure during spraying and dermal exposure after spraying.

Frequency
The frequency of use, 150 per year, is derived from Ficheux et al. (2015). A Q-factor of 4 is assigned, as the default is based on data from a high-quality study involving a large number of participants.

Exposed area
The exposed area is half of the head. The defaults are based on data from the General Fact Sheet (Te Biesebeek et al., 2014) and is set to 600 cm^2 for adults and 520 cm^2 for children. The Q-factor assigned is 3.

6.1.1.1 Application: spraying

Dry shampoo is available on the consumer market in spray cans that release the shampoo as an inhalable loose powder. Inhalation exposure to both volatile and non-volatile substances is anticipated in this scenario. The consumer can inhale non-volatile substances available for inhalation in the sprayed droplets, since volatile substances are expected to remain in the indoor air after spraying. The ***inhalation-exposure to spray-spraying*** model is used to estimate the inhalation exposure to the non-volatile substances (Section 4.1.3.2). The ***spraying towards person*** option is considered relevant, as spray is directed towards the consumer's hair. The ***inhalation-exposure to spray-instantaneous release*** model is used to estimate inhalation exposure to volatile substances (Section 4.1.3.1). The mass generation rate of 0.8 g/s, airborne fraction of 0.2, density non-volatile of 0.7 g/cm^3, and initial particle distribution with a median of 46.5 µm and a C.V of 2.1 for dry shampoo sprays are assumed to be similar to those of aerosol hair spray. The data from Berrada-Gomez et al. 2023 suggest that the use of hair spray as a surrogate for dry shampoo may underestimate the exposure to the inhalable fraction.

Released mass
The released mass of 3.4 g is set to be equal to the product amount that is sprayed out of the bottle or can. The product amount used is derived from Ficheux et al. (2016), and the released mass default is set accordingly. A Q-factor of 4 is assigned, as the default is based on data from a high-quality study involving a large number of participants and including extensive data on various product types.

Table 6.1 Default values for estimating consumer exposure to substances in dry shampoo during spraying

Default value		**Q-factor**	**Source(s)**
General			
Frequency	150 per year	4	Ficheux et al., 2015
Inhalation-exposure to spray-spraying-spraying towards person[1]			
Spray duration	4.3 s	2	Released mass/mass generation rate (Section 4.1.3.2)
Exposure duration	5 min	2	Section 4.1.3.2
Room volume	10 m^3	4	Section 4.1.3.2

Default value		Q-factor	Source(s)
Room height	2.5 m	4	Section 4.1.3.2
Ventilation rate	2 per hour	3	Section 4.1.3.2
Cloud volume	0.0625 m^3	2	Section 4.1.3.2
Mass generation rate	0.8 g/s	2	Aerosol hair spray (Section 6.3.1)
Airborne fraction	0.2	2	Aerosol hair spray (Section 6.3.1)
Density non-volatile	0.7 g/cm^3	1	Aerosol hair spray (Section 6.3.1)
Initial particle distribution Median (C.V.)	 46.5 µm 2.1	2	Aerosol hair spray (Section 6.3.1)
Inhalation cut-off diameter	15 µm	3	Delmaar & Schuur, 2017
Inhalation-exposure to spray-instantaneous release[2]			
Exposure duration	8.5 s	1	Twice the spray duration, Section 4.1.3.1
Released mass	3.4 g	4	Ficheux et al., 2016
Room volume	1 m^3	1	Section 4.1.3.1
Ventilation rate	2 per hour	1	Section 4.1.3.1

1: Applies to non-volatile substances
2: Applies to volatile substances

6.1.1.2 Application: leave-on

Dry shampoo is applied to the hair and scalp and is left on for a prolonged duration. Therefore, the scenario of using dry shampoo is fits the generic exposure scenario for dermal exposure from sprays (Section 4.2.4). The ***dermal-direct product contact-instant application*** model is used to estimate dermal exposure to substances in dry shampoo.

Product amount

The product amount of 3.4 g is derived from Ficheux et al. (2016). A Q-factor of 4 is assigned, as the default is based on data from a high-quality study involving a large number of participants and including extensive data on various product types.

Retention factor

For spray products, it is assumed that only 85% of the sprayed product amount is on the consumer's skin or hair after spraying (Bremmer et al., 2006a). In addition, since the product is applied to the hair, it is assumed that only 10% of the product is transferred to the skin and is available for dermal exposure (Bremmer et al., 2006a).Therefore, a retention factor of 0.085 needs to be applied to reflect the amount of product actually on the consumer's skin after spraying.

Table 6.2 Default values for estimating consumer exposure to substances in dry shampoo following application

Default value		Q-factor	Source(s)
General			
Frequency	150 per year	4	Ficheux et al., 2015
Dermal-direct product contact-instant application			
Exposed area Adults (19+ years) Children (14-18 years)	600 cm^2 520 cm^2	3 3	Half head (Te Biesebeek et al., 2014) Half head (Te Biesebeek et al., 2014)
Product amount	3.4 g	4	Ficheux et al., 2016
Retention factor	0.085	1	See above

6.1.2 Shampoo (rinse-off)

Rinse-off shampoo is used on wet hair to cleanse the hair and scalp. Rinse-off shampoo is mainly available as a liquid and is anticipated to be used by all age groups.

Rinse-off shampoo is also available on the market as a solid bar that is lathered like a bar of soap, applied to the hair, and rinsed out like liquid shampoo. Although the scenario of using solid rinse-off shampoo is similar to the scenario of using liquid rinse-off shampoo, it is expected that a smaller amount of the solid product is used per application.

Scenario for consumer exposure

During application, the shampoo is applied directly to wet hair and scalp, massaged in, and then rinsed out. A fraction of the product remains on the hair, nonetheless. Therefore, the consumer exposure scenario for shampoo is anticipated to involve dermal contact following rinse-off, where it is assumed that the brief undiluted time on one's hands is not considered to contribute significantly to the dermal exposure.

Frequency

The frequency of use is derived from Loretz et al. (2006) or Ficheux et al. (2015) depending on the age group. A Q-factor of 4 is assigned, as the defaults are derived from high-quality studies involving a large number of participants.

6.1.2.1 Application: rinse-off

Shampoo is applied to wet hair and scalp, massaged in, and rinsed out of the hair. It is assumed that a fraction of the product remains on the hair and skin after rinsing. Therefore, the scenario of using shampoo fits the generic exposure scenario for dermal exposure from residues of rinse-off products (Section 4.2.2). The ***dermal-direct product contact-instant application*** model is used to estimate dermal exposure to substances in rinse-off shampoo.

Exposed area

The default for the exposed area is set to be equal to the surface area of half of the head plus half of the hands for adults totalling 1050 cm^2. It is

assumed that infants (aged 0-3) will not wash their own hair, and thus will only have exposure on half of the head (390 cm^2; Te Biesebeek et al., 2014). The Q-factor assigned is 3.

Product amount
The product amount used is derived from Loretz et al. (2006) or Gomez-Berrada et al. (2013), depending on the age group, i.e. 16 g and 10.6 g for adults and infants respectively. A Q-factor of 4 is assigned, as the defaults are derived from high-quality studies involving a large number of participants.

Retention factor
For rinse-off products, it is assumed that only 10% of the applied product amount remains on the consumer's skin or hair after rinsing (SDA, 2010). In addition, since the product is applied to the hair, it is assumed that only 10% of the product is transferred to the skin and is available for dermal exposure (Bremmer et al., 2006a). Therefore, a retention factor of 0.01 needs to be applied to reflect the amount of product actually on the consumer's skin following rinse-off. The Q-factor assigned is 1, as the retention factor is based on assumptions.

Table 6.3 Default values for estimating consumer exposure to substances in shampoo residues after rinsing

Default value		Q-factor	Source(s)
General			
Frequency Adults (19+ years) Infants (1 year)	 416 per year [1] 332 per year	 4 4	 Loretz et al., 2006 Ficheux et al., 2015
Dermal-direct product contact-instant application			
Exposed area Adults (19+ years) Infants (1 year)	 1050 cm^2 390 cm^2	 3 3	 Half head and half hands (Te Biesebeek et al., 2014) Half head (Te Biesebeek et al., 2014)
Product amount Adults (19+ years) Infants (1 year)	 16.0 g [2] 10.6 g	 4 4	 Loretz et al., 2006 Gomez-Berrada et al., 2013
Retention factor	0.01	1	See above

1: The frequency of use for adults (19+ years) is set to the 80th percentile value, as the estimated 75th percentile value was higher than the reported 80th percentile value.
2: The product amount for adults (19+ years) is set to the 80th percentile value, as the estimated 75th percentile value was higher than the reported 80th percentile value.

6.2 Conditioner

The active cleaning agents in shampoos are often strong degreasers, and thus can deprive hair of its natural oils. Conditioners are used on

the hair and scalp to restore moisture and oils to the hair and thus improve its health, shine, and softness (Bremmer et al., 2006a). Hair conditioners are available as rinse-off or leave-on products. Rinse-off conditioner is usually used on wet hair after shampooing, and is rinsed out, while leave-on conditioner is usually used on damp or dry hair and left on for a prolonged duration. Data in the literature did not specify the type of conditioner; therefore, in this section, the frequency, exposed area, and product amount are the same for both rinse-off and leave-on conditioners. What differentiates these two products is their use scenarios (rinse-off versus leave-on) and the proportion of the product left on the skin following use. Both rinse-off and leave-on conditioners require a retention factor to account for transfer of product from hair to skin. However, while rinse-off conditioner has an additional retention factor to account for only a portion of the used product remaining on the hair and skin after rinsing, the leave-on conditioner scenario does not as it is assumed that all of the product remains on the hair following application.

Both rinse-off and leave-on conditioners are anticipated to be used by ages 2 and up. Information is available for the 4-8 age group and therefore, the defaults have been based on this age category.

Frequency
The frequency of use is derived from Loretz et al. (2008), or Wu et al. (2010), depending on the age group, i.e. 402 and 268 times per year for adults and children, respectively. A Q-factor of 4 is assigned, as these are high-quality studies involving large numbers of participants.

Product amount
The product amount used is derived from Loretz et al. (2008) or Ficheux et al. (2016), depending on the age group, i.e. 18.9 g and 11.5 g for adults and children, respectively. A Q-factor of 4 is assigned, as the defaults are derived from high-quality studies involving large numbers of participants.

6.2.1 *Conditioner (rinse-off)*

Rinse-off conditioner is usually used on wet hair after shampooing to restore moisture and oils to the hair and scalp (Bremmer et al., 2006a). Conditioner is mainly available in liquid form.

Like rinse-off shampoo, rinse-off conditioner is also available on the market as a solid bar that is lathered like a bar of soap, applied to the hair, and rinsed out like regular liquid conditioner. Although the scenario of using solid rinse-off conditioner is similar to the scenario of using liquid rinse-off conditioner, it is expected that a smaller amount of the solid product is used per application.

Scenario for consumer exposure
During application, the conditioner is applied directly to wet hair and scalp, massaged in, and then rinsed out. A fraction of the product remains on the hair, nonetheless. Therefore, the consumer exposure scenario for conditioner is anticipated to run by dermal contact following rinse-off.

6.2.1.1 Application: rinse-off

Conditioner is applied to wet hair and scalp, massaged in, left on for a few minutes, and is then rinsed out. It is assumed that a fraction of the product remains on the hair and skin after rinsing. Therefore, the scenario of using conditioner fits the generic exposure scenario for dermal exposure from residues of rinse-off products (see Section 4.2.2). The ***dermal-direct product contact-instant application*** model is used to estimate dermal exposure to substances in conditioner.

Retention factor

For rinse-off products, it is assumed that only 10% of the applied product amount is on the consumer's skin or hair following rinse-off (SDA, 2010). In addition, since the product is applied to the hair, it is assumed that only 10% of the product is transferred to the skin and is available for dermal exposure (Bremmer et al., 2006a). Therefore, a retention factor of 0.01 needs to be applied to reflect the amount of product actually on the consumer's skin following rinse-off. The Q-factor assigned is 1 as the retention factor is based on assumptions.

Table 6.4 Default values for estimating consumer exposure to substances in conditioner residues after rinsing

Default value		Q-factor	Source(s)
General			
Frequency Adults (19+ years) Children (4-8 years)	 402 per year [1] 268 per year	 4 4	 Loretz et al., 2008 Wu et al., 2010
Dermal-direct product contact-instant application			
Exposed area Adults (19+ years) Children (4-8 years)	 1050 cm^2 700 cm^2	 3 3	 Half head and half hands (Te Biesebeek et al., 2014) Half head and half hands (Te Biesebeek et al., 2014)
Product amount Adults (19+ years) Children (4-8 years)	 18.9 g [2] 11.5 g	 4 4	 Loretz et al., 2008 Ficheux et al., 2016
Retention factor	0.01	1	See above

1: The frequency of use for adults (19+ years) is set to the 80th percentile value, as the estimated 75th percentile value was higher than the reported 80th percentile value.
2: The product amount for adults (19+ years) is set to the 80th percentile value, as the estimated 75th percentile value was higher than the reported 80th percentile value.

6.2.2 Conditioner (leave-on)

Similar to rinse-off conditioner, leave-on conditioner is used to restore moisture and oils to hair, and to improve its health, shine, and softness. Some leave-on conditioners may also help detangle the hair or protect the hair (e.g. from sun, wind damage, heat damage, etc.). Leave-on conditioner may be available as a liquid, cream, or oil; and as a spray or non-spray product. In this section, non-spray leave-on conditioner is described.

Scenario for consumer exposure
During application, the user applies the conditioner directly to damp or dry hair and scalp, massaging the product in, and leaving it on for a prolonged duration. Therefore, the consumer exposure scenario for leave-on conditioner is anticipated to run by dermal contact during leave-on.

6.2.2.1 Application: leave-on

Leave-on conditioner is applied to damp or dry hair and left on for a prolonged duration. Therefore, the scenario of using leave-on conditioner fits the generic exposure scenario for dermal exposure from leave-on products (Section 4.2.1). The ***dermal-direct product contact-instant application*** model is used to estimate dermal exposure to substances in leave-on conditioner. The frequency, exposed area, and product amount for leave-on conditioner are the same as for rinse-off conditioner.

Retention factor
Since the product is applied to the hair, it is assumed that only 10% of the product is transferred to the skin and is available for dermal exposure (Bremmer et al., 2006a). Therefore, a retention factor of 0.1 needs to be applied to reflect the amount of product actually on the consumer's skin. The Q-factor assigned is 1, as the retention factor is based on assumptions.

Table 6.5 Default values for estimating consumer exposure to substances in leave-on conditioner following application

Default value		**Q-factor**	**Source(s)**
General			
Frequency Adults (19+ years) Children (4-8 years)	 402 per year [1] 268 per year	 4 4	 Loretz et al., 2008 Wu et al., 2010
Dermal-direct product contact-instant application			
Exposed area Adults (19+ years) Children (4-8 years)	 1050 cm^2 700 cm^2	 3 3	 Half head and half hands (Te Biesebeek et al., 2014) Half head and half hands (Te Biesebeek et al., 2014)
Product amount Adults (19+ years) Children (4-8 years)	 18.9 g [2] 11.5 g	 4 4	 Loretz et al., 2008 Ficheux et al., 2016
Retention factor	0.1	1	See above

1: The frequency of use for adults (19+ years) is set to the 80th percentile value, as the estimated 75th percentile value was higher than the reported 80th percentile value.
2: The product amount for adults (19+ years) is set to the 80th percentile value, as the estimated 75th percentile value was higher than the reported 80th percentile value.

6.3 Hair styling products

Hair styling products are used on the hair to help style the hair and hold hairstyles in place. Their functions include increasing the appearance of hair volume, minimising frizz and stray hairs, increasing the shine and sleekness of hair, holding hair and hair accessories in place for long periods of time, etcetera. These products are typically applied and left on for a prolonged duration.

6.3.1 Hair spray

Hair spray is a liquid that is applied to hair by spraying, using either an aerosol can or a pump spray bottle, and is left on for an extended period of time. It is used to help style the hair by providing stiffness and hold to the hair, thus keeping hairstyles in place. Hairsprays may also have additional uses, such as lightening the hair, or providing volume, curl, wave, smoothing, or straightening effects. Hairspray is anticipated to be used by ages 4 and up.

Scenario for consumer exposure

During application, the user applies the hair spray directly to the hair, and leaves the product on for a prolonged duration. Therefore, the consumer exposure scenarios for hair spray are anticipated to run by inhalation of non-volatile substances in sprayed droplets, inhalation of volatile substances that remain in the air after spraying, and by dermal contact after spraying. In this section, the exposure to aerosol and pump hair sprays is described separately. Within each product section, the exposures to hair spray are described in two separate scenarios: inhalation exposure during spraying and dermal exposure after spraying.

Hair spray is applied to the hair and is left on for a prolonged duration. Therefore, the scenario of using hair spray fits the generic exposure scenario for dermal exposure from sprays (see Section 4.2.4). The ***dermal-direct product contact-instant application*** model is used to estimate dermal exposure to substances in hair spray. Hair sprays are mostly used in the bathroom (EPHECT, 2012). Inhalation exposure to both volatile and non-volatile substances is anticipated in this scenario. The consumer can inhale non-volatile substances available for inhalation in the sprayed droplets, since volatile substances are expected to remain in the indoor air after spraying. The ***inhalation-exposure to spray-spraying*** model is used to estimate the inhalation exposure to the non-volatile substances (Section 4.1.3.2). The ***spraying towards person*** option is considered relevant as spray is directed towards the consumer's hair. The ***inhalation-exposure to spray-instantaneous release*** model is used to estimate inhalation exposure to volatile substances (Section 4.1.3.1).

6.3.1.1 Hair spray (aerosol)

Frequency

The frequency of use is derived from Loretz et al. (2006) or Ficheux et al. (2015) depending on the age group. A Q-factor of 4 is assigned, as these studies are of high quality and involve a large number of participants.

6.3.1.1.1 *Application: spraying*

Mass generation rate

In the report by Delmaar & Bremmer (2009), the mass generation rate of aerosol hair spray cans was experimentally determined for 6 aerosol hair spray cans by spraying for 10 seconds and determining the weight loss of the spray can. The resulting mass generation rate of 0.8 g/s is consistent with the earlier measured mass generation rate of 6 hair spray samples reported by Tuinman (2004). Therefore, the default mass generation rate for aerosol hair spray cans is set to 0.8 g/s (Delmaar & Bremmer, 2009). The Q-factor assigned is 3, because the default directly refers to the mass generation rate of hair sprays, but the number of samples (N=12) is limited.

Airborne fraction

The default airborne fraction in this scenario refers to a scaled airborne fraction that is complementary to the fitted initial particle distribution (see Section 4.1.3.2). Prior to the exercise conducted by RIVM in 2010, Delmaar & Bremmer (2009) characterised a default initial particle distribution for droplets released during the use of aerosol hair spray with a median particle diameter of 46.5 µm and a C.V. of 2.1. However, this initial fitting exercise underestimates (or misfits) the part of the distribution that is most relevant for inhalation, i.e. the inhalable particles < 22.5 µm. Therefore, the fraction of the inhalable particles (< 22.5 µm) was fitted separately to acquire a more accurate estimate of the inhalable fraction. The fit has since been performed on a part of the whole distribution; complementary to this fit, the airborne fraction is scaled as the mass fraction of the sprayed droplets that is both directly airborne during the spray event and < 22.5 µm. Delmaar & Bremmer (2009) determined the mass fraction that is directly airborne to be 1, whereas the mass fraction < 22.5 µm is determined to be 0.2. The default airborne fraction is thus scaled as 1 x 0.2 = 0.2 and is applicable to the fitted initial particle distribution – in this case, 46.5 µm and a C.V. of 2.1. The Q-factor assigned is 3, because the measurements by Delmaar & Bremmer (2009) directly refer to airborne fractions of hair sprays, but the number of samples (N=6) is limited.

Density non-volatile

The density of non-volatile materials in hair sprays is estimated by Delmaar & Bremmer (2009) to be 0.7 g/cm^3. The default density non-volatile is set accordingly. The Q-factor assigned is 2, because the estimation by Delmaar & Bremmer (2009) directly refers to the density of non-volatile materials in hair sprays, but includes only one sample.

Initial particle distribution

A default initial particle distribution of droplet sizes during the use of hair sprays is characterised by Delmaar & Bremmer (2009) and RIVM (2010) with a median particle diameter of 46.5 µm and a C.V. of 2.1 (see airborne fraction above). The Q-factor assigned is 3, because the defaults directly refer to initial particle distribution of hair sprays, but the number of samples (N=6) is limited.

Released mass

The released mass is set to be equal to the product amount that is sprayed out of the bottle or can. The product amount used is derived

from Loretz et al. (2006) or from Ficheux et al. (2016), depending on the age group, and the released mass default is set accordingly. A Q-factor of 4 is assigned, as the default is based on data from high-quality studies involving a large number of participants and including extensive data on various product types.

Table 6.6 Default values for estimating consumer exposure to substances in aerosol hair spray during spraying

Default value		**Q-factor**	**Source(s)**
General			
Frequency Adults (19+ years) Children (4-8 years)	 657 per year[1] 369 per year	 4 4	 Loretz et al., 2006 Ficheux et al., 2015
Inhalation-exposure to spray-spraying-spraying towards person[2]			
Spray duration Adults (19+ years) Children (4-8 years)	 4.4 s 4.0 s	 3 3	Released mass/mass generation rate (Section 4.1.3.2)
Exposure duration	5 min	2	Section 4.1.3.2
Room volume	10 m^3	4	Section 4.1.3.2
Room height	2.5 m	4	Section 4.1.3.2
Ventilation rate	2 per hour	3	Section 4.1.3.2
Cloud volume	0.0625 m^3	2	Section 4.1.3.2
Mass generation rate	0.8 g/s	3	Delmaar & Bremmer, 2009
Airborne fraction	0.2	3	Delmaar & Bremmer, 2009
Density non-volatile	0.7 g/cm^3	2	Delmaar & Bremmer, 2009
Initial particle distribution Median (C.V.)	 46.5 µm 2.1	3	Delmaar & Bremmer, 2009; RIVM 2010
Inhalation cut-off diameter	15 µm	3	Delmaar & Schuur, 2017
Inhalation-exposure to spray-instantaneous release[3]			
Exposure duration Adults (19+ years) Children (4-8 years)	 8.9 s 7.9 s	 1 1	Twice the spray duration, Section 4.1.3.1
Released mass Adults (19+ years) Children (4-8 years)	 3.6 g[4] 3.2 g	 4 4	 Loretz et al., 2006 Ficheux et al., 2016
Room volume	1 m^3	1	Section 4.1.3.1
Ventilation rate	2 per hour	1	Section 4.1.3.1

1: The frequency of use for adults (19+ years) is set to the 80th percentile value, as the estimated 75th percentile value was higher than the reported 80th percentile value.
2: Applies to non-volatile substances
3: Applies to volatile substances
4: The product amount for adults (19+ years) is set to the 80th percentile value, as the estimated 75th percentile value was higher than the reported 80th percentile value.

6.3.1.1.2 *Application: leave-on*

Product amount

The product amount used is derived from Loretz et al. (2006) or from Ficheux et al. (2016) depending on the age group. A Q-factor of 4 is assigned, as they are high-quality studies involving large numbers of participants.

Retention factor

For spray products, it is assumed that only 85% of the sprayed product amount is on the consumer's skin or hair after spraying (Bremmer et al., 2006a). In addition, since the product is applied to the hair, it is assumed that only 10% of the product is transferred to the skin and is available for dermal exposure (Bremmer et al., 2006a). Therefore, a retention factor of 0.085 needs to be applied to reflect the amount of product actually on the consumer's skin after spraying.

Table 6.7 Default values for estimating consumer exposure to substances in aerosol hair spray following application

Default value		Q-factor	Source(s)
General			
Frequency Adults (19+ years) Children (4-8 years)	 657 per year[1] 369 per year	 4 4	 Loretz et al., 2006 Ficheux et al., 2015
Dermal-direct product contact-instant application			
Exposed area Adults (19+ years) Children (4-8 years)	 600 cm^2 470 cm^2	 3 3	 Half head (Te Biesebeek et al., 2014) Half head (Te Biesebeek et al., 2014)
Product amount Adults (19+ years) Children (4-8 years)	 3.6 g[2] 3.2 g	 4 4	 Loretz et al., 2006 Ficheux et al., 2016
Retention factor	0.085	1	See above

1: The frequency of use for adults (19+ years) is set to the 80th percentile value, as the estimated 75th percentile value was higher than the reported 80th percentile value.
2: The product amount for adults (19+ years) is set to the 80th percentile value, as the estimated 75th percentile value was higher than the reported 80th percentile value.

6.3.1.2 Hair spray (pump)

Frequency

The frequency of use is derived from Loretz et al. (2006). A Q-factor of 4 is assigned, as this study is of high quality and involves a large number of participants.

6.3.1.2.1 *Application: spraying*

Unfortunately, no data was available that referred specifically to the mass generation rate, airborne fraction, density non-volatile, and initial particle distribution upon spraying with pump hair sprays and that is also compatible with the units used in the input fields in ConsExpoWeb . The default values for these input parameters described below (Table 6.8) actually refer to the specific use of spraying with hair spray out of

an aerosol spray can (see Table 6.6. in Section 6.3.1.1). It is not acknowledged that using such aerosol spray can in the pump spray scenario does not fit, but due to the lack of relevant pump hair spray data, it is set as such, nonetheless. The data from Berrada-Gomez et al. (2023) suggest that pump sprays containing hair spray generate larger droplets. The Q-factors assigned for the mass generation rate, airborne fraction, density non-volatile, and initial particle distribution are set to 1 in order to acknowledge that pump spray droplets may disperse differently from aerosol spray droplets.

Released mass
The released mass is set to be equal to the product amount that is sprayed out of the bottle or can. The product amount used is derived from Loretz et al. (2006), and the released mass default is set accordingly. A Q-factor of 4 is assigned, as the default is based on data from a high-quality study involving a large number of participants and including extensive data on various product types.

Table 6.8 Default values for estimating consumer exposure to substances in pump hair spray during spraying

Default value		**Q-factor**	**Source(s)**
General			
Frequency	704 per year[1]	4	Loretz et al., 2006
Inhalation-exposure to spray-spraying-spraying towards person[2]			
Spray duration	6.5 s	2	Released mass/mass generation rate (Section 4.1.3.2)
Exposure duration	5 min	2	Section 4.1.3.2
Room volume	10 m^3	4	Section 4.1.3.2
Room height	2.5 m	4	Section 4.1.3.2
Ventilation rate	2 per hour	3	Section 4.1.3.2
Cloud volume	0.0625 m^3	1	Section 4.1.3.2
Mass generation rate	0.8 g/s	1	See section 6.3.1.2.1 above
Airborne fraction	0.2	1	See section 6.3.1.2.1 above
Density non-volatile	0.7 g/cm^3	1	See section 6.3.1.2.1 above
Initial particle distribution Median	 46.5 µm	2	See section 6.3.1.2.1 above

Default value		Q-factor	Source(s)
(C.V.)	2.1		
Inhalation cut-off diameter	15 µm	3	Delmaar & Schuur, 2017
Inhalation-exposure to spray-instantaneous release[3]			
Exposure duration	12.9 s	1	Twice the spray duration, Section 4.1.3.1
Released mass	5.2 g[4]	4	Loretz et al., 2006
Room volume	1 m^3	1	Section 4.1.3.1
Ventilation rate	2 per hour	1	Section 4.1.3.1

1: The frequency of use is set to the 80th percentile value, as the estimated 75th percentile value was higher than the reported 80th percentile value.
2: Applies to non-volatile substances
3: Applies to volatile substances
4: The product amount is set to the 80th percentile value, as the estimated 75th percentile value was higher than the reported 80th percentile value.

6.3.1.2.2 *Application: leave-on*

Product amount

The product amount used is derived from Loretz et al. (2006). A Q-factor of 4 is assigned, as it is a high-quality study involving a large number of participants.

Retention factor

For spray products, it is assumed that only 85% of the sprayed product amount is on the consumer's skin or hair after spraying (Bremmer et al., 2006a). In addition, since the product is applied to the hair, it is assumed that only 10% of the product is transferred to the skin and is available for dermal exposure (Bremmer et al., 2006a). Therefore, a retention factor of 0.085 needs to be applied to reflect the amount of product actually on the consumer's skin after spraying. The Q-factor assigned is 1, as the retention factor is based on assumptions.

Table 6.9 Default values for estimating consumer exposure to substances in pump hair spray following application

Default value		Q-factor	Source(s)
General			
Frequency	704 per year[1]	4	Loretz et al., 2006
Dermal-direct product contact-instant application			
Exposed area	600 cm^2	3	Half head (Te Biesebeek et al., 2014)
Product amount	5.2 g[2]	4	Loretz et al., 2006
Retention factor	0.085	1	See above

1: The frequency of use is set to the 80th percentile value, as the estimated 75th percentile value was higher than the reported 80th percentile value.
2: The product amount is set to the 80th percentile value, as the estimated 75th percentile value was higher than the reported 80th percentile value.

6.3.2 *Hair styling gel*

Hair styling gel is a gel, wax, or paste that is applied to the hair using the hands, and is left on for a prolonged duration. It is used to help style the hair by providing stiffness and hold to the hair, thus keeping hairstyles in place. Hair gel is anticipated to be used by ages 2 and up.

Scenario for consumer exposure

During application, the user applies the hair gel directly to the hair using their hands, and leaves the product on for a prolonged duration. Therefore, the consumer exposure scenarios for hair gel are anticipated to run by dermal contact and inhalation of evaporated substances during leave-on.

Frequency

The frequency of use is adopted from Ficheux et al. (2015). A Q-factor of 4 is assigned, as it is a high-quality study involving a large number of participants.

6.3.2.1 Application: leave-on

Hair styling gel is a cosmetic product that is applied to the hair and from which substances may evaporate for a prolonged duration. Therefore, the scenario of using hair styling gel fits the generic exposure scenarios for dermal exposure from leave-on products (Section 4.2.1) and for inhalation of substances evaporating from leave-on products (Section 4.1.1). The ***dermal-direct product contact-instant application*** model is used to estimate dermal exposure to substances in hair styling gel. The ***inhalation-exposure to vapour-evaporation-constant release area*** model is used to estimate inhalation exposure to substances evaporating from hair styling gel and the ***product is substance in pure form*** option is selected.

Product amount

The product amount used is derived from Ficheux et al. (2016). A Q-factor of 4 is assigned, as the product amount is from a high-quality study involving a large number of participants. For the age groups for which no data was available, a Q-factor of 2 is assigned for the calculated product amount, as the default was not based on an empirical value for that age group.

Retention factor

Since the product is applied to the hair, it is assumed that only 10% of the product is transferred to the skin and is available for dermal exposure (Bremmer et al., 2006a). Therefore, a retention factor of 0.1 needs to be applied to reflect the amount of product actually on the consumer’s skin. The Q-factor assigned is 1, as the retention factor is based on assumptions.

Table 6.10 Default values for estimating consumer exposure to substances in hair styling gel following application

Default value		Q-factor	Source(s)
General			
Frequency Adults (19+ years) Infants (2-3 years)	 397 per year 408 per year	 4 4	 Ficheux et al., 2015 Ficheux et al., 2015
Inhalation-exposure to vapour-evaporation-constant release area			
Exposure duration Adults (19+ years) Infants (2-3 years)	 22 hours 21 hours	 4 4	Section 4.1.1
Product amount Adults (19+ years) Infants (2-3 years)	 5.9 g 2.3 g	 4 2	Product amount (dermal)
Room volume	20 m^3	3	Section 4.1.1
Ventilation rate	0.6 per hour	3	Section 4.1.1
Application temperature	32 °C	4	Section 4.1.1
Mass transfer coefficient	10 m/h	2	Section 4.1.1
Release area Adults (19+ years) Infants (2-3 years)	 1050 cm^2 350 cm^2	 3 3	Exposed area (dermal)
Emission duration Adults (19+ years) Infants (2-3 years)	 22 hours 21 hours	 4 4	Exposure duration
Dermal-direct product contact-instant application			
Exposed area Adults (19+ years) Infants (2-3 years)	 1050 cm^2 350 cm^2	 3 3	 Half head and half hands (Te Biesebeek et al., 2014) Half head (Te Biesebeek et al., 2014)
Product amount Adults (19+ years) Infants (2-3 years)	 5.9 g 2.3 g	 4 2	 Ficheux et al., 2016 Section 4.5
Retention factor	0.1	1	See above

6.3.3 *Hair styling mousse*

Hair styling mousse is a foam or mousse that is applied to the hair using the hands, and is left on for a prolonged duration. It is used to help style the hair by providing stiffness and hold to the hair, thus keeping hairstyles in place. Hair mousse is anticipated to be used by ages 2 and up.

Scenario for consumer exposure
During application, the user applies the hair mousse directly to the hair using their hands, and leaves the product on for a prolonged duration. Therefore, the consumer exposure scenarios for mousse are anticipated to run by dermal contact and inhalation of evaporated substances during leave-on.

Frequency
The frequency of use is derived from Wu et al. (2010). A Q-factor of 4 is assigned, as it is a high-quality study involving a large number of participants.

6.3.3.1 Application: leave-on

Hair styling mousse is a cosmetic product that is applied to the hair and from which substances may evaporate for a prolonged duration. Therefore, the scenario of using hair styling mousse fits the generic exposure scenarios for dermal exposure from leave-on products (see Section 4.2.1) and for inhalation of substance evaporating from leave-on products (Section 4.1.1). The ***dermal-direct product contact-instant application*** model is used to estimate dermal exposure to substances in hair mousse. The ***inhalation-exposure to vapour-evaporation-constant release area*** model is used to estimate inhalation exposure to substances evaporating from hair styling mousse and the ***product is substance in pure form*** option is selected.

Product amount
The product amount used is derived from Ficheux et al. (2016). A Q-factor of 4 is assigned, as the product amount is from a high-quality study involving a large number of participants. For the age groups for which no data was available, a Q-factor of 2 is assigned for the calculated product amounts, as the default was not based on an empirical value for that age group.

Retention factor
Since the product is applied to the hair, it is assumed that only 10% of the product is transferred to the skin and is available for dermal exposure (Bremmer et al., 2006a). Therefore, a retention factor of 0.1 needs to be applied to reflect the amount of product actually on the consumer's skin. The Q-factor assigned is 1 as the retention factor is based on assumptions.

Table 6.11 Default values for estimating consumer exposure to substances in hair styling mousse following application

Default value		**Q-factor**	**Source(s)**
General			
Frequency Adults (19+ years) Children (4-8 years)	 360 per year[1] 317 per year	 4 4	 Wu et al., 2010 Wu et al., 2010
Inhalation-exposure to vapour-evaporation-constant release area			
Exposure duration Adults (19+ years) Children (4-8 years)	 24 hours 24 hours[2]	 4 1	Section 4.1.1

Default value		Q-factor	Source(s)
Product amount Adults (19+ years) Children (4-8 years)	 12.4 g 9.7 g	 4 2	Product amount (dermal)
Room volume	20 m^3	3	Section 4.1.1
Ventilation rate	0.6 per hour	3	Section 4.1.1
Application temperature	32°C	4	Section 4.1.1
Mass transfer coefficient	10 m/h	2	Section 4.1.1
Release area Adults (19+ years) Children (4-8 years)	 1050 cm^2 700 cm^2	 3 3	Exposed area (dermal)
Emission duration Adults (19+ years) Children (4-8 years)	 24 hours 24 hours[2]	 4 1	Exposure duration
Dermal-direct product contact-instant application			
Exposed area Adults (19+ years) Children (4-8 years)	 1050 cm^2 700 cm^2	 3 3	 Half head and half hands (Te Biesebeek et al., 2014) Half head and half hands (Te Biesebeek et al., 2014)
Product amount Adults (19+ years) Children (4-8 years)	 12.4 g 9.7 g	 4 2	 Ficheux et al., 2016 Section 4.5
Retention factor	0.1	1	See above

1: The frequency of use for adults (19+ years) is set to the 90th percentile value, as the estimated 75th percentile value was higher than the reported 90th percentile value.
2: For children, the exposure duration and emission duration are set to 24 hours, rather than calculated using the frequency of use, since the frequency of use is less than once per day (Section 4.1.1).

6.4 Hair dyes

Hair dye is a product that is applied to the hair to change its colour . There are various types of hair dyes available. The main types include permanent, semi-permanent, and temporary hair dyes. Depending on the type of product, hair dye is available as a cream, liquid, powder, spray, or a product consisting of multiple components that are combined immediately prior to use.

6.4.1 Permanent hair dye

Permanent hair dye is intended to colour the hair for a longer duration than other hair dye products. It is expected that permanent hair dye will last for at least ten hair washes. Typically, permanent hair dyes consist of two parts that are mixed just before using the product. The first part consists of a primary intermediate and coupler, and the second part consists of an oxidiser. When the two parts are mixed, the hair dye is

activated and ready to colour hair (Bremmer et al., 2006a). Permanent hair dye is anticipated to be used by ages 14 and up.

Scenario for consumer exposure
During application, the user mixes the two components together and applies the mixed product to the hair. The product is left on for a short duration and then rinsed out. A fraction of the product remains on the hair, nonetheless. Therefore, the consumer exposure scenario for permanent hair dye is anticipated to run by dermal contact following rinse-off.

Frequency
The frequency of use is derived from Bernard et al. (2016). A Q-factor of 4 is assigned, as it is a high-quality study involving a large number of participants.

6.4.1.1 Application: time-limited leave-on

Permanent hair dye is applied to dry hair, left on for 20 to 40 min (Bremmer et al., 2006a), and then rinsed out. A fraction of the product remains on the scalp, nonetheless. Therefore, the scenario of using permanent hair dye fits the generic exposure scenario for dermal exposure from residues of rinse-off products (see Section 4.2.2). The ***dermal-direct product contact-instant application*** model is used to estimate dermal exposure to substances in hair dye. The consumer use of permanent hair dyes includes a period of time during which the product needs to remain in the hair in order to effectively dye it. Substances evaporate from the consumer's head into the room air during this limited leave-on time before the product is rinsed out. The consumer may then inhale these evaporated substances. The ***inhalation-exposure to vapour-evaporation-constant release area*** model is used to estimate inhalation exposure to substances evaporating from the pure products during the limited leave-on time prior to rinse-off.

Exposure duration
Here, exposure duration refers to the time between the moment the product is applied to the hair and the moment product is rinsed out. In Bremmer et al. (2006a), a duration of 20 to 40 minutes was described. Most product information mentions a maximum duration of 45 minutes with a caution not to exceed this duration as it may be harmful to one's hair. The default is set to 40 minutes. The Q-factor assigned is 2, because the exposure duration refers to a direct instruction of use provided as product information.

Product amount – inhalation
The product amount that is available for inhalation exposure refers to the total amount of product used for hair dying. A default product amount of 157 g is derived from the data in Ramirez-Martinez et al. (2015)

Room volume
The default room volume refers to the volume of the location where the product is being applied. For hair dyes, the bathroom is the most common application location, because the use of the products requires a

mirror, lavatory or shower. According to the General Fact Sheet (Te Biesebeek et al., 2014) the default room volume of a bathroom is 10 m^3 with a Q-factor of 4.

Ventilation rate
The default ventilation rate is set to that of a bathroom. The default ventilation rate is set to 2/h with a Q-factor of 3 as described in the General Fact Sheet (Te Biesebeek et al., 2014).

Release area
The release area refers to the half of the head to which the product is applied as described, which is also described as an *exposed area* of 600 cm^2 with a Q-factor of 3.

Emission duration
The default emission duration is equal to the default exposure duration, because they both refer to the time between the moment the product is applied to the hair and the moment product is being rinsed out. The emission duration for hair dyes is set to 40 minutes. The Q-factor assigned is 2, because the emission and exposure duration refer to a direct instruction of use provided as product information.

Exposed area
The default for the exposed area is set to be equal to the surface area of half of the head. Permanent hair dye kits usually come with gloves and it is recommended that gloves are worn to prevent staining the skin. It is thus assumed that users will wear gloves while using permanent hair dye, and will therefore only be dermally exposed to hair dye on the scalp. Surface area values are derived from the General Fact Sheet and assigned a Q-factor of 3 in accordance with the General Fact Sheet (Te Biesebeek et al., 2014).

Product amount – dermal
The product amount used is derived from Ramirez-Martinez et al. (2015).Ramirez-Martinez et al. (2015) measured the amount of the hair dye after mixing the components together; therefore, the product amount presented here is the total product amount after mixing. A Q-factor of 2 is assigned for the product amount as it is derived from a study with a small number of participants that consisted primarily of professional hairdressers, which does not fully represent the product use by non-professional users.

Retention factor
Similar to other rinse-off hair products, rinse-off and transfer need to be considered when calculating the amount of product that is actually available for dermal exposure. However, since hair dye remains on the hair and scalp for about 20 to 40 minutes before being rinsed out (Bremmer et al., 2006a), it is assumed that 10% of the product is potentially available for dermal exposure after rinsing (SCCS, 2015; Bremmer et al., 2006a). Therefore, a retention factor of 0.1 needs to be applied to reflect the amount of product actually on the consumer’s skin. The Q-factor assigned is 1 as the retention factor is based on assumptions.

Table 6.12 Default values for estimating consumer exposure to substances in permanent hair dye residues after rinsing

Default value		Q-factor	Source(s)
General			
Frequency Adults (19+ years)	11 per year	4	Bernard et al., 2016
Inhalation-exposure to vapour-evaporation-constant release area			
Exposure duration	40 min	2	See above
Product amount Adults (19+ years)	157 g	2	Ramirez-Martinez et al., 2015
Room volume	10 m^3	4	Te Biesebeek et al., 2014
Ventilation rate	2 per hour	3	Te Biesebeek et al., 2014
Application temperature	32 °C	4	Section 4.1.1
Mass transfer coefficient	10 m/h	2	Section 4.1.1
Release area Adults (19+ years)	600 cm^2	3	Exposed area (dermal)
Emission duration	40 min	2	See above
Dermal-direct product contact-instant application			
Exposed area Adults (19+ years)	600 cm^2	3	Half head (Te Biesebeek et al., 2014)
Product amount Adults (19+ years)	157 g	2	Ramirez-Martinez et al., 2015 (total product amount, after mixing components)
Retention factor	0.1	1	See above

6.4.2 *Semi-permanent hair dye*

Semi-permanent hair dye is intended to colour the hair for a shorter duration than permanent hair dye. It is expected that semi-permanent hair dye will last for about 4-5 hair washes. Typically, semi-permanent hair dyes consist of a single part containing a primary intermediate and coupler (Bremmer et al., 2006a). Unlike permanent hair dye, this product is usually ready-to-use and does not require mixing prior to application. Semi-permanent hair dye is anticipated to be used by ages 14 and up.

Scenario for consumer exposure

During application, the user applies the product to the hair. The product is left on for a short duration and then rinsed out. A fraction of the product remains in the hair, nonetheless. Therefore, the consumer

exposure scenario for semi-permanent hair dye is anticipated to run by dermal contact following rinse-off.

Frequency
The frequency of use is derived from Bernard et al. (2016). A Q-factor of 4 is assigned, as it is a high-quality study involving a large number of participants.

6.4.2.1 Application: time-limited leave-on

Semi-permanent hair dye is applied to dry hair, left on for 20 to 40 min (Bremmer et al., 2006a) and then rinsed out. A fraction of the product remains on the skin, nonetheless. Therefore, the scenario of using semi-permanent hair dye fits the generic exposure scenario for dermal exposure from residues of rinse-off products (see Section 4.2.2). The ***dermal-direct product contact-instant application*** model is used to estimate dermal exposure to substances in hair dye. The consumer use of semi-permanent hair dyes includes a period of time during which the product needs to remain in the hair in order to effectively dye the hair. Substances evaporate from the consumer's head into the room air during this limited leave-on time before the product is rinsed out. The consumer may then inhale these evaporated substances. The ***inhalation-exposure to vapour-evaporation-constant release area*** model is used to estimate inhalation exposure to substances evaporating from the pure products during the limited leave-on time before rinse-off. The default values and Q-factors for the inhalation model presented below (Table 6.13) refer to the similar inhalation exposure scenario for the limited leave-on time of permanent hair dyes (see Section 6.4.1.2).

Product amount – inhalation
The product amount that is available for inhalation exposure refers to the total amount of product used for hair dying. A default product amount of 35 g is derived from the data in SCCS (2023). A Q-factor of 3 is assigned, as this is a reliable publication, albeit with limited data on hair dyes.

Exposed area
The default for the exposed area is set to be equal to the surface area of half of the head. It is assumed that users will wear gloves while using hair dye; therefore they will only be dermally exposed to hair dye on the scalp. Surface area values are derived from the General Fact Sheet and assigned a Q-factor of 3 in accordance with the General Fact Sheet (Te Biesebeek et al., 2014).

Product amount
The product amount used is derived from SCCS (2015). A Q-factor of 3 is assigned, as this is a reliable publication, albeit with limited data on hair dyes.

Retention factor
Similar to other rinse-off hair products, rinse-off and transfer need to be considered when calculating the amount of product that is actually available for dermal exposure. However, since hair dye remains on the hair and scalp for about 20 to 40 minutes before being rinsed out

(Bremmer et al., 2006a), it is assumed that 10% of the product is potentially available for dermal exposure after rinsing (SCCS, 2015; Bremmer et al., 2006a). Therefore, a retention factor of 0.1 needs to be applied to reflect the amount of product actually on the consumer's skin. The Q-factor assigned is 1, as the retention factor is based on assumptions.

Table 6.13 Default values for estimating consumer exposure to substances in semi-permanent hair dye residues after rinsing

Default value		Q-factor	Source(s)
General			
Frequency Adults (19+ years)	10 per year	4	Bernard et al., 2016
Inhalation-exposure to vapour-evaporation-constant release area			
Exposure duration	40 min	2	Section 6.1.4.2
Product amount Adults (19+ years)	35 g	3	SCCS, 2023
Room volume	10 m^3	4	Section 6.1.4.2
Ventilation rate	2 per hour	3	Section 6.1.4.2
Application temperature	32°C	4	Section 6.1.4.2
Mass transfer coefficient	10 m/h	2	Section 6.1.4.2
Release area Adults (19+ years)	600 cm^2	3	Section 6.1.4.2 Section 6.1.4.2
Emission duration	40 min	2	Section 6.1.4.2
Dermal-direct product contact-instant application			
Exposed area Adults (19+ years)	600 cm^2	3	Half head (Te Biesebeek et al., 2014)
Product amount Adults (19+ years)	35 g [1]	3	SCCS, 2015
Retention factor	0.1	1	See above

1: The product amount is set to the mean value, as 75th percentile values were not available.

6.4.3 *Temporary hair dye spray*

Temporary hair dye is a product that is used on the hair to colour the hair for a shorter amount of time than the other types of hair dye. It is expected that temporary hair dye will rinse out after one wash. This type of hair dye is more commonly used for special occasions, e.g. sporting events, children's parties, and carnivals. Temporary hair dye is commonly available as a cream or an aerosol spray. However, it is also available in other forms, such as chalk. Some temporary hair dyes are applied to the hair, left on for a short duration, and rinsed out. After rinsing, the dye remains on the hair until it is washed out. The use scenario for these products is similar to the one for semi-permanent hair dye (see Section 6.4.2). There are also some temporary hair dyes that are applied similarly to a liquid shampoo (6.1.2). In this section, temporary hair dye creams and sprays that are applied to hair and left

on until rinsed out are described. Temporary hair dye is anticipated to be used by ages 4 and up.

Scenario for consumer exposure
During application, the user applies the product to the hair and leaves the product on for prolonged duration, then rinses it out. Therefore, the consumer exposure scenario for temporary hair dye is anticipated to run by dermal contact during leave-on.

Frequency
The frequency of use is derived from Bernard et al. (2016) or Bremmer et al. (2006a) depending on the age group. A Q-factor of 4 is assigned for data from Bernard et al. (2016) as it is a high-quality study. A Q-factor of 3 is assigned for data from Bremmer et al. (2006a) as this is a reliable publication, albeit with limited information on temporary hair dye, and the value for frequency of use from this study was based on an assumption of using the product six times per year (rather than quantitative data).

6.4.3.1 Application: spraying

Temporary hair dye is applied to the hair and left on for a prolonged duration. The spray application is similar to the one of hair spray and for that reason the defaults for exposure to hair sprays (aerosols) have been adopted, except for frequency. The default parameter values described below refer to spraying temporary hair dye out of an aerosol spray can as well as out of a pump spray. However, Q-factors for mass generation rate, airborne fraction, density non-volatile, and initial particle distribution upon spraying temporary hair dyes out of a pump spray format are set to 1 (see Section 6.3.1.2.1 for motivation).

Mass generation rate
In the report by Delmaar & Bremmer (2009), the mass generation rate of aerosol hair spray cans was experimentally determined for 6 aerosol hair spray cans by spraying for 10 seconds and determining the weight loss of the spray can. The resulting mass generation rate of 0.8 g/s is consistent with the earlier measured mass generation rate of 6 hair spray samples reported by Tuinman (2004). The default mass generation rate for aerosol hair spray cans is therefore set to 0.8 g/s (Delmaar & Bremmer, 2009). The Q-factor assigned is 2, because the default refers to the mass generation rate of hair sprays rather than hair dye, but the number of samples (N=12) is limited.

Airborne fraction
The default airborne fraction in this scenario refers to a scaled airborne fraction that is complementary to the fitted initial particle distribution (see Section 4.1.3.2). Prior to the exercise conducted by RIVM in 2010, Delmaar & Bremmer (2009) characterised a default initial particle distribution for droplets released during the use of aerosol hair spray with a median particle diameter of 46.5 µm and a C.V. of 2.1. However, this initial fitting exercise underestimates (or misfits) the part of the distribution that is most relevant for inhalation, i.e. the inhalable particles < 22.5 µm. Therefore the fraction of the inhalable particles (< 22.5 µm) was fitted separately to acquire a more accurate estimate of the inhalable fraction. The fit has since been performed on a part of the

entire distribution; complementary to this fit, the airborne fraction is scaled as the mass fraction of the sprayed droplets that is both directly airborne during the spray event and < 22.5 µm. Delmaar & Bremmer (2009) determined the mass fraction that is directly airborne to be 1, whereas the mass fraction < 22.5 µm is determined to be 0.2. The default airborne fraction is thus scaled as 1 x 0.2 = 0.2 and is applicable to the fitted initial particle distribution; in this case 46.5 µm and a C.V. of 2.1. The Q-factor assigned is 2, because the measurements by Delmaar & Bremmer (2009) refer to airborne fractions of hair sprays, but the number of samples (N=6) is limited.

Density non-volatile
The density of non-volatile materials in hair sprays is estimated by Delmaar & Bremmer (2009) to be 0.7 g/cm^3. The default density non-volatile is set accordingly. The Q-factor assigned is 1, because the estimation of Delmaar & Bremmer (2009) refers to the density of non-volatile materials in hair sprays, but includes only one sample.

Initial particle distribution
A default initial particle distribution of droplet sizes during the use of hair sprays is characterised by Delmaar & Bremmer (2009) and RIVM (2010) with a median particle diameter of 46.5 µm and a C.V. of 2.1 (see airborne fraction above). The Q-factor assigned is 2, because the defaults refers to initial particle distribution of hair sprays, but the number of samples (N=6) is limited.

Released mass
Due to a lack of data on temporary hair dye spray, the released mass is assumed to be similar to the product amount default for pump hair spray (5.2 g). A Q-factor of 2 is assigned, as the default values are derived from a similar product scenario, but relate to pump hair spray rather than to temporary hair dye spray.

Spray duration
The spray durations are derived from the product amount divided by the mass generation rate resulting in 6.5 seconds. Since it is derived from the product amount and mass generation mass for hair spray the Q-factor assigned is 2.

Table 6.14 Default values for estimating consumer exposure to substances in temporary hair dye during spraying

Default value		**Q-factor**	**Source(s)**
General			
Frequency Adults (19+ years) Children (4-8 years)	 11 per year 11 per year	 4 4	Bernard et al., 2016
Inhalation-exposure to spray-spraying-spraying towards person[1]			
Spray duration Adults (19+ years)	 6.5 s	 2	Released mass/mass generation rate (Section 4.1.3.2)

Default value		Q-factor	Source(s)
Children (4-8 years)	6.5 s	2	
Exposure duration	5 min	2	Section 4.1.3.2
Room volume	10 m^3	4	Section 4.1.3.2
Room height	2.5 m	4	Section 4.1.3.2
Ventilation rate	2 per hour	3	Section 4.1.3.2
Cloud volume	0.0625 m^3	2	Section 4.1.3.2
Mass generation rate	0.8 g/s	2 or 1[3]	Delmaar & Bremmer, 2009
Airborne fraction	0.2	2 or 1[3]	Delmaar & Bremmer, 2009
Density non-volatile	0.7 g/cm^3	1	Delmaar & Bremmer, 2009
Initial particle distribution Median (C.V.)	 46.5 µm 2.1	 2 or 1[3]	 Delmaar & Bremmer, 2009; RIVM 2010
Inhalation cut-off diameter	15 µm	3	Delmaar & Schuur, 2017
Inhalation-exposure to spray-instantaneous release[2]			
Exposure duration Adults (19+ years) Children (4-8 years)	 13 s 13 s	 1 1	Twice the spray duration, Section 4.1.3.1
Released mass	5.2 g	2	See above
Room volume	1 m^3	1	Section 4.1.3.1
Ventilation rate	2 per hour	1	Section 4.1.3.1

1: Applies to non-volatile substances
2: Applies to volatile substances
3: The default mass generation rate, airborne fraction, density non-volatile, and initial particle distribution upon spraying temporary hair dye refer to the use of both aerosol hair spray cans and pump hair sprays. This is because the default parameter values for using pump hair sprays are actually based on data for spraying with aerosol hair spray cans due to a lack of data (see Section 6.3.1.2.1).

6.4.3.2 Application: leave-on

The scenario of using temporary hair dye spray fits the generic exposure scenario for dermal exposure from sprays (Section 4.2.4). The ***dermal-direct product contact-instant application*** model is used to estimate dermal exposure to substances in temporary hair dye spray.

Product amount

Due to a lack of data on temporary hair dye spray, the product amount used is assumed to be similar to the default for pump hair spray (5.2 g). A Q-factor of 2 is assigned, as the default values are derived from a similar product scenario, but relate to pump hair spray rather than to temporary hair dye spray.

Retention factor

For spray products, it is assumed that only 85% of the sprayed product amount is on the consumer's skin or hair after spraying (Bremmer et al., 2006a). In addition, since the product is applied to the hair, it is

assumed that only 10% of the product is transferred to the skin and is available for dermal exposure (Bremmer et al., 2006a). Therefore, a retention factor of 0.085 needs to be applied to reflect the amount of product actually on the consumer's skin after spraying. The Q-factor assigned is 1, as the retention factor is based on assumptions.

Table 6.15 Default values for estimating consumer exposure to substances in temporary hair dye spray following application

Default value		Q-factor	Source(s)
General			
Frequency	11 per year	4	Bernard et al., 2016
Dermal-direct product contact-instant application			
Exposed area Adults (19+ years) Children (4-8 years)	 600 cm^2 470 cm^2	3	Half head (Te Biesebeek et al., 2014)
Product amount Adults (19+ years) Children (4-8 years)	 5.2 g[1] 5.2 g[1]	 2 2	 See above See above
Retention factor	0.085	1	See above

1: The product amount is set to the 80th percentile value, as the estimated 75th percentile value was higher than the reported 80th percentile value.

6.4.4 *Temporary hair dye cream*

Temporary hair dye is applied to the hair and left on for a prolonged duration. Therefore, the scenario of using temporary hair dye fits the generic exposure scenario for dermal exposure from leave-on products (see Section 4.2.1). The ***dermal-direct product contact-instant application*** model is used to estimate dermal exposure to substances in temporary hair dye.

Frequency

The frequency of use of temporary hair cream is derived from Bernard et al. (2016) or from Bremmer et al. (2006a) depending on the age group. A Q-factor of 4 is assigned for data from Bernard et al. (2016) as it is a high-quality study. A Q-factor of 3 is assigned for data from Bremmer et al. (2006a) as this is a reliable publication, albeit with limited information on temporary hair dye, and the value for frequency of use from this study was based on an assumption of using the product 6 times per year.

Product amount

Due to a lack of data on temporary hair dye, it is assumed that temporary hair dye cream is applied similarly to semi-permanent hair dye. Therefore, the product amount used is derived from the value for semi-permanent hair dye (35 g). A Q-factor of 2 is assigned, as the default values are derived from a reliable publication that had limited information on hair dyes, and the product amount was not specifically for temporary hair dye cream.

Retention factor
Since the product is applied to hair, it is assumed that only 10% of the product is transferred to the skin and is available for dermal exposure (Bremmer et al., 2006a). Therefore, a retention factor of 0.1 needs to be applied to reflect the amount of product actually on the consumer's skin. The Q-factor assigned is 1, as the retention factor is based on assumptions.

Table 6.16 Default values for estimating consumer exposure to substances in temporary hair dye following application

Default value		Q-factor	Source(s)
General			
Frequency Adults (19+ years) Children (4-8 years)	 11 per year 6 per year	 4 3	 Bernard et al., 2016 Bremmer et al., 2006a
Dermal-direct product contact-instant application			
Exposed area Adults (19+ years) Children (4-8 years)	 600 cm^2 470 cm^2	 3 3	 Half head (Te Biesebeek et al., 2014) Half head (Te Biesebeek et al., 2014)
Product amount Adults (19+ years) Children (4-8 years)	 35 g [1] 35 g [1]	 2 2	 See above See above
Retention factor	0.1	1	See above

1: The product amount is set to the mean value, as 75th percentile values were not available.

6.5 Hair bleach

Hair bleach is intended to lighten or bleach the colour of hair. Typically, hair bleach consists of three parts that are mixed just before using the product. The first part contains the bleaching agent (H_2O_2), the second part contains a 'bleach base' that contains alkali to increase the pH, and the third part contains a substance (often sodium persulfate) to improve the bleaching power (Bremmer et al., 2006a). Hair bleach is anticipated to be used by ages 14 and up. It is anticipated that the user would wear gloves during application of hair bleach, since hair bleach is often sold in kits with gloves or because product labels recommend the user wear gloves.

Scenario for consumer exposure
During application, the user mixes the components together and applies the mixed product generously to dry hair. The product is left on for a short duration and is then rinsed out. Therefore, the consumer exposure scenarios for hair bleach are anticipated to run by inhalation of evaporated substances during application and by dermal contact following rinse-off.

Frequency
The frequency of use is derived from Bernard et al. (2016). A Q-factor of 4 is assigned, as it is a high-quality study involving a large number of participants.

6.5.1 *Application: time-limited leave-on*

Hair bleach is a product that is applied to the hair and from which substances may evaporate for a defined duration. User instructions from hair bleach product labels describe that the consumer is expected to generously apply the bleach to dry hair and leave it there to process. After a certain amount of time, the product is rinsed out. Therefore, the scenario of using hair bleach fits the generic exposure scenario for dermal exposure from residues of rinse-off products (see Section 4.2.2), as the dermal exposure is considered to be highest following rinse-off. This scenario also fits the generic exposure scenario for inhalation of substances evaporating from leave-on products (Section 4.1.1), as the inhalation exposure is considered to be highest during the period of time that the bleach sits on the hair prior to rinsing. The ***dermal-direct product contact-instant application*** model is used to estimate dermal exposure to substances in hair bleach. The ***inhalation-exposure to vapour-evaporation-constant release area*** model is used to estimate inhalation exposure to substances evaporating from hair bleach during the processing period. Furthermore, the consumer is expected to use the product in the bathroom.

Exposure duration
The exposure duration is described here as the time between application and the moment the product is rinsed out. User instructions indicate a maximum exposure duration of 45 min. The default is set to 45 min and the Q-factor assigned is 1, because it is solely based on product information.

Exposed area
The default for the exposed area is set to be equal to the surface area of half of the head. It is assumed that users will wear gloves while using hair bleach and will therefore only be dermally exposed to hair dye on the scalp. Surface area values are derived from the General Fact Sheet and assigned a Q-factor of 3, in accordance with the General Fact Sheet (Te Biesebeek et al., 2014).

Product amount – inhalation
The product amount that is available for inhalation is derived from the total amount of hair bleach used. A default of 200 g is derived from Bremmer et al. (2006a), in which the product amount was estimated on the basis of product labels, assuming the entire package was used. Product labels indicate that hair bleaching kits consist of multiple components that are used in a multi-step application process. The product amount of each component varies. A decolourant cream (40 to 120 mL), developer (50 to 120 mL), and powder (12.5 to 48 g) are mixed prior to application. Depending on the product, the total product amount varies from 100 to 228 g. These amounts only concern the hair bleaching products themselves; hair care products, such as conditioners, that are included in the packaging are not considered. Therefore, the

total used amount for hair bleach is set to 200 g. A Q-factor of 3 is assigned, as the product amount is based on product labels.

Product amount – dermal
The product amount that is available for dermal exposure refers to the amount of hair bleach that is used. As such, the product available for dermal exposure is equal to the product amount that is available for inhalation. The default is thus set to 200 g, which is assigned with a Q-factor of 3 (see above).

Retention factor
Similar to other rinse-off hair products, rinse-off and transfer need to be considered when calculating the amount of product that is actually available for dermal exposure. However, since hair bleach remains on the hair and scalp for about 45 minutes before being rinsed out, it is assumed that 10% of the product is potentially available for dermal exposure after rinsing (SCCS, 2015; Bremmer et al., 2006a). Therefore, a retention factor of 0.1 needs to be applied to reflect the amount of product actually on the consumer's skin. The Q-factor assigned is 1, as the retention factor is based on assumptions.

Table 6.17 Default values for estimating consumer exposure to substances in hair bleach during application

Default value		**Q-factor**	**Source(s)**
General			
Frequency	15 per year	4	Bernard et al., 2016
Inhalation-exposure to vapour-evaporation-constant release area			
Exposure duration	45 min	1	See above
Product amount	200 g	3	Product amount (dermal)
Room volume	10 m^3	4	Section 4.1.1
Ventilation rate	2 per hour	3	Section 4.1.1
Application temperature	32 °C	4	Section 4.1.1
Mass transfer coefficient	10 m/h	2	Section 4.1.1
Release area	600 cm^2	3	Exposed area (dermal)
Emission duration	45 min	1	Exposure duration
Dermal-direct product contact-instant application			
Exposed area	600 cm^2	3	Half head (Te Biesebeek et al., 2014)
Product amount	200 g	3	Bremmer et al., 2006a (total product amount, after mixing components)
Retention factor	0.1	1	See above

6.6 Permanent waves

Hair permanent waving treatments are intended to permanently change the texture of the hair (e.g. make it more curly or wavy). Typically, hair perms consist of 2 parts that are used one after the other. The first part

contains the perm lotion, which breaks sulphur bridges in hair strands. The second part contains a neutralising or fixing lotion that repairs the sulphur bridges in the hair strands (Bremmer et al., 2006a). Permanent waves are anticipated to be used by ages 4 and up. It is anticipated that the user will wear gloves during application of hair permanent waving products, since these products are often sold in kits with gloves or product labels recommending that the user wear gloves.

The process of permanent waving hair is a two-step process. First the hair is washed and rinsed, then curled using perming rollers and is covered with perm lotion. The perm lotion breaks down proteins in the hair, thus allowing the hair to form curls around the rollers. The product is then rinsed out thoroughly, and step two begins. This second step involves applying fixing lotion to the hair, which repairs the proteins in the hair, thus allowing the hair to maintain the shape they are set in by the rollers. The product is then rinsed out and the rollers are removed.

Scenario for consumer exposure
During application, the user applies the product to the hair as described above. The product is left on for a short duration and is then rinsed out. Therefore, the consumer exposure scenario for hair perming products is anticipated to run by dermal contact following rinse-off.

Frequency
The frequency of use is derived from Wu et al. (2010) or from Ficheux et al. (2015), depending on the age group. A Q-factor of 4 is assigned, as both are high-quality studies involving large numbers of participants.

6.6.1 Application: time-limited leave-on

Hair perm is a product that is applied to the hair and is rinsed out. Therefore, the scenario of using hair perm fits the generic exposure scenario for dermal exposure from residues of rinse-off products (see Section 4.2.2). The ***dermal-direct product contact-instant application*** model is used to estimate dermal exposure to substances in hair perm. The consumer use of permanent waves includes a period of time during which the product needs to remain in the hair in order to effectively curl the hair. Substances evaporate from the consumer's head into the room air during this limited leave-on time before the product is rinsed off. The consumer may then inhale these evaporated substances. The ***inhalation-exposure to vapour-evaporation-constant release area*** model is used to estimate inhalation exposure to substances evaporating from the pure products during the limited leave-on time before rinse-off.

Exposure duration
Here, the exposure duration refers to the time between the moment the product is applied to the hair and the moment product is rinsed out. Applying permanent waves product consists of two separate lotions that are applied subsequently. The exposure duration is set to the total duration it takes to apply one of the lotions, amounting to 40 minutes. Note that this process may take place twice, if one substance is present in both lotions required. The Q-factor assigned is 2, because the exposure duration refers to a direct instruction of use provided as product information.

Product amount – inhalation
The default product amounts and respective Q-factors refer to the actual amount of product that is applied to the hair before rinse-off. As such, they are the same as the respective default values for the product amount in the generic scenario for inhalation of substances evaporating from residues after application, but without the corrections of a retention factor (see Section 4.1.2). For permanent waves, the product amount is set to 80 g per lotion with a Q-factor of 3 (see *product amount – dermal* below).

Room volume
The default room volume refers to the volume of the location where the product is being applied. For permanent waves, the bathroom is the most common location for such activity, because the use of the products requires a mirror, lavatory or shower. According to the General Fact Sheet (Te Biesebeek et al., 2014) the default room volume of a bathroom is 10 m^3 with a Q-factor of 4.

Ventilation rate
The default ventilation rate is set to the rate of a bathroom. The default ventilation rate is set to 2/h with a Q-factor of 3, as described in the General Fact Sheet (Te Biesebeek et al., 2014).

Emission duration
The default emission duration is equal to the default exposure duration, because both refer to the time between the moment the product is applied to the hair and the moment product is rinsed out. The emission duration for permanent waves per lotion is set to 40 minutes.

Exposed area
The default for the exposed area is set to be equal to the surface area of half of the head. It is assumed that users will wear gloves while using hair perm and will therefore only be dermally exposed to the product on the scalp. Surface area values are derived from the General Fact Sheet and assigned a Q-factor of 3 in accordance with the General Fact Sheet (Te Biesebeek et al., 2014).

Product amount – dermal
The amounts used are derived from Bremmer et al. (2006a), in which the product amount was estimated on the basis of product labels. Hair perming kits consist of multiple components that are used in a multi-step application process. The product amount is estimated to be 80 g for each component (a perm lotion and a fixing lotion). Therefore, the total product amount in hair perms is estimated to be 160 g. A Q-factor of 3 is assigned.

Retention factor
Similar to other rinse-off hair products, rinse-off and transfer need to be considered when calculating the amount of product that is actually available for dermal exposure. However, since hair perming product remains on the hair and scalp for about 15 to 45 minutes before being rinsed off (Bremmer et al., 2006a), it is assumed that 10% of the product is potentially available for dermal exposure after rinsing (SCCS, 2015; Bremmer et al., 2006a). Therefore, a retention factor of 0.1

needs to be applied to reflect the amount of product actually on the consumer's skin. The Q-factor assigned is 1, as the retention factor is based on assumptions.

Table 6.18 Default values for estimating consumer exposure to substances in hair perming products residues after rinsing

Default value		Q-factor	Source(s)
General			
Frequency Adults (19+ years) Children (14-18 years)	 4 per year [1] 10 per year	 4 4	 Wu et al., 2010; Ficheux et al., 2015 Ficheux et al., 2015
Inhalation-exposure to vapour-evaporation-constant release area			
Exposure duration	40 min	2	See above
Product amount Perm lotion Fixing lotion	 80 g 80 g	 3 3	 Bremmer et al., 2006a Bremmer et al., 2006a
Room volume	10 m^3	4	Te Biesebeek et al., 2014
Ventilation rate	2 per hour	3	Te Biesebeek et al., 2014
Application temperature	32°C	4	Section 4.1.1
Mass transfer coefficient	10 m/h	2	Section 4.1.1
Release area Adults (19+ years) Children (14-18 years)	 600 cm^2 520 cm^2	 3 3	 Exposed area Exposed area
Emission duration	40 min	2	See above
Dermal-direct product contact-instant application			
Exposed area Adults (19+ years) Children (14-18 years)	 600 cm^2 520 cm^2	 3 3	 Half head (Te Biesebeek et al., 2014) Half head (Te Biesebeek et al., 2014)
Product amount Perm lotion Fixing lotion	 80 g 80 g	 3 3	Bremmer et al., 2006a
Retention factor	0.1	1	See above

1: The frequency of use for adults (19+ years) is set to the 90th percentile value, as the estimated 75th percentile value was higher than the reported 90th percentile value.

6.7 Permanent hair straighteners

Permanent hair straightening treatments, also known as chemical hair straighteners, or hair relaxers, are intended to permanently change the texture of the hair (i.e. straighten hair or loosen curls/waves). Permanent straighteners are anticipated to be used by ages 4 and up. It is anticipated that the user will wear gloves during application of hair straightening

treatments, since these products are often sold in kits containing gloves or with product labels recommending that the user wear gloves.

The process of permanently straightening hair is a multi-step process. First, a pre-treatment product (e.g. cream, petroleum jelly) is applied to the scalp, hairline and ears to protect the hair and skin. Then, the chemical straightener is prepared by mixing a liquid activator into the texturising/relaxing cream. This mixture is applied to the hair using a brush or gloved hands and left on for a total of 10-16 minutes (children) or 10-20 minutes (adults) (including the active application time). The product is then rinsed out of the hair using warm water, and the hair is washed with a neutralising shampoo to stop the relaxing process and restore the pH. Hair conditioner is then applied to the hair to restore hydration.

Scenario for consumer exposure
During application, the user applies the product to the hair as described above. The product is left on for a short duration and is then rinsed out. Therefore, the consumer exposure scenario for hair straightener products is anticipated to run by dermal contact following rinse-off.

Frequency
The frequency of use is derived from Wu et al. (2010) or from Ficheux et al. (2015) depending on the age group. A Q-factor of 4 is assigned, as these are high-quality studies involving large numbers of participants. Note that the 90th and 95th percentile values indicated in Wu et al. (2010) and Ficheux et al. (2015), respectively, are used rather than means or 75th percentiles, as they may be more reflective of actual use patterns when compared to product labels.

6.7.1 Application: time-limited leave-on

Permanent hair straighteners are applied to the hair and then rinsed out. Therefore, the scenario of using permanent hair straighteners fits the generic exposure scenario for dermal exposure from residues of rinse-off products (see Section 4.2.2). The ***dermal-direct product contact-instant application*** model is used to estimate dermal exposure to substances in permanent hair straighteners. The consumer use of permanent hair straighteners includes a period of time in which the product needs to remain in the hair in order to effectively straighten it. Substances evaporate from the consumer's head into the room air during this limited leave-on time before the product is rinsed out. The consumer may then inhale these evaporated substances. The ***inhalation-exposure to vapour-evaporation-constant release area*** model is used to estimate inhalation exposure to substances evaporating from the pure products during the limited leave-on time before rinse-off.

Exposure duration
Here, the exposure duration refers to the time between the moment the product is applied to the hair and the moment the product is rinsed out. For permanent hair straighteners, the exposure duration is set to 20 and 15 minutes for adults and children, respectively. The Q-factor assigned is 2, because the exposure duration refers to direct instructions of use provided as product information.

Product amount – inhalation
The product amount that is available for inhalation refers to the total amount of hair straightener applied to the consumer's hair. Product labels collected in 2022 indicate that hair straightening kits consist of multiple components that are used in a multi-step application process. The product amount of each component varies. A liquid activator (44 to 58 g) is mixed with texturising/relaxing cream (85 to 201 g) prior to application. According to product labels, the total product amount in chemical hair straighteners is estimated to be 260 g and 230 g for adults and children, respectively. A Q-factor of 2 is assigned, as the data quality depends on product information.

Room volume
The default room volume refers to the volume of the location where the product is being applied. For hair straighteners, the bathroom is the most common location for such activity, because the use of the products requires a mirror, lavatory or shower. According to the General Fact Sheet (Te Biesebeek et al., 2014) the default room volume of a bathroom is 10 m^3 with a Q-factor of 4.

Ventilation rate
The default ventilation rate is set to the rate of a bathroom. The default ventilation rate is set to 2/h with a Q-factor of 3 as described in the General Fact Sheet (Te Biesebeek et al., 2014).

Emission duration
The default emission duration is equal to the default exposure duration, because both refer to the time between the moment the product is applied to the hair and the moment product is being rinsed out. The emission duration for hair straighteners is set to 20 and 15 minutes for adults and children, respectively. The Q-factor assigned is 2, because the exposure duration and thus emission duration refer to a direct instruction of use provided as product information

Exposed area
The default for the exposed area is set to be equal to the surface area of half of the head. It is assumed that users will wear gloves while using permanent hair straighteners and will therefore only be dermally exposed to the product on the scalp. Surface area values are derived from the General Fact Sheet and assigned a Q-factor of 3 in accordance with the General Fact Sheet (Te Biesebeek et al., 2014).

Product amount – dermal
Product labels collected in 2022 indicate that hair straightening kits consist of multiple components that are used in a multi-step application process. The product amount of each component varies. A liquid activator (44 to 58 g) is mixed with texturising/relaxing cream (85 to 201 g) prior to application. After rinsing, the hair is washed with a neutralising shampoo (14 to 44 g) and hair conditioner (14 to 52 g) is applied. According to product labels, the total product amount in chemical hair straighteners is estimated to be 260 g and 230 g for adults and children respectively. A Q-factor of 2 is assigned.

Retention factor
Similar to other rinse-off hair products, rinse-off and transfer need to be considered when calculating the amount of product that is actually available for dermal exposure. However, since the permanent hair straightener remains on the hair and scalp for about 10 to 20 minutes before being rinsed out (according to product labels), it is assumed that 10% of the product is potentially available for dermal exposure after rinsing (SCCS, 2015; Bremmer et al., 2006a). Therefore, a retention factor of 0.1 needs to be applied to reflect the amount of product actually on the consumer's skin. The Q-factor assigned is 1, as the retention factor is based on assumptions.

Table 6.19 Default values for estimating consumer exposure to substances in permanent hair straightener residues after rinsing

Default value		Q-factor	Source(s)
General			
Frequency			
Adults (19+ years)	11 per year [1]	4	Ficheux et al., 2015
Children (4-8 years)	6 per year [1]	4	Wu et al., 2010
Inhalation-exposure to vapour-evaporation-constant release area			
Exposure duration			
Adults (19+ years)	20 min	2	See above
Children (4-18 years)	15 min	2	See above
Product amount			
Adults (19+ years)	260 g	2	See above
Children (4-8 years)	230 g	2	See above
Room volume	10 m^3	4	Te Biesebeek et al., 2014
Ventilation rate	2 per hour	3	Te Biesebeek et al., 2014
Application temperature	32°C	4	Section 4.1.1
Mass transfer coefficient	10 m/h	2	Section 4.1.1
Release area			
Adults (19+ years)	600 cm^2	3	Exposed area
Children (14-18 years)	470 cm^2	3	Exposed area
Emission duration			
Adults (19+ years)	20 min	2	Exposure duration
Children (14-18 years)	15 min	2	Exposure duration
Dermal-direct product contact-instant application			
Exposed area			
Adults (19+ years)	600 cm^2	3	Half head (Te Biesebeek et al., 2014)
Children (4 -8 years)	470 cm^2	3	Half head (Te Biesebeek et al., 2014)
Product amount			
Adults (19+ years)	260 g	2	

Default value		Q-factor	Source(s)
Children (4-8 years)	230 g	2	See above (total product amount of all components combined)
Retention factor	0.1	1	See above

1: The frequency of use is set to the 95th percentile value for adults and the 90th percentile for children, respectively, as they may be more reflective of actual use patterns when compared to product labels.

7 Bathing and showering products

Bathing and showering products are used on the skin while a person is partially or fully submerged in water, e.g. in a sink or a bath, or while a person is partially or fully exposed to running water, e.g. in a sink or a shower. Bathing and showering products are intended to be rinsed off the skin. The products can be distinguished on the basis of their function, e.g. cleansing or nourishing the skin.

Bathing and showering products are available as creams, gels, foams, liquids, powders, semi-solids, solids, etcetera. Exposure to substances in bathing and showering products can occur through:

- Dermal contact with product residues;
- Dermal contact with diluted products during immersion;
- Inhalation of evaporated substances.

7.1 Hand soap

Hand soaps are used with water to cleanse the skin of the hands. They are available as a foam or gel and as liquid or solid soap. The foam, gel, and liquid soap are usually dosed by using a dispenser. Hand soaps are anticipated to be used by ages 2 and up.

Scenario for consumer exposure
During application, the user applies the soap directly to wet hands lathers, and immediately rinses off the product with water. A fraction of the product remains on the skin, nonetheless. Therefore, the consumer exposure scenario for hand soap is anticipated to run by dermal contact following rinse-off.

Frequency
According to information from the second Canadian Human Activity Pattern Survey (CHAPS 2), approximately 97% of the population wash their hands at least 3-5 times per day (Matz et al., 2014; personal communication, email from the Air Health Effects Assessment Division, Health Canada, to the Existing Substances Risk Assessment Bureau, Health Canada, dated October 2, 2013; unreferenced). According to US-EPA (2011), children under the age of 18 wash their hands about four times a day (median value). However, these studies did not specify the types of soap used, so for these products, the frequency of use is derived from Wu et al. (2010). No specific data on the frequency of use of solid soap was identified; it is assumed that solid hand soap is used with the same frequency as liquid hand soap. The frequency for hand washing and the use of hand soap only considers data from before the 2019 COVID pandemic, and may therefore be an underestimation of the handwashing frequency during and following the pandemic. For liquid hand soap, the Q-factor assigned for frequency is 4, as this publication is considered to have reliable quantitative data for liquid soap, and the results were similar to the data from CHAPS 2 (2014) and US-EPA (2011). For solid hand soap, a Q-factor of 3 is assigned, as the data applies to liquid hand soap, rather than to solid hand soap.

7.1.1 *Application: rinse-off*

Hand soap is applied to the skin, lathered, and then rinsed off. A small fraction of the product remains on the skin. Therefore, the scenario of using hand soap fits the generic exposure scenario for dermal exposure from residues of rinse-off products (see Section 4.2.2). The ***dermal-direct product contact-instant application*** model is used to estimate dermal exposure to substances in hand soap.

Product amount – liquid hand soap

The product amount used is derived from Garcia-Hidalgo et al. (2017) and is supported by values from Ficheux et al. (2016). A Q-factor of 4 is assigned for the product amounts, as they are derived from high-quality studies involving large numbers of participants.

Product amount – solid hand soap

The product amount used is derived from Ficheux et al. (2016). A Q-factor of 3 is assigned for the product amounts as they are derived from a high-quality study involving a large number of participants; however, there was less quantitative data on solid hand soap. When no product amount data was available for a certain age group, the estimated product amount was calculated using the dermal load for the age group for which data was142
available (Section 4.5). For these cases, a Q-factor of 2 is assigned, as the default was not based on an empirical value for that age group.

Retention factor

For rinse-off products, it is assumed that only 10% of the applied product amount is on the consumer's skin or hair following rinse-off (SDA, 2010). In addition, since hand soap readily dissolves in water and is applied to wet skin, an additional 10% factor is applied (SDA, 2010). Therefore, a retention factor of 0.01 needs to be applied to reflect the amount of product actually on the consumer's skin following rinse-off. The Q-factor assigned is 1, as the retention factor is based on assumptions.

Table 7.1 Default values for estimating consumer exposure to substances in hand soap residues after rinsing

Default value		**Q-factor**	**Source(s)**
General			
Frequency Adults (19+ years) Children (4-8 years)	 2707 per year 1956 per year	 4 4	 Wu et al., 2010 Wu et al., 2010
Dermal-direct product contact-instant application			
Exposed area Adults (19+ years) Children (4-8 years)	 900 cm^2 460 cm^2	 3 3	 Hands (Te Biesebeek et al., 2014) Hands (Te Biesebeek et al., 2014)
Product amount – liquid hand soap			

Default value		Q-factor	Source(s)
Adults (19+ years)	6.0 g	4	Garcia-Hidalgo et al., 2017
Children (4-8 years)	6.1 g	4	Garcia-Hidalgo et al., 2017
Product amount – solid hand soap			
Adults (19+ years)	0. 45 g	3	Ficheux et al., 2016
Children (4-8 years)	0.27 g	2	Section 4.5
Retention factor	0.01		See above

7.2 Body soap

Body soaps are used with water to cleanse the skin of the body. They are available as a foam, gel or liquid, and as a soap bar or solid soap. Body soaps are anticipated to be used by all age groups.

Scenario for consumer exposure
During application, the user applies the soap directly to wet skin of the entire body except for the head, lathers, and then rinses off the product with water. A fraction of the product remains on the skin, nonetheless. Therefore, the consumer exposure scenario for body soap is anticipated to run by dermal contact following rinse-off.

Frequency
On the basis of information from the CHAPS 2, approximately 78% of the population showered at least once on the day prior to responding to the survey (Matz et al., 2014; personal communication, email from the Air Health Effects Assessment Division, Health Canada, to the Existing Substances Risk Assessment Bureau, Health Canada, dated October 2, 2013; unreferenced). Similarly, Ficheux et al. (2015) and Loretz et al. (2006) indicated a P75 frequency of use amounting to 1.3-1.8 times per day. The frequency of use is derived from Ficheux et al. (2015) or from Loretz et al. (2006), depending on the age group. The only study identified that investigated the frequency of use of solid soap used during showering was by Ficheux et al. (2015), which indicated a P75 frequency of use amounting to 1.5-1.7 times per day. It is assumed that solid body soap is used with the same frequency as liquid body soap. For liquid body soap, the Q-factor assigned for frequency is 4, as these publications are high-quality studies involving large numbers of participants. For solid body soap, a Q-factor of 3 is assigned, as the data applies to liquid body soap, rather than to solid body soap.

7.2.1 Application: rinse-off

Body soap is applied to wet skin, lathered, and then rinsed off. A small fraction of the product remains on the skin. Therefore, the scenario of using body soap fits the generic exposure for dermal exposure from residues of rinse-off products (see Section 4.2.2). The ***dermal-direct product contact-instant application*** model is used to estimate dermal exposure to substances in body soap.

Product amount – liquid body soap
The product amount used is derived from Loretz et al. (2006) or from Gomez-Berrada et al. (2017), depending on the age group. A Q-factor of 4 is assigned for the product amounts as they are derived from high-quality studies involving large numbers of participants.

Product amount – solid body soap
The product amount used is derived from Ficheux et al. (2016). A Q-factor of 4 is assigned for the product amounts as they are derived from high-quality studies involving large numbers of participants. When no product amount data was available for a certain age group, the estimated product amount was calculated using the dermal load for the age group for which data is available (see Section 4.5). For these cases, a Q-factor of 2 is assigned, as the default was not based on an empirical value for that age group.

Retention factor
For rinse-off products, it is assumed that only 10% of the applied product amount is on the consumer's skin or hair following rinse-off (SDA, 2010). In addition, since body soap readily dissolves in water and is applied to wet skin, an additional 10% factor is applied (SDA, 2010). Therefore, a retention factor of 0.01 needs to be applied to reflect the amount of product actually on the consumer's skin following rinse-off. The Q-factor assigned is 1, as the retention factor is based on assumptions.

Table 7.2 Default values for estimating consumer exposure to substances in body soap residues after rinsing

Default value		**Q-factor**	**Source(s)**
General			
Frequency Adults (19+ years) Infants (0-5 months)	643 per year 599 per year	4 (liquid) / 3 (solid) 4 (liquid) / 3 (solid)	Loretz et al., 2006 Ficheux et al., 2015
Dermal-direct product contact-instant application			
Exposed area Adults (19+ years) Infants (0-5 months)	17000 cm^2 2780 cm^2	3 3	Total body except head (Te Biesebeek et al., 2014) Total body except head (Te Biesebeek et al., 2014)
Product amount – liquid body soap Adults (19+ years) Infants (0-5 months)	 16.0 g 6.7 g	 4 4	 Loretz et al., 2006 Gomez-Berrada et al., 2017
Product amount – solid body soap			

Default value		Q-factor	Source(s)
Adults (19+ years)	1.8 g	4	Ficheux et al., 2016
Infants (0-5 months)	0. 31 g	2	Section 4.5
Retention factor	0.01		See above

7.3 Hand sanitiser

Hand sanitiser or waterless hand cleansers are products used to cleanse or disinfect the skin of the hands without adding water or rinsing the product off. They are available as a foam, liquid, or gel, and are often dosed by using a dispenser. Hand sanitiser is anticipated to be primarily used by persons aged 2 and up.

Scenario for consumer exposure
During application, the user applies the sanitiser directly to dry hands, rubbing it into the skin until the product is no longer wet, and leaving the product on for a prolonged duration. Therefore, the consumer exposure scenarios for hand sanitiser are anticipated to run by dermal contact and inhalation of evaporated substances during leave-on.

Frequency
The frequency of use is derived from Wu et al. (2010). The frequency for the use of hand sanitiser only considers data from before the COVID pandemic, and therefore may be an underestimation of the hand sanitiser use frequency during and following the pandemic. The Q-factor assigned for frequency is 4, as it is derived from a high-quality study involving a large number of participants.

Application: leave-on
Hand sanitiser is a product that is often dosed by using a dispenser, applied to the skin of the hands and left on for a prolonged duration, during which substances may evaporate for an extended period of time. Therefore, the scenario of using hand sanitiser fits the generic exposure scenarios for dermal exposure from leave-on products (see Section 4.2.1) and for inhalation of substances evaporating from leave-on products (Section 4.1.2). The ***dermal-direct product contact-instant application*** model is used to estimate dermal exposure to substances in hand sanitiser. The ***inhalation-exposure to vapour-evaporation-constant release area*** model is used to estimate inhalation exposure to substances evaporating from hand sanitiser and the ***product is substance in pure form*** option is selected.

Product amount
The product amount that is available for dermal exposure is the amount of hand sanitiser that is applied to the entire surface of both hands. Limited information was available on the amount of product used per application. According to the occupational data available, most health care workers use one pump per use. Therefore, it was considered reasonable to assume that the general population would also dispense one pump per application. The default is set to 1.5 g per use on the basis of available data (Bánsághi et al., 2020; Kampf et al., 2013; and Macinga et al., 2013) and a Q-factor of 4 is assigned.

Table 7.3 Default values for estimating consumer exposure to substances in hand sanitiser following application

Default value		Q-factor	Source(s)
General			
Frequency Adults (19+ years) Children (4-8 years)	 2880 per year[1] 1184 per year	 4 4	 Wu et al., 2010 Wu et al., 2010
Inhalation-exposure to vapour-evaporation-constant release area			
Exposure duration Adults (19+ years) Children (4-8 years)	 3 hours 7 hours	 4 4	Section 4.1.1
Product amount Adults (19+ years) Children (4-8 years)	 1.5 g 1.5 g	 4 4	Product amount (dermal)
Room volume	20 m^3	3	Section 4.1.1
Ventilation rate	0.6 per hour	3	Section 4.1.1
Application temperature	32°C	4	Section 4.1.1
Mass transfer coefficient	10 m/h	2	Section 4.1.1
Release area Adults (19+ years) Children (4-8 years)	 900 cm^2 460 cm^2	 3 3	Exposed area (dermal)
Emission duration Adults (19+ years) Children (4-8 years)	 3 hours 7 hours	 4 4	Exposure duration
Dermal-direct product contact-instant application			
Exposed area Adults (19+ years) Children (4-8 years)	 900 cm^2 460 cm^2	 3 3	 Hands (Te Biesebeek et al., 2014) Hands (Te Biesebeek et al., 2014)
Product amount Adults (19+ years) Children (4-8 years)	 1.5 g 1.5 g	 4 4	 Bánsághi et al., 2020; Kampf et al., 2013; and Macinga et al., 2013 Bánsághi et al., 2020; Kampf et al., 2013; and Macinga et al., 2013

1: The frequency of use for adults (19+ years) is set to the 90th percentile value, as the estimated 75th percentile value was higher than the reported 90th percentile value.

7.4 Bath products

Bath products are added to a bath to moisturise skin, add scent, and for the purpose of relaxation. Bath products are available in various forms including oils or capsules, salts (powder, granules or tablet form), and foam or bubble products. Since bath products are generally added to a bathtub containing water prior to using the product, the product amount is adjusted to account for dilution of the product. It is not anticipated that these products will be rinsed off at the end of the bath.

Scenario for consumer exposure
During application, the user mixes the product with the water in a bathtub, and then immerses themselves in the bathtub containing the diluted product in water. Therefore, the consumer exposure scenario for bath products is anticipated to run by dermal contact during immersion in diluted products.
The scenario of using bath products fits the generic exposure scenario for dermal exposure from diluted products (see Section 4.2.3). The ***dermal-direct product contact-instant application*** model is used to estimate dermal exposure to substances in bath products.

7.4.1 Bubble / foam bath

It is anticipated that bubble bath will be used by all age groups.

Frequency
The frequency of use is derived from Ficheux et al. (2015). A Q-factor of 4 is assigned, as the defaults were derived from a high-quality study involving a large number of participants.

7.4.1.1 Application: bathing

Product amount
The used product amount is the amount of product added to the bath water. The product amount, 38.8 g, is derived from Ficheux et al. (2016).
Since the product is diluted in the bath water, not all of the used product amount is anticipated to make contact with the consumer's skin. Therefore, a dilution factor needs to be applied to the used product amount to calculate the amount of product that comes into contact with the skin. Such a dilution factor for bathing is estimated to be 0.14 for adults and 0.13 for children (Section 4.2.3). The product amounts available for dermal exposure are as such set to 5.4 g for adults and 5.0 g for children. Q-factor of 4 is assigned, as the default is from a high-quality study involving a large number of participants.

Table 7.4 Default values for estimating consumer exposure to substances in bubble bath during immersion in diluted product

Default value		Q-factor	Source(s)
General			
Frequency Adults (19+ years) Children (14-18 years)	 232 per year 252 per year	 4 4	 Ficheux et al., 2015 Ficheux et al., 2015

Default value		Q-factor	Source(s)
Dermal-direct product contact-instant application			
Exposed area Adults (19+ years) Children (14-18 years)	 17000 cm^2 15760 cm^2	 3 3	 Total body except head (Te Biesebeek et al., 2014) Total body except head (Te Biesebeek et al., 2014)
Product amount Adults (19+ years) Children (14-18 years)	 5.4 g 5.0 g	 4 4	 See above See above

7.4.2 Bath salts

Bath salts come in various forms including as granules, tablets and powders. It is anticipated that bath salts will be used by ages 9 and up.

Frequency

Limited information is available on bath salts; therefore, it is assumed that bath salts/tablets will be used twice a week (Bremmer et al., 2006a). The CTFA (1983) did have measured frequencies for the bath salts and tablets; however, the frequency of use was low given the frequency of baths taken identified in the CHAPS 2. Therefore, the values from Bremmer et al. (2006a) were used instead. The Q-factor assigned for frequency is 3, as this is a reliable publication, albeit with limited information on bath products.

7.4.2.1 Application: bathing

Product amount

The amount of bath salts added to the bath water is considered to be 18.9 g for both adults and children, as derived from CTFA (1983). Since the product is diluted in the bath water, not all of the used product amount is anticipated to make contact with the consumer's skin. Therefore, dilution factors of 0.14 for adults and 0.11 for children need to be applied to the used product amount to calculate the amount of product that comes into contact with the skin (Section 4.1.3). As such, the product amounts available for dermal exposure are 2.6 g for adults and 2.1 g for children. A Q-factor of 3 is assigned for CTFA (1983) data.

Table 7.5 Default values for estimating consumer exposure to substances in bath salts during immersion in diluted product

Default value		Q-factor	Source(s)
General			
Frequency Adults (19+ years) Children (9-13 years)	 104 per year 104 per year	 3 3	 Bremmer et al., 2006a Bremmer et al., 2006a
Dermal-direct product contact-instant application			
Exposed area Adults (19+ years)	 17000 cm^2	 3	Total body except head (Te

Default value		Q-factor	Source(s)
Children (9-13 years)	12950 cm^2	3	Biesebeek et al., 2014)
Product amount Adults (19+ years) Children (9-13 years)	 2.6 g[1] 2.1 g[1]	 3 3	 See above See above

1: The product amount for adults and children is set to the mean value, as 75th percentile values were not available

7.4.3 Bath oils

Bath oils can be divided into various categories depending on the behaviour of the product after it has been added to the water (Bremmer et al., 2006a):

- floating type: oil droplets float on the water surface
- spreading type: thin film of oil spreads out over the water surface
- dispersal type: oil is dispersed in small particles into the bath water
- milky type: oil gives a white cloudy dispersion in the bath water

Bath oils may consist of various types of oils mixed together. Note that the use of essential oils in bath water is discussed in Section 19.2. It is anticipated that bath oils will be used by ages 9 and up.

Frequency

Limited information was available on bath oils; therefore, it is assumed that bath oils will be used twice a week (Bremmer et al., 2006a). The Q-factor assigned for frequency is 3, as this is a reliable publication, albeit with limited information on bath products.

7.4.3.1 Application: bathing

Product amount

The amount of bath oil added to the bath water is considered to be 14.7 g for both adults and children, as derived from CTFA (1983). Since the product is diluted in the bath water, not all of the used product amount is anticipated to make contact with the consumer's skin. Therefore, dilution factors of 0.14 for adults and 0.11 for children need to be applied to the used amount to calculate the amount of product that comes into contact with the skin (Section 4.1.3). As such, the product amounts available for dermal exposure are 2.1 g for adults and 1.6 g for children. A Q-factor of 3 is assigned for CTFA (1983) data.

Table 7.6 Default values for estimating consumer exposure to substances in bath oils during immersion in diluted product

Default value		Q-factor	Source(s)
General			
Frequency Adults (19+ years) Children (9-13 years)	 104 per year 104 per year	 3 3	 Bremmer et al., 2006a Bremmer et al., 2006a
Dermal-direct product contact-instant application			
Exposed area Adults (19+ years)	 17000 cm^2	 3	Total body except head (Te

Default value		Q-factor	Source(s)
Children (9-13 years)	12950 cm^2	3	Biesebeek et al., 2014)
Product amount Adults (19+ years) Children (9-13 years)	 2.1 g[1] 1.6 g[1]	 3 3	 See above See above

1: The product amount for adults and children, 14.7 g, is set to the mean value, as 75^{th} percentile values were not available

8 Skin care products

Skin care products are cosmetic products used on the skin. The products can be distinguished on the basis of their function, such as moisturising, exfoliating, nourishing, or changing the texture or shade of the skin. Some skin care products are intended to be left on the skin, while others are intended to be rinsed off.

Skin care products are available as creams/lotions, liquids, semi-solids, gels, loose powders, etcetera. Exposure to substances in skin care products can occur through:

- Direct dermal contact;
- Inhalation of evaporated substances.

8.1 Leave-on creams

Leave-on creams are applied to the consumer's skin and left on for a prolonged duration. Leave-on creams can be differentiated by the area of the body to which they are applied (e.g. body, face, hands). Creams may also be differentiated by their function or purpose, such as moisturising, protecting, brightening, and soothing. In this section, face cream, hand cream, and body lotion are described. These three product types have similar use scenarios, but different frequencies, product amounts, exposed areas, and exposure durations.

Scenario for consumer exposure
During application, the cream is applied to the skin and is left on for a prolonged duration. Therefore, the consumer exposure scenarios for leave-on creams are anticipated to run by dermal contact and inhalation of evaporated substances during leave-on.

The scenario of using leave-on creams fits the generic exposure scenarios for dermal exposure from leave-on products (see Section 4.1.1) and for inhalation of substances evaporating from leave-on products (Section 4.1.1). The ***dermal-direct product contact-instant application*** model is used to estimate dermal exposure to substances in leave-on creams. The ***inhalation-exposure to vapour-evaporation-constant release area*** model is used to estimate inhalation exposure to substances evaporating from leave-on creams and the ***product is substance in pure form*** option is selected.

8.1.1 Face cream

Face cream is anticipated to be used by ages 9 and up. It is anticipated that users under the age of 9 may use body lotion on the face (see Section 8.1.3).

Frequency
The frequency of use is derived from Loretz et al. (2005). The Q-factor assigned for frequency is 4, as this publication is a high-quality study involving a large number of participants.

8.1.1.1 Application: leave-on

Product amount

The product amount that is available for dermal and inhalation exposure is derived from Ficheux et al. (2016). A Q-factor of 4 is assigned, as the default is based on a high-quality study involving a large number of participants and product types.

Table 8.1 Default values for estimating consumer exposure to substances in face cream following application

Default value		Q-factor	Source(s)
General			
Frequency	931 per year	4	Loretz et al., 2005
Inhalation-exposure to vapour-evaporation-constant release area			
Exposure duration	9 hours	4	Section 4.1.1
Product amount	2.5 g	4	Product amount (dermal)
Room volume	20 m^3	3	Section 4.1.1
Ventilation rate	0.6 per hour	3	Section 4.1.1
Application temperature	32 °C	4	Section 4.1.1
Mass transfer coefficient	10 m/h	2	Section 4.1.1
Release area	600 cm^2	3	Exposed area (dermal)
Emission duration	9 hours	4	Exposure duration
Dermal-direct product contact-instant application			
Exposed area	600 cm^2	3	Half head (Te Biesebeek et al., 2014)
Product amount	2.5 g	4	Ficheux et al., 2016

8.1.2 Hand cream

Hand cream is anticipated to be used by ages 2 and up.

Frequency

The frequency of use is derived from Loretz et al. (2005). The Q-factor assigned for frequency is 4, as this publication is a high-quality study involving a large number of participants.

8.1.2.1 Application: leave-on

Product amount

The product amount that is available for dermal and inhalation exposure is derived from Ficheux et al. (2016). A Q-factor of 4 is assigned, as this is a high-quality study involving a large number of participants and product types.

Table 8.2 Default values for estimating consumer exposure to substances in hand cream following application

Default value		Q-factor	Source(s)
General			
Frequency	1165 per year	4	Loretz et al., 2005
Inhalation-exposure to vapour-evaporation-constant release area			
Exposure duration	8 hours	4	Section 4.1.1

Default value		Q-factor	Source(s)
Product amount	2.5 g	4	Product amount (dermal)
Room volume	20 m^3	3	Section 4.1.1
Ventilation rate	0.6 per hour	3	Section 4.1.1
Application temperature	32°C	4	Section 4.1.1
Mass transfer coefficient	10 m/h	2	Section 4.1.1
Release area	900 cm^2	3	Exposed area (dermal)
Emission duration	8 hours	4	Exposure duration
Dermal-direct product contact-instant application			
Exposed area	900 cm^2	3	Hands (Te Biesebeek et al., 2014)
Product amount	2.5 g	4	Ficheux et al., 2016

8.1.3 Body lotion

Body lotion is anticipated to be used by all age groups. It is anticipated that users under the age of 9 may also use body lotion on the face.

Frequency

The frequency of use is derived from Ficheux et al. (2015) or from Wu et al. (2010), depending on the age group. The Q-factor assigned for frequency is 4, as these publications are considered to be of high quality.

8.1.3.1 Application: leave-on

Product amount

The product amount is derived from Ficheux et al. (2016). A Q-factor of 4 is assigned, as the product amount is derived from a high-quality study involving a large number of participants and product types. For the age groups for which no data was available, a Q-factor of 2 is assigned for the calculated product amounts, as the default was not based on an empirical value for that age group.

Table 8.3 Default values for estimating consumer exposure to substances in body lotion following application

Default value		Q-factor	Source(s)
General			
Frequency Adults (19+ years) Infants (0-5 months)	 360 per year[1] 455 per year	 4 4	 Wu et al., 2010 Ficheux et al., 2015
Inhalation-exposure to vapour-evaporation-constant release area			
Exposure duration Adults (19+ years) Infants (0-5 months)	 24 hours 19 hours	 4 4	Section 4.1.1
Product amount Adults (19+ years) Infants (0-5 months)	 15.4 g 3.8 g	 4 2	Product amount (dermal)
Room volume	20 m^3	3	Section 4.1.1

Default value		Q-factor	Source(s)
Ventilation rate	0.6 per hour	3	Section 4.1.1
Application temperature	32°C	4	Section 4.1.1
Mass transfer coefficient	10 m/h	2	Section 4.1.1
Release area Adults (19+ years) Infants (0-5 months)	 17000 cm^2 3090 cm^2	 3 3	Exposed area (dermal)
Emission duration Adults (19+ years) Infants (0-5 months)	 24 hours 19 hours	 4 4	Exposure duration
Dermal-direct product contact-instant application			
Exposed area Adults (19+ years) Infants (0-5 months)	 17000 cm^2 3090 cm^2	 3 3	 Total body except head (Te Biesebeek et al., 2014) Total body except half head (Te Biesebeek et al., 2014)
Product amount Adults (19+ years) Infants (0-5 months)	 15.4 g 3.8 g	 4 2	 Ficheux et al., 2016 Section 4.5

1: The frequency of use for adults (19+ years) is set to the 90th percentile value, as the estimated 75th percentile value was higher than the reported 90th percentile value.

8.2 Face exfoliators

Face exfoliators are creams or gels that are applied to the skin as a scrub or a physical or chemical peel. Face exfoliators are used to cleanse the facial skin, to stimulate blood circulation, and/or to achieve 'soft' skin. They remove the uppermost layer of the epidermis. Face exfoliators are water-based with water-soluble polymers, to which abrasives, humectants, surface-active ingredients, preservatives, colouring, and perfume are added (Bremmer et al., 2006a). Plastic granules, ground nutshells or fruit stones, and silicates can be used as abrasives in face exfoliator products (Bremmer et al., 2006a). Face exfoliators are anticipated to be used by ages 14 and up.

Scenario for consumer exposure
During application, the user applies the face exfoliator to wet or dry facial skin, leaves the product on for a short duration, and then rinses or peels it off. Therefore, the consumer exposure scenario for face exfoliator is anticipated to run by dermal contact following rinse-off.

Frequency
The frequency of use is derived from Ficheux et al. (2015). A Q-factor of 4 is assigned, as it is a high-quality study involving a large number of participants.

8.2.1 *Application: rinse-off*

A face exfoliator is a cosmetic product that is applied to the skin and rinsed off. It is assumed that a fraction of the product remains on the skin after rinsing. Therefore, the scenario of using a face exfoliator fits the generic exposure scenario for dermal exposure from residues of rinse-off products (Section 4.1.2). The ***dermal-direct product contact-instant application*** model is used to estimate dermal exposure to substances in face exfoliators.

Product amount

The applied product amount is derived from Ficheux et al. (2016). A Q-factor of 4 is assigned, as the product amount was derived from a high-quality study involving a large number of participants and product types.

Retention factor

For rinse-off products, it is assumed that only 10% of the applied product amount is on the consumer's skin or hair following rinse-off (SDA, 2010). Therefore, a retention factor of 0.1 needs to be applied to reflect the amount of product actually on the consumer's skin following rinse-off. The Q-factor assigned is 1, as the retention factor is based on assumptions.

Table 8.4 Default values for estimating consumer exposure to substances in face exfoliator residues after rinsing

Default value		Q-factor	Source(s)
General			
Frequency Adults (19+ years) Children (14-18 years)	 202 per year 202 per year	 4 4	 Ficheux et al., 2015 Ficheux et al., 2015
Dermal-direct product contact-instant application			
Exposed area Adults (19+ years) Children (14-18 years)	 600 cm^2 520 cm^2	 3 3	 Half head (Te Biesebeek et al., 2014) Half head (Te Biesebeek et al., 2014)
Product amount Adults (19+ years) Children (14-18 years)	 5.1 g 5.1 g	 4 4	 Ficheux et al., 2016 Ficheux et al., 2016
Retention factor	0.1	1	See above

8.3 Face packs

Face packs and masks are used to cleanse the skin of the face, to stimulate blood circulation, and/or achieve 'soft' skin. Ready to use face packs are available, such as gel, mud, physical peel-off, and chemical peel face packs. They are also sold in powder form. After mixing the powder with water, the mixture can be applied to the face. As the face pack dries, the skin contracts and cools off due to evaporation. Face packs are anticipated to be used by ages 14 and up.

Scenario for consumer exposure
During application, the user applies the face pack to wet or dry facial skin, leaves the product on for a short duration, and then rinses or peels it off. Therefore, the consumer exposure scenario for face packs is anticipated to run by dermal contact following rinse-off.

Frequency
The frequency of use is derived from Ficheux et al. (2015). A Q-factor of 4 is assigned, as it is a high-quality study involving a large number of participants.

8.3.1 Application: rinse-off
A face pack is a cosmetic product that is applied to the skin and rinsed off. It is assumed that a fraction of the product remains on the skin after rinsing. Therefore, the scenario of using a face pack fits the generic exposure scenario for dermal exposure from residues of rinse-off products (Section 4.2.2). The ***dermal-direct product contact-instant application*** model is used to estimate dermal exposure to substances in face packs.

Product amount
The applied product amount is derived from Ficheux et al. (2016). A Q-factor of 4 is assigned, as the product amount was derived from a high-quality study involving a large number of participants and product types.

Retention factor
For rinse-off products, it is assumed that only 10% of the applied product amount is on the consumer's skin or hair following rinse-off (SDA, 2010). Therefore, a retention factor of 0.1 needs to be applied to reflect the amount of product actually on the consumer's skin following rinse-off. The Q-factor assigned is 1, as the retention factor is based on assumptions.

Scenario for consumer exposure
During application, the user applies the face pack to wet or dry facial skin, leaves the product on for a short duration, and then rinses or peels it off. Therefore, the consumer exposure scenario for face packs is anticipated to run by dermal contact following rinse-off.

Frequency
The frequency of use is derived from Ficheux et al. (2015). A Q-factor of 4 is assigned, as it is a high-quality study involving a large number of participants.

8.3.2 Application: rinse-off
A face pack is a cosmetic product that is applied to the skin and rinsed off. It is assumed that a fraction of the product remains on the skin after rinsing. Therefore, the scenario of using a face pack fits the generic exposure scenario for dermal exposure from residues of rinse-off products (Section 4.2.2). The ***dermal-direct product contact-instant application*** model is used to estimate dermal exposure to substances in face packs.

Product amount
The applied product amount is derived from Ficheux et al. (2016). A Q-factor of 4 is assigned, as the product amount was derived from a high-quality study involving a large number of participants and product types.

Retention factor
For rinse-off products, it is assumed that only 10% of the applied product amount is on the consumer's skin or hair following rinse-off (SDA, 2010). Therefore, a retention factor of 0.1 needs to be applied to reflect the amount of product actually on the consumer's skin following rinse-off. The Q-factor assigned is 1, as the retention factor is based on assumptions.

8.4 Body packs

Body packs are used to cleanse the skin, to stimulate blood circulation, and/or to achieve 'soft' skin, and they have a relaxing effect. Body packs are applied to the skin usually as a part of a 'beauty-day' or 'spa-day'. They can be mud baths, clay baths, or algae packs. Depending on the type of body pack, the product may be used in various ways. During a mud bath or clay bath, a mixture of mud and cream is applied to the body. There are also products consisting of powder that need to be mixed with water. Another possibility is that the body is treated with an algae pack, consisting of a gel-like algae substance, and wrapped in film. In this section, a mud or clay body pack is described. Body packs are anticipated to be used by adults.

Scenario for consumer exposure
During application, the user applies the body pack to the skin, leaves the product on for a short duration and then rinses it off. Therefore, the consumer exposure scenario for body packs is anticipated to run by dermal contact following rinse-off.

Frequency
The frequency of use of body packs is estimated to be only four times a year, as derived from Bremmer et al. (2006a), as those who attend 'beauty-days' do so infrequently. The Q-factor assigned for frequency is 3, as there is limited information on body packs.

Application: rinse-off
A body pack is applied to the skin and rinsed off. A fraction of the product remains on the skin. Therefore, the scenario of using a body pack fits the generic exposure scenario for dermal exposure from residues of rinse-off products (see Section 4.2.2). The ***dermal-direct product contact-instant application*** model is used to estimate dermal exposure to substances in body packs.

Product amount
There was limited information on product amount for body packs. Therefore, the product amount is calculated using a surface area adjustment from the face packs product amount (Section 4.5). This method of calculating product amount for body packs is adopted from the previous Cosmetics Fact Sheet (Bremmer et al., 2006a). The

assigned Q-factor is 3, as it is derived from limited information on body packs.

Retention factor
For rinse-off products, it is assumed that only 10% of the applied product amount is on the consumer's skin or hair following rinse-off (SDA, 2010). Therefore, a retention factor of 0.1 needs to be applied to reflect the amount of product actually on the consumer's skin following rinse-off. The Q-factor assigned is 1, as the retention factor is based on assumptions.

Table 8.6 Default values for estimating consumer exposure to substances in body pack residues after rinsing

Default value		**Q-factor**	**Source(s)**
General			
Frequency Adults (19+ years)	4 per year	3	Bremmer et al., 2006a
Dermal-direct product contact-instant application			
Exposed area Adults (19+ years)	17000 cm^2	3	Total body except head (Te Biesebeek et al., 2014)
Product amount Adults (19+ years)	450 g	3	See above
Retention factor	0.1	1	See above

9 Make-up products

Make-up products are cosmetic products used to beautify the face. However, products for other purposes may be included in this section when it makes sense. For example, lip salves are included in the lipstick section; facial cleansers are included in the facial make-up section. Make-up products can be distinguished on the basis of their function, e.g. there are products for particular parts of the face such as lipstick (lips), blusher (cheeks), and eye shadow (eyes), and products that can be applied to the whole face, such as foundation.

Make-up products are available as creams, liquids, semi-solids, gels, loose powders, etc. Make-up products are usually applied to the face and left on for a prolonged duration. Exposure to substances in make-up products can occur through:

- Direct dermal contact;
- Ingestion of products on the lips;
- Inhalation of powders;
- Inhalation of evaporated substances.

In addition, some make-up products are not given their own sections, but are included in sections that are expected to have similar use scenarios. Examples of this include face primer (in the liquid foundation section), setting powder (in the powder foundation section), and contour, highlight, and bronzer powder (in the powder blusher section). When a product can be categorised under a similarly used product, it is mentioned in the product section. Some make-up products may be used on other areas of the body, such as body foundation or body paint. Body foundation and body paint may be used similarly to facial foundation and face paint, respectively, but with larger surface areas and larger product amounts.

9.1 Facial make-up

Facial make-up products are applied in a uniform layer over the facial skin to beautify the face. Sometimes, the facial make-up is applied over a layer of face cream. Sometimes, a face primer is used before other make-up or is worn on its own. A face primer is expected to have a similar use scenario to liquid foundation, and is therefore not given its own section. In addition, setting powder is sometimes used following make-up to 'set' the make-up in place. It is expected that setting powder will have a similar use scenario to foundation powder, and therefore it does not have its own section.

Facial make-up can be a loose or compact powder, a cream, or a liquid. Facial make-up is anticipated to be used by ages 9 and up.

9.1.1 Foundation (liquid / cream / foam)

Scenario for consumer exposure

During application, the user applies the liquid foundation directly to the skin using fingers, a make-up brush, or sponge, and leaves the product on for a prolonged duration. Therefore, the consumer exposure scenario

for liquid foundation is anticipated to run by dermal contact during leave-on.

Frequency
The frequency of use is derived from Loretz et al. (2006). The Q-factor assigned for frequency is 4, as this publication is considered to be of high quality.

9.1.1.1 Application: leave-on
Liquid foundation is a cosmetic product that is applied to the skin and left on for a prolonged duration. Therefore, the scenario of using facial liquid foundation fits the generic exposure scenario for dermal exposure from leave-on products (Section 4.2.1). The ***dermal-direct product contact-instant application*** model is used to estimate dermal exposure to substances in liquid foundation.

Product amount
The product amount that is available for dermal exposure is the amount of product applied to the face (half of the head). The product amount per application is derived from Loretz et al. (2006). A Q-factor of 4 is assigned, as this is a high-quality study involving a large number of participants.

Table 9.1 Default values for estimating consumer exposure to substances in liquid foundation following application

Default value		**Q-factor**	**Source(s)**
General			
Frequency Adults (19+ years)	531 per year	4	Loretz et al., 2006
Dermal-direct product contact-instant application			
Exposed area Adults (19+ years)	600 cm^2	3	Half head (Te Biesebeek et al., 2014)
Product amount Adults (19+ years)	0.86 g [1]	4	Loretz et al., 2006

1: The product amount for adults (19+ years) is set to the 80th percentile value, as the estimated 75th percentile value was higher than the reported 80th percentile value.

9.1.2 Foundation powder
Scenario for consumer exposure
During application, the foundation powder is applied directly to the skin using a make-up brush or sponge, and the product is left on the skin for a prolonged duration. Therefore, the consumer exposure scenarios for foundation powder are anticipated to run by inhalation of powder during powdering, and by dermal contact during leave-on.

Frequency
The frequency of use is derived from Ficheux et al. (2015) for loose powder foundation. A Q-factor of 4 is assigned, as this publication is considered to be of high quality.

9.1.2.1 Application: powdering

Foundation powder is a loose powdered cosmetic product that is applied to the facial skin. The generic exposure scenario for inhalation of powder particles applied to the face area (Section 4.1.4.1) is considered representative for the inhalation exposure to a substance in foundation powder. As such, the ConsExpo Web ***inhalation exposure to spray - instantaneous release model*** is considered fit for purpose to determine the exposure to powders via inhalation. The default exposure duration, released mass room volume, and ventilation rate are derived by means of the approach described in the generic exposure scenario.

Exposure duration

The default exposure duration is set to 1 min. It is acknowledged that the exposure duration is less than the standard default value of 5 minutes in accordance with the time spent in a bathroom (RIVM 2006, US-EPA 2011). The Q-factor assigned is 1.

Released mass

As described in Section 4.1.4.1, the default release mass is set to 668 ug (0.67 mg) and assigned a Q-factor of 2.

Room volume

The room volume is set to be equal to the volume of air that is inhaled by the consumer for the duration of the exposure event. The exposure duration is set to 1 min, while the default inhalation rate is 11 L/min. The default 'room volume' is thus set to 1 ×11 = 11 L = 0.011 m^3. The Q-factor assigned is 1, because the 0.011 m^3 does not refer to the actual room volume, but to the volume of air inhaled.

Ventilation rate

The ventilation rate is set to 0 in order to fit into the generic approach to powdering in the facial area described in Section 4.1.4.1. The Q-factor assigned is 1.

9.1.2.2 Application: leave-on

The scenario of using foundation powder fits the generic exposure scenario for dermal exposure from leave-on products (Section 4.2.1). The ***dermal-direct product contact-instant application*** model is used to estimate dermal exposure to substances in foundation powder.

Product amount

The product amount is derived from Ficheux et al. (2016). A Q-factor of 4 is assigned, as this is a high-quality study involving a large number of participants.

Table 9.3 Default values for estimating consumer exposure to substances in foundation powder following application

Default value		**Q-factor**	**Source(s)**
General			
Frequency Adults (19+ years) Children (14-18 years)	 393 per year 393 per year	 4 4	 Ficheux et al., 2015 Ficheux et al., 2015
Dermal-direct product contact-instant application			

Default value		Q-factor	Source(s)
Exposed area Adults (19+ years) Children (14-18 years)	 600 cm^2 520 cm^2	 3 3	 Half head (Te Biesebeek et al., 2014) Half head (Te Biesebeek et al., 2014)
Product amount Adults (19+ years) Children (14-18 years)	 0.12 g 0.12 g	 4 4	 Ficheux et al., 2016 Ficheux et al., 2016

9.1.3 Blusher / contour / highlight powder

Scenario for consumer exposure

During application, the blusher powder is applied directly to the skin by means of a make-up brush or sponge, and the product is left on the skin for a prolonged duration. Therefore, the consumer exposure scenarios for powder blusher are anticipated to run by inhalation of powder during powdering, and by dermal contact during leave-on.

Frequency

The frequency of use of 365 per year is derived from Ficheux et al. (2015). A Q-factor of 4 is assigned, as this publication is considered to be of high quality.

9.1.3.1 Application: powdering

Blusher, contour, or highlight powder is considered to be a loose powdered cosmetic product that is applied to the skin of the face. Therefore, the generic exposure scenario for inhalation of powder particles applied to the face area (Section 4.1.4.1) is considered representative of the inhalation exposure to a substance in blusher, contour or highlight powder. As such, the ConsExpo Web ***inhalation exposure to spray - instantaneous release model*** is considered fit for purpose to determine the exposure to powders via inhalation. The default exposure duration, released mass room volume, and ventilation rate are derived by means of the approach described in the generic exposure scenario.

Exposure duration

The default exposure duration is set to 1 min. It is acknowledged that the exposure duration is less than the standard default value of 5 minutes in accordance with the time spent in a bathroom (RIVM 2006, US-EPA 2011). The Q-factor assigned is 1.

Released mass

As described in Section 4.1.4.1, the default release mass is set to 668 ug (0.67 mg) and assigned a Q-factor of 2.

Room volume

The room volume is set to be equal to the volume of air that is inhaled by the consumer for the duration of the exposure event. The exposure duration is set to 1 min, while the default inhalation rate is 11 L/min. The default 'room volume' is thus set to 1 ×11 = 11 L = 0.011 m^3. The

Q-factor assigned is 1, because the 0.011 m^3 does not refer to the actual room volume, but to the volume of air inhaled.

Ventilation rate
The ventilation rate is set to 0 in order to fit into the generic approach to powdering in the facial area described in Section 4.1.4.1. The Q-factor assigned is 1.

9.1.3.2 Application: leave-on
The scenario of using powder blusher fits the generic exposure scenario for dermal exposure from leave-on products (Section 4.2.1). The ***dermal-direct product contact-instant application*** model is used to estimate dermal exposure to substances in powder blusher.

Product amount
The product amount is derived from Ficheux et al. (2016). A Q-factor of 4 is assigned, as it is a high-quality study involving a large number of participants.

Table 9.5 Default values for estimating consumer exposure to substances in powder blusher following application

Default value		Q-factor	Source(s)
General			
Frequency Adults (19+ years) Children (14-18 years)	 365 per year[1] 365 per year[1]	 4 4	 Ficheux et al., 2015 Ficheux et al., 2015
Dermal-direct product contact-instant application			
Exposed area Adults (19+ years) Children (14-18 years)	 300 cm^2 260 cm^2	 3 3	 Quarter head (Te Biesebeek et al., 2014) Quarter head (Te Biesebeek et al., 2014)
Product amount Adults (19+ years) Children (14-18 years)	 21 mg 21 mg	 4 4	 Ficheux et al., 2016 Ficheux et al., 2016

1: The frequency is set to the 95th percentile value, as the estimated 75th percentile value was higher than the reported 95th percentile value.

9.2 Facial cleansers and make-up removers

Facial cleansers are used to remove make-up or cleanse the skin of the face. They are available as a liquid, foam, gel, oil, or milk, and can be dosed by using a dispenser. There are various types of facial cleansers on the market. In addition to make-up removers, there are cleansing lotions and foams suitable for cleaning the face and removing any light make-up. Most make-up removers are wiped off with a tissue or cotton pad, or rinsed off with water after use. There are also make-up remover wipes (see Section 18.2), and facial toners (similar scenario to facial make-up remover). Facial cleansers and make-up removers are anticipated to be used by ages 9 and up.

9.2.1 *Facial cleanser*

Scenario for consumer exposure

During application, the user applies the facial cleanser directly to the facial skin, and then rinses off the product with water. A fraction of the product remains on the skin, nonetheless. Therefore, the consumer exposure scenario for facial cleanser is anticipated to run by dermal contact following rinse-off.

Frequency

The frequency of use is derived from Loretz et al. (2008) or from Ficheux et al. (2015), depending on the age group. The Q-factor assigned for frequency is 4, as both publications are considered to be of high quality.

9.2.1.1 Application: rinse-off

Facial cleanser is a product that is usually dosed by using a dispenser, applied to the skin, and then rinsed off. A small fraction of the product remains on the skin. Therefore, the scenario of using facial cleanser fits the generic exposure scenario for dermal exposure from residues of rinse-off products (Section 4.2.2). The ***dermal-direct product contact-instant application*** model is used to estimate dermal exposure to substances in facial cleanser.

Product amount

The product amount used is derived from Ficheux et al. (2016). A Q-factor of 4 is assigned, as the product amount is derived from a high-quality study involving a large number of participants. For the age group for which no data was available, a Q-factor of 2 is assigned for the calculated product amount, as the default was not based on an empirical value for that age group.

Retention factor

For rinse-off products, it is assumed that only 10% of the applied product amount is on the consumer's skin or hair following rinse-off (SDA, 2010). In addition, since facial cleanser readily dissolves in water and is applied to wet skin, an additional 10% factor is applied (SDA, 2010). Therefore, a retention factor of 0.01 needs to be applied to reflect the amount of product actually on the consumer's skin following rinse-off. The Q-factor assigned is 1, as the retention factor is based on assumptions.

Table 9.6 Default values for estimating consumer exposure to substances in facial cleanser residues after rinsing

Default value		**Q-factor**	**Source(s)**
General			
Frequency Adults (19+ years) Children (9-13 years)	 712 per year 577 per year	 4 4	 Loretz et al., 2008 Ficheux et al., 2015
Dermal-direct product contact-instant application			
Exposed area Adults (19+ years)	 600 cm^2	 3	 Half head (Te Biesebeek et al., 2014)

Default value		Q-factor	Source(s)
Children (9-13 years)	525 cm^2	3	Half head (Te Biesebeek et al., 2014)
Product amount Adults (19+ years) Children (9-13 years)	 4.8 g 4.8 g	 4 2	 Ficheux et al., 2016 Section 4.5
Retention factor	0.01	1	See above

9.2.2 Facial make-up remover

There are various types of facial make-up removers, including lotions, milks, and oils. Oils and milks are expected to be thinner than lotions, therefore the product amount for these products may be lower than the product amount for lotions. In this section, facial make-up remover lotion is described.

Scenario for consumer exposure

During application, the user applies the facial make-up remover directly to facial skin, and then usually wipes off the product. A fraction of the product remains on the skin, nonetheless. Therefore, the consumer exposure scenario for facial make-up remover is anticipated to run by dermal contact following wipe-off.

Frequency

The frequency of use is derived from Ficheux et al. (2015). Ficheux et al. (2015) reported frequencies for facial make-up removers with various formulations, including lotion, milk, oil, and foam. The highest frequency was for lotion (501 per year) followed by milk (452 per year). The frequency for facial make-up remover lotion was used for this scenario. The Q-factor assigned for frequency is 4, as this publication is considered to be of high quality.

9.2.2.1 Application: wipe-off

Facial make-up remover is a product that is usually dosed by using a dispenser, applied to the skin, and then wiped off. The scenario of wiping a product off is similar to the scenario of rinsing a product off, except following a wipe-off there tends to be more product left behind on the skin than following a rinse-off. Therefore, while a rinse-off scenario is used, a larger retention factor is typically factored in to account for the wipe-off of the product. Therefore, the scenario of using facial make-up remover fits the generic exposure scenario for dermal exposure from residues of rinse-off products (Section 4.2.2). The ***dermal-direct product contact-instant application*** model is used to estimate dermal exposure to substances in facial make-up remover.

Product amount

The product amount used is derived from Ficheux et al. (2016). Ficheux et al. (2016) reported product amounts for facial make-up removers with various formulations, including lotion, milk, oil, and foam. The highest product amount was for lotion (6.6 g) followed by milk (3.8 g). The product amount for facial make-up remover lotion was used for this scenario. A Q-factor of 4 is assigned for the product amount, as it is derived from a high-quality study involving a large number of participants.

Retention factor
Similar to rinse-off products, for wipe-off products, it is assumed that only 10% of the applied product amount remains on the consumer's skin or hair following wipe-off (SCCS 2023; Bremmer et al., 2006a). Therefore, a retention factor of 0.1 needs to be applied to reflect the amount of product actually on the consumer's skin following wipe-off. The Q-factor assigned is 1, as the retention factor is based on assumptions.

Table 9.7 Default values for estimating consumer exposure to substances in facial make-up remover residues following wipe-off

Default value		Q-factor	Source(s)
General			
Frequency Adults (19+ years) Children (14-18 years)	 501 per year 501 per year	 4 4	 Ficheux et al., 2015 Ficheux et al., 2015
Dermal-direct product contact-instant application			
Exposed area Adults (19+ years) Children (14-18 years)	 600 cm^2 520 cm^2	 3 3	 Half head (Te Biesebeek et al., 2014) Half head (Te Biesebeek et al., 2014)
Product amount Adults (19+ years) Children (14-18 years)	 6.5 g 6.5 g	 4 4	 Ficheux et al., 2016 Ficheux et al., 2016
Retention factor	0.1	1	See above

9.3 Eye make-up products and eye make-up remover

Eye make-up products are applied to the eyelid, eye area, and under the eyebrows to beautify the face. Eye make-up products are typically applied using a make-up brush or applicator and are left on the skin for a prolonged period. Eye make-up is available as a loose or compact powder, a liquid, a gel, a semi-solid, or a stick or pencil. Eye make-up and eye make-up remover are anticipated to be used by ages 9 and up.

9.3.1 Eye shadow

Eye shadow is usually a loose or pressed powder that is applied to the eye area, eyelids, and under the eyebrows. It may also come in the form of a cream, liquid, or gel. In this section, the use of eye shadow powder on adults is considered.

Scenario for consumer exposure
During application, the eye shadow powder is applied directly to the skin around the eye, eyelids, and/or under the eyebrows by means of a make-up brush or sponge, and the product is left on the skin for a prolonged duration. Therefore, the consumer exposure scenarios for eye shadow powder are anticipated to run by inhalation of powder during powdering, and by dermal contact during leave-on.

Frequency
The frequency of use is derived from Loretz et al. (2008). A Q-factor of 4 is assigned, as this publication is considered to be of high quality, and the data is supported by values reported by Statistics Canada (2012).

9.3.1.1 Application: powdering

For this scenario, eye shadow is assumed to be a loose powder that is applied to the face area. Therefore, the generic exposure scenario of inhalation of powder particles applied to the face area (Section 4.1.4.1) is considered representative of inhalation exposure to a substance in eye shadow powder. The ConsExpo Web ***inhalation exposure to spray - instantaneous release model*** is considered fit for purpose to determine the exposure to powders via inhalation. The default exposure duration, released mass, room volume and ventilation rate are derived by means of the approach described in the generic exposure scenario.

Exposure duration
The default exposure duration is set to 1 min. It is acknowledged that the exposure duration is less than the standard default value of 5 minutes in accordance with the time spent in a bathroom (RIVM 2006, US-EPA 2011). The Q-factor assigned is 1.

Released mass
As described in Section 4.1.4.1, the default release mass is set to 668 ug (0.67 mg) and assigned a Q-factor of 2.

Room volume
The room volume is set to be equal to the volume of air that is inhaled by the consumer for the duration of the exposure event. The exposure duration is set to 1 min, while the default inhalation rate is 11 L/min. The default 'room volume' is thus set to 1 ×11 = 11 L = 0.011 m^3. The Q-factor assigned is 1, because the 0.011 m^3 does not refer to the actual room volume, but to the volume of air inhaled.

Ventilation rate
The ventilation rate is set to 0 in order to fit into the generic approach to powdering in the facial area described in Section 4.1.4.1. The Q-factor assigned is 1.

9.3.1.2 Application: leave-on

The scenario of using eye shadow powder fits the generic exposure scenario for dermal exposure from leave-on products (see Section 4.2.1). The ***dermal-direct product contact-instant application*** model is used to estimate dermal exposure to substances in eye shadow.

Exposed area
The default for the exposed area is set to be equal to the surface area of the eyelid, 24 cm^2 (4 cm x 3 cm x 2; Bremmer et al., 2006a). A Q-factor of 3 is assigned.

Product amount
The product amount is derived from Ficheux et al. (2016). A Q-factor of 4 is assigned, as this is a high-quality study involving a large number of participants.

Table 9.8 Default values for estimating consumer exposure to substances in eye shadow powder following application

Default value		Q-factor	Source(s)
General			
Frequency	511 per year [1]	4	Loretz et al., 2008
Dermal-direct product contact-instant application			
Exposed area	24 cm^2	3	Eyelids (Bremmer et al., 2006)
Product amount	19 mg	4	Ficheux et al., 2016

1: The frequency is set to the 80th percentile value, as the estimated 75th percentile value was higher than the reported 80th percentile value.

9.3.2 Mascara

Mascara is usually a liquid or semi-solid that is applied to the eyelashes using an applicator or wand, and is left on for a prolonged period. Some mascaras claim to lengthen or thicken the appearance of the lashes. Mascara can be waterproof or non-waterproof.

Scenario for consumer exposure
During application, the user applies the mascara directly to the eyelashes using an applicator or wand, and leaves the product on for a prolonged duration. Therefore, the consumer exposure scenario for mascara is anticipated to run by dermal contact during leave-on.

Frequency
The frequency of use is derived from Ficheux et al. (2015). The Q-factor assigned for frequency is 4, as the study is of high quality, and the values are supported by values reported by Statistics Canada (2012).

9.3.2.1 Application: leave-on

Mascara is applied to the eyelashes and is left on for a prolonged duration of time. Therefore, the scenario of using mascara fits the generic exposure scenario for dermal exposure from leave-on products (Section 4.2.1). The ***dermal-direct product contact-instant application*** model is used to estimate dermal exposure to substances in mascara.

Exposed area
The default for the exposed area is set to be equal to the surface area of the skin adjacent to the top and bottom eyelashes of both eyes – 1.6 cm^2 (4 cm x 0.1 cm x 4; Bremmer et al., 2006a). The exposed area is adopted from the previous Cosmetics Fact Sheet (Bremmer et al., 2006a), and a Q-factor of 3 is assigned.

Product amount
The product amount per application is derived from Ficheux et al. (2016). A Q-factor of 4 is assigned, as this is a high-quality study involving a large number of participants.

Table 9.9 Default values for estimating consumer exposure to substances in mascara following application

Default value		Q-factor	Source(s)
General			
Frequency Adults (19+ years) Children (9-13 years)	 410 per year 390 per year	 4 4	 Ficheux et al., 2015 Ficheux et al., 2015
Dermal-direct product contact-instant application			
Exposed area Adults (19+ years) Children (9-13 years)	 1.6 cm^2 1.6 cm^2	 3 3	 Skin adjacent to eyelashes (Bremmer et al., 2006a) Skin adjacent to eyelashes (Bremmer et al., 2006a)
Product amount Adults (19+ years) Children (9-13 years)	 0.025 g 0.025 g	 4 4	 Ficheux et al., 2016 Ficheux et al., 2016

9.3.3 Eyeliner

Eyeliner is available as a liquid, gel, cream, or pencil that is applied to a portion of the eye area, usually next to the top and/or bottom eyelashes.

Scenario for consumer exposure

During application, the user applies the eyeliner directly to a portion of the eye area near the eyelashes using an applicator, brush, or pencil, and leaves the product on for a prolonged duration. Therefore, the consumer exposure scenario for eyeliner is anticipated to run by dermal contact during leave-on.

Frequency

The frequency of use is derived from Ficheux et al. (2015). On the basis of reported frequencies from Ficheux et al. (2016), the 75th percentile product amounts for eyeliner and eye pencil are 397 per year and 413 per year, respectively. The higher frequency, for eye pencil, is used in this scenario. The Q-factor assigned for frequency is 4, as both studies are of high quality and involve large numbers of participants.

9.3.3.1 Application: leave-on

Eyeliner is applied to the eye area and is left on for a prolonged duration. Therefore, the scenario of using eyeliner fits the generic exposure scenario for dermal exposure from leave-on products (Section 4.2.1). The ***dermal-direct product contact-instant application*** model is used to estimate dermal exposure to substances in eyeliner.

Exposed area

Eyeliner is applied as a thin line on the eyelid just above or below the eyelashes. The default for the exposed area is set to be equal to the surface area of the portion of eye where eyeliner is expected to be

applied – 3.2 cm^2 (4 cm x 0.2 cm x 4) (Bremmer et al., 2006a). The exposed area is adopted from the previous Cosmetics Fact Sheet (Bremmer et al., 2006a), and a Q-factor of 3 is assigned.

Product amount
The product amount that is available for dermal exposure is the amount of product applied to the eye area. On the basis of reported product amounts from Ficheux et al. (2016), the 75th percentile product amounts for eyeliner and eye pencil are 12 mg and 6.7 mg, respectively. The higher product amount, for eyeliner, is used in this scenario. A Q-factor of 4 is assigned, as it is a high-quality study involving a large number of participants.

Table 9.10 Default values for estimating consumer exposure to substances in eyeliner following application

Default value		**Q-factor**	**Source(s)**
General			
Frequency Adults (19+ years) Children (9-13 years)	 413 per year 381 per year	 4 4	 Ficheux et al., 2015 Ficheux et al., 2015
Dermal-direct product contact-instant application			
Exposed area Adults (19+ years) Children (9-13 years)	 3.2 cm^2 3.2 cm^2	 3 3	 Portion of eye area (Bremmer et al., 2006) Portion of eye area (Bremmer et al., 2006)
Product amount Adults (19+ years) Children (9-13 years)	 0.013 g 0.013 g	 4 4	 Ficheux et al., 2016 Ficheux et al., 2016

9.3.4 *Eye make-up remover*

Eye make-up remover is used to remove eye make-up from the eye area. It is applied to the eye area and wiped off or rinsed off. Eye make-up remover is available as both oil-based and water-based products. Oil-based removers are usually used for removing heavy make-up. Water-based remover can be used for light make-up or after using oil-based removers, to remove the oiliness and any remaining make-up. Some eye make-up removers are available as wipes. For these products, the defaults are anticipated to be similar to the defaults described in this section.

Scenario for consumer exposure
During application, the user applies the eye make-up remover directly to the eye area, and then wipes or rinses the product off. A fraction of the product remains on the skin, nonetheless. Therefore, the consumer exposure scenario for facial eye make-up remover is anticipated to run by dermal contact following rinse-off.

Frequency
CTFA (1983) reported a frequency of use of 270 per year for eye make-up remover. Although Ficheux et al. (2015) did not report a use frequency for eye make-up remover specifically, they did report frequencies for facial make-up remover. It is assumed that eye-make-up remover would be used with the same frequency as facial make-up remover. Therefore, the frequency of use is derived from Ficheux et al. (2015). A Q-factor of 3 is assigned, as the study is of high quality and involves a large number of participants, but the frequencies of use apply to facial make-up remover.

9.3.4.1 Application: rinse-off / wipe-off

Eye make-up remover is a product that is applied to the eye area and then wiped off or rinsed off. The scenario of wiping a product off is similar to the scenario of rinsing a product off, except during a wipe-off there tends to be more product left behind on the skin than during a rinse-off. Therefore, while a rinse-off scenario is used, a larger retention factor is typically factored in to account for the wipe-off of the product. Therefore, the scenario of using eye make-up remover fits the generic exposure scenario for dermal exposure from residues of rinse-off products (see Section 4.2.2). The ***dermal-direct product contact-instant application*** model is used to estimate dermal exposure to substances in eye make-up remover.

Exposed area
The default for the exposed area is set to 50 cm^2 (5 cm x 5 cm x 2) (Bremmer et al., 2006a). The exposed area is adopted from the previous Cosmetics Fact Sheet (Bremmer et al., 2006a), and a Q-factor of 3 is assigned.

Product amount
The product amount used is derived from Bremmer et al. (2006a). A Q-factor of 3 is assigned.

Retention factor
Similar to rinse-off products, for wipe-off products, it is assumed that only 10% of the applied product amount is on the consumer's skin or hair following wipe-off (SCCS 2023; Bremmer et al., 2006a). Therefore, a retention factor of 0.1 needs to be applied to reflect the amount of product actually on the consumer's skin following wipe-off. The Q-factor assigned is 1, as the retention factor is based on assumptions.

Table 9.11 Default values for estimating consumer exposure to substances in eye make-up remover residues after rinse-off or wipe-off

Default value		**Q-factor**	**Source(s)**
General			
Frequency Adults (19+ years) Children (9-13 years)	 501 per year 426 per year	 3 3	 See above See above
Dermal-direct product contact-instant application			
Exposed area			

Default value		Q-factor	Source(s)
Adults (19+ years)	50 cm^2	2	Eye area (Bremmer et al., 2006a)
Children (9-13 years)	50 cm^2	2	Eye area (Bremmer et al., 2006a)
Product amount			
Adults (19+ years)	0.5 g [1]	3	Bremmer et al., 2006a
Children (9-13 years)	0.5 g [1]	3	Bremmer et al., 2006a
Retention factor	0.1	1	See above

1: The product amount is set to the mean value, as 75th percentile values were not available.

9.4 Lip make-up products

Lip make-up products are liquids or semi-solids that are applied to the skin of the lips using a make-up brush or applicator to beautify or nourish the lips. In this section, lipstick and lip salve/balm are described together, as their use scenarios are expected to be similar. Lip make-up products are anticipated to be used by ages 2 and up.

Scenario for consumer exposure
During application, the lipstick or lip balm is applied to the lips, and left on for a prolonged duration. It is assumed that the entire applied product amount may be ingested. Therefore, the consumer exposure scenario for lip make-up products is anticipated to run by ingestion. It is anticipated that, compared to oral exposure, the contribution to the total exposure by inhalation and dermal exposure is negligible. The risk assessor is advised to perform an exposure assessment for the inhalation and/or dermal route if route-specific toxicity is expected.

Frequency
The frequency of use is derived from Statistics Canada (2017) for lipstick. A Q-factor of 4 is assigned, as the default is based on data from a high-quality study.

9.4.1 Application: ingestion

The scenario of using lip make-up products fits the generic exposure scenario for oral exposure to substances in ingested products (Section 4.3.1). The ***oral-direct product contact-direct oral intake*** model is used to estimate oral exposure to substances in lip make-up products.

Amount ingested
It is assumed that the entire applied product amount may be ingested. Therefore, the amount ingested is set to be equal to the applied product amount for lip balm, derived from Ficheux et al. (2016). A Q-factor of 4 is assigned, as the default is based on data from a high-quality study involving a large number of participants.

Table 9.12 Default values for estimating consumer exposure to substances in lip make-up products following application

Default value		Q-factor	Source(s)
General			
Frequency Adults (19+ years) Children (14-18 years)	 1092 per year 1812 per year [1]	 4 4	 Statistics Canada, 2017 Statistics Canada, 2017
Oral-direct product contact-direct oral intake			
Amount ingested Adults (19+ years) Children (14-18 years)	 0.032 g 0.032 g	 4 4	 Ficheux et al., 2016 Ficheux et al., 2016

1: The frequency of use for children (14-18 years) is set to the 90th percentile value, as the estimated 75th percentile value was higher than the reported 90th percentile value.

10 Nail care products

Nail care products are used to beautify, clean, or treat fingernails and/or toenails. They include products such as nail polish, nail polish remover, nail strengthener, nail hardener, and artificial nails.

Nail care products are mainly available as liquids and gels. Exposure to substances in nail care products can occur through:

- Direct dermal contact;
- Inhalation of evaporated substances.

Some nail care products are intended to be left on the nails (e.g. nail polish, artificial nails), while others are intended to be wiped off (e.g. nail polish remover). Dermal exposure to nail care products is assumed to be mainly through the skin around the sides and bottom of the nail and it is assumed that exposure through the nail (ungual route) would be negligible (Bremmer et al., 2006a; Walters et al., 1983; Brown et al., 2009).

10.1 Nail polish, base coat, and top coat

Nail polish is applied to the nails using a small brush to add colour or shine, and/or to protect the nails. Nail polish comes in various forms such as gel polish, matte polish, and shellac (Bremmer et al., 2006a). Base coat and top coat are similar to nail polish, but are often clear and can be worn with or without nail polish. Nail polish can be applied in single or multiple layers, either alone or with a base coat and/or top coat. In this section, base coat, top coat, and nail polish will be described together, but are expected to have different product amounts, exposure durations, and release areas. Nail polish is anticipated to be used by ages 2 and up, while top coat and base coat are anticipated to be used by ages 14 and up. The values described in this section apply to ages 14-18 and 19+.

Scenario for consumer exposure
During application, the nail polish, base coat, and/or top coat is applied to the nails using a small brush; the product dries, and is left on for a prolonged duration. It is assumed that the product is applied to both fingernails and toenails, and that some product comes in contact with the skin around the nails. Therefore, the consumer exposure scenarios for nail polish are anticipated to run by dermal contact and inhalation of evaporated substances during application.

Frequency
Only two studies on the frequency of use of nail polish are available (Wu et al., 2010; Ficheux et al., 2014). Ficheux et al. (2014) presented frequency data for multiple nail cosmetics, but only considered regular users of nail polish. Regular users were those who used nail cosmetics at least once per week (Ficheux et al., 2014). However, Wu et al. (2010) only presents data for nail polish that is applied by both the consumer and the professional. While both studies are of high quality, the use frequency for nail polish, base coat, and top coat is derived from Ficheux

et al. (2014), as they had higher frequency values than Wu et al. (2010). A Q-factor of 4 is assigned, as the Ficheux et al. study (2014) is considered to be of high quality.

10.1.1 Application: Nail polish, base coat, or top coat

It is assumed that nail polish, base coat, and top coat are applied to the fingernails and toenails. It is also assumed that nail polish are applied in two layers or coats, while base coat and top coat are applied in one layer or coat. Furthermore, it is assumed that product will spill on the skin around the nails. During the application of nail polish, base coat, and top coat, volatile substances evaporate. The layer of polish then hardens out, so that evaporation of substances stops and no prolonged inhalation exposure duration is expected. Therefore, the scenario of using nail polish, base coat, or top coat fits the generic exposure scenarios for dermal exposure from leave-on products (see Section 4.2.1) and for inhalation of substances evaporating from leave-on products (Section 4.1.1). The ***dermal-direct product contact-instant application*** model is used to estimate dermal exposure to substances in nail polish, base coat, or top coat. The ***inhalation-exposure to vapour-evaporation-increasing release area*** model is used to estimate inhalation exposure to substances evaporating from nail polish, base coat, or top coat.

Exposure duration

The default exposure duration refers to the time the consumer spends in the room during and after the application of the product, which includes setting and drying time. According to Ficheux et al. (2014), the mean duration for applying and drying one coat of nail polish on all fingernails is 8.8 min. Assuming 2 coats of nail polish is applied to the fingernails and toenails, the duration is set to 35 min. It is assumed that the duration for applying a top coat is the same as for nail polish. Assuming application to both fingernails and toenails, the duration is set to 18 minutes. According to Ficheux et al. (2014), the mean duration for applying and drying one coat of base coat on all fingernails is 3.3 min. Assuming application to both fingernails and toenails, the duration is set to 7 minutes. A Q-factor of 2 is assigned, as the exposure durations are estimates based on empirical data from a reliable source.

Molecular weight matrix

The molecular weight matrix is used to calculate the relative vapour pressure of the component in question. The molecular weight matrix is roughly equal to the mean molecular weight of the solvents divided by the total contribution of these solvents. Bremmer et al. (2006a) show that nail polish contains 75% organic solvents; ethyl acetate (Mw = 88 g/mol), butyl acetate (Mw = 116 g/mol), ethyl alcohol (Mw = 46 g/mol) and toluene (Mw = 92 g/mol) in the ratio 4:3:1:7. The molecular weight matrix is calculated as:

$$\left[\left(\frac{4}{15}\times 88\right)+\left(\frac{3}{15}\times 116\right)+\left(\frac{1}{15}\times 46\right)+\left(\frac{7}{15}\times 92\right)\right]:0.75=124\ g/mol$$

Product amount (inhalation)

The product amount that is available for inhalation exposure is the amount of product applied to the fingernails and toenails. The product

amounts for nail polish, base coat, and top coat are derived from Ficheux et al. (2014) and adjusted to account for application to both fingernails and toenails. For nail polish, the product amount is further adjusted to account for application of 2 layers of nail polish. A Q-factor of 4 is assigned, as the defaults are calculated on the basis of empirical data from a high-quality study involving a large number of participants.

Release area
The release area is the surface area from which substances evaporate from nail polish, base coat, or top coat during application and drying. It is calculated as the surface area of the nail and skin around the nail. Ficheux et al. (2014) calculated the surface area of the fingernails and the nail wall for all of the participants in their laboratory study. It is assumed that individuals aged 14-18 have the same nail and nail wall surface areas as adults (19+), and that the surface area of the toenails is similar to the one of fingernails. Therefore, the calculated surface area for the nail and the skin around the nails for all the fingers on both hands is multiplied by 2 to account for application of the product to fingernails and toenails. For nail polish, this value is further multiplied by 2 to account for application of 2 layers of nail polish. A Q-factor of 3 is assigned, as the default is estimated from a high-quality study involving a large number of participants.

Exposed area
Ficheux et al. (2014) measured the surface area of the fingernails and the nail wall for all the participants in their laboratory study. It is assumed that dermal exposure would mainly occur through the skin around the nails. It is assumed that individuals aged 14-18 have the same nail and nail wall surface areas as adults (19+), and that the surface area of the toenails is similar to the one of fingernails. Therefore, the calculated surface area for the skin around the nails for all the fingers on both hands is multiplied by 2 to account for application of the product to both fingernails and toenails. A Q-factor of 3 is assigned for the exposed area, as it is estimated from a high-quality study involving a large number of participants.

Product amount (dermal)
The product amount that is available for dermal exposure is the amount of product that comes into contact with the skin around the fingernails and toenails. The applied product amounts for nail polish, base coat, and top coat are derived from Ficheux et al. (2014) and adjusted to account for application to both fingernails and toenails. Since it is assumed that dermal exposure mainly occurs through the skin around the nails, the product amount is further adjusted using a ratio of the surface area of the skin around the nails to the surface area of the nails plus the skin around the nails (5.4 cm^2 / 26.2 cm^2 = 0.206). For example, for nail polish, the product amount available for dermal exposure is equal to the applied product amount (1.0 g) multiplied by the adjustment factor (0.206), which is equal to 0.21 g. A Q-factor of 4 is assigned, as the default is calculated on the basis of empirical data from a high-quality study involving a large number of participants.

Table 10.1 Default values for estimating consumer exposure to substances in nail polish, base coat, or top coat

Default		Q-factor	Source(s)
General			
Frequency Adults (19+ years) Children (14-18 years)	 104 per year 119 per year	 4 4	 Ficheux et al., 2014 Ficheux et al., 2014
Inhalation-exposure to vapour-evaporation-increasing release area			
Exposure duration Nail polish Base coat Top coat	 35 min 7 min 18 min	 2 2 2	 See above See above See above
Molecular weight matrix	124 g/mol	2	Bremmer et al., 2006a
Product amount Nail polish Base coat Top coat	 1.0 g 0.23 g 0.40 g	 4 4 4	See above
Room volume	20 m^3	3	Section 4.1.1
Ventilation rate	0.6 per hour	3	Section 4.1.1
Application temperature	32 °C	4	Section 4.1.1
Mass transfer coefficient	10 m/h	2	Section 4.1.1
Release area Nail polish Base coat Top coat	 52.4 cm^2 26.2 cm^2 26.2 cm^2	 3 3 3	See above
Application duration Nail polish Base coat Top coat	 35 min 7 min 18 min	 2 2 2	Exposure duration
Dermal-direct product contact-instant application			
Exposed area	5.4 cm^2	3	See above
Product amount Nail polish Base coat Top coat	 0.21 g 0.047 g 0.083 g	 4 4 4	See above

10.2 Nail polish remover

Nail polish remover is a liquid that is usually applied to a piece of cotton wool or a cotton pad, which is then rubbed onto the surface of the nail to wipe off nail polish. Nail polish remover is anticipated to be used by ages 2 and up. The values described in this section are for ages 14-18 and 19+.

Scenario for consumer exposure
During application, the nail polish remover is applied to a piece of cotton wool or a cotton pad, which is then rubbed onto the surface of the nail to remove nail polish. The product is assumed to be wiped off as the nail polish is wiped off. It is assumed that the product is applied to both fingernails and toenails, and that some product comes in contact with the skin around the nails. Therefore, the consumer exposure scenarios

for nail polish remover are anticipated to run by dermal contact and inhalation of evaporated substances during application.

Frequency
Some data was available on the frequency of use of nail polish remover (Ficheux et al., 2014; Bremmer et al., 2006a; CTFA 1983; Wu et al., 2010). The frequency of use for nail polish remover is derived from Ficheux et al. (2014) because it was the highest ranking study and presents frequency data for multiple nail cosmetics, even though it only considered regular users (those who used nail cosmetics at least once per week; Ficheux et al., 2014). A Q-factor of 4 is assigned, as this publication is considered to be of high quality.

10.2.1 Application: Nail polish removal

It is assumed that nail polish remover is used on fingernails and toenails. It is also assumed that product will spill on the skin around the nails. Volatile substances evaporate during the removal of nail polish using nail polish remover. Therefore, the scenario of using nail polish remover fits the generic exposure scenarios for dermal exposure from leave-on products (see Section 4.2.1) and for inhalation of substances evaporating from leave-on products (Section 4.1.1). The ***dermal-direct product contact-instant application*** model is used to estimate dermal exposure to substances in nail polish remover. The ***inhalation-exposure to vapour-evaporation-increasing release area*** model is used to estimate inhalation exposure to substances evaporating from nail polish remover.

Exposure duration
The default exposure duration refers to the time the consumer spends in the room during and after their use of the nail polish remover. According to Ficheux et al. (2014), the mean duration for using nail polish remover on all fingernails is 4.1 min. Assuming use on both fingernails and toenails, the duration is set to 8 min. A Q-factor of 2 is assigned, as the exposure duration is estimated on the basis of empirical data from a reliable source.

Molecular weight matrix
The molecular weight matrix is used to calculate the relative vapour pressure of the component in question. The molecular weight matrix is roughly equal to the mean molecular weight of the solvents divided by the total contribution of these solvents. Bremmer et al. (2006a) show that nail polish remover contains 91% organic solvents; acetone (Mw = 58 g/mol), ethyl acetate (Mw = 88 g/mol), butyl acetate (Mw = 116 g/mol), in the ratio 13:4:1. The molecular weight matrix is calculated as:

$$\left[\left(\frac{13}{18}\times 58\right)+\left(\frac{4}{18}\times 88\right)+\left(\frac{1}{18}\times 116\right)\right]:0.91=75\ g/mol$$

Product amount (inhalation)
The product amount that is available for inhalation exposure is the amount of product applied to the fingernails and toenails. The product amount is derived from Ficheux et al. (2014) and adjusted to account for application to both fingernails and toenails. A Q-factor of 4 is

assigned, as the default is calculated on the basis of empirical data from a high-quality study involving a large number of participants.

Release area
The release area is the surface area from which substances evaporate from nail polish remover during application. Similar to nail polish, it is calculated as the surface area of the nail and skin around the nail, but assumes that a larger surface area of skin around the nail is in contact with the product. Ficheux et al. (2014) calculated the surface area of the fingernails and the nail wall for all of the participants in their laboratory study. For nail polish remover, the surface area of the skin around the nail is calculated as described below ('Exposed area'). It is assumed that individuals aged 14-18 have the same nail and nail wall surface areas as adults (19+), and that the surface area of the toenails is similar to the surface area of the fingernails. Therefore, the calculated surface area for the nails and the skin around the nails for all the fingers on both hands is multiplied by 2 to account for application of the product to both fingernails and toenails. A Q-factor of 3 is assigned, as the default is estimated on the basis of a high-quality study involving a large number of participants.

Exposed area
It is assumed that dermal exposure from nail cosmetics would mainly occur through the skin around the nails. It is also assumed that a larger surface area of skin around the nail is in contact with nail polish remover than is the case with nail polish. Ficheux et al. (2014) calculated the surface area of the fingernails and the nail wall for all of the participants in their laboratory study. For nail polish remover, the nail perimeter measured by Ficheux et al. (2014; 2.7 cm) and the nail wall breadth from Bremmer et al., (2006a) are used to calculate the surface area of the nail wall that comes into contact with nail polish remover during its use (((2.025 cm x 2 mm) + (0.675 cm x 5 mm)) x 10 fingers = 7.4 cm^2). It is then assumed that individuals aged 14-18 have the same nail and nail wall surface areas as adults (19+), and that the surface area of the toenails is similar to the one of fingernails. Therefore, the calculated surface area for the skin around the nails for all the fingers on both hands is multiplied by 2 to account for application of the product to both fingernails and toenails. Furthermore, it is assumed that this exposed area is sufficiently large to cover any additional exposures through the skin on the fingers holding the cotton ball or pad. A Q-factor of 3 is assigned, as the default is estimated on the basis of a high-quality study involving a large number of participants.

Product amount (dermal)
The product amount that is available for dermal exposure is the amount of product that comes into contact with the skin around the fingernails and toenails. The applied product amount for nail polish remover is derived from Ficheux et al. (2014) and adjusted to account for application to both fingernails and toenails. Since it is assumed that dermal exposure mainly occurs through the skin around the nails, the product amount is further adjusted using a ratio of the surface area of the skin around the nails to the surface area of the nails plus the skin around the nails (14.9 cm^2 / 35.7 cm^2 = 0.42). Therefore, the product amount available for dermal exposure is equal to the applied product

amount (8.0 g) multiplied by the adjustment factor (0.42), which is equal to 3.4 g. A Q-factor of 4 is assigned, as the default is calculated on the basis of empirical data from a high-quality study involving a large number of participants.

Table 10.2 Default values for estimating consumer exposure to substances in nail polish remover

Default		Q-factor	Source(s)
General			
Frequency Adults (19+ years) Children (14-18 years)	 104 per year 119 per year	 4 4	 Ficheux et al., 2014 Ficheux et al., 2014
Inhalation-exposure to vapour-evaporation-increasing release area			
Exposure duration	8 min	2	See above
Molecular weight matrix	75 g/mol	2	Bremmer et al., 2006a
Product amount	8.0 g	4	See above
Room volume	20 m^3	3	Section 4.1.1
Ventilation rate	0.6 per hour	3	Section 4.1.1
Application temperature	32 °C	4	Section 4.1.1
Mass transfer coefficient	10 m/h	2	Section 4.1.1
Release area	35.7 cm^2	3	See above
Application duration	8 min	2	Exposure duration
Dermal-direct product contact-instant application			
Exposed area	14.9 cm^2	3	See above
Product amount	3.4 g	4	See above

10.3 Other nail products

Other nail cosmetics products include nail strengthener and artificial nails (gel, acrylic, glue-on, etc.; Acrylnagels | Waarzitwatin | Rijksoverheid; Gelnagels | Waarzitwatin | Rijksoverheid, in Dutch). Although the use scenarios for these products are not described in this fact sheet, similar use scenarios are suggested when applicable.

10.3.1 Nail strengthener and nail hardener

Nail strengthener or hardener is used to strengthen/harden weak and breakable nails. The product is applied to nails using a small brush. The composition is similar to that of ordinary nail polish, but without colouring (Bremmer et al., 2006a). The use scenario for these products is similar to the one for base coat.

10.3.2 Hard artificial nails

Hard artificial nails are attached to the fingernails or toenails using glue. These products may be used to repair or extend broken, torn or short fingernails, as well as for decorative purposes. The real nail underneath may be damaged when the artificial nail is removed. The use scenario for the glue for these nails is similar to the one for base coat.

10.3.3 Liquid artificial nails

Liquid-type artificial nails are used for a similar purpose to hard artificial nails. Artificial nails can be made by mixing a liquid (monomer) with a

polymer powder and applying this to the nails using a fine brush. The liquid nails harden within 5 minutes due to polymerisation.

10.3.4 Gel nails

Gel nails are another system for achieving artificial nails, in which UV gels are applied to the nails and hardened under the influence of UV light. The product contains photo-bonded acrylates that harden when light-cured. The acrylates include methylacrylated and acrylated urethanes, triethyleneglycol dimethacrylate, methacrylated epoxy resin and hydroxyl functional methacrylates (Bremmer et al., 2006a, Steunebrink et al., 2024).

11 Deodorants and anti-perspirant products

Deodorant is used on the skin of the armpits to deodorise skin and often to deposit a scent. Some products are also anti-perspirants, which contain medicinal ingredients to hinder the body's release of perspiration in the applied areas. Deodorant and anti-perspirant are intended to be left on the skin for a prolonged duration.

Deodorants are mainly available as aerosol sprays, or as solid, gel, or roll-on sticks. Exposure to substances in deodorants can occur through:

- Direct dermal contact;
- Inhalation of non-volatile and volatile substances in sprays;
- Inhalation of evaporated substances.

Although some deodorants may be applied in other locations, deodorants are mainly applied to the armpits, or underarms. Deodorant is anticipated to be used by ages 9 and up.

11.1 Deodorant spray

Scenario for consumer exposure
During application, the user sprays the deodorant spray towards their underarms, and leaves the product on for a prolonged duration. Therefore, the consumer exposure scenarios for deodorant spray are anticipated to run by inhalation of non-volatile substances in sprayed droplets, inhalation of volatile substances that remain in the air after spraying, and by dermal contact after spraying. In this section, the exposure to deodorant spray is described in two separate scenarios: inhalation exposure during spraying and dermal exposure after spraying.

Frequency
The frequency of use is derived from Loretz et al. (2006) or from Ficheux et al. (2015), depending on the age group. The Q-factor assigned for frequency is 4, as both studies are of high quality and involve large numbers of participants.

11.1.1 Application: spraying

Deodorant sprays are mostly used in the bathroom (EPHECT, 2012). Inhalation exposure to both volatile and non-volatile substances is anticipated in this scenario. The consumer can inhale non-volatile substances available for inhalation in the sprayed droplets, since volatile substances are expected to remain in the indoor air after spraying. The ***inhalation-exposure to spray-spraying*** model is used to estimate the inhalation exposure to the non-volatile substances. The ***spraying towards person*** option is considered, as spray is directed towards the consumer's axilla (see Section 4.1.3.2). The ***inhalation-exposure to spray instantaneous release*** model is used to estimate inhalation exposure to volatile substances (see Section 4.1.3.1). The spray is directed towards the person, so that the volatile substances are released into the user's personal breathing zone.

Mass generation rate
In the report by Delmaar & Bremmer (2009), the mass generation rate of aerosol deodorant spray cans was experimentally determined for 6 aerosol deodorant spray cans by spraying for 10 seconds and determining the weight loss of the spray can. The resulting mass generation rate of 0.9 g/s is consistent with the earlier measured mass generation rate of 6 deodorant spray samples reported by Tuinman (2004; 2007). Therefore, the default mass generation rate for aerosol deodorant spray cans is set to 0.9 g/s (Delmaar & Bremmer, 2009). The Q-factor assigned is 3, because the default directly refers to the mass generation rate of deodorant sprays, but the number of samples (N=12) is limited.

Airborne fraction
The default airborne fraction in this scenario refers to a scaled airborne fraction that is complementary to the fitted initial particle distribution (Section 4.1.3.2). Delmaar & Bremmer (2009) characterised a default initial particle distribution for droplets released during the use of aerosol deodorant spray with a median particle diameter of 8.3 µm and a C.V. of 0.84 that is fitted to represent the fraction of the inhalable particles (< 22.5 µm) most accurately. Complementary to this fit, the airborne fraction is scaled as the mass fraction of the sprayed droplets that is both directly airborne during the spray event and < 22.5 µm. Delmaar & Bremmer (2009) determined the mass fraction that is directly airborne to be 1, whereas the mass fraction < 22.5 µm is determined to be 0.9. The default airborne fraction is thus scaled as 1 x 0.9 = 0.9. The Q-factor assigned is 3, because the measurements of Delmaar & Bremmer (2009) directly refer to airborne fractions of deodorant sprays, but the number of samples (N=6) is limited.

Density non-volatile
The density of non-volatile materials in deodorant sprays is estimated by Delmaar & Bremmer (2009) to be 1.5 g/cm^3. The default density non-volatile is set accordingly. The Q-factor assigned is 2, because the estimation made by Delmaar & Bremmer (2009) directly refers to the density of non-volatile materials in deodorant sprays, but includes only one sample.

Initial particle distribution
A default initial particle distribution of droplet sizes during the use of deodorant sprays is characterised by Delmaar & Bremmer (2009) and RIVM (2010) by a median particle diameter of 8.3 µm and a C.V. of 0.84 (see airborne fraction above). The Q-factor assigned is 3, because the defaults directly refer to initial particle distribution of deodorant sprays, but the number of samples (N=6) is limited.

Released mass
The released mass is set to be equal to the product amount that is sprayed out of the bottle or can. The product amount used is derived from Hall et al. (2007), and the released mass default is set accordingly. A Q-factor of 4 is assigned for the product amount, as it is derived from a high-quality study involving a large number of participants.

Table 11.1 Default values for estimating consumer exposure to substances in deodorant spray during spraying

Default value		Q-factor	Source(s)
General			
Frequency Adults (19+ years) Children (14-18 years)	 573 per year 570 per year	 4 4	 Loretz et al., 2006 Ficheux et al., 2015
Inhalation-exposure to spray-spraying-spraying towards person[1]			
Spray duration	3.4 s	3	Released mass/mass generation rate (Section 4.1.3.2)
Exposure duration	5 min	2	Section 4.1.3.2
Room volume	10 m^3	4	Section 4.1.3.2
Room height	2.5 m	4	Section 4.1.3.2
Ventilation rate	2 per hour	3	Section 4.1.3.2
Cloud volume	0.0625 m^3	2	Section 4.1.3.2
Mass generation rate	0.9 g/s	3	Delmaar & Bremmer, 2009
Airborne fraction	0.9	3	Delmaar & Bremmer, 2009
Density non-volatile	1.5 g/cm^3	2	Delmaar & Bremmer, 2009
Initial particle distribution Median (C.V.)	 8.3 µm 0.84	3	Delmaar & Bremmer, 2009; RIVM 2010
Inhalation cut-off diameter	15 µm	3	Delmaar & Schuur, 2017
Inhalation-exposure to spray-instantaneous release[2]			
Exposure duration	6.9 s	1	Twice the spray duration, Section 4.1.3.1
Released mass	3.1 g	4	Hall et al., 2007
Room volume	1 m^3	1	Section 4.1.3.1
Ventilation rate	2 per hour	1	Section 4.1.3.1

1: Applies to non-volatile substances
2: Applies to volatile substances

11.1.2 *Application: leave-on*

Deodorant spray is applied to the skin of the underarms and left on for a prolonged duration. Therefore, the scenario of using deodorant spray fits the generic exposure scenario for dermal exposure from sprays (Section 4.2.4). The ***dermal-direct product contact-instant application*** model is used to estimate dermal exposure to substances in deodorant spray.

Exposed area

The default for the exposed area is set to be equal to the surface area of the underarms (Danish EPA, 2007). This publication only reported the underarm surface area of adults; therefore the underarm surface area for ages 14-18 was calculated using the ratio of arm surface areas for adults to children. A Q-factor of 3 is assigned for the adult exposed area, and a

Q-factor of 2 is assigned for the children exposed area as the value was estimated on the basis of known data and supported by expert judgment.

Product amount
The product amount is derived from Hall et al. (2007). A Q-factor of 4 is assigned, as this is a high-quality study involving a large number of participants.

Retention factor
For spray products, it is assumed that only 85% of the sprayed product amount is on the consumer's skin after spraying (Bremmer et al., 2006a). Therefore, a retention factor of 0.85 needs to be applied to reflect the amount of product actually on the consumer's skin after spraying.

Table 11.2 Default values for estimating consumer exposure to substances in deodorant spray following application

Default value		Q-factor	Source(s)
General			
Frequency Adults (19+ years) Children (14-18 years)	 573 per year 570 per year	 4 4	 Loretz et al., 2006 Ficheux et al., 2015
Dermal-direct product contact-instant application			
Exposed area Adults (19+ years) Children (14-18 years)	 240 cm^2 227 cm^2	 3 2	 Underarms (Danish EPA, 2007) Underarms (See above)
Product amount	3.1 g	4	Hall et al., 2007
Retention factor	0.85	1	See above

11.2 Deodorant stick

Scenario for consumer exposure
During application, the user applies the deodorant to their underarms, and leaves the product on for a prolonged duration. Therefore, the consumer exposure scenarios for deodorant are anticipated to run by dermal contact and inhalation of evaporated substances during leave-on.

Frequency
The frequency of use is derived from Loretz et al. (2005) or from Ficheux et al. (2015), depending on the age group. The Q-factor assigned for frequency is 4, as both studies are of high quality and involve large numbers of participants.

11.2.1 Application: leave-on

A deodorant stick is a cosmetic product that is applied directly to the skin of the underarms and from which substances may evaporate for a prolonged duration. Therefore, the scenario of using stick deodorant therefore fits the generic exposure scenarios for dermal exposure from leave-on products (see Section 4.2.1) and for inhalation of substance evaporating from leave-on products (Section 4.1.1). The ***dermal-direct product contact-instant application*** model is used to estimate dermal exposure to substances in deodorant. The ***inhalation-exposure to vapour-evaporation-constant release area*** model is used to estimate

inhalation exposure to substances evaporating from the deodorant and the ***product is substance in pure form*** option is selected.

Exposed area
The default for the exposed area is set to be equal to the surface area of the underarms (Danish EPA, 2007). This publication only reported the underarm surface area of adults; therefore, the underarm surface area of ages 14-18 was calculated using the ratio of arm surface areas for adults to children (Section 4.5). A Q-factor of 3 is assigned for the adult exposed area, and a Q-factor of 2 is assigned for the children exposed area.

Product amount
The product amount is derived from Ficheux et al. (2016), which is assigned a Q-factor of 4, as it is a high-quality study involving a large number of participants and relevant data.

Table 11.3 Default values for estimating consumer exposure to substances in deodorant sticks following application

Default value		**Q-factor**	**Source(s)**
General			
Frequency Adults (19+ years) Children (14-18 years)	 573 per year 527 per year	 4 4	 Loretz et al., 2006 Ficheux et al., 2015
Inhalation-exposure to vapour-evaporation-constant release area			
Exposure duration Adults (19+ years) Children (14-18 years)	 15 hours 17 hours	 4 4	Section 4.1.1
Product amount Adults (19+ years) Children (14-18 years)	 1.5 g 1.5 g	 4 4	Product amount (dermal)
Room volume	20 m^3	3	Section 4.1.1
Ventilation rate	0.6 per hour	3	Section 4.1.1
Application temperature	32 °C	4	Section 4.1.1
Mass transfer coefficient	10 m/h	2	Section 4.1.1
Release area Adults (19+ years) Children (14-18 years)	 240 cm^2 227 cm^2	 3 2	Exposed area (dermal)
Emission duration Adults (19+ years) Children (14-18 years)	 15 hours 17 hours	 4 4	Exposure duration
Dermal-direct product contact-instant application			
Exposed area Adults (19+ years) Children (14-18 years)	 240 cm^2 227 cm^2	 3 2	 Underarms (Danish EPA, 2007) Underarms (See above)
Product amount Adults (19+ years) Children (14-18 years)	 1.5 g 1.5 g	 4 4	 Ficheux et al., 2016 Ficheux et al., 2016

12 Oral hygiene products

Oral hygiene products are used to cleanse the teeth and mouth. Some oral hygiene products also aim to whiten, desensitise, or strengthen the teeth. Oral hygiene products are available as liquids, pastes, gels, powders, and tablets. Exposure to substances in oral hygiene products is anticipated to occur mainly through ingestion.

12.1 Toothpaste

Toothpaste is a paste or gel applied with a toothbrush to clean and maintain the aesthetics and health of teeth. Toothpaste is anticipated to be used by ages 1 and up.

Scenario for consumer exposure
During application, the toothpaste is applied in the mouth, including on the teeth and tongue by means of a toothbrush, and then spit out. However, some product may be ingested, especially by younger age groups. Therefore, the consumer exposure scenario for toothpaste is anticipated to run by ingestion.

Frequency
The survey by Garcia-Hidalgo et al. (2017) (Section 5.3) reported a 75th percentile for frequency of use of toothpaste as 3 times per day. This value is chosen as the default frequency as it is similar to values identified in other studies (CTFA 1983; Park et al., 2015; Ficheux et al., 2015), but is slightly higher. A Q-factor of 4 is assigned, as the default is based on large datasets that specifically measure the frequency of brushing teeth.

12.1.1 Application: ingestion

The scenario of using toothpaste fits the generic exposure scenario for oral exposure to substances in ingested products (Section 4.3.1). The ***oral-direct product contact-direct oral intake*** model is used to estimate oral exposure to substances in toothpaste.

Amount ingested
Since some, but probably not all, of the product may be ingested during use, the amount of product used is adjusted to reflect the anticipated ingested amount. It has been shown that the amount of toothpaste ingested differs greatly between various age groups; therefore, information on the amount of toothpaste used and the amount of toothpaste ingested was evaluated. Although several studies were available on the amount of toothpaste used (CTFA 1983; McNamara et al., 2007; Lorenz et al., 2010; Biesterbos et al., 2013; Ficheux et al., 2016; Strittholt et al., 2016; Barnhart et al., 1974), only two studies were identified on the amount of toothpaste ingested (Barnhart et al., 1974; Strittholt et al., 2016). In addition, SCCS (2023) contains a recommended ingestion factor of 5% for adults. For adults, the default used product amount was derived from Ficheux et al. (2016), as this study was ranked highest . However, it did not include information on the amount of toothpaste ingested. Although the study by Barnhart et

al. (1974) contains information on the amount of toothpaste ingested by adults, the SCCS (2023) default ingestion factor of 5% was applied to the product amount from Ficheux et al. (2016), as it is slightly higher and has been used by other regulatory agencies in risk assessment (NICNAS, 2009). A Q-factor of 4 is assigned for adults as the default is based on reliable publications. For infants, the default ingested product amount was derived from Strittholt et al. (2016) and is assigned a Q-factor of 3. Although this study was not ranked as highly as Ficheux et al. (2016), it contains quantitative values for the amount of toothpaste ingested by young children.

Table 12.1 Default values for estimating consumer exposure to substances in toothpaste

Default value		Q-factor	Source(s)
General			
Frequency Adults (19+ years) Infants (2-3 years)	 1095 per year 1095 per year	 4 4	 Garcia-Hidalgo et al., 2017 Garcia-Hidalgo et al., 2017
Oral-direct product contact-direct oral intake			
Amount ingested Adults (19+ years) Infants (2-3 years)	 0.10 g 0.32 g	 4 3	 See above Strittholt et al., 2016

12.2 Mouthwash

Mouthwash is a rinse, often antiseptic, that can help prevent tooth decay, reduce plaque, prevent or reduce gingivitis, reduce the formation of tartar on teeth, and freshen breath (ADA, 2016). Mouthwash is anticipated to be used by ages 6 and up.

Scenario for consumer exposure
During application, the mouthwash is taken into the mouth, swished around, and then spit out. However, some of the product may be ingested. Therefore, the consumer exposure scenario for mouthwash is anticipated to run by ingestion.

Frequency
The frequency of use is derived from Ficheux et al. (2015). A Q-factor of 4 is assigned, as the default is based on data from a high-quality study involving a large number of participants.

12.2.1 Application: ingestion

The scenario of using mouthwash fits the generic exposure scenario for oral exposure to substances in ingested products (Section 4.3.1). The ***oral-direct product contact-direct oral intake*** model is used to estimate oral exposure to substances in mouthwash.

Amount ingested
Similar to toothpaste, some, but probably not all, of the product may be ingested during use. Therefore, the amount of product used is adjusted to reflect the anticipated ingested amount. The default used product

amounts were derived from Ficheux et al. (2016) or derived from product label recommendations, for adults and children respectively. A 10% ingestion factor from SCCS (2023) was applied to the product amounts. A Q-factor of 4 is assigned for adults as the default is based on reliable publications. A Q-factor of 2 is assigned for children.

Table 12.2 Default values for estimating consumer exposure to substances in mouthwash

Default value		**Q-factor**	**Source(s)**
General			
Frequency Adults (19+ years) Children (4-8 years)[1]	 479 per year 500 per year	 4 4	 Ficheux et al., 2015 Ficheux et al., 2015
Oral-direct product contact-direct oral intake			
Amount ingested Adults (19+ years) Children (4-8 years)[1]	 2.3 g 1.0 g	 4 2	 See above See above

1: Mouthwash is not recommended for children under the age of 6 years.

13 Foot care products

Foot care products are cosmetic products that are used to care for the skin of the feet. The products can be distinguished on the basis of their function, such as moisturising the skin, treating fungal growth, or reducing sweating and/or odours.

Foot care products are available as creams/lotions, sprays, and powders. Exposure to substances in foot care products can occur through:

- Direct dermal contact;
- Inhalation of non-volatile and volatile substances in sprays.

13.1 Foot cream / moisturiser

Foot creams and lotions are used to moisturise the feet. It is anticipated that foot cream is used by ages 14 and up.

Scenario for consumer exposure
During application, the foot cream is applied to the skin of both feet and the product is left on the skin for a prolonged duration. Therefore, the consumer exposure scenario for foot cream is anticipated to run by dermal contact during leave-on.

Frequency
The frequency of use was based on the frequency of body lotion applied to the feet from Loretz et al. (2005). This was the highest value from all of the available studies (Loretz et al., 2005; Ficheux et al., 2015). A Q-factor of 4 is assigned, as it is a high-quality study involving a large number of participants.

13.1.1 Application: leave-on

Foot cream is applied to the skin and left on for a prolonged duration. Therefore, the scenario of using foot cream fits the generic exposure scenario for dermal exposure from leave-on products (see Section 4.2.1). The ***dermal-direct product contact-instant application*** model is used to estimate dermal exposure to substances in foot cream.

Product amount
The product amount that is available for dermal exposure is the amount of cream applied to both feet. The product amount is derived from Ficheux et al. (2016). A Q-factor of 4 is assigned, as this is a high-quality study involving a large number of participants and product types.

Table 13.1 Default values for estimating consumer exposure to substances in foot cream following application

Default value		Q-factor	Source(s)
General			
Frequency Adults (19+ years) Children (14-18 years)	 595 per year 595 per year	 4 4	 Loretz et al., 2005 Loretz et al., 2005
Dermal-direct product contact-instant application			
Exposed area Adults (19+ years) Children (14-18 years)	 1200 cm^2 1080 cm^2	 3 3	 Feet (Te Biesebeek et al., 2014) Feet (Te Biesebeek et al., 2014)
Product amount Adults (19+ years) Children (14-18 years)	 6.0 g 6.0 g	 4 4	 Ficheux et al., 2016 Ficheux et al., 2016

13.2 Foot antiperspirant

Foot antiperspirants are creams used to reduce sweating of the feet similar to antiperspirants being used for armpits. It is unclear whether such products are used by children. On the basis of information for other foot care products (such as antifungal foot cream), it is assumed that young age groups could use these products. Therefore, foot antiperspirants are anticipated to be used by ages 2 and up.

Scenario for consumer exposure
During application, the user applies the foot antiperspirant directly to the skin of both feet and leaves the product on for a prolonged duration. Therefore, the consumer exposure scenario for foot antiperspirant is anticipated to run by dermal contact during leave-on.

Frequency
The frequency of use for adults is derived from Ficheux et al. (2015). A Q-factor of 4 is assigned for adults, as the default is based on a high-quality study involving a large number of participants. In the absence of data, it is assumed that the product could be used by children at the same frequency as adults, and a Q-factor of 2 is assigned.

13.2.1 Application: leave-on

Foot antiperspirant is applied to clean skin and left on for a prolonged duration. Therefore, the scenario of using foot antiperspirant fits the generic exposure scenario for dermal exposure from leave-on products (Section 4.2.1). The ***dermal-direct product contact-instant application*** model is used to estimate dermal exposure to substances in foot antiperspirant.

Product amount
The product amount for adults is derived from Ficheux et al. (2016). A Q-factor of 4 is assigned, as this is a high-quality study involving a large number of participants and product types. No product amount data was available for younger age groups, so the product amount was calculated using the dermal load for the age group for which data is available

(Section 4.5). For these cases, a Q-factor of 2 is assigned, as the default was not based on an empirical value for that age group.

Table 13.2 Default values for estimating consumer exposure to substances in foot antiperspirant following application

Default value		Q-factor	Source(s)
General			
Frequency Adults (19+ years) Infants (2-3 years)	 416 per year 416 per year	 4 2	 Ficheux et al., 2015 See above
Dermal-direct product contact-instant application			
Exposed area Adults (19+ years) Infants (2-3 years)	 1200 cm^2 360 cm^2	 3 3	 Feet (Te Biesebeek et al., 2014) Feet (Te Biesebeek et al., 2014)
Product amount Adults (19+ years) Infants (2-3 years)	 3.9 g 1.3 g	 4 2	 Ficheux et al., 2016 Section 4.5

13.3 Foot anti-fungal creams

Antifungal foot creams are used to treat foot fungus such as athlete's foot. According to Health Canada, these types of foot care products should only be used on children aged 2 and up unless advised by a doctor (Health Canada 1993; 1995).

Scenario for consumer exposure
During application, the anti-fungal foot cream is applied to the clean and dry skin of both feet and the product is left on the skin for a prolonged duration. Therefore, the consumer exposure scenario for anti-fungal foot cream is anticipated to run by dermal contact during leave-on.

Frequency
The frequency of use for adults is derived from Bremmer et al. (2006a) which estimates the frequency on the basis of a recommended use of the product of 2 times per day for 45 days (to get rid of a fungal infection). In the absence of data for frequency of use in younger age groups, it was assumed that the product would be used at the same frequency as adults. A Q-factor of 3 is assigned, as the default is based on a reliable publication, albeit with limited information on foot care products.

13.3.1 Application: leave-on

Anti-fungal foot cream is applied to the skin and left on for a prolonged duration. Therefore, the scenario of using anti-fungal foot cream fits the generic exposure scenario for dermal exposure from leave-on products (Section 4.2.1). The ***dermal-direct product contact-instant application*** model is used to estimate dermal exposure to substances in anti-fungal foot cream.

Product amount
The product amount that is available for dermal exposure is the amount of anti-fungal foot cream applied to both feet. The product amount is

calculated using a dermal load calculation that is based on the product amounts for body cream and taking into account the surface areas corresponding to the use of body cream and foot cream (see Section 4.5). This method of calculating product amount is adopted from the previous Cosmetics Fact Sheet (Bremmer et al., 2006a). A Q-factor of 3 is assigned.

Table 13.3 Default values for estimating consumer exposure to substances in anti-fungal foot cream following application

Default value		Q-factor	Source(s)
General			
Frequency Adults (19+ years) Infants (2-3 years)	 90 per year 90 per year	 3 3	 Bremmer et al., 2006a Bremmer et al., 2006a
Dermal-direct product contact-instant application			
Exposed area Adults (19+ years) Infants (2-3 years)	 1200 cm^2 360 cm^2	 3 3	 Feet (Te Biesebeek et al., 2014) Feet (Te Biesebeek et al., 2014)
Product amount Adults (19+ years) Infants (2-3 years)	 1.2 g 0.36 g	 3 3	 See above See above

13.4 Foot spray

Foot sprays may be used to reduce sweating and/or odours on feet or in footwear. Foot sprays are anticipated to be used by ages 2 and up.

Scenario for consumer exposure
During application, the user directly sprays the foot spray on the skin of both feet and leaves the product on for a prolonged duration. Therefore, the consumer exposure scenarios for foot spray are anticipated to run by inhalation of non-volatile substances in sprayed droplets, inhalation of volatile substances that remain in the air after spraying, and by dermal contact after spraying. In this section, the exposure to aerosol and pump foot sprays are described separately. For each type of foot spray, the exposure to foot spray is described in two separate scenarios: inhalation exposure during spraying and dermal exposure after spraying.

Frequency
The frequency of use is derived from Ficheux et al. (2015). A Q-factor of 4 is assigned, as this is a high-quality study involving a large number of participants.

13.4.1 Foot spray (aerosol)

13.4.1.1 Application: spraying

Inhalation exposure to both volatile and non-volatile substances is anticipated in this scenario. The consumer can inhale non-volatile substances available for inhalation in the sprayed droplets, while volatile substances are expected to remain in the indoor air after spraying. The ***inhalation-exposure to spray-spraying*** model is used to estimate the inhalation exposure to the non-volatile substances. The ***spraying towards person*** option is considered as spray is directed towards the

consumer (Section 4.1.3.2). The ***inhalation-exposure to spray instantaneous release*** model is used to estimate inhalation exposure to volatile substances (Section 4.1.3.1). The spray is directed towards the person, so that the volatile substances are released into the user's personal breathing zone. The exposure duration, mass generation rate, airborne fraction, density non-volatile, and initial particle distribution defaults for aerosol foot sprays are assumed to be similar to those of aerosol deodorant.

Spray duration
The spray duration is defined here as the net spraying time between the start and finish of spraying, not counting time between sprays (Delmaar & Schuur, 2017). It is expected that the spray duration would be 8 seconds in total (4 seconds per foot). A Q-factor of 2 is assigned, as it is an estimate based on product labels.

Released mass
The released mass is set to be equal to the product amount that is sprayed out of the bottle or can. The product amount used is calculated using the mass generation rate (0.9 g/s; Delmaar & Bremmer, 2009) and assuming a spray duration of 8 seconds, and the released mass default is set accordingly. A Q-factor of 2 is assigned, as the value is calculated using a mass generation rate for deodorant spray and a spray duration that is derived from product labels.

Table 13.4 Default values for estimating consumer exposure to substances in aerosol foot spray during spraying

Default value		**Q-factor**	**Source(s)**
General			
Frequency	416 per year	4	Ficheux et al., 2015
Inhalation-exposure to spray-spraying[1]			
Spray duration	8 sec	2	See above
Exposure duration	5 min	2	Section 4.1.3.2
Room volume	20 m^3	3	Section 4.1.3.2
Room height	2.5 m	4	Section 4.1.3.2
Ventilation rate	0.6 per hour	3	Section 4.1.3.2
Cloud volume	0.0625 m^3	2	Section 4.1.3.2
Mass generation rate	0.9 g/s	2	Aerosol deodorant spray (Section 11.1)
Airborne fraction	0.9	2	Aerosol deodorant spray (Section 11.1)
Density non-volatile	1.5 g/cm^3	1	Aerosol deodorant spray (Section 11.1)
Inhalation cut-off diameter	15 µm	3	Delmaar & Schuur, 2017
Initial particle distribution Median (C.V.)	 8.3 µm 0.84	2	Aerosol deodorant spray (Section 11.1)

Default value		Q-factor	Source(s)
Inhalation-exposure to spray-instantaneous release[2]			
Exposure duration	16 s	1	Twice the spray duration, Section 4.1.3.1
Released mass	7.2 g	2	See above
Room volume	1 m^3	1	Section 4.1.3.1
Ventilation rate	0.6 per hour	1	Section 4.1.3.1

1: Applies to non-volatile substances
2: Applies to volatile substances

13.4.1.2 Application: leave-on

Foot spray is applied to the skin, allowed to dry, and left on for a prolonged duration; therefore, the scenario of using foot spray fits the generic exposure scenario for dermal exposure from sprays (see Section 4.2.4). The ***dermal-direct product contact-instant application*** model is used to estimate dermal exposure to substances in foot spray.

Product amount

The product amount is calculated using the mass generation rate (0.9 g/s; Delmaar & Bremmer, 2009) and assuming a spray duration of 8 seconds. A Q-factor of 2 is assigned, as the value is calculated using a mass generation rate for deodorant spray and a spray duration that is derived from product labels.

Retention factor

For spray products, it is assumed that only 85% of the sprayed product amount is on the consumer's skin after spraying (Bremmer et al., 2006a). Therefore, a retention factor of 0.85 needs to be applied to reflect the amount of product actually on the consumer's skin after spraying. The Q-factor assigned is 1, as the retention factor is based on assumptions.

Table 13.5 Default values for estimating consumer exposure to substances in aerosol foot spray following application

Default value		Q-factor	Source(s)
General			
Frequency	416 per year	4	Ficheux et al., 2015
Dermal-direct product contact-instant application			
Exposed area Adults (19+ years) Infants (2-3 years)	 1200 cm^2 360 cm^2	 3 3	 Feet (Te Biesebeek et al., 2014) Feet (Te Biesebeek et al., 2014)
Product amount	7.2 g	2	See above
Retention factor	0.85	1	See above

13.4.2 Foot spray (pump)

13.4.2.1 Application: spraying

Inhalation exposure to both volatile and non-volatile substances is anticipated in this scenario. The consumer can inhale non-volatile

substances available for inhalation in the sprayed droplets, since volatile substances are expected to remain in the indoor air after spraying. The ***inhalation-exposure to spray-spraying*** model is used to estimate the inhalation exposure to the non-volatile substances. The ***spraying towards person*** option is considered as spray is directed towards the consumer (Section 4.1.3.2). The ***inhalation-exposure to spray instantaneous release*** model is used to estimate inhalation exposure to volatile substances (Section 4.1.3.1). The spray is directed towards the person, so that the volatile substances are released into the user's personal breathing zone.

Spray duration
The spray duration is defined here as the net spraying time between the start and finish of spraying, not counting time between sprays (Delmaar & Schuur, 2017). It is expected that the spray duration would be 8 seconds in total (4 seconds per foot). A Q-factor of 2 is assigned, as it is an estimate based on product labels.

Mass generation rate
The mass generation rate for pump foot spray is set to the default mass generation rate of 1.6 g/s, as determined for trigger sprays by Delmaar & Bremmer (2009) (Section 4.1.3.2). The Q-factor assigned is 3, because the underlying dataset is large, but does not refer to any specific exposure scenario.

Airborne fraction
The airborne fraction of pump foot sprays has not been experimentally determined in previous Delmaar and Bremmer (2009) work. Therefore, it is suggested to take the upper value of the range of trigger and pump sprays, resulting in an airborne fraction of 0.02. This equals the airborne fraction of eau de toilette, which was also used in the previous version of this fact sheet. It is acknowledged that foot spray is likely to have other characteristics, but may nonetheless result in similar airborne fractions. The Q-factor assigned is 1, since no product information is available and the upper range was selected.

Density non-volatile
The density of the non-volatile substances is set to 1.8 g/cm^3 on the basis of the default value for complex mixtures including organic compounds. The Q-factor assigned is 3, as the assumption that foot products are indeed complex mixtures is justified.

Initial particle distribution
The particle size distribution of the spray has not been previously studied. The particle size distribution of eau de toilette was used in the previous version of this fact sheet. Even though it is recognised that eau de toilette is a different type of formulation, the particle size distributions of trigger sprays gathered by Delmaar and Bremmer (2009) show results in a similar distribution range. Therefore, the initial particle distribution of eau de toilette is used for foot spray, i.e. a median of 2.7 µm with C.V. of 0.73. The Q-factor assigned is 1.

Released mass
The released mass is set to be equal to the product amount that is sprayed out of the bottle or can. The product amount used is calculated using the mass generation rate (1.6 g/s; Delmaar & Bremmer, 2009) and assuming a spray duration of 8 seconds, and the released mass default is set accordingly. A Q-factor of 2 is assigned, as the value is calculated using a mass generation rate for trigger sprays rather than specifically for foot sprays and a spray duration that is derived from product labels.

Table 13.6 Default values for estimating consumer exposure to substances in pump foot spray during spraying

Default value		Q-factor	Source(s)
General			
Frequency	416 per year	4	Ficheux et al., 2015
Inhalation-exposure to spray-spraying[1]			
Spray duration	8 sec	2	See above
Exposure duration	5 min	2	Section 4.1.3.2
Room volume	20 m^3	3	Section 4.1.3.2
Room height	2.5 m	4	Section 4.1.3.2
Ventilation rate	0.6 per hour	3	Section 4.1.3.2
Cloud volume	0.0625 m^3	2	Section 4.1.3.2
Mass generation rate	1.6 g/s	3	Delmaar & Bremmer, 2009
Airborne fraction	0.02	1	See above
Density non-volatile	1.8 g/cm^3	3	See above
Inhalation cut-off diameter	15 µm	3	Delmaar & Schuur, 2017
Initial particle distribution Median (C.V.)	2.7 µm 0.73	1	See above
Inhalation-exposure to spray-instantaneous release[2]			
Exposure duration	16 s	1	Twice the spray duration, Section 4.1.3.1
Released mass	12.8 g	2	See above
Room volume	1 m^3	1	Section 4.1.3.1
Ventilation rate	0.6 per hour	1	Section 4.1.3.1

1: Applies to non-volatile substances
2: Applies to volatile substances

13.4.2.2 Application: leave-on
Foot spray is applied to the skin, allowed to dry, and left on for a prolonged duration; therefore, the scenario of using foot spray fits the generic exposure scenario for dermal exposure from sprays (see Section 4.2.4). The ***dermal-direct product contact-instant application*** model is used to estimate dermal exposure to substances in foot spray.

Product amount
The product amount is calculated using the mass generation rate (1.6 g/s; Delmaar & Bremmer, 2009) and assuming a spray duration of

8 seconds. A Q-factor of 2 is assigned, as the value is calculated using a mass generation rate for trigger sprays rather than specifically for foot sprays and a spray duration that is derived from product labels.

Retention factor
For spray products, it is assumed that only 85% of the sprayed product amount is on the consumer's skin after spraying (Bremmer et al., 2006a). Therefore, a retention factor of 0.85 needs to be applied to reflect the amount of product actually on the consumer's skin after spraying. The Q-factor assigned is 1, as the retention factor is based on assumptions.

Table 13.7 Default values for estimating consumer exposure to substances in pump foot spray following application

Default value		Q-factor	Source(s)
General			
Frequency	416 per year	4	Ficheux et al., 2015
Dermal-direct product contact-instant application			
Exposed area Adults (19+ years) Infants (2-3 years)	 1200 cm^2 360 cm^2	 3 3	 Feet (Te Biesebeek et al., 2014) Feet (Te Biesebeek et al., 2014)
Product amount	12.8 g	2	See above
Retention factor	0.85		See above

13.5 Foot powder

Foot powders may be used to reduce sweating and/or odours on feet or in footwear. Foot powders are anticipated to be used by ages 2 and up.

Scenario for consumer exposure
During application, the user applies the foot powder directly to the skin of both feet and leaves the product on for a prolonged duration. Therefore, the consumer exposure scenario for foot powder is anticipated to run by dermal contact during leave-on. It is assumed that the body powder inhalation exposure defaults will also apply to foot powders (Section 4.1.4.2).

Frequency
The frequency of use is derived from Ficheux et al. (2015). A Q-factor of 4 is assigned, as it is a high-quality study involving a large number of participants.

13.5.1 Application: powdering

Foot powder is a loose powdered product applied to the skin of bare feet. The generic exposure scenario for inhalation of powder particles applied to the body area (see Section 4.1.4.2) is considered representative of the inhalation exposure to a substance in foot powder. The ***inhalation-exposure to spray-instantaneous release*** model is used to estimate inhalation exposure to substances in foot powder. The default exposure duration, released mass, room volume and ventilation rate are derived using the approach described in the generic exposure scenario.

Released mass
The default released mass is set to 125.8 µg, which refers to the amount of product inhaled for the duration of exposure. The Q-factor assigned is 2, because measurements were obtained from 2 studies that involved human subjects applying body powder (Section 4.1.4.2)

Exposure duration
The default exposure duration of 5 minutes refers to the time the exposed person is in the room where the substance is being released. The assigned Q-factor is 2.

Room volume
The default room volume for cosmetic body powder products is set to 0.055 m^3 which refers to the volume of air inhaled via the user's personal breathing zone for the duration of exposure . The Q-factor assigned is 1.

Ventilation rate
The ventilation is set to 0 per hour, which best aligns with the equation used to estimate the released mass on the basis of air concentration data.

13.5.2 Application: leave-on

Foot powder is applied to the skin and left on for a prolonged duration; therefore, the scenario of using foot powder fits the generic exposure scenario for dermal exposure from leave-on products (Section 4.2.1). The ***dermal-direct product contact-instant application*** model is used to estimate dermal exposure to substances in foot powder.

Product amount
The product amount that is available for dermal exposure is the amount of powder applied to both feet. No product amount data was available for foot powder. Therefore, the product amount was calculated using a surface area adjustment based on the dermal load for body powder (Section 4.5). A Q-factor of 2 is assigned, as the defaults are estimated on the basis of a similar product.

Table 13.8 Default values for estimating consumer exposure to substances in foot powder following application

Default value		**Q-factor**	**Source(s)**
General			
Frequency Adults (19+ years) Infants (2-3 years)	 416 per year 416 per year	 4 4	 Ficheux et al., 2015 Ficheux et al., 2015
Dermal-direct product contact-instant application			
Exposed area Adults (19+ years) Infants (2-3 years)	 1200 cm^2 360 cm^2	 3 3	 Feet (Te Biesebeek et al., 2014) Feet (Te Biesebeek et al., 2014)
Product amount Adults (19+ years) Infants (2-3 years)	 0.66 g 0.21 g	 2 2	 See above See above

14 Fragrance products

Fragrance products are applied to the skin to add a scent. One main ingredient of fragrance products are the raw materials of scent, 'fragrances' or 'essences'. These scents can be natural or synthetic, and fragrance products can contain one or multiple fragrances (Bremmer et al., 2006a). Ethanol is usually used as a solvent, and many fragrance products also contain a fixing agent to slow down the evaporation of the volatile ingredients and to extend the duration of scent release from the product after application (Bremmer et al., 2006a).

Fragrance products (e.g. perfume, eau de toilette, eau de cologne, and body spray) can be distinguished on the basis of the concentration of fragrance materials in the product. Perfume tends to contain the highest concentration of fragrance, subsequently followed by eau de toilette and eau de cologne, while body spray has the lowest concentration of fragrance. Typically, fragrance products with higher concentrations of scent tend to be applied in smaller amounts and in smaller areas. In this section, an eau de toilette is described. Parameters such as surface area and product amount may be adjusted as needed, depending on the type of fragrance product being modelled.

Fragrance products are available in liquid spray form, liquid 'roll-on' or 'dab-on' form, and solid stick form. Exposure to substances in fragrance products can occur through:

- Direct dermal contact;
- Inhalation of non-volatile and volatile substances in sprays.

Fragrance products are anticipated to be used by ages 2 and up.

Scenario for consumer exposure
During application, the user sprays the product directly on the skin and leaves the product on for a prolonged duration. Therefore, the consumer exposure scenarios for fragrance spray are anticipated to run by inhalation of non-volatile substances in sprayed droplets, inhalation of volatile substances that remain in the air after spraying, and by dermal contact after spraying. In this section, the exposure to fragrance spray is described in two separate scenarios: inhalation exposure during spraying and dermal exposure after spraying.

Frequency
The frequency of use is derived from Loretz et al. (2006) or Statistics Canada (2017) depending on the age group. A Q-factor of 4 is assigned, as the defaults are derived from high-quality publications involving large numbers of participants.

14.1 Application: spraying

Fragrance sprays are expected to be mainly applied in the bathroom (EPHECT, 2012). Inhalation exposure to both volatile and non-volatile substances is anticipated in this scenario. The consumer can inhale non-volatile substances available for inhalation in the sprayed droplets, since

volatile substances are expected to remain in the indoor air after spraying. The ***inhalation-exposure to spray-spraying*** model is used to estimate the inhalation exposure to the non-volatile substances. The ***spraying towards person*** option is considered as spray is directed towards the consumer's skin (Section 4.1.3.2). The ***inhalation-exposure to spray-instantaneous release*** model is used to estimate inhalation exposure to volatile substances. The spray is directed towards the person, so the volatile substances are released into the user's personal breathing zone (Section 4.1.3.1).

Mass generation rate
On the basis of experimentally determined data from Delmaar & Bremmer (2009) and from Tuinman (2007), the default mass generation rate for eau de toilette is set to 0.1 g/s. The Q-factor assigned is 3, because the default directly refers to the mass generation rate of eau de toilette sprays, but the number of samples (N=5) is limited.

Airborne fraction
The default airborne fraction in this scenario refers to a scaled airborne fraction that is complementary to the fitted initial particle distribution (Section 4.1.3.2). A default initial particle distribution for droplets released during the application of eau de toilette spray is characterised by a median particle diameter of 2.7 µm and a C.V. of 0.73 (RIVM, 2010). This default is fitted to represent the fraction of the inhalable particles (< 22.5 µm) most accurately. Complementary to this fit, the airborne fraction is scaled as the mass fraction of the sprayed droplets that is both directly airborne during the spray event and < 22.5 µm. The mass fraction that is directly airborne is characterised as 0.1, whereas the mass fraction < 22.5 µm is determined to be 0.2. The default airborne fraction is thus scaled as 0.1 x 0.2 = 0.02. The Q-factor assigned is 3, because the default directly refers to eau de toilette sprays, but the number of samples (N=3) is limited.

Density non-volatile
The density of non-volatile materials in eau de toilette sprays is estimated by Bremmer et al. (2006a) to be 1.5 g/cm^3. The default density non-volatile is set accordingly. The Q-factor assigned is 2, because the estimation by Bremmer et al. (2006a) generically refers to the density of large organic compounds in cosmetic sprays, but not specifically to the density of non-volatile materials in eau de toilette sprays.

Initial particle distribution
A default initial particle distribution of droplet sizes during the application of eau de toilette sprays is characterised by RIVM (2010) with a median particle diameter of 2.7 µm and a C.V. of 0.73 (see airborne fraction above). The Q-factor assigned is 3, because the defaults directly refer to initial particle distribution of eau de toilette sprays, but the number of samples (N=3) is limited.

Released mass
The released mass is set to be equal to the product amount that is sprayed out of the bottle or can. The product amount used is derived from Loretz et al. (2006), and the released mass default is set

accordingly. A Q-factor of 4 is assigned, as the default was derived from a high-quality study involving a large number of participants.

Table 14.1 Default values for estimating consumer exposure to substances in fragrance spray during spraying

Default value		Q-factor	Source(s)
General			
Frequency Adults (19+ years) Children (9-13 years)	 730 per year[1] 644 per year	 4 4	 Loretz et al., 2006 Statistics Canada, 2017
Inhalation-exposure to spray-spraying-spraying towards person[2]			
Spray duration	4.9 s	3	Released mass/mass generation rate (Section 4.1.3.2)
Exposure duration	5 min	2	Section 4.1.3.2
Room volume	10 m^3	4	Section 4.1.3.2
Room height	2.5 m	4	Section 4.1.3.2
Ventilation rate	2 per hour	3	Section 4.1.3.2
Cloud volume	0.0625 m^3	1	Section 4.1.3.2
Mass generation rate	0.1 g/s	3	Delmaar & Bremmer, 2009
Airborne fraction	0.02	3	RIVM, 2010
Density non-volatile	1.5 g/cm^3	2	Bremmer et al., 2006a
Initial particle distribution Median (C.V.)	 2.7 µm 0.73	3	RIVM, 2010
Inhalation cut-off diameter	15 µm	3	Delmaar & Schuur, 2017
Inhalation-exposure to spray-instantaneous release[3]			
Exposure duration	9.8 s	1	Twice the spray duration, Section 4.1.3.1
Released mass	0.49 g[4]	4	Loretz et al., 2006
Room volume	1 m^3	1	Section 4.1.3.1
Ventilation rate	2 per hour	1	Section 4.1.3.1

1: The frequency of use for adults (19+ years) is set to the 80th percentile value, as the estimated 75th percentile value was higher than the reported 80th percentile value.
2: Applies to non-volatile substances
3: Applies to volatile substances
4: The product amount is set to the 80th percentile value, as the estimated 75th percentile value was higher than the reported 80th percentile value.

14.2 Application: leave-on

Fragrance spray is applied to the skin in various places on the body and left on for a prolonged duration. Therefore, the scenario of using fragrance spray fits the generic exposure scenario for dermal exposure from sprays (see Section 4.2.4). The ***dermal-direct product contact-instant application*** model is used to estimate dermal exposure to substances in fragrance spray.

Exposed area
It is expected that eau de toilette spray will be sprayed onto small areas such as the pulse points (e.g. wrists, neck, under the ears). Therefore, the exposed area is calculated as 200 cm^2 (25 cm^2 x 8 places; Bremmer et al., 2006a). A Q-factor of 3 is assigned.

Product amount
The product amount is derived from Loretz et al. (2006). A Q-factor of 4 is assigned, as the default is derived from a high-quality study involving a large number of participants.

Retention factor
For spray products, it is assumed that only 85% of the sprayed product amount is on the consumer's skin after spraying (Bremmer et al., 2006a). Therefore, a retention factor of 0.85 needs to be applied to reflect the amount of product actually on the consumer's skin after spraying.

Table 14.2 Default values for estimating consumer exposure to substances in fragrance spray following application

Default value		**Q-factor**	**Source(s)**
General			
Frequency Adults (19+ years) Children (9-13 years)	 730 per year[1] 644 per year	 4 4	 Loretz et al., 2006 Statistics Canada, 2017
Dermal-direct product contact-instant application			
Exposed area Adults (19+ years) Children (9-13 years)	 200 cm^2 200 cm^2	 3 3	 Bremmer et al., 2006a Bremmer et al., 2006a
Product amount	0.49 g[2]	4	Loretz et al., 2006
Retention factor	0.85		See above

1: The frequency of use for adults (19+ years) is set to the 80th percentile value, as the estimated 75th percentile value was higher than the reported 80th percentile value.
2: The product amount is set to the 80th percentile value, as the estimated 75th percentile value was higher than the reported 80th percentile value.

15 Hair removal products

Hair removal products are cosmetic products used during hair removal. They include shaving cream/foam/gel to help lubricate the skin prior to shaving; aftershave or after hair removal products to help soothe the skin following hair removal; and hair removal cream/depilatory to remove hair using chemical processes.

Hair removal products are available as creams, lotions, solid bars, liquids, gels, foams, and aerosols. Exposure to substances in hair removal products can occur through:

- Direct dermal contact;
- Dermal contact with product residues;
- Inhalation of evaporated substances;
- Inhalation of non-volatile and volatile substances in sprays.

Some hair removal products are intended to be left on the skin, while others are intended to be rinsed off. Hair removal products are anticipated to be used by ages 9 and up.

15.1 Shaving products

Shaving cream, foam, or gel is applied to the skin using the hands or a brush. A uniform, viscous, thick foam layer is formed on the skin. The skin is then shaved to remove the hair, and the shaving cream is rinsed off using water and hands.

There are various types of products that can be used for shaving hair off the skin: gel and foam (aerosol can), shaving soap (in a bar or tablet form), and cream (tube).

15.1.1 Shaving cream (face)

Scenario for consumer exposure

During application, the user applies the shaving cream directly to the skin of the face and shaves the skin. The shaving cream is then rinsed off. A fraction of the product remains on the skin, nonetheless. Therefore, the consumer exposure scenario for shaving cream is anticipated to run by dermal contact following rinse-off.

Frequency

The frequency of use for shaving cream is set to be equal to the frequency for aftershave (Wu et al., 2010). This is based on the assumption that shaving frequency is similar to aftershave use. The frequency of use for ages 9-13 is based on data relating to ages 12-17 from Wu et al. (2010). Therefore, the frequency presented below may be more representative of older users. The Q-factor assigned is 1, as the defaults are based on a high-quality study, but relate to a different age group.

15.1.1.1 Application: rinse-off

Shaving cream is a cosmetic product that is applied to the skin and rinsed off. Therefore, the scenario of using shaving cream fits the

generic exposure scenario for dermal exposure from residues of rinse-off products (Section 4.2.2). The ***dermal-direct product contact-instant application*** model is used to estimate dermal exposure to substances in shaving cream.

Exposed area
The default for the exposed area is set to be equal to the surface area of half of the face (quarter of head). Dermal exposure from a shaving product intentionally or inadvertently applied to the fingers or hand is considered negligible in comparison to dermal exposure when applied to the face. Such events are considered to be less frequent and of short duration (the user is assumed to rinse their hands prior to shaving). Surface area values are derived from the General Fact Sheet and assigned a Q-factor of 3 in accordance with the General Fact Sheet (Te Biesebeek et al., 2014).

Product amount
The product amount used is derived from Ficheux et al. (2016). A Q-factor of 4 is assigned, as the product amount is derived from a high-quality study involving a large number of participants. For the age group for which no data was available, a Q-factor of 2 is assigned for the calculated product amount as the default is not based on an empirical value for that age group.

Retention factor
For rinse-off products, it is assumed that only 10% of the applied product amount remains on the consumer's skin following rinse-off (SDA, 2010). In addition, since shaving cream readily dissolves in water and is applied to wet skin, an additional 10% factor is applied (SDA, 2010). Therefore, a retention factor of 0.01 needs to be applied to reflect the amount of product actually on the consumer's skin following rinse-off. The Q-factor assigned is 1, as the retention factor is based on assumptions.

Table 15.1 Default values for estimating consumer exposure to substances in shaving cream (face) residues after rinsing

Default value		**Q-factor**	**Source(s)**
General			
Frequency Adults (19+ years) Children (9-13 years)	 353 per year 456 per year	 1 1	 See above See above
Dermal-direct product contact-instant application			
Exposed area Adults (19+ years) Children (9-13 years)	 300 cm^2 263 cm^2	 1 1	 Quarter head (Te Biesebeek et al., 2014) Quarter head (Te Biesebeek et al., 2014)
Product amount Adults (19+ years) Children (9-13 years)	 10.6 g 10.7 g	 4 2	 Ficheux et al., 2016 Section 4.5
Retention factor	0.01		See above

15.1.2 Shaving cream (body)

Scenario for consumer exposure

During application, the user applies the shaving cream directly to the skin of the entire body except for the head and shaves the skin. The shaving cream is then rinsed off. However, some product remains on the skin after rinsing. The consumer exposure scenarios for shaving cream is anticipated to run by dermal contact during a rinse-off application.

Frequency

The frequency of use is from Biesterbos et al. (2013). The Q-factor assigned is 3, as it is a high-quality study. but involves limited age groups.

15.1.2.1 Application: rinse-off

Shaving cream is a cosmetic product that is applied to the skin and rinsed off, and from which substances may remain on the skin for a prolonged duration. Therefore, the scenario of using shaving cream fits the generic exposure scenario for dermal exposure from residues of rinse-off products (Section 4.2.2). The ***dermal-direct product contact-instant application*** model is used to estimate dermal exposure to substances in shaving cream.

Product amount

The product amount used is derived from Ficheux et al. (2016). A Q-factor of 4 is assigned, as the product amount is derived from a high-quality study involving a large number of participants. For the age group for which no data was available, a Q-factor of 2 is assigned for the calculated product amount, as the default was not based on an empirical value for that age group.

Retention factor

For rinse-off products, it is assumed that only 10% of the applied product amount is on the consumer's skin or hair following rinse-off (SDA, 2010). In addition, since shaving cream readily dissolves in water and is applied to wet skin, an additional 10% factor is applied (SDA, 2010). Therefore, a retention factor of 0.01 needs to be applied to reflect the amount of product actually on the consumer's skin following rinse-off. The Q-factor assigned is 1, as the retention factor is based on assumptions.

Table 15.2 Default values for estimating consumer exposure to substances in shaving cream (body) residues after rinsing

Default value		**Q-factor**	**Source(s)**
General			
Frequency Adults (19+ years)	104 per year	3	Biesterbos et al., 2013
Children (9-13 years)	104 per year	3	Biesterbos et al., 2013
Dermal-direct product contact-instant application			
Exposed area			

Default value		Q-factor	Source(s)
Adults (19+ years)	9100 cm^2	3	Half total body (Te Biesebeek et al., 2014)
Children (9-13 years)	7000 cm^2	3	Half total body (Te Biesebeek et al., 2014)
Product amount			
Adults (19+ years)	18.4 g	4	Ficheux et al., 2016
Children (9-13 years)	15.3 g	2	Section 4.5
Retention factor	0.01	1	See above

15.2 After hair removal products

Aftershave (or after hair removal product) is a liquid or cream product that is applied to the skin and left on following hair removal. Aftershave can be a spray or a lotion, and can be used on the face or the body Some aftershave products are also sold with or as anti-chafing products. Anti-chafing products are used to minimise skin irritation caused by friction between skin and skin or clothing, and is anticipated to be used similarly to the aftershave body scenario.

15.2.1 Aftershave spray (face)

Scenario for consumer exposure

During application, the aftershave spray is sprayed towards the skin, and the product is left on for a prolonged duration. Therefore, the consumer exposure scenarios for aftershave spray are anticipated to run by inhalation of non-volatile substances in sprayed droplets, inhalation of volatile substances that remain in the air after spraying, and by dermal contact after spraying. In this section, the exposure to aftershave spray is described in two separate scenarios: inhalation exposure during spraying and dermal exposure after spraying.

Frequency

The frequency of use is based on data from Wu et al. (2010) on aftershave use (product type not specified). The frequency of use by ages 9-13 is based on data relating to ages 12-17 in Wu et al. (2010). Therefore, the frequency presented below may be more representative of the upper end of the 9-13 age group. The Q-factor assigned is 4, as the data was derived from a high-quality study including comprehensive data on shaving behaviour.

15.2.1.1 Application: spraying

Aftershave sprays are mostly used in the bathroom (EPHECT, 2012). Inhalation exposure to both volatile and non-volatile substances is anticipated in this scenario. The consumer can inhale non-volatile substances available for inhalation in the sprayed droplets, since volatile substances are expected to remain in the indoor air after spraying. The ***inhalation-exposure to spray-spraying*** model is used to estimate the inhalation exposure to the non-volatile substances. The ***spraying towards person*** option is considered as spray is directed towards the consumer's face (Section 4.1.3.2). The ***inhalation-exposure to spray-instantaneous release*** model is used to estimate inhalation

exposure to volatile substances. The spray is directed towards the person, so that the volatile substances are released into the user's personal breathing zone (Section 4.1.3.1). The spray duration, mass generation rate, airborne fraction, density non-volatile, and initial particle distribution defaults for aftershave sprays are assumed to be similar to those of eau de toilette.

Released mass
The released mass is set to be equal to the product amount that is sprayed out of the bottle or can. The product amount used by adults is calculated using the mass generation rate (0.1 g/s; Delmaar & Bremmer, 2009) and spray duration (4.9 s), and the released mass default is set accordingly. A Q-factor of 2 is assigned, as the value is calculated using a mass generation rate and a spray duration for eau de toilette. The product amount used by children is calculated using a surface area adjustment based on the product amount used by adults (Section 4.5), and a Q-factor of 2 is assigned.

Table 15.3 Default values for estimating consumer exposure to substances in aftershave spray during spraying

Default value		**Q-factor**	**Source(s)**
General			
Frequency Adults (19+ years) Children (9-13 years)[1]	 353 per year 456 per year	 4 4	 Wu et al., 2010 Wu et al., 2010
Inhalation-exposure to spray-spraying-spraying towards person[2]			
Spray duration	4.9 s	2	Eau de toilette spray (Chapter 14)
Exposure duration	5 min	2	Section 4.1.3.2
Room volume	10 m^3	4	Section 4.1.3.2
Room height	2.5 m	4	Section 4.1.3.2
Ventilation rate	2 per hour	3	Section 4.1.3.2
Cloud volume	0.0625 m^3	1	Section 4.1.3.2
Mass generation rate	0.1 g/s	2	Eau de toilette spray (Section 14)
Airborne fraction	0.02	2	Eau de toilette spray (Section 14)
Density non-volatile	1.5 g/cm^3	1	Eau de toilette spray (Section 14)
Initial particle distribution Median (C.V.)	 2.7 µm 0.73	2	Eau de toilette spray (Section 14)
Inhalation cut-off diameter	15 µm	3	Delmaar & Schuur, 2017
Inhalation-exposure to spray-instantaneous release[3]			
Exposure duration	9.8 s	1	Twice the spray duration, Section 4.1.3.1
Released mass Adults (19+ years) Children (9-13 years)	 0.49 g 0.50 g	 2 2	See above

Default value		Q-factor	Source(s)
Room volume	1 m^3	1	Section 4.1.3.1
Ventilation rate	2 per hour	1	Section 4.1.3.1

1: The frequency of use by ages 9-13 is based on data relating to ages 12-17 in Wu et al. (2010). Therefore, the frequency presented in the table may be more representative of the upper end of the 9-13 year old age group.
2: Applies to non-volatile substances
3: Applies to volatile substances

15.2.1.2 Application: leave-on

Aftershave spray is applied to the skin following hair removal and left on for a prolonged duration. Therefore, the scenario of using aftershave fits the generic exposure scenario for dermal exposure from sprays (Section 4.2.4). The ***dermal-direct product contact-instant application*** model is used to estimate dermal exposure to substances in aftershave.

Product amount

The product amount used by adults is calculated using the mass generation rate (0.1 g/s; Delmaar & Bremmer, 2009) and spray duration (4.9 s), and the released mass default is set accordingly. A Q-factor of 2 is assigned, as the value is calculated using a mass generation rate and a spray duration for eau de toilette. The product amount used by children is calculated using a surface area adjustment based on the product amount used by adults (Section 4.5), and a Q-factor of 2 is assigned.

Retention factor

For spray products, it is assumed that only 85% of the sprayed product amount is on the consumer's skin after spraying (Bremmer et al., 2006a). Therefore, a retention factor of 0.85 needs to be applied to reflect the amount of product actually on the consumer's skin after spraying. The Q-factor assigned is 1, as the retention factor is based on assumptions.

Table 15.4 Default values for estimating consumer exposure to substances in aftershave following application

Default value		Q-factor	Source(s)
General			
Frequency Adults (19+ years) Children (9-13 years)[1]	 353 per year 456 per year	 4 4	 Wu et al., 2010 Wu et al., 2010
Dermal-direct product contact-instant application			
Exposed area Adults (19+ years) Children (9-13 years)	 300 cm^2 263 cm^2	 3 3	 Quarter head (Te Biesebeek et al., 2014) Quarter head (Te Biesebeek et al., 2014)
Product amount Adults (19+ years) Children (9-13 years)	 0.49 g 0.50 g	 2 2	See above
Retention factor	0.85		See above

1:The frequency of use by ages 9-13 is based on data relating to ages 12-17 in Wu et al. (2010). Therefore, the frequency presented in the table may be more representative of the upper end of the 9-13 year old age group.

15.2.2 Aftershave lotion (face)

Scenario for consumer exposure

During application, the user applies the aftershave directly to the skin of the face following shaving or hair removal. The aftershave is left on the skin for a prolonged duration. Therefore, the consumer exposure scenarios for aftershave lotion are anticipated to run by dermal contact and inhalation of evaporated substances during leave-on.

Frequency

The frequency of use is based on aftershave use data from Wu et al. (2010) (product type not specified). The frequency of use by ages 9-13 is based on data relating to ages 12-17 from Wu et al. (2010). Therefore, the frequency presented below may be more representative of older users. The Q-factor assigned is 4, as the data was derived from a high-quality study including comprehensive data on shaving behaviour.

15.2.2.1 Application: leave-on

Aftershave is applied to the skin following hair removal and left on for a prolonged duration. Therefore, the scenario of using aftershave fits the generic exposure scenarios for dermal exposure from leave-on products (Section 4.2.1) and for inhalation of substances evaporating from leave-on products (Section 4.1.1). The ***dermal-direct product contact-instant application*** model is used to estimate dermal exposure to substances in aftershave. The ***inhalation-exposure to vapour-evaporation-constant release area*** model is used to estimate inhalation exposure to substances evaporating from aftershave, and the ***product is substance in pure form*** option is selected.

Product amount

The product amount used is derived from Ficheux et al. (2016). A Q-factor of 4 is assigned, as the product amount is derived from a high-quality study involving a large number of participants. For the age group for which no data was available, a Q-factor of 2 is assigned for the calculated product amount as the default was not based on an empirical value for that age group.

Table 15.5 Default values for estimating consumer exposure to substances in aftershave lotion following application

Default value		**Q-factor**	**Source(s)**
General			
Frequency Adults (19+ years) Children (9-13 years)[1]	 353 per year 456 per year	 4 4	 Wu et al., 2010 Wu et al., 2010
Inhalation-exposure to vapour-evaporation-constant release area			
Exposure duration Adults (19+ years) Children (9-13 years)	 24 hours[2] 19 hours	 1 4	Section 4.1.1
Product amount			Product amount (dermal)

Default value		Q-factor	Source(s)
Adults (19+ years) Children (9-13 years)	3.7 g 3.7 g	4 2	
Room volume	20 m^3	3	Section 4.1.1
Ventilation rate	0.6 per hour	3	Section 4.1.1
Application temperature	32 °C	4	Section 4.1.1
Mass transfer coefficient	10 m/h	2	Section 4.1.1
Release area Adults (19+ years) Children (9-13 years)	 300 cm^2 263 cm^2	 3 3	Exposed area (dermal)
Emission duration Adults (19+ years) Children (9-13 years)	 24 hours[2] 19 hours	 1 4	Exposure duration
Dermal-direct product contact-instant application			
Exposed area Adults (19+ years) Children (9-13 years)	 300 cm^2 263 cm^2	 3 3	 Quarter head (Te Biesebeek et al., 2014) Quarter head (Te Biesebeek et al., 2014)
Product amount Adults (19+ years) Children (9-13 years)	 3.7 g 3.7 g	 4 2	 Ficheux et al., 2016 Section 4.5

1: The frequency of use by ages 9-13 is based on data relating to ages 12-17 in Wu et al. (2010). Therefore, the frequency presented in the table may be more representative of the upper end of the 9-13 age group.
2: For adults, the exposure duration and emission duration are set to 24 hours, rather than calculated using the frequency of use, since the frequency of use is less than once per day (Section 4.1.1).

15.2.3 After hair removal spray (body)

Scenario for consumer exposure

During application, the aftershave spray is sprayed towards the skin, and the product is left on for a prolonged duration. Therefore, the consumer exposure scenarios for aftershave spray are anticipated to run by inhalation of non-volatile substances in sprayed droplets, inhalation of volatile substances that remain in the air after spraying, and by dermal contact after spraying. In this section, the exposure to aftershave spray is described in two separate scenarios: inhalation exposure during spraying and dermal exposure after spraying.

Frequency

The frequency of use is derived from Biesterbos et al. (2013). The Q-factor assigned is 3, as it is a high-quality study, but involves limited age groups.

15.2.3.1 Application: spraying

After hair removal body sprays are mostly used in the bathroom (EPHECT, 2012). Inhalation exposure to both volatile and non-volatile substances is anticipated in this scenario. The consumer can inhale non-

volatile substances available for inhalation in the sprayed droplets, since volatile substances are expected to remain in the indoor air after spraying. The ***inhalation-exposure to spray-spraying*** model is used to estimate the inhalation exposure to the non-volatile substances. The ***spraying towards person*** option is considered as spray is directed towards the consumer's face (Section 4.1.3.2). The ***inhalation-exposure to spray-instantaneous release*** model is used to estimate inhalation exposure to volatile substances. The spray is directed towards the person, so that the volatile substances are released into the user's personal breathing zone (Section 4.1.3.1). The density non-volatile and initial particle distribution defaults are assumed to be similar to those of sun protection sprays.

Mass generation rate
After hair removal body sprays are available as pump sprays and aerosol sprays. In this scenario, an aerosol spray is described. Therefore, the mass generation rate of 1.2 g/s for aerosol sprays (Delmaar & Bremmer, 2009; 4.1.3.2) is considered appropriate. The Q-factor assigned is 3, because the underlying dataset is large, but does not refer to any specific exposure scenario.

Airborne fraction
The airborne fraction has not been studied for after hair removal sprays nor for the sun protection products to which is being referred. Their use and occurrence are quite diverse as they come in aerosol and pump spray applications. As a conservative approach the default that is used for sun protection sprays, i.e. based on deodorant spray, is applied here as well. This results in an airborne fraction of 0.9, with a Q-factor of 1, due to the lack of product information and made assumptions.

Released mass
The released mass is set to be equal to the product amount that is sprayed out of the bottle or can. The product amount used is calculated using a surface area adjustment based on the product amount for sun protection sprays. A Q-factor of 2 is assigned, as the product amount is based on sun protection spray rather than on after hair removal body spray.

Table 15.6 Default values for estimating consumer exposure to substances in after hair removal body spray during spraying

Default value		**Q-factor**	**Source(s)**
General			
Frequency	364 per year	3	Biesterbos et al., 2013
Inhalation-exposure to spray-spraying-spraying towards person[1]			
Spray duration Adults (19+ years) Children (9-13 years)	 3.7 s 2.9 s	 2 2	Released mass/mass generation rate (Section 4.1.3.2)
Exposure duration	5 min	2	Section 4.1.3.2

Default value		Q-factor	Source(s)
Room volume	10 m^3	4	Section 4.1.3.2
Room height	2.5 m	4	Section 4.1.3.2
Ventilation rate	2 per hour	3	Section 4.1.3.2
Cloud volume	0.0625 m^3	2	Section 4.1.3.2
Mass generation rate	1.2 g/s	3	Delmaar & Bremmer, 2009
Airborne fraction	0.9	1	See above
Density non-volatile	0.80 g/cm^3	2	Sun protection spray (Section 16.1.1)
Initial particle distribution Median (C.V.)	 10.7 µm 3.4	2	Sun protection spray (Section 16.1.1)
Inhalation cut-off diameter	15 µm	3	Delmaar & Schuur, 2017
Inhalation-exposure to spray-instantaneous release[2]			
Exposure duration Adults (19+ years) Children (9-13 years)	 7.5 s 5.7 s	 1 1	Twice the spray duration, Section 4.1.3.1
Released mass Adults (19+ years) Children (9-13 years)	 4.5 g 3.4 g	 2 2	 See above See above
Room volume	1 m^3	1	Section 4.1.3.1
Ventilation rate	2 per hour	1	Section 4.1.3.1

1: Applies to non-volatile substances
2: Applies to volatile substances

15.2.3.2 Application: leave-on

The scenario of using aftershave fits the generic exposure scenario for dermal exposure from sprays (see Section 4.2.4). The ***dermal-direct product contact-instant application*** model is used to estimate dermal exposure to substances in aftershave.

Product amount

The product amount used is calculated using a surface area adjustment based on the product amount for sun protection sprays. A Q-factor of 2 is assigned, as the product amount is based on sun protection spray rather than on after hair removal body spray.

Retention factor

For spray products, it is assumed that only 85% of the sprayed product amount is on the consumer's skin after spraying (Bremmer et al., 2006a). Therefore, a retention factor of 0.85 needs to be applied to reflect the amount of product actually on the consumer's skin after spraying. The Q-factor assigned is 1, as the retention factor is based on assumptions.

Table 15.7 Default values for estimating consumer exposure to substances in aftershave following application

Default value		Q-factor	Source(s)
General			
Frequency	364 per year	3	Biesterbos et al., 2013
Dermal-direct product contact-instant application			
Exposed area Adults (19+ years) Children (9-13 years)	 9100 cm^2 7000 cm^2	 3 3	 Half total body (Te Biesebeek et al., 2014) Half total body (Te Biesebeek et al., 2014)
Product amount Adults (19+ years) Children (9-13 years)	 4.5 g 3.4 g	 2 2	 See above See above
Retention factor	0.85	1	See above

15.2.4 After hair removal lotion (body)

Scenario for consumer exposure

During application, the user applies the aftershave directly to the skin of their body following shaving or hair removal. The aftershave is left on the skin for a prolonged duration. Therefore, the consumer exposure scenarios for aftershave lotion are anticipated to run by dermal contact and inhalation of evaporated substances during leave-on.

Frequency

The frequency of use is derived from Biesterbos et al. (2013). The Q-factor assigned is 3, as it is a high-quality study, but involves limited age groups.

15.2.4.1 Application: leave-on

Aftershave is applied to the skin after hair removal and left on for a prolonged duration. Therefore, the scenario of using aftershave lotion fits the generic exposure scenarios for dermal exposure from leave-on products (see Section 4.2.1) and for inhalation of substances evaporating from leave-on products (Section 4.1.1). The ***dermal-direct product contact-instant application*** model is used to estimate dermal exposure to substances in aftershave. The ***inhalation-exposure to vapour-evaporation-constant release area*** model is used to estimate inhalation exposure to substances evaporating from aftershave, and the ***product is substance in pure form*** option is selected.

Product amount

The product amount used is derived from Ficheux et al. (2016). A Q-factor of 4 is assigned, as the product amount is derived from a high-quality study involving a large number of participants. For the age group for which no data was available, a Q-factor of 2 is assigned for the calculated product amount as the default was not based on an empirical value for that age group.

Table 15.8 Default values for estimating consumer exposure to substances in aftershave lotion following application

Default value		Q-factor	Source(s)
General			
Frequency	364 per year	3	Biesterbos et al., 2013
Inhalation-exposure to vapour-evaporation-constant release area			
Exposure duration	24 hours[1]	3	Section 4.1.1
Product amount Adults (19+ years) Children (9-13 years)	 11.4 g 9.5 g	 4 2	Product amount (dermal)
Room volume	20 m^3	3	Section 4.1.1
Ventilation rate	0.6 per hour	3	Section 4.1.1
Application temperature	32 °C	4	Section 4.1.1
Mass transfer coefficient	10 m/h	2	Section 4.1.1
Release area Adults (19+ years) Children (9-13 years)	 9100 cm^2 7000 cm^2	 3 3	Exposed area (dermal)
Emission duration	24 hours[1]	3	Exposure duration
Dermal-direct product contact-instant application			
Exposed area Adults (19+ years) Children (9-13 years)	 9100 cm^2 7000 cm^2	 3 3	 Half total body (Te Biesebeek et al., 2014) Half total body (Te Biesebeek et al., 2014)
Product amount Adults (19+ years) Children (9-13 years)	 11.4 g 9.5 g	 4 2	 Ficheux et al., 2016 Section 4.5

1: The exposure duration and emission duration are set to 24 hours, rather than calculated using the frequency of use, since the frequency of use is less than once per day (Section 4.1.1).

15.3 Hair removal cream/depilatory

Hair on the body can be removed in a variety of ways including shaving (see Section 15. 1) or using chemical hair removal creams, waxes, gels, roll-ons or foam/sprays. Only the chemical-based hair removal creams or depilatory creams are examined in this section. Hair removal creams/depilatories are anticipated to be used by ages 9 and up.

Scenario for consumer exposure
During application, the user applies the hair removal cream directly to the skin of the legs and then removes the cream, along with the hair. A fraction of the product remains on the skin, nonetheless. Therefore, the consumer exposure scenario for hair removal cream is anticipated to run by dermal contact following rinse-off.

Frequency
For frequency of use, information was derived from the CTFA (1983) and from Bremmer et al. (2006a). When comparing these values it was determined that the highest value from the CTFA survey was similar to the reported value from Bremmer et al. (2006a). Therefore, frequency of use is derived from the CTFA (1983) survey. A Q-factor of 4 is assigned, as the study is of high quality and involves a large number of participants.

15.3.1 *Application: rinse-off*

Hair removal cream is a cosmetic product that is applied to the skin and rinsed off. Therefore, the scenario of using hair removal cream fits the generic exposure scenario for dermal exposure from residues of rinse-off products (see Section 4.2.2). The ***dermal-direct product contact-instant application*** model is used to estimate dermal exposure to substances in hair removal cream.

Product amount
The product amount used is derived from Ficheux et al. (2016). A Q-factor of 4 is assigned, as the product amount is derived from a high-quality study involving a large number of participants. For the age group for which no data was available, a Q-factor of 2 is assigned for the calculated product amount as the default was not based on an empirical value for that age group.

Retention factor
For rinse-off products, it is assumed that only 10% of the applied product amount is on the consumer's skin or hair following rinse-off (SDA, 2010). Therefore, a retention factor of 0.1 needs to be applied to reflect the amount of product actually on the consumer's skin following rinse-off. The Q-factor assigned is 1, as the retention factor is based on assumptions.

Table 15.9 Default values for estimating consumer exposure to substances in hair removal cream following application

Default value		**Q-factor**	**Source(s)**
General			
Frequency Adults (19+ years) Children (9-13 years)	 36 per year 36 per year	 3 3	 CTFA, 1983 CTFA, 1983
Dermal-direct product contact-instant application			
Exposed area Adults (19+ years) Children (9-13 years)	 5900 cm^2 4210 cm^2	 3 3	 Legs (Te Biesebeek et al., 2014) Legs (Te Biesebeek et al., 2014)
Product amount Adults (19+ years) Children (9-13 years)	 46.7 g 39.3 g	 4 2	 Ficheux et al., 2016 Section 4.5
Retention factor	0.1	1	See above

16 Sun cosmetics

Sun cosmetics are products that are used before, during, or after exposure to sunlight. Sun cosmetics include sunscreen/sun protection (which contains UV filters to protect the skin from the sun's rays) and after sun products (which are applied to soothe the skin following damage from the sun).

Sun cosmetics are available as creams, lotions, oils, gels, liquids, and spray products. Exposure to substances in sun cosmetics can occur through:

- Direct dermal contact;
- Inhalation of evaporated substances;
- Inhalation of non-volatile and volatile substances in sprays.

Sun cosmetics are applied to various parts of the body and are left on for a prolonged duration. These products are anticipated to be used by, or on, ages 6 months and up.

16.1 Sun protection products

Sunscreens are topical products that absorb or reflect some of the sun's ultraviolet (UV) radiation and thus help protect against sunburn. They come in a variety of product types including creams, lotions, powders, sprays, gels or ointments, and they are classified as either chemical filters (absorb some of the UVA and UVB radiation and convert it into heat) or physical filters (small particles that scatter and reflect both UVB and UVA radiation) (Government of Canada, 2017). All sunscreens must have a sun protection factor (SPF) on their labels, which informs consumers on the length of time it takes for exposed skin to burn (Government of Canada, 2017). This SPF is determined by manufacturers adhering to an internationally agreed upon standard thickness of 2 mg/cm^2 (Reich et al., 2009; Petersen and Wulf 2014), i.e. the protection claimed by the SPF rating on a bottle of sunscreen is based on the assumption that the product is applied with a thickness of 2 mg/cm^2. Even though various studies have shown that consumers may apply much less (0.39 to about 1 mg/cm^2) (Reich et al., 2009; Autier et al., 2001; Diaz et al., 2012; Neale et al., 2002; Szepietowski et al., 2004), the default product amount for cream/lotion sunscreen is based on the assumption that the user would apply the sunscreen with a thickness of 2 mg/cm^2.

On the basis of survey data from Ficheux et al. (2015), it is assumed that sun protection products and after sun products may be applied to the entire body and face, except for areas covered by a bathing suit, for 2 months per year. According to various sun safety guidelines, sunscreen should be applied to the face daily when the UV index is 3 or higher (approximately 6 months per year). However, in this section, a scenario for sunscreen used only on the face is not presented.

16.1.1 Sun protection spray

Scenario for consumer exposure

During application, the sun protection spray is sprayed towards the skin, and the product is left on for a prolonged duration. Therefore, the consumer exposure scenarios for sun protection spray are anticipated to run by inhalation of non-volatile substances in sprayed droplets, inhalation of volatile substances that remain in the air after spraying, and by dermal contact after spraying. In this section, the exposure to sun protection spray is described in two separate scenarios: inhalation exposure during spraying and dermal exposure after spraying.

Frequency

The frequency of use is derived from the survey data reported by Ficheux et al. (2015) for pump sunscreen spray. It is assumed that aerosol sunscreen spray would be used with the same frequency as pump sunscreen spray. According to the survey data, consumers who use sun protection products apply it for less than 2 months per year. Therefore, sun protection spray is assumed to be used at a frequency of 1.85 times per day for adults and 2 times per day for infants for a duration of 2 months (approximately 60 days). The Q-factor assigned for frequency is 4, as it is derived from a high-quality study involving a large number of participants.

16.1.1.1 Application: spraying

In this scenario, the consumer sprays the sun protection spray towards their skin while indoors and then goes outdoors. Inhalation exposure to both volatile and non-volatile substances is anticipated in this scenario. The consumer can inhale non-volatile substances available for inhalation in the sprayed droplets, since volatile substances are expected to remain in the indoor air after spraying. The ***inhalation-exposure to spray-spraying*** model is used to estimate the inhalation exposure to the non-volatile substances (Section 4.1.3.2). The ***spraying towards person*** option is considered relevant as spray is directed towards the consumer's skin. The ***inhalation-exposure to spray-instantaneous release*** model is used to estimate inhalation exposure to volatile substances (Section 4.1.3.1).

Exposure duration

ConsExpo Web estimates inhalation exposure for indoor use of consumer products. Therefore, the default exposure duration refers to the time the consumer spends indoors during and after the application of the sun protection spray, which is set to 30 min, because it is recommended to apply sunscreen half an hour before going outdoors (KWF, 2018). A Q-factor of 2 is assigned, because the default is derived from a recommendation for healthy use of sunscreen and the actual time spent indoors using sunscreen remains unclear.

Room volume – non-volatile

The room volume here refers to the room in which the consumer resides during and after application of the spray to the skin. Sun care products are developed for outdoor use and it is recommended to apply sunscreen half an hour before going outdoors (KWF, 2018). Therefore, it is assumed that sun protection spray is applied indoors. The default room volume is set to 20 m^3, representing an unspecified room as

described in the General Fact Sheet (Te Biesebeek et al., 2014). The Q-factor assigned is 3 for this scenario, since it is unclear in which room the consumer may apply the sun protection spray.

Mass generation rate
Sun protection sprays are available as pump sprays and aerosol sprays. In this scenario, an aerosol spray is described. Therefore, the mass generation rate of 1.2 g/s for aerosol sprays (Delmaar & Bremmer, 2009; 4.1.3.2) is considered appropriate. The Q-factor assigned is 3, because the underlying dataset is large but does not refer to any specific exposure scenario.

Airborne fraction
The airborne fraction for sun protection sprays is based on the assumption that its application is similar to deodorant spray and. especially for aerosol sun protection sprays, it is assumed that the airborne fraction will be in the same range. Therefore, the airborne fraction is set to 0.9. The Q-factor assigned is 1, as the default relies heavily on the assumption made.

Density non-volatile
The two product samples of sun protection spray investigated by Calderon et al. (2017) have densities of 0.80 and 0.98 g/cm^3. The default density non-volatile is set to 0.80 g/cm^3 as this value yields the highest exposure estimates in ConsExpo Web. The Q-factor assigned is 3, because the underlying data specifically refers to the density of sun protection sprays, but only comprises two samples.

Initial particle distribution
Calderon et al. (2017) measured the initial particle distribution of two different sun protection sprays. The sizes of the sprayed droplets fit a log-normal distribution with a median mass diameter of 10.7 µm with a C.V. of 3.4. The Q-factor assigned is 3, because the underlying data only refers to 2 samples of sun protection sprays. It is noted that the data provided by Berrada-Gomez et al. (2023) show larger droplets. However, a PSD could not be derived from that data.

Released mass
The released mass is set to be equal to the product amount that is sprayed out of the bottle or can. The product amount used is derived from Ficheux et al. (2016) for pump sunscreen spray. It is assumed that the product amount for aerosol sunscreen spray would be similar to pump sunscreen spray. A Q-factor of 4 is assigned, as the default is based on a high-quality study involving a large number of participants.

Table 16.1 Default values for estimating consumer exposure to substances in sun protection spray during spraying

Default value		**Q-factor**	**Source(s)**
General			
Frequency[1] Adults (19+ years) Infants (6-11 months)	 111 per year 120 per year[2]	 4 4	 Ficheux et al., 2015 Ficheux et al., 2015

Default value		Q-factor	Source(s)
Inhalation-exposure to spray-spraying-spraying towards person[3]			
Spray duration Adults (19+ years) Infants (6-11 months)	 7.0 s 3.2 s	 3 3	Released mass/mass generation rate (Section 4.1.3.2)
Exposure duration	30 min	2	See above
Room volume	20 m^3	3	Section 4.1.3.2
Room height	2.5 m	4	Section 4.1.3.2
Ventilation rate	0.6 per hour	3	Section 4.1.3.2
Cloud volume	0.0625 m^3	2	Section 4.1.3.2
Mass generation rate	1.2 g/s	3	Delmaar & Bremmer, 2009
Airborne fraction	0.9	1	See above
Density non-volatile	0.80 g/cm^3	3	Calderon et al., 2017
Initial particle distribution Median (C.V.)	 10.7 µm 3.4	3	Calderon et al., 2017
Inhalation cut-off diameter	15 µm	3	Delmaar & Schuur, 2017
Inhalation-exposure to spray-instantaneous release[4]			
Exposure duration Adults (19+ years) Infants (6-11 months)	 13.9 s 6.3 s	 1 1	Twice the spray duration, Section 4.1.3.1
Released mass Adults (19+ years) Infants (6-11 months)	 8.4 g 3.8 g	 4 4	 Ficheux et al., 2016 Ficheux et al., 2016
Room volume	1 m^3	1	Section 4.1.3.1
Ventilation rate	0.6 per hour	1	Section 4.1.3.1

1: See above. Sun protection products are anticipated to be used for less than 2 months per year.
2: The frequency of use for infants (6-11 months) is set to the 95th percentile value, as the estimated 75th percentile value was higher than the reported 95th percentile value.
3: Applies to non-volatile substances
4: Applies to volatile substances

16.1.1.2 Application: leave-on

Sunscreen spray is a cosmetic product that is sprayed onto to the skin and left on for a prolonged duration. Therefore, the scenario of using sun protection spray fits the generic exposure scenario for dermal exposure from sprays (Section 4.2.4). The ***dermal-direct product contact-instant application*** model is used to estimate dermal exposure to substances in sun protection spray.

Exposed area

It is assumed that sun protection products and after sun products may be applied to the entire body and face, except for areas covered by a bathing suit. Due to a lack of data on the surface area of bathing suit

coverage, the exposed area is assumed to be similar to the surface area of the total body except for the head.

Product amount
The product amount is derived from Ficheux et al. (2016) for pump sunscreen spray. It is assumed that the product amount for aerosol sunscreen spray would be similar to pump sunscreen spray. A Q-factor of 4 is assigned, as the default is based on a high-quality study involving a large number of participants.

Retention factor
For spray products, it is assumed that only 85% of the sprayed product amount is on the consumer's skin after spraying (Bremmer et al., 2006a). Therefore, a retention factor of 0.85 needs to be applied to reflect the amount of product actually on the consumer's skin after spraying.

Table 16.2 Default values for estimating consumer exposure to substances in sun protection spray following application

Default value		**Q-factor**	**Source(s)**
General			
Frequency[1] Adults (19+ years) Infants (6-11 months)	 111 per year 120 per year[2]	 4 4	 Ficheux et al., 2015 Ficheux et al., 2015
Dermal-direct product contact-instant application			
Exposed area Adults (19+ years) Infants (6-11 months)	 17000 cm^2 3350 cm^2	 3 3	 See above See above
Product amount Adults (19+ years) Infants (6-11 months)	 8.4 g 3.8 g	 4 4	 Ficheux et al., 2016 Ficheux et al., 2016
Retention factor	0.85		See above

1: See above. Sun protection products are anticipated to be used for less than 2 months per year.
2: The frequency of use for infants (6-11 months) is set to the 95th percentile value, as the estimated 75th percentile value was higher than the reported 95th percentile value.

16.1.2 *Sun protection cream/milk/lotion*

Scenario for consumer exposure
During application, the sun protection cream/milk/lotion is applied to the skin, and the product is left on for a prolonged duration. Therefore, the consumer exposure scenarios for sun protection cream/milk/lotion are anticipated to run by dermal contact and by inhalation of evaporated substances during leave-on.

Frequency
The frequency of use is derived from the survey data reported by Ficheux et al. (2015), which showed that consumers of sun protection products apply it for less than 2 months per year. Therefore, the frequency of use of sunscreen on the body is assumed to be 1.88 times per day for adults and 2 times per day for infants for a duration of 2

months (approximately 60 days). The Q-factor assigned for frequency is 4, as it is derived from a high-quality study involving a large number of participants.

16.1.2.1 Application: leave-on

Sun protection cream/milk/lotion is applied to the skin and the product is left on for a prolonged duration. The user is expected to be outdoors during the leave-on period, whereas ConsExpo simulates inhalation exposure for the indoor environment. Therefore, the inhalation exposure is assumed to be mainly during a 30-minute period between application of the product and the user going outdoors. Therefore, the scenario of using sun protection cream fits the generic exposure scenarios for dermal exposure from leave-on products (see Section 4.2.1) and for inhalation of substances evaporating from leave-on products (Section 4.1.1). The ***dermal-direct product contact-instant application*** model is used to estimate dermal exposure to substances in sun protection cream/milk/lotion. The ***inhalation-exposure to vapour-evaporation-constant release area*** model is used to estimate inhalation exposure to substances evaporating from sun protection cream/milk/lotion and the ***product is substance in pure form*** option is selected.

Exposure duration

ConsExpo Web estimates inhalation exposure for indoor use of consumer products. The default exposure duration therefore refers to the time the consumer spends indoors during and after the application of the sun protection cream, which is set to 30 min, because it is recommended to apply sunscreen half an hour before going outdoors (KWF, 2018). A Q-factor of 2 is assigned, because the default is derived from a recommendation for healthy use of sunscreen while the actual time spent indoors using sunscreen remains unclear.

Exposed area

It is assumed that sun protection products and after sun products may be applied to the entire body and face, except for areas covered by a bathing suit. Due to a lack of data on the surface area of bathing suit coverage, the exposed area is assumed to be similar to the surface area of the total body except for the head.

Product amount

The product amount is based on the assumption that the user would apply the sunscreen with a thickness of 2 mg/cm^2. A Q-factor of 4 is assigned, as the product amount is based on an internationally agreed upon standard thickness for sunscreen.

Table 16.3 Default values for estimating consumer exposure to substances in sun protection cream/milk/lotion following application

Default value		**Q-factor**	**Source(s)**
General			
Frequency[1] Adults (19+ years) Infants (6-11 months)	 113 per year 120 per year	 4 4	 Ficheux et al., 2015 Ficheux et al., 2015
Inhalation-exposure to vapour-evaporation-constant release area			

Default value		Q-factor	Source(s)
Exposure duration	30 min	2	See above
Product amount Adults (19+ years) Infants (6-11 months)	 34.0 g 6.7 g	 4 4	Product amount (dermal)
Room volume	20 m^3	3	Section 4.1.1
Ventilation rate	0.6 per hour	3	Section 4.1.1
Application temperature	32˚C	4	Section 4.1.1
Mass transfer coefficient	10 m/h	2	Section 4.1.1
Release area Adults (19+ years) Infants (6-11 months)	 17000 cm^2 3350 cm^2	 3 3	Exposed area (dermal)
Emission duration	30 min	2	Exposure duration
Dermal-direct product contact-instant application			
Exposed area Adults (19+ years) Infants (6-11 months)	 17000 cm^2 3350 cm^2	 3 3	 See above See above
Product amount Adults (19+ years) Infants (6-11 months)	 34.0 g 6.7 g	 4 4	 See above See above

1: See above. Sun protection products are anticipated to be used for less than 2 months per year.

16.2 After sun products

After sun products are sprays or lotions applied to the skin following exposure to the sun. They can provide relief to sunburns and/or a cooling/soothing sensation to the skin.

16.2.1 After sun spray

Scenario for consumer exposure

During application, the user sprays the after sun spray directly towards their skin and leaves the product on for a prolonged duration. Therefore, the consumer exposure scenarios for after sun spray are anticipated to run by inhalation of non-volatile substances in sprayed droplets, by inhalation of volatile substances that remain in the air after spraying, and by dermal contact after spraying. In this section, the exposure to after sun spray is described in two separate scenarios: inhalation exposure during spraying and dermal exposure after spraying.

Frequency

It is assumed that after sun spray would be used with the same frequency as sun protection spray. The Q-factor assigned for frequency is 3, as is the default is based on data from a high-quality study involving a large number of participants, but relates to sun protection spray.

16.2.1.1 Application: spraying

In this scenario, the consumer sprays the after sun spray towards their skin and the product is left on for a prolonged duration. Inhalation

exposure to both volatile and non-volatile substances is anticipated in this scenario. The consumer can inhale non-volatile substances available for inhalation in the sprayed droplets, since volatile substances are expected to remain in the indoor air after spraying. The ***inhalation-exposure to spray-spraying*** model is used to estimate the inhalation exposure to the non-volatile substances (Section 4.1.3.2). The ***spraying towards person*** option is considered relevant as spray is directed towards the consumer's skin. The ***inhalation-exposure to spray-instantaneous release*** model is used to estimate inhalation exposure to volatile substances (Section 4.1.3.1). The density non-volatile and initial particle distribution defaults are assumed to be similar to those for sun protection sprays.

Mass generation rate
After sun sprays are available as pump sprays and aerosol sprays. In this scenario, an aerosol spray is described. Therefore, the mass generation rate of 1.2 g/s for aerosol sprays (Delmaar & Bremmer, 2009; see Section 4.1.3.2) is considered appropriate. The Q-factor assigned is 3, because the underlying dataset is large but does not refer to any specific exposure scenario.

Airborne fraction
The airborne fraction for after sun sprays is, similarly to for sun protection sprays, based on the assumption that its application is similar to deodorant spray, and especially for aerosol sun protection sprays, it is assumed that the airborne fraction will be in the same range. Therefore, the airborne fraction is set to 0.9. The Q-factor assigned is 1, as the default relies heavily on the assumptions made.

Released mass
The released mass is set to be equal to the product amount that is sprayed out of the bottle or can. The product amount used is assumed to be similar to the product amount for sun protection spray derived from Ficheux et al. (2016). A Q-factor of 2 is assigned for the product amount as it is based on sunscreen spray, rather than on after sun spray.

Table 16.4 Default values for estimating consumer exposure to substances in after sun spray during spraying

Default value		**Q-factor**	**Source(s)**
General			
Frequency Adults (19+ years) Infants (6-11 months)	 111 per year 120 per year	 3 3	 See above See above
Inhalation-exposure to spray-spraying-spraying towards person[1]			
Spray duration Adults (19+ years)) Infants (6-11 months)	 7.0 s 3.2 s	 2 2	Released mass/mass generation rate (Section 4.1.3.2)
Exposure duration	5 min	2	Section 4.1.3.2
Room volume	10 m^3	4	Section 4.1.3.2
Room height	2.5 m	4	Section 4.1.3.2

Default value		Q-factor	Source(s)
Ventilation rate	2 per hour	3	Section 4.1.3.2
Cloud volume	0.0625 m^3	2	Section 4.1.3.2
Mass generation rate	1.2 g/s	3	Delmaar and Bremmer, 2009
Airborne fraction	0.9	1	See above
Density non-volatile	0.80 g/cm^3	2	Sun protection spray (Section 16.1.1)
Initial particle distribution Median (C.V.)	 10.7 µm 3.4	2	Sun protection spray (Section 16.1.1)
Inhalation cut-off diameter	15 µm	3	Delmaar & Schuur, 2017
Inhalation-exposure to spray-instantaneous release[2]			
Exposure duration Adults (19+ years) Infants (6-11 months)	 13.9 s 6.3 s	 1 1	Twice the spray duration, Section 4.1.3.1
Released mass Adults (19+ years)) Infants (6-11 months)	 8.4 g 3.8 g	 2 2	 See above See above
Room volume	1 m^3	1	Section 4.1.3.1
Ventilation rate	2 per hour	1	Section 4.1.3.1

1: Applies to non-volatile substances
2: Applies to volatile substances

16.2.1.2 Application: leave-on

After sun spray is sprayed onto to the skin and left on for a prolonged duration. Therefore, the scenario of using after sun spray fits the generic exposure scenario for dermal exposure from sprays (Section 4.2.4). The ***dermal-direct product contact-instant application*** model is used to estimate dermal exposure to substances in after sun spray.

Exposed area

It is assumed that sun protection products and after sun products may be applied to the entire body and face, except for areas covered by a bathing suit. Due to a lack of data on the surface area of bathing suit coverage, the exposed area is assumed to be similar to the surface area of the total body except for the head.

Product amount

The product amount used is assumed to be similar to the product amount for sun protection spray derived from Ficheux et al. (2016). A Q-factor of 2 is assigned for the product amount as it is based on sunscreen spray, rather than after sun spray.

Retention factor

For spray products, it is assumed that only 85% of the sprayed product amount is on the consumer's skin after spraying (Bremmer et al., 2006a). Therefore, a retention factor of 0.85 needs to be applied to reflect the amount of product actually on the consumer's skin after

spraying. The Q-factor assigned is 1, as the retention factor is based on assumptions.

Table 16.5 Default values for estimating consumer exposure to substances in after sun spray following application

Default value		Q-factor	Source(s)
General			
Frequency Adults (19+ years) Infants (6-11 months)	 111 per year 120 per year	 3 3	 See above See above
Dermal-direct product contact-instant application			
Exposed area Adults (19+ years) Infants (6-11 months)	 17000 cm^2 3350 cm^2	 3 3	 See above See above
Product amount Adults (19+ years) Infants (6-11 months)	 8.4 g 3.8 g	 2 2	 See above See above
Retention factor	0.85	1	See above

16.2.2 *After sun lotion*

Scenario for consumer exposure

During application, the user applies the product directly to their skin and leaves the product on for a prolonged duration. Therefore, the consumer exposure scenarios for after sun lotion are anticipated to run by dermal contact and by inhalation of evaporated substances during leave-on.

Frequency

It is assumed that after sun lotion would be used with the same frequency as sun protection cream. The Q-factor assigned for frequency is 3 as the default is based on data from a high-quality study involving a large number of participants, but relating to sun protection cream.

16.2.2.1 Application: leave-on

After sun lotion is a cosmetic product that is applied to the skin and from which substances may evaporate for a prolonged duration. Therefore, the scenario of using after sun lotion fits the generic exposure scenarios for dermal exposure from leave-on products (Section 4.2.1) and for inhalation of substances evaporating from leave-on products (Section 4.1.1). The ***dermal-direct product contact-instant application*** model is used to estimate dermal exposure to substances in after sun lotion. The ***inhalation-exposure to vapour-evaporation-constant release area*** model is used to estimate inhalation exposure to substances evaporating from after sun lotion and the ***product is substance in pure form*** option is selected.

Exposed area

It is assumed that sun protection products and after sun products may be applied to the entire body and face, except for areas covered by a bathing suit. Due to a lack of data on the surface area of bathing suit

coverage, the exposed area is assumed to be similar to the surface area of the total body except for the head.

Product amount
The product amount is derived from Ficheux et al. (2016). A Q-factor of 4 is assigned, as the product amount is derived from a high-quality study involving a large number of participants.

Table 16.6 Default values for estimating consumer exposure to substances in after sun lotion following application

Default value		**Q-factor**	**Source(s)**
General			
Frequency Adults (19+ years) Infants (6-11 months)	 113 per year 120 per year	 3 3	 See above See above
Inhalation-exposure to vapour-evaporation-constant release area			
Exposure duration Adults (19+ years) Infants (6-11 months)	 17 h 15 h	 4 4	Section 4.1.1
Product amount Adults (19+ years) Infants (6-11 months)	 20.3 g 7.8 g	 4 4	Product amount (dermal)
Room volume	20 m^3	3	Section 4.1.1
Ventilation rate	0.6 per hour	3	Section 4.1.1
Application temperature	32 °C	4	Section 4.1.1
Mass transfer coefficient	10 m/h	2	Section 4.1.1
Release area Adults (19+ years) Infants (6-11 months)	 17000 cm^2 3350 cm^2	 3 3	Exposed area (dermal)
Emission duration Adults (19+ years) Infants (6-11 months)	 17 h 15 h	 4 4	Exposure duration
Dermal-direct product contact-instant application			
Exposed area Adults (19+ years) Infants (6-11 months)	 17000 cm^2 3350 cm^2	 3 3	 See above See above
Product amount Adults (19+ years) Infants (6-11 months)	 20.3 g 7.8 g	 4 4	 Ficheux et al., 2016 Ficheux et al., 2016

17 Baby care products

Baby care products are products that are marketed for the care of infants, such as diaper cream, baby powder, baby oil, and baby cleanser. The products can be distinguished on the basis of their function, for instance, to cleanse the skin, moisturise the skin, treat and prevent skin irritation, and reduce sweating and accumulation of moisture. In addition to the marketed uses of these products, some of them can also be used for other purposes. For instance baby powder, can also be used on the feet to reduce sweating, and baby oil can be used on the face to remove make-up.

Baby care products are available as creams, lotions, powders, oils, liquids, etcetera. Exposure to baby care products can occur through:

- Direct dermal contact;
- Inhalation of powders;
- Inhalation of evaporated substances.

While these products are marketed for use on infants, some of them are also used by older age groups. Where appropriate, populations in addition to infants and young children are included in the default tables.

17.1 Baby powder

Baby powder is a loose powder that is used by all age groups for various uses. Baby powder is mainly used on the genitals and bottom of infants during diaper changes. Baby powder can also be used on the bodies of children and adults, on the feet to reduce sweating, and on the hair as a dry shampoo, among other uses (Sampedro, 2014; Lee, 2015). In this section, the scenario for dermal exposure from baby powder is described. It is assumed that the body powder inhalation exposure defaults will apply to baby powders (see Section 4.1.4).

Scenario for consumer exposure
For use on adults, the baby powder is assumed to be applied directly to the skin of the body, and the product is left on the skin for a prolonged duration. For use on infants, the baby powder is applied directly to the skin of the genitals and bottom by an adult, and the product is left on the skin for a prolonged duration.

Frequency
The frequency of use is derived from CTFA (1983) for use on infants. However, no 75th percentile values were available for powdering on adults, so the frequency of use is assumed to be once per day on the basis of professional judgment and product labels. A Q-factor of 3 is assigned for data from CTFA (1983) as it is a reliable publication, and a Q-factor of 1 is assigned for adults, as the values were not based on empirical data.

17.1.1 Application: powdering

Baby powder is a loose powdered product assumed to be applied to the body area of an adult for this scenario. As indicated in Section 4.1.4.3,

the generic exposure scenario for inhalation of powder particles applied to the body area (see Section 4.1.4.2) is considered representative of the inhalation exposure to a substance in baby powder.

Released mass
The default released mass is set to 125.8 µg, which refers to the amount of product inhaled for the duration of exposure. The Q-factor assigned is 1, because measurements were obtained from two studies that involved human subjects applying body powder (Section 4.1.4.2)

Exposure duration
The default exposure duration of 5 minutes refers to the time the exposed person is in the room where the substance is being released. The Q-factor assigned is 2.

Room volume
The default room volume for cosmetic body powder products is set to 0.0125 m^3 for the infant to whom the powder is applied as they have a breathing rate of 2,5 L/min (see Appendix III), so that the volume of air inhaled via the user's personal breathing zone during the five-minute duration of exposure is 12.5 L (0.0125 m^3). The adult applying the powder is considered to breathe with a rate of 11 L/min, so that the volume of air inhaled would be 0.055 m^3 .The Q-factor assigned is 1.

Ventilation rate
The ventilation is set to 0 per hour, which best aligns with the equation used to estimate the released mass on the basis of air concentration data.

17.1.2 Application: leave-on

The baby powder used on infants, and used as a body powder on adults, is applied directly to the skin and left on for a prolonged duration. Therefore, the scenario of using baby powder fits the generic exposure scenario for dermal exposure from leave-on products (Section 4.2.1). The ***dermal-direct product contact-instant application*** model is used to estimate dermal exposure to substances in baby powder.

Exposed area
The default for the exposed area is set to be equal to the genitals and bottoms (7% of total body surface area; US-EPA 2011) for infants, and equal to a third of the torso and the feet for adults. Surface area values are derived from the General Fact Sheet and assigned a Q-factor of 3 in accordance with the General Fact Sheet (Te Biesebeek et al., 2014).

Product amount
The product amount per application is derived from CTFA (1983) for infants, and from Anderson et al. (2017) for adults and children. A Q-factor of 3 is assigned for CTFA (1983) data on infants, as it is a high-quality study, but includes limited information on diaper powder. A Q-factor of 3 is assigned for the Anderson et al. (2017) study, as it is a high-quality study but only involves a small number of participants.

Table 17.1 Default values for estimating consumer exposure to substances in baby powder following application

Default value		Q-factor	Source(s)
General			
Frequency Adults (19+ years) Infants (0-5 months)	365 per year 835 per year [1]	1 3	Professional judgment CTFA, 1983
Dermal-direct product contact-instant application			
Exposed area Adults (19+ years) Infants (0-5 months)	3400 cm^2 238 cm^2	3 3	Third of trunk and feet (Te Biesebeek et al., 2014) See above
Product amount Adults (19+ years) Infants (0-5 months)	1.9 g 0.80 g [2]	3 3	Anderson et al., 2017 CTFA, 1983

1: The frequency for infants and applicator is assumed to be the same, and is equal to the frequency of use for ages 0-5 months .
2: The product amount for infants is set to the mean value, as 75th percentile values were not available.

17.2 Diaper cream

Diaper cream (also called baby salve) is used on infants' bottoms for various purposes, mainly to treat or prevent diaper rash. Diaper cream is anticipated to be used on ages 0-3. Some caregivers use diaper cream every time they change their infant's diaper, while some use it only when they see redness or a rash on the infant's bottom. According to surveys by Ficheux et al. (2015) and Gomez-Berrada et al. (2017), the percentage of participants who regularly use diaper cream ranges from 26 to 97.4%.

Dermal absorption of substances in products varies on the basis of many factors, including the anatomy of the skin that is in contact with the product. Since diaper cream may be applied to skin that is abraded or broken, the dermal absorption may higher than if applied to unbroken skin. This difference in dermal absorption is not reflected in the defaults described for this scenario, but it is suggested that a higher level of dermal absorption is considered when estimating exposures to diaper cream.

Scenario for consumer exposure
During application, the product is applied to the infant's bottom, and the product is left on the skin for a prolonged duration. Therefore, the consumer exposure scenarios for diaper cream are anticipated to run by dermal contact and by inhalation of evaporated substances during leave-on.

Frequency
The frequency of use is derived from Gomez-Berrada et al. (2013). A Q-factor of 4 is assigned, as this is a high-quality study involving a large number of participants.

17.2.1 Application: leave-on

Diaper cream is a cosmetic product that is applied directly to the skin and from which substances may evaporate for a prolonged duration. Therefore, the scenario of using diaper cream fits the generic exposure scenarios for dermal exposure from leave-on products (see Section 4.2.1) and for inhalation of substances evaporating from leave-on products (Section 4.1.1). The ***dermal-direct product contact-instant application*** model is used to estimate dermal exposure to substances in diaper cream. The ***inhalation-exposure to vapour-evaporation-constant release area*** model is used to estimate inhalation exposure to substances evaporating from diaper cream and the ***product is substance in pure form*** option is selected.

Exposed area

The default for the exposed area is set to be equal to the surface area of the genitals and bottom (7% total body surface area; US-EPA 2011). Surface area values are derived from the General Fact Sheet and assigned a Q-factor of 3 in accordance with the General Fact Sheet (Te Biesebeek et al., 2014).

Product amount

The product amount available for dermal exposure and inhalation exposure is derived from Gomez-Berrada et al. (2013). A Q-factor of 4 is assigned, as this is a high-quality study involving a large number of participants.

Table 17.2 Default values for estimating consumer exposure to substances in diaper cream following application

Default value		Q-factor	Source(s)
General			
Frequency	975 per year	4	Gomez-Berrada et al., 2013
Inhalation-exposure to vapour-evaporation-constant release area			
Exposure duration	9 hours	4	Section 4.1.1
Product amount	12.2 g	4	Product amount (dermal)
Room volume	20 m^3	3	Section 4.1.1
Ventilation rate	0.6 per hour	3	Section 4.1.1
Application temperature	32 °C	4	Section 4.1.1
Mass transfer coefficient	10 m/h	2	Section 4.1.1
Release area	238 cm^2	4	Exposed area (dermal)
Emission duration	9 hours	4	Exposure duration
Dermal-direct product contact-instant application			
Exposed area	238 cm^2	3	Genitals and bottom (Te Biesebeek et al., 2014)
Product amount	12.2 g	4	Gomez-Berrada et al., 2013

17.3 Baby oil

Baby oil has various uses for infants, children, and adults. For all age groups, the product can be used as a moisturiser, or diluted in bath

water. It can also be used for removing make-up, or as a substitute for shaving cream, among other uses. For the purposes of the fact sheet, and to provide conservative exposure estimates, it is assumed that all age groups may apply baby oil as a moisturiser to the entire body except for the head, in a leave-on scenario.

Scenario for consumer exposure
During application, the product is applied to the skin and left on the skin for a prolonged duration. Therefore, the consumer exposure scenarios for baby oil are anticipated to run by dermal contact and by inhalation of evaporated substances during leave-on.

Frequency
The frequency of use is derived from CTFA (1983) or from Wu et al. (2010), depending on the age group. A Q-factor of 3 is assigned for data from CTFA (1983), as it has limited information on baby oils, and a Q-factor of 4 is assigned for data from Wu et al. (2010) as this is a high-quality study involving a large number of participants.

17.3.1 Application: leave-on

Baby oil is a cosmetic product that is applied directly to the skin and from which substances may evaporate for a prolonged duration. Therefore, the scenario of using baby oil fits the generic exposure scenarios for dermal exposure from leave-on products (Section 4.2.1) and for inhalation of substances evaporating from leave-on products (Section 4.1.1). The ***dermal-direct product contact-instant application*** model is used to estimate dermal exposure to substances in baby oil. The ***inhalation-exposure to vapour-evaporation-constant release area*** model is used to estimate inhalation exposure to substances evaporating from baby oil and the ***product is substance in pure form*** option is selected.

Product amount
The product amount available for dermal exposure and inhalation exposure is derived from CTFA (1983). A Q-factor of 3 is assigned, as it is a high-quality study, but includes limited information on baby oil.

Table 17.3 Default values for estimating consumer exposure to substances in baby oil following application

Default value		Q-factor	Source(s)
General			
Frequency Adults (19+ years) Infants (0-5 months)	 132 per year 689 per year	 3 4	 CTFA, 1983 Wu et al., 2010
Inhalation-exposure to vapour-evaporation-constant release area			
Exposure duration Adults (19+ years) Infants (0-5 months)	 24 hours[1] 13 hours	 1 4	Section 4.1.1
Product amount Adults (19+ years) Infants (0-5 months)	 5.0 g [2] 1.3 g [2]	 3 3	Product amount (dermal)
Room volume	20 m^3	3	Section 4.1.1

Default value		Q-factor	Source(s)
Ventilation rate	0.6 per hour	3	Section 4.1.1
Application temperature	32°C	4	Section 4.1.1
Mass transfer coefficient	10 m/h	2	Section 4.1.1
Release area Adults (19+ years) Infants (0-5 months)	 17000 cm^2 2780 cm^2	 3 3	Exposed area (dermal)
Emission duration Adults (19+ years) Infants (0-5 months)	 24 hours[1] 13 hours	 1 4	Exposure duration
Dermal-direct product contact-instant application			
Exposed area Adults (19+ years) Infants (0-5 months)	 17000 cm^2 2780 cm^2	 3 3	 Total body except head (Te Biesebeek et al., 2014) Total body except head (Te Biesebeek et al., 2014)
Product amount Adults (19+ years) Infants (0-5 months)	 5.0 g [2] 1.3 g [2]	 3 3	 CTFA, 1983 CTFA, 1983

1: For adults, the exposure duration and emission duration are set to 24 hours, rather than calculated using the frequency of use, since the frequency of use is less than once per day (Section 4.1.1).
2: The product amount is set to the mean value, as 75th percentile values were not available.

17.4 Baby cleanser

Baby cleansers are often 2-in-1 body wash and shampoo products, and are therefore used on both the body and the scalp of infants. Baby cleansers are available mainly in liquid form and are used while bathing an infant. Therefore, it is anticipated that baby cleansers will be used on children aged 0-3.

Scenario for consumer exposure
During application, the product is applied to the skin, lathered, and rinsed off immediately. A small fraction of the product remains on the skin after rinsing. Therefore, the consumer exposure scenario for baby cleanser is anticipated to run by dermal contact following rinse-off.

Frequency
The frequency of use is derived from Ficheux et al. (2015). A Q-factor of 4 is assigned, as it is a high-quality study involving a large number of participants.

17.4.1 Application: leave-on

Baby cleanser is a cosmetic product that is applied directly to the skin as a 2-in-1 body wash and shampoo product. Therefore, the scenario of using baby cleanser fits the generic exposure scenario for dermal exposure from residues of rinse-off products (Section 4.2.2). The

dermal-direct product contact-instant application model is used to estimate dermal exposure to substances in baby cleanser.

Product amount
The product amount used is derived from Gomez-Berrada et al. (2017). A Q-factor of 4 is assigned for the product amount, as it is derived from a high-quality study presenting relevant data.

Retention factor
For rinse-off products, it is assumed that only 10% of the applied product amount is on the consumer's skin or hair following rinse-off (SDA, 2010). In addition, since baby cleanser readily dissolves in water and is applied to wet skin, an additional 10% factor is applied (SDA, 2010). Therefore, a retention factor of 0.01 needs to be applied to reflect the amount of product actually on the consumer's skin following rinse-off. The Q-factor assigned is 1, as the retention factor is based on assumptions.

Table 17.4 Default values for estimating consumer exposure to substances in baby cleanser residues after rinsing

Default value		**Q-factor**	**Source(s)**
General			
Frequency Infants (0-5 months)	356 per year	4	Ficheux et al., 2015
Dermal-direct product contact-instant application			
Exposed area Infants (0-5 months)	3090 cm^2	3	Total body except half head (Te Biesebeek et al., 2014)
Product amount Infants (0-5 months)	8.8 g	4	Gomez-Berrada et al., 2017
Retention factor	0.01	1	See above

18 Wipes

Wipes are ready-to-use disposable products, typically consisting of a solid permeable cloth that is saturated in a liquid cleansing product. There are several different types of wipes, which are marketed with a variety of uses including:

- Baby wipes: for cleansing skin of the bottom and genitals while changing a baby's diaper or for cleaning the skin in general (e.g. to clean the face and hands after meal times).
- Facial cleansing wipes: for cleansing the face, e.g. makeup remover, face wash, cosmetic wipes.
- Hand wipes: for cleansing the skin of the hands, individually packaged or in bulk.
- Intimate hygiene wipes: e.g. flushable wipes intended to be a toilet paper replacement, feminine hygiene wipes marketed for women, hygiene wipes marketed for men, etcetera.

Wipes are intended to be used on the skin in various locations of the body (depending on the product type) and the liquid from the wipe is usually left on the skin for a prolonged duration. Exposure to substances in wipes occurs mainly through direct dermal contact with the product during leave-on applications.

Wipes are used by various age groups depending on the product type. If the specific type of wipe is unknown, it is recommended to use a baby wipe scenario for ages 0-3; and it is recommended to use a facial cleansing wipe scenario for ages 4-18 and 19+.

Scenario for consumer exposure
During application, the product is applied directly to the skin and the liquid from the wipes is left on the skin for a prolonged duration. Therefore, the consumer exposure scenario for the use of wipes is anticipated to run by dermal contact during leave-on.

Wipes are cloths saturated in a cleansing liquid, and are used on the various areas of the body, depending on the type of wipe. When wiping the skin, the liquid from the cloth is left on the skin and not rinsed off. Therefore, the scenario of using wipes fits the generic scenario for dermal exposure from leave-on products (see Section 4.2.1). The ***dermal-direct product contact-instant application*** model is used to estimate dermal exposure to substances in wipes.

18.1 Baby wipes

Baby wipes are mainly used on the skin of the bottom and genital area of infants (ages 0-3) while changing an infant's diaper. Baby wipes are also used for cleansing other areas of an infant, such as the face and hands, for quick clean up after eating or playing.

Frequency
According to Dey et al. (2016), the 75th percentile for wipe use is 15.9 wipes used per day. The Q-factor assigned for frequency is 4, as this study is of high quality and involves a large number of participants.

18.1.1 Application: leave-on

Exposed area
The default for the exposed area is set to be equal to the surface area of half of the head, the hands, and the genitals and bottom (7% of total surface area; US-EPA 2011). Surface area values are derived from the General Fact Sheet and assigned a Q-factor of 3 in accordance with the General Fact Sheet (Te Biesebeek et al., 2014).

Product amount
The product amount available for dermal exposure is the amount of product present on the wipe, 0.77 g per wipe (Ficheux et al., 2016). A Q-factor of 4 is assigned, as it is a high-quality study involving a large number of participants and product types.

Table 18.1 Default values for estimating consumer exposure to substances in baby wipes following application

Default value		**Q-factor**	**Source(s)**
General			
Frequency Infants (0-5 months)	5808 per year	4	Dey et al., 2016
Dermal-direct product contact-instant application			
Exposed area Infants (0-5 months)	728 cm^2	3	Half head, hands, genitals, and bottom (Te Biesebeek et al., 2014)
Product amount Infants (0-5 months)	0.77 g	4	Ficheux et al., 2016

18.2 Facial cleansing/make-up removal wipes

Facial cleansing wipes are mainly used on the skin of the face by ages 9 and up. These wipes are used to cleanse the face, remove makeup, and/or treat the skin (e.g. tone, exfoliate, etc.). For eye make-up removal wipes, see Section 9.3.4.

Frequency
According to Ficheux et al. (2015), the 75th percentile for wipe use is 1.03 times per day. The Q-factor assigned for frequency is 4, as this study is of high quality, involving a large number of participants.

18.2.1 Application: leave-on

Product amount
The product amount available for dermal exposure is the amount of product present on the skin after using the wipes. According to the 75th percentiles from Ficheux et al. (2016), 2.8 wipes are applied per use, and each wipe leaves 1.2 g of product on the skin. Therefore, the

product amount per use is 2.8 wipes x 1.2 g = 3.4 g. A Q-factor of 4 is assigned, as it is a high-quality study involving a large number of participants and product types.

Table 18.2 Default values for estimating consumer exposure to substances in facial cleansing wipes following application

Default value		Q-factor	Source(s)
General			
Frequency Adults (19+ years) Children (14-18 years)	 376 per year 376 per year	 4 4	 Ficheux et al., 2015 Ficheux et al., 2015
Dermal-direct product contact-instant application			
Exposed area Adults (19+ years) Children (14-18 years)	 600 cm^2 520 cm^2	 3 3	 Half head (Te Biesebeek et al., 2014) Half head (Te Biesebeek et al., 2014)
Product amount Adults (19+ years) Children (14-18 years)	 3.4 g 3.4 g	 4 4	 Ficheux et al., 2016 Ficheux et al., 2016

18.3 Hand cleansing wipes

Hand cleansing wipes are mainly used on the skin of the hands by adults (19+) and older children (ages 14-18), to cleanse the skin. These wipes are available in individual packs or in bulk.

Frequency
According to Ficheux et al. (2015), the 75th percentile for wipe use is 1.3 wipes used per day. The Q-factor assigned for frequency is 4, as this study is of high quality and involves a large number of participants.

18.3.1 Application: leave-on

Product amount
The product amount that is available for dermal exposure is the amount of product present on the skin after using the wipes, 1.2 g per wipe (Ficheux et al., 2016). A Q-factor of 4 is assigned, as it is a high-quality study involving a large number of participants and product types.

Table 18.3 Default values for estimating consumer exposure to substances in hand cleansing wipes following application

Default value		Q-factor	Source(s)
General			
Frequency Adults (19+ years) Children (14-18 years)	 473 per year 473 per year	 4 4	 Ficheux et al., 2015 Ficheux et al., 2015
Dermal-direct product contact-instant application			
Exposed area Adults (19+ years)	 900 cm^2	 3	 Hands (Te Biesebeek et al., 2014)

Default value		Q-factor	Source(s)
Children (14-18 years)	750 cm^2	3	Hands (Te Biesebeek et al., 2014)
Product amount			
Adults (19+ years)	1.2 g	4	Ficheux et al., 2016
Children (14-18 years)	1.2 g	4	Ficheux et al., 2016

18.4 Intimate hygiene wipes

Intimate hygiene wipes are mainly used by adults (19+) and older children (ages 14-18). These wipes are used to cleanse the genital area.

Frequency
According to Ficheux et al. (2015) the 75th percentile for wipe use is 1.3 times per day. The Q-factor assigned for frequency is 4, as this study is of high quality, involving a large number of participants.

18.4.1 Application: leave-on

Exposed area
The default for the exposed area is set to be equal to the surface area of the genitals (3.5% total body; US-EPA 2011). Surface area values are derived from the General Fact Sheet and assigned a Q-factor of 3 in accordance with the General Fact Sheet (Te Biesebeek et al., 2014).

Product amount
The product amount available for dermal exposure is the amount of product present on the skin after using the wipes. According to the 75th percentiles from Ficheux et al. (2016), 2 wipes are applied per use, and each wipe leaves 0.37 g of product on the skin. Therefore, the product amount per use is 2 wipes x 0.37 g = 0.75 g. A Q-factor of 4 is assigned, as it is a high-quality study involving a large number of participants and product types.

Table 18.4 Default values for estimating consumer exposure to substances in intimate hygiene wipes following application

Default value		Q-factor	Source(s)
General			
Frequency			
Adults (19+ years)	463 per year	4	Ficheux et al., 2015
Children (14-18 years)	463 per year	4	Ficheux et al., 2015
Dermal-direct product contact-instant application			
Exposed area			
Adults (19+ years)	637 cm^2	3	Genitals (3.5% total body) (Te Biesebeek et al., 2014)
Children (14-18 years)	588 cm^2	3	Genitals (3.5% total body) (Te Biesebeek et al., 2014)
Product amount			
Adults (19+ years)	0.75 g	4	Ficheux et al., 2016
Children (14-18 years)	0.75 g	4	Ficheux et al., 2016

19 Miscellaneous

The purpose of this section is to present the exposure factors for products that do not fit into other product categories. These products include massage oil, essential oil, face paint, and douche.

19.1 Massage oil

Massage oil is a liquid cosmetic product used to help lubricate skin during a massage, thus helping the massagers hands glide more easily over the skin of the person being massaged. Massage oil can consist of various oils mixed together, such as almond oil, wheat germ oil, jojoba oil, and essential oils (Bremmer et al., 2006a). It is assumed that massage oils can contain up to 5% essential oils. More details on essential oils can be found in Section 19.2. It is anticipated that massage oil will be used by all age groups.

Scenario for consumer exposure
During a massage, massage oil is rubbed into the skin repeatedly for the duration of the massage, and the product is left on the skin for a prolonged duration following the massage. Therefore, the consumer exposure scenarios for massage oil are anticipated to run by dermal contact and by inhalation of evaporated substances during leave-on.

Frequency
Limited data was available on the use of massage oil (Bremmer et al., 2006a; Ficheux et al., 2015). Data from Ficheux et al. (2015) was used for the frequency of use. A Q-factor of 4 is assigned, as it is a high-quality study presenting relevant data and involving a large number of participants.

19.1.1 Application: leave-on

Massage oil is applied to the skin from which substances may evaporate for a prolonged duration. Therefore, the scenario of using massage oil fits the generic exposure scenarios for dermal exposure from leave-on products (see Section 4.2.1) and for inhalation of a substance evaporating from leave-on products (Section 4.1.1). The ***dermal-direct product contact-instant application*** model is used to estimate dermal exposure to substances in massage oil. The ***inhalation-exposure to vapour-evaporation-constant release area*** model is used to estimate inhalation exposure to substances in evaporating from massage oil and the ***product is substance in pure form*** option is selected as it is assumed that substances leave the product matrix once the massage oil has been rubbed into the skin.

Exposure duration
The exposure duration is the time the consumer spends during and after the massage. It is assumed that the consumer goes to sleep after the massage in the bedroom, so that the exposure duration is set to the duration of the massage (30 minutes for adults and 15 minutes for infants) plus 8 hours of sleep. The exposure duration is assigned a Q-factor of 2, as it is based on professional judgment.

Product amount
The product amount that is available for dermal and inhalation exposure is derived from Ficheux et al. (2016). A Q-factor of 4 is assigned, as it is a high-quality study involving a large number of participants and product types.

Table 19.1 Default values for estimating consumer exposure to substances in massage oil following application

Default value		Q-factor	Source(s)
General			
Frequency Adults (19+ years) Infants (0-5 months)	 62 per year 70 per year	 4 4	 Ficheux et al., 2015 Ficheux et al., 2015
Inhalation-exposure to vapour-evaporation-constant release area			
Exposure duration Adults (19+ years) Infants (0-5 months)	 8.5 hours 8.25 hours	 2 2	See above
Product amount Adults (19+ years) Infants (0-5 months)	 5.7 g 3.4 g	 4 4	Product amount (dermal)
Room volume	16 m^3	4	Section 4.1.1
Ventilation rate	0.6 per hour	3	Section 4.1.1
Application temperature	32 °C	4	Section 4.1.1
Mass transfer coefficient	10 m/h	2	Section 4.1.1
Release area Adults (19+ years) Infants (0-5 months)	 14300 cm^2 3090 cm^2	 3 3	Exposed area (dermal)
Emission duration Adults (19+ years) Infants (0-5 months)	 8.5 hours 8.25 hours	 2 2	Exposure duration
Dermal-direct product contact-instant application			
Exposed area Adults (19+ years) Infants (0-5 months)	 14300 cm^2 3090 cm^2	 3 3	 Total body except half head - half trunk (Te Biesebeek et al., 2014) Total body except half head (Te Biesebeek et al., 2014)
Product amount Adults (19+ years) Infants (0-5 months)	 5.7 g 3.4 g	 4 4	 Ficheux et al., 2016 Ficheux et al., 2016

19.2 Essential oils

Essential oils are strongly scented liquids that have a variety of cosmetic uses. The oil can be obtained by distillation or by extraction from various parts of plants, or the oil can be synthetically prepared. Essential oils are often used to lend fragrance to various cosmetic products, such as the 'essence' of fragrance in perfumes, lotions, bath products, aromatherapy products, or massage oils. Examples of essential oils

include lavender oil, peppermint oil, lemon oil, etcetera. This section will provide an overview of some of the uses of essential oil in cosmetic products.

19.2.1 Massage oil

Massage oil is used to lubricate skin during a massage, and the scenario of using massage oil is described in Section 19.1. Massage oil can contain up to 5% essential oils (Bremmer et al., 2006a).

19.2.2 Bath oil

The scenario for adding essential oil to bath water is similar to the one for regular bath oils except that essential oils are expected to be used in much smaller amounts. It is expected that up to 10 drops (0.05 mL per drop, or up to 0.5 mL in total) of essential oil may be added to a bath. If essential oil is added to water, it will either float or disperse, depending on the type of oil. Various ready-to-use bath oil products contain up to approximately 30% essential oils, depending on the type of oil. Therefore, to evaluate the use of essential oils in bath water it may be assumed that 10 mL of bath oil (containing 30% essential oils) may be added to 120 litres of bath water (Bremmer et al., 2006a). The general scenario of using bath oil in bath water is described in Section 7.4.3.

19.3 Face paint

Face paint is a cosmetic product used to decorate the face, usually during special events such as parties, sporting events, carnivals, or for putting on plays (Bremmer et al., 2006a). Face paint products are available as creams and liquids, and can be oil or water based. Face paint is anticipated to be used by children and infants primarily at parties and carnivals, and by adults primarily at sporting events, carnivals, and during amateur theatrical events. Therefore, it is anticipated that face paint will be used by ages 2 and up.

Scenario for consumer exposure

During application, the user applies the face paint directly to the face using a make-up brush or sponge, and leaves the product on for a prolonged duration. Therefore, the consumer exposure scenarios for face paint are anticipated to run by dermal contact and by inhalation of evaporated substances during leave-on.

Frequency

The frequency of use is derived from Bremmer et al. (2006a), in which the frequency was assumed to be 6 times per year for adults, and 12 times per year for children and infants. No other values for this product were identified. A Q-factor of 3 is assigned.

19.3.1 Application: leave-on

Face paint is applied to the skin and left on for a prolonged duration. Therefore, the scenario of using face paint fits the generic exposure scenario for dermal exposure from leave-on products (Section 4.2.1). The ***dermal-direct product contact-instant application*** model is used to estimate dermal exposure to substances in face paint. Face paint is a cosmetic product from which substances may evaporate for a prolonged duration. Therefore, the scenario of using face paint fits the

generic exposure scenario for inhalation of substances evaporating from leave-on products (Section 4.1.1). The ***inhalation-exposure to vapour-evaporation-constant release area*** model is used to estimate inhalation exposure to substances evaporating from face paint and the ***product is substance in pure form*** option is selected.

Exposure duration
The consumer is not expected to wear the face paint during sleep. Bremmer et al. (2006a) estimated the exposure time to be 8 hours. Therefore, the default exposure duration is set to 8 hours. The Q-factor assigned is 2.

Product amount
The product amount used is calculated on the basis of a rate of 3 mg/cm^2 (3 times that of a general cream) applied to half the area of the head (Bremmer et al., 2006a). A Q-factor of 2 is assigned for the frequency, as the values were based on professional judgment.

Table 19.2 Default values for estimating consumer exposure to substances in face paint following application

Default value		**Q-factor**	**Source(s)**
General			
Frequency Adults (19+ years) Infants (2-3 years)	 6 per year 12 per year	 3 3	 Bremmer et al., 2006a Bremmer et al., 2006a
Inhalation-exposure to vapour-evaporation-constant release area			
Exposure duration	8 hours	2	Bremmer et al., 2006a
Product amount Adults (19+ years) Infants (2-3 years)	 1.8 g 1.1 g	 2 2	Product amount (dermal)
Room volume	20 m^3	3	Section 4.1.1
Ventilation rate	0.6 per hour	3	Section 4.1.1
Application temperature	32°C	4	Section 4.1.1
Mass transfer coefficient	10 m/h	2	Section 4.1.1
Release area Adults (19+ years) Infants (2-3 years)	 600 cm^2 350 cm^2	 3 3	Exposed area (dermal)
Emission duration	8 hours	2	Exposure duration
Dermal-direct product contact-instant application			
Exposed area Adults (19+ years)	 600 cm^2	 3	 Half head (Te Biesebeek et al., 2014)

Default value		Q-factor	Source(s)
Infants (2-3 years)	350 cm^2	3	Half head (Te Biesebeek et al., 2014)
Product amount Adults (19+ years) Infants (2-3 years)	 1.8 g 1.1 g	 2 2	See above

19.4 Douche

Douching refers to rinsing or cleansing the inside of the vagina with water or a mixture of fluids, which come in a bottle, or can be squirted into the vagina using a tube or nozzle (US Dept. of Health & Human Services, 2005). The American College of Obstetricians and Gynecologists and other health professionals recommend not using such products as they have been associated with an increased risk of pelvic and vaginal infections (McKee et al., 2009; US Dept. of Health & Human Services, 2005); however, these products remain on the market.

Dermal absorption of substances in products varies on the basis of many factors, including the anatomy of the skin that is in contact with the product. Since the skin inside the vagina is anatomically different to the skin on external body parts, dermal absorption may be different for products used in the vagina. This difference in dermal absorption is not reflected in the defaults described for this scenario, but it is suggested that the difference in skin anatomy be considered when modelling dermal exposure to substances in douche.

It is expected that these products would be used mainly by adults (19+) and older children (ages 14-18), and that the products would be used in the same product amount and frequency for both age groups.

Scenario for consumer exposure
During application, the douche is used directly in the vagina. Therefore, the consumer exposure scenario for douche is anticipated to run by dermal contact following rinse-off.

Frequency
The frequency of use for douche products is derived from CTFA (1983). A Q-factor of 3 is assigned, as the information on douche products is limited.

19.4.1 Application: mucosal

Douche is applied directly to the inside of the vagina, and is therefore available for exposure in the genital mucosal area. Therefore, the scenario of using douche fits the generic exposure scenario for dermal exposure from rinse-off products (see Section 4.2.2). The ***dermal-direct product contact-instant application*** model is used to estimate exposure to substances in douche.

Product amount
Very limited data was available on the amount of product used per application but information from a web search of such products available in pharmacies indicated that the product was packaged in 133 mL units.

Ficheux et al. (2016) measured the amount of 'intimate hygiene liquid cleanser' used by women aged 15 and up but it was unclear if this was a douche product since the amount per use was low (2.5 mg/use) compared to the product labels. The recommended product amount was based on the products available in pharmacies, assuming that one unit would be used per application. A density of 1 g/mL was assumed in order to convert the product amount to 133 g/use. A Q-factor of 2 is assigned for the product amount, as it is derived from product packaging.

Retention factor
For rinse-off products, it is assumed that only 10% of the applied product amount is on the consumer's skin or hair following rinse-off (SDA, 2010). Since douche is applied by releasing the liquid product in and around the genitals as a rinse, it is anticipated that only a portion of the product will remain on the consumer's skin and mucosa . Therefore, a retention factor of 0.1 needs to be applied to reflect the amount of product actually on the consumer's skin following rinse-off. The Q-factor assigned is 1, as the retention factor is based on assumptions.

Table 19.3 Default values for estimating consumer exposure to substances in douche residues after rinsing

Default value		**Q-factor**	**Source(s)**
General			
Frequency Adults (19+ years) Children (14-18 years)	 71 per year 71 per year	 3 3	 CTFA, 1983 CTFA, 1983
Dermal-direct product contact-instant application			
Exposed area Adults (19+ years) Children (14-18 years)	 637 cm^2 588 cm^2	 3 3	 Genitals (3.5% total body) (Te Biesebeek et al., 2014) Genitals (3.5% total body) (Te Biesebeek et al., 2014)
Product amount Adults (19+ years) Children (14-18 years)	 133 g 133 g	 2 2	 See above See above
Retention factor	0.1	1	See above

Acknowledgements

We would like to thank our colleagues from the ConsExpo2015-project partners, i.e. ANSES, BfR, and FOPH, for critically reviewing the draft version of the revised Cosmetics Fact Sheet, as well as for their contribution to general discussions.

Many thanks to the numerous colleagues from Health Canada who have worked on drafting or reviewing this update of the Cosmetics Fact Sheet, their contribution has been invaluable. Also, many thanks to the colleagues at RIVM who have contributed the inhalation exposure sections of this updated fact sheet and have reviewed several versions of the overall document. Special thanks to Gerlienke Schuur and Christian Delmaar for their patience with the many discussions while developing this document.

We also thank external reviewers for providing insightful comments during the public consultation period.

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List of acronyms

ANSES	Agence Nationale de Sécurité Sanitaire de l'alimentation, de l'environnement et du travail
BfR	Bundesinstitut für Risikobewertung
CHAPS	Canadian Human Activity Pattern Survey
CTFA	Cosmetic, Toiletry and Fragrance Association
C.V.	Coefficient of Variation
DIY	Do-It-Yourself
ECCC	Environment and Climate Change Canada
EPHECT	Emissions, Exposure Patterns and Health Effects of Consumer Products in the EU
ETH	Federal Institute of Technology Zürich
EU	European Union
FOPH	Federal Office of Public Health
HC	Health Canada
KEMI	Swedish Chemical Agency
NIOSH	National Institute for Occupational Safety and Health
NVWA	Nederlandse Voedsel- en Warenautoriteit
OECD	Organisation for Economic Co-operation and Development
P75	75^{th} percentile
PM4	Particulate Matter < 4 µm
PM10	Particulate Matter < 10 µm
Q-factor	Quality Factor
REACH	Registration, Evaluation, Authorisation and Restriction of Chemicals
RIVM	National Institute for Public Health and the Environment (Rijksinstituut voor Volksgezondheid en Milieu)
SCCS	Scientific Committee on Consumer Safety
SDA	Soap and Detergent Association
UEB-UBO	Université Européenne de Bretagne - Université de Bretagne Occidentale
US-EPA	United States Environmental Product Agency
UV	Ultraviolet
VWS	Ministry of Health, Welfare and Sports

Appendix I Estimated release fraction of cosmetic powders

Table AI.1 Overview of measured and calculated air concentrations and inhaled doses presented in scientific publications (measurement data from studies is expressed in bold(*))

Study	Sampled cosmetic powder product	Sampled particulate matter size range	Air concentration (mg/m^3)	Inhaled dose (µg)	Remarks
Nazarenko et al. 2012b	Moisturiser	0.1 -10 µm	0.13	1.5	Values calculated from study raw data provided in personal communication with Nazarenko
	Blusher	0.1 -10 µm	2.21	24.4	
	Sunscreen (with TiO_2, ZnO)	0.1 -10 µm	2.18	24.0	
	Blot powder	0.1 -10 µm	2.03	22.3	
	Blot powder	0.1 -10 µm	4.56	50.2	
	Cosmetic powder	0.1 -10 µm	170	1875	
Rasmussen et al. 2019	Face powder	< 4 µm	**1.8***	19.8	Inhaled mass calculated from reported air concentration using same equation as Nazarenko (11.0 L/min, 1 min contact time)
Oh and Kim 2020	Face powder	< 10 µm	61	**668***	Inhaled dose reported in Oh and Kim 2020 S3.5. Air concentration calculated from inhaled dose using equation as Nazarenko (11.0 L/min, 1 min contact time)
	Face powder	< 10 µm	63.5	**698***	
	Eyeshadow powder	< 10 µm	52.9	**582***	
	Eyeshadow powder	< 10 µm	74.3	**817***	
Oh et al. 2021	Eyebrow powder	< 10 µm	**0.066***	1.4	Air concentration derived from table 1 in Oh et al 2021, inhaled dose calculated from table 2 in Oh et al 2021
	Eyebrow powder	< 10 µm	**0.185***	NR	
	Eyebrow powder	< 10 µm	**0.206***	3.3	
	Eyebrow powder - nano	< 10 µm	**0.074***	NR	
	eyebrow powder - nano	NT2, PM10 - OPC	**0.056***	2,6	

Study	Sampled cosmetic powder product	Sampled particulate matter size range	Air concentration (mg/m^3)	Inhaled dose (µg)	Remarks
Overall	Average	< 10 µm	29	367	Rasmussen et al. 2019 is excluded from the overall data, because the size range is only up to 4 µm
	Median	< 10 µm	2.2	24.4	
	75^{th} percentile	< 10 µm	57	668	
	Minimum	< 10 µm	0.056	1.36	
	Maximum	< 10 µm	170	1875	

Appendix II Defaults Cosmetics Fact Sheet 2025 compared to 2006

All Cosmetics Fact Sheet data for exposure scenarios, selected ConsExpo models and default parameter values reported in the current fact sheet and that of the 2006 version are presented in one table below (Table AII.1). Alterations compared to 2006 are marked in yellow (or grey in black and white view).

Table AII.1 All Cosmetics Fact Sheet data for exposure scenarios, selected ConsExpo models and default parameter values published in 2006 and 2025. All cells with an asterisk (*) are marked in yellow. It shows the parameters that have been changed, added or removed compared to the 2006 version of the Cosmetics Fact Sheet.

				Cosmetics Fact Sheet 2025			Cosmetics Fact Sheet 2006		
Scenario (Section FS 2025 ~ Section FS 2006)	Selected Exposure Model	Parameter	Age group	Default Value	Unit	Q-factor	Default Value	Unit	Q-Factor
*Shampoo, dry spray (6.1.1 ~)	*General	*Frequency	*Adults (19+ years) Children (14-18 years)	*150	*/year	*4	Not included in FS 2006		
	*Inhalation-instantaneous release – spraying towards exposed person	*Spray duration		*4.3	*s	*2			
		*Exposure duration		*5	*min	*2			
		*Room volume		*10	*m^3	*4			
		*Room height		*2.5	*m	*4			
		*Ventilation rate		*2	*/hour	*3			
		*Cloud volume		*0.0625	*m^3	*2			
		*Mass generation rate		*0.8	*g/s	*2			
		*Airborne fraction		*0.2	*g/g	*2			
		*Density non-volatile		*0.7	*g/cm^3	*1			
		*Initial particle distribution Median (C.V.)		*46.5 (2.1)	*µm	*2			
		*Inhalation cut-off diameter		*15	*µm	*3			
	*Inhalation-instantaneous release – spraying towards exposed person	*Exposure duration		*8.5	*S	*1			
		*Released mass		*3.4	*g	*4			
		*Room volume		*1	*m^3	*1			
		*Ventilation rate		*2	*/hour	*1			
		*Exposed Area	*Adults (19+ years)	*600	*cm^2	*3			

				Cosmetics Fact Sheet 2025			Cosmetics Fact Sheet 2006		
Scenario (Section FS 2025 ~ Section FS 2006)	Selected Exposure Model	Parameter	Age group	Default Value	Unit	Q-factor	Default Value	Unit	Q-Factor
	*Dermal-direct product contact-instant application		*Children (14-18 years)	*520	*cm^2	*3			
		*Product Amount	*Adults (19+ years) *Children (14-18 years)	*3.4	*g	*4			
		*Retention factor		*0.085		*1			
Shampoo, rinse-off (6.1.2 ~ 3.1.1)	General	Frequency	Adults (19+ years)	*416	*/year	*4	260	/year	3
			*Infants (1 year old)	*332	*/year	*4	Not included in FS 2006		
	Dermal-direct product contact-instant application	Exposed Area	Adults (19+ years)	*1050	*cm^2	3	1440	cm^2	3
			*Infants (1 year old)	*390	*cm^2	*3	Not included in FS 2006		
		Product Amount	Adults (19+ years)	*16	*g	*4	20	g	2
			*Infants (1 year old)	*10.6	*g	*4	Not included in FS 2006		
		*Retention factor		*0.01		*1	Not included in FS 2006		
	*Dermal - uptake, diffusion	*Exposure time	*Adults (19+ years)	*Not included in FS 2025			4	min	2
Conditioner, rinse-off (6.2.1 ~ 3.1.2)	General	Frequency	Adults (19+ years)	*402	*/year	*4	104	/year	3
			*Children (4-8 years)	*268	*/year	*4	Not included in FS 2006		
		Exposed Area	Adults (19+ years)	*1050	*cm^2	3	1440	cm^2	3

				Cosmetics Fact Sheet 2025			Cosmetics Fact Sheet 2006		
Scenario (Section FS 2025 - Section FS 2006)	Selected Exposure Model	Parameter	Age group	Default Value	Unit	Q-factor	Default Value	Unit	Q-Factor
	Dermal-direct product contact-instant application		*Children (4-8 years)	*700	*cm^2	*3	Not included in FS 2006		
		Product Amount	Adults (19+ years)	*18.9	*g	*4	14	g	2
			*Children (4-8 years)	*11.5	*g	*4	Not included in FS 2006		
		*Retention factor		*0.01		*1	Not included in FS 2006		
	*Dermal - uptake, diffusion	*Exposure time	*Adults (19+ years)	*Not included in FS 2025			4	min	2
*Conditioner, leave-on (6.2.2 -)	*General	*Frequency	*Adults (19+ years)	*402	*/year	*4	Not included in FS 2006		
			*Children (4-8 years)	*268	*/year	*4			
	*Dermal-direct product contact-instant application	*Exposed Area	*Adults (19+ years)	*1050	*cm^2	*4			
			*Children (4-8 years)	*700	*cm^2	*4			
		*Product Amount	*Adults (19+ years)	*18.9	*g	*4			
			*Children (4-8 years)	*11.5	*G	*4			
		*Retention factor		*0.1		*1			
Hairspray, aerosol can (6.3.1 - 3.1.3)	General	Frequency	Adults (19+ years)	*657	*/year	*4	438	/year	3
			*Children (4-8 years)	*369	*/year	*4	Not included in FS 2006		

				Cosmetics Fact Sheet 2025			Cosmetics Fact Sheet 2006		
Scenario (Section FS 2025 - Section FS 2006)	Selected Exposure Model	Parameter	Age group	Default Value	Unit	Q-factor	Default Value	Unit	Q-Factor
		*Body weight female	*Adults (19+ years)	*Not included in FS 2025			61	kg	4
	Inhalation - exposure to spray – spraying towards exposed person	Spray duration	Adults (19+ years)	*4.4	*s	3	0.24	min	3
			*Children (4-8 years)	*4	*s	*3	Not included in FS 2006		
		Exposure duration	Adults (19+ years) Children (4-8 years) (Not included in FS 2006)	5	min	2	5	min	2
		Room volume		10	m^3	*4	10	m^3	3
		Room height		2.5	m	4	2.5	m	4
		Ventilation rate		2	h^{-1}	3	2	h^{-1}	3
		Cloud volume		0.0625	m^3	2	0.0625	m^3	2
		Mass generation rate		*0.8	*g/sec	3	0.47	g/sec	3
		Airborne fraction		*0.2	*g/g	*3	1	g/g	2
		*Weight fraction non-volatile		*Not included in FS 2025			0.03	g/g	2
		Density non-volatile		*0.7	*g/cm^3	*2	1.5	g/cm^3	3
		Initial particle distribution (c.v.)		*46.5 (2.1)	*µm	3	35 (0.3)	µm	3
		Inhalation cut-off diameter		15	µm	*3	15	µm	
	*Inhalation – uptake, fraction model	*Uptake fraction	*Adults (19+ years)	*Not included in FS 2025			1		2
		*Inhalation rate					23.1	l/min	3
		*Oral uptake fraction					1		2
	*Inhalation-exposure to spray-	*Exposure duration	*Adults (19+ years)	*8.9	*s	*1	Not included in FS 2006		

				Cosmetics Fact Sheet 2025			Cosmetics Fact Sheet 2006		
Scenario (Section FS 2025 - Section FS 2006)	Selected Exposure Model	Parameter	Age group	Default Value	Unit	Q-factor	Default Value	Unit	Q-Factor
	instantaneous release		*Children (4-8 years)	*7.9	*s	*1			
		*Released mass	*Adults (19+ years)	*3.6	*g	*4			
			*Children (4-8 years)	*3.2	*g	*4			
		*Room volume		*1	*m^3	*1			
		*Ventilation rate		*2	*h^{-1}	*1			
	Dermal-direct product contact-instant application	Exposed area	Adults (19+ years)	*600	*cm^2	3	565	cm^2	3
			*Children (4-8 years)	*470	*cm^2	*3	Not included in FS 2006		
		*Amount upon head	*Adults (19+ years)	*Not included in FS 2025			0.6	g	2
		*Product amount	*Adults (19+ years)	*3.6	*g	*4	Not included in FS 2006		
			*Children (4-8 years)	*3.2	*g	*4			
		*Retention factor		*0.085		*1	Not included in FS 2006		
	*Dermal - uptake, diffusion	*Exposure time	*Adults (19+ years)	*Not included in FS 2025			960	min	2
*Hairspray, pump (6.2.2 -)	*General	*Frequency	*Adults (19+ years)	*704	*/year	*4	Not included in FS 2006		
	*Inhalation - exposure to spray – spraying	*Spray duration		*6.5	*s	*3			
		*Exposure duration		*5	*min	*2			
		*Room volume		*10	*m^3	*4			
		*Room height		*2.5	*m	*4			

				Cosmetics Fact Sheet 2025			Cosmetics Fact Sheet 2006		
Scenario (Section FS 2025 - Section FS 2006)	Selected Exposure Model	Parameter	Age group	Default Value	Unit	Q-factor	Default Value	Unit	Q-Factor
	towards exposed person	*Ventilation rate		*2	*h^{-1}	*3			
		*Cloud volume		*0.0625	*m^3	*1			
		*Mass generation rate		*0.8	*g/sec	*2			
		*Airborne fraction		*0.2	*g/g	*2			
		*Density non-volatile		*0.7	*g/cm^3	*1			
		*Initial particle distribution (c.v.)		*46.5 (2.1)	*µm	*2			
		*Inhalation cut-off diameter		*15	*µm	*3			
	*Inhalation-exposure to spray-instantaneous release	*Exposure duration		*12.9	*s	*1			
		*Released mass		*5.2	*g	*4			
		*Room volume		*1	*m^3	*1			
		*Ventilation rate		*2	*h^{-1}	*1			
	*Dermal-direct product contact-instant application	*Exposed area		*600	*cm^2	*3			
		*Product amount		*5.2	*g	*4			
		*Retention factor		*0.085		*1			
Hair styling, gel (6.3.3 - 3.1.4)	General	Frequency	Adults (19+ years)	*397	*/year	*4	358	/year	3
			*Infants (2-3 years)	*408	*/year	*4	Not included in FS 2006		
	*Inhalation-exposure to vapour-evaporation-	*Exposure duration	*Adults (19+ years)	*22	*h	*4	Not included in FS 2006		
			*Infants (2-3 years)	*21	*h	*4			

				Cosmetics Fact Sheet 2025			Cosmetics Fact Sheet 2006		
Scenario (Section FS 2025 - Section FS 2006)	Selected Exposure Model	Parameter	Age group	Default Value	Unit	Q-factor	Default Value	Unit	Q-Factor
	constant release area	*Molecular weight matrix		*Pure					
		*Product amount	*Adults (19+ years)	*5.9	*g	*4			
			*Infants (2-3 years)	*2.3	*g	*2			
		*Room volume		*20	*m^3	*3			
		*Ventilation rate		*0.6	*h^{-1}	*3			
		*Application temperature		*32	*°C	*4			
		*Mass transfer coefficient		*10	*m/h	*2			
		*Release area	*Adults (19+ years)	*1050	*cm^2	*3			
			*Infants (2-3 years)	*350	*cm^2	*3			
		*Emission Duration	*Adults (19+ years)	*22	*h	*4			
			*Infants (2-3 years)	*21	*h	*4			
	*Dermal-direct product contact-instant application (½ area head)	*Exposed Area	*Adults (19+ years)	*Not included in FS 2025			580	cm^2	3
		*Amount upon head					0.3	g	2
	*Dermal - uptake, diffusion	*Exposure time	*Adults (19+ years)	*Not included in FS 2025			1440	min	2
	Dermal-direct product contact-instant application	Exposed Area	Adults (19+ years)	*1050	*cm^2	3	1010	cm^2	3
			*Infants (2-3 years)	*350	*cm^2	*3	Not included in FS 2006		

				Cosmetics Fact Sheet 2025			Cosmetics Fact Sheet 2006		
Scenario (Section FS 2025 - Section FS 2006)	Selected Exposure Model	Parameter	Age group	Default Value	Unit	Q-factor	Default Value	Unit	Q-Factor
	(½ area hands+½ area head)	Product amount	Adults (19+ years)	*5.9	*g	*4	2.9	g	3
			*Infants (2-3 years)	*2.3	*g	*2	Not included in FS 2006		
		*Retention factor		*0.1		*1	Not included in FS 2006		
	*Dermal - uptake, diffusion	*Exposure time	*Adults (19+ years)	*Not included in FS 2025			0.63	min	3
Hair styling, mousse (6.3.4 - 3.1.5)	General	Frequency	Adults (19+ years)	*360	*/year	*4	274	/year	3
			*Children (4-8 years)	*317	*/year	*4	Not included in FS 2006		
	*Inhalation-exposure to vapour-evaporation-constant release area	*Exposure duration	*Adults (19+ years)	*24	*h	*4	Not included in FS 2006		
			*Children (4-8 years)	*24	*h	*1			
		*Molecular weight matrix		*Pure					
		*Product amount	*Adults (19+ years)	*12.4	*g	*4			
			*Children (4-8 years)	*9.7	*g	*2			
		*Room volume		*20	*m^3	*3			
		*Ventilation rate		*0.6	*h^{-1}	*3			
		*Application temperature		*32	*°C	*4			
		*Mass transfer coefficient		*10	*m/h	*2			
		*Release area	*Adults (19+ years)	*1050	*cm^2	*3			

				Cosmetics Fact Sheet 2025			Cosmetics Fact Sheet 2006		
Scenario (Section FS 2025 ~ Section FS 2006)	Selected Exposure Model	Parameter	Age group	Default Value	Unit	Q-factor	Default Value	Unit	Q-Factor
			*Children (4-8 years)	*700	*cm^2	*3			
		*Emission duration	*Adults (19+ years)	*24	*h	*4			
			*Children (4-8 years)	*24	*h	*1			
	*Dermal-direct product contact-instant application (½ area head)	*Exposed Area	*Adults (19+ years)	*Not included in FS 2025			580	cm^2	3
		*Amount upon head					0.3	g	2
	*Dermal - uptake, diffusion	*Exposure time	*Adults (19+ years)	*Not included in FS 2025			1440	min	2
	Dermal-direct product contact-instant application (½ area hands+½ area head)	Exposed Area	Adults (19+ years)	*1050	*cm^2	*3	1010	cm^2	3
			*Children (4-8 years)	*700	*cm^2	*3	Not included in FS 2006		
		Product amount	Adults (19+ years)	*12.4	*g	*4	2.7	g	3
			*Children (4-8 years)	*9.7	*g	*2	Not included in FS 2006		
		*Retention factor		*0.1		*1	Not included in FS 2006		
	*Dermal - uptake, diffusion	*Exposure time	*Adults (19+ years)	*Not included in FS 2025			0.67	min	3
*Hair dyes, permanent (~ 6.4.1)	*General	*Frequency	*Adults (19+ years)	*11	*/year	*4	Not included in FS 2006		
	*Dermal-direct product contact-instant application	*Exposed Area		*600	*cm^2	*3			
		*Product amount		*157	*g	*2			
		*Retention factor		*0.1		*1			

				Cosmetics Fact Sheet 2025			Cosmetics Fact Sheet 2006		
Scenario (Section FS 2025 - Section FS 2006)	Selected Exposure Model	Parameter	Age group	Default Value	Unit	Q-factor	Default Value	Unit	Q-Factor
*Hair dyes, semi-permanent (- 6.4.2)	*General	*Frequency	*Adults (19+ years)	*10	*/year	*4	Not included in FS 2006		
	*Dermal-direct product contact-instant application	*Exposed Area		*600	*cm^2	*3			
		*Product amount		*35	*g	*3			
		*Retention factor		*0.1		*1			
Hair dyes, hair dye spray (6.4.3.1 - 3.1.6)	General	Frequency	Adults (19+ years)	*11	*/year	*4	6	/year	2
	*Inhalation-instantaneous release – spraying towards exposed person	*Spray duration		*Not included in FS 2025			0.24	min	2
		*Exposure duration					5	min	3
		*Room volume					10	m^3	3
		*Room height					2.5	m	4
		*Ventilation rate					2	h^{-1}	3
		*Cloud volume					0.0625	m^3	2
		*Mass generation rate					0.47	g/sec	2
		*Airborne fraction					1	g/g	2
		*Weight fraction non-volatile					0.03	g/g	1
		*Density non-volatile					1.5	g/cm^3	3
		*Initial particle distribution (c.v.)					35 (0.3)	µm	1
		*Inhalation cut-off diameter					15	µm	
	*Uptake-fraction model	*Uptake fraction		*Not included in FS 2025			1		2
		*Inhalation rate					23.1	l/min	3
		*Oral uptake fraction					1		2
		Exposed area		*600	*cm^2	3	580	cm^2	3

				Cosmetics Fact Sheet 2025			Cosmetics Fact Sheet 2006		
Scenario (Section FS 2025 ~ Section FS 2006)	Selected Exposure Model	Parameter	Age group	Default Value	Unit	Q-factor	Default Value	Unit	Q-Factor
	Dermal-direct product contact-instant application	*Amount upon head		*Not included in FS 2025			0.6	g	2
		*Product amount		*6	*g	*2	Not included in FS 2006		
	*Dermal - uptake, diffusion	*Exposure time		*Not included in FS 2025			480	min	2
Hair dyes, hair dye cream (6.4.3.2 ~ 3.1.6)	General	Frequency	Adults (19+ years)	*11	*/year	*4	10	/year	3
			*Children (4-8 years)	*6	*/year	*3	Not included in FS 2006		
	Dermal-direct product contact-instant application	Exposed Area	Adults (19+ years)	*600	*cm^2	3	580	cm^2	3
			*Children (4-8 years)	*470	*cm^2	*3	Not included in FS 2006		
		Product Amount	Adults (19+ years)	*35	*g	*2	100	g	3
			*Children (4-8 years)				Not included in FS 2006		
		*Retention factor		*0.1		*1	Not included in FS 2006		
	*Dermal - uptake, diffusion	*Exposure time	*Adults (19+ years)	*Not included in FS 2025			40	min	3
Hair bleaching products (6.5.1 ~ 3.1.7)	General	Frequency	Adults (19+ years)	*15	*/year	*4	10	/year	2
	*Inhalation-exposure to vapour-evaporation-constant release area	*Exposure duration		*45	*min	*1	Not included in FS 2006		
		*Product amount		*200	*g	*3			
		*Room volume		*10	*m^3	*4			
		*Ventilation rate		*2	*h^{-1}	*3			
		*Application temperature		*32	*°C	*4			

				Cosmetics Fact Sheet 2025			Cosmetics Fact Sheet 2006		
Scenario (Section FS 2025 - Section FS 2006)	Selected Exposure Model	Parameter	Age group	Default Value	Unit	Q-factor	Default Value	Unit	Q-Factor
		*Mass transfer coefficient		*10	*m/h	*2			
		*Release area		*600	*cm^2	*3			
		*Emission duration		*45	*min	*1			
	Dermal-direct product contact-instant application	Exposed Area		*600	*cm^2	3	580	cm^2	3
		Product Amount		200	G	3	200	g	3
		*Retention factor		*0.1		*1	Not included in FS 2006		
	*Dermal - uptake, diffusion	*Exposure time		*Not included in FS 2025			45	min	3
Permanent waves (6.6 - 3.1.8)	General	Frequency	Adults (19+ years)	*4	*/year	*4	4	/year	2
			*Children (14-18 years)	*10	*/year	*4	Not included in FS 2006		
	Dermal-direct product contact-instant application	Exposed Area	Adults (19+ years)	*600	*cm^2	3	580	cm^2	3
			*Children (14-18 years)	*520	*cm^2	*3	Not included in FS 2006		
		Product Amount - Perm lotion		80	G	3	80	g	3
		Product Amount - Fixing lotion		80	G	3	80	g	3
		*Retention factor		*0.1		*1	Not included in FS 2006		
	*Dermal - uptake, diffusion	*Exposure time - Perm lotion	*Adults (19+ years)	*Not included in FS 2025			40	min	3
		*Exposure time - Fixing lotion		*Not included in FS 2025			15	min	3

				Cosmetics Fact Sheet 2025			Cosmetics Fact Sheet 2006		
Scenario (Section FS 2025 - Section FS 2006)	Selected Exposure Model	Parameter	Age group	Default Value	Unit	Q-factor	Default Value	Unit	Q-Factor
*Permanent hair straightener (6.7)	*General	*Frequency	*Adults (19+ years)	*11	*/year	*4	Not included in FS 2006		
			*Children (4-8 years)	*6	*/year	*4			
	*Dermal-direct product contact-instant application	*Exposed Area	*Adults (19+ years)	*600	*cm^2	*3			
			*Children (4-8 years)	*470	*cm^2	*3			
		*Product Amount	*Adults (19+ years)	*260	*g	*2			
			*Children (4-8 years)	*230	*g	*2			
		*Retention factor		*0.1		*1			
Hand soap, liquid, solid (7.1 - 3.2.1)	General	Frequency	Adults (19+ years)	*2707	*/year	*4 (liquid) 3 (solid)	1825	/year	3
			*Children (4-8 years)	*1956	*/year	*4 (liquid) 3 (solid)	Not included in FS 2006		
	Dermal-direct product contact-instant application	Exposed Area	Adults (19+ years)	*900	*cm^2	3	860	cm^2	3
			*Children (4-8 years)	*460	*cm^2	*3	Not included in FS 2006		
		Amount upon skin - Soap liquid	Adults (19+ years)	*6	*g	*4	3	g	2
			*Children (4-8 years)	*6.1	*g	*4	Not included in FS 2006		

				Cosmetics Fact Sheet 2025			Cosmetics Fact Sheet 2006		
Scenario (Section FS 2025 - Section FS 2006)	Selected Exposure Model	Parameter	Age group	Default Value	Unit	Q-factor	Default Value	Unit	Q-Factor
		Amount upon skin - Soap solid	Adults (19+ years)	*0.45	*g	*3	2.4	g	2
			*Children (4-8 years)	*0.27	*g	*2	Not included in FS 2006		
		*Retention factor		*0.01		*1	Not included in FS 2006		
	*Dermal - uptake, diffusion	*Exposure time	*Adults (19+ years)	*Not included in FS 2025			1	min	2
Body soap, liquid, solid (7.2 - 3.2.2)	General	Frequency	Adults (19+ years)	*643	*/year	*4 (liquid) 3 (solid)	329	/year	3
			*Infants (0-5 months)	*599	*/year	*4 (liquid) 3 (solid)	Not included in FS 2006		
	Dermal-direct product contact-instant application	Exposed Area	Adults (19+ years)	*17000	*cm^2	*3	17500	cm^2	4
			*Infants (0-5 months)	*2780	*cm^2	*3	Not included in FS 2006		
		Amount upon skin - Soap liquid	Adults (19+ years)	*16	*g	*4	26.1	g	2
			*Infants (0-5 months)	*6.7	*g	*4	Not included in FS 2006		
		Amount upon skin - Soap solid	Adults (19+ years)	*1.8	*g	*4	21	g	2
			*Infants (0-5 months)	*0.31	*g	*2	Not included in FS 2006		
		*Retention factor		*0.01		*1	Not included in FS 2006		

				Cosmetics Fact Sheet 2025			Cosmetics Fact Sheet 2006		
Scenario (Section FS 2025 - Section FS 2006)	Selected Exposure Model	Parameter	Age group	Default Value	Unit	Q-factor	Default Value	Unit	Q-Factor
	*Dermal - uptake, diffusion	*Exposure time	*Adults (19+ years)	*Not included in FS 2025			4	min	3
*Hand sanitiser (~ 7.3)	*General	*Frequency	*Adults (19+ years)	*2880	*/year	*4	Not included in FS 2006		
			*Children (4-8 years)	*1184	*/year	*4			
	*Inhalation-exposure to vapour-evaporation-constant release area	*Exposure duration	*Adults (19+ years)	*3	*h	*4			
			*Children (4-8 years)	*7	*h	*4			
		*Molecular weight matrix		*Pure					
		*Product amount	*Adults (19+ years)	*1.5	*g	*4			
			*Children (4-8 years)						
		*Room volume		*20	*m^3	*3			
		*Ventilation rate		*0.6	*h^{-1}	*3			
		*Application temperature		*32	*°C	*4			
		*Mass transfer coefficient		*10	*m/h	*2			
		*Release area	*Adults (19+ years)	*900	*cm^2	*3			
			*Children (4-8 years)	*460	*cm^2	*3			
		*Emission duration	*Adults (19+ years)	*3	*h	*4			

				Cosmetics Fact Sheet 2025			Cosmetics Fact Sheet 2006		
Scenario (Section FS 2025 - Section FS 2006)	Selected Exposure Model	Parameter	Age group	Default Value	Unit	Q-factor	Default Value	Unit	Q-Factor
			*Children (4-8 years)	*7	*h	*4			
	*Dermal-direct product contact-instant application	*Exposed area	*Adults (19+ years)	*900	*cm^2	*3			
			*Children (4-8 years)	*460	*cm^2	*3			
		*Product amount	*Adults (19+ years)	*1.5	*g	*4			
			*Children (4-8 years)						
Bath products, bubble/foam bath, bath salts, bath oils (7.4 - 3.2.3)	General	Frequency – bubble/foam bath	Adults (19+ years)	*232	*/year	*4	104	/year	3
			*Children (14-18 years)	*252	*/year	*4	Not included in FS 2006		
		Frequency – bath salts and bath oils	Adults (19+ years)	104	/year	3	104	/year	3
			*Children (9-13 years)				Not included in FS 2006		
	Dermal-direct product contact-instant application	Exposed Area – bubble/foam bath	Adults (19+ years)	*17000	*cm^2	*3	16340	cm^2	4
			*Children (14-18 years)	*15760	*cm^2	*3	Not included in FS 2006		
		Exposed area – bath salts and bath oils	Adults (19+ years)	*17000	*cm^2	*3	16340	cm^2	4
			*Children (9-13 years)	*12950	*cm^2	*3	Not included in FS 2006		
		*Product amount (in bath) – bubble/foam bath	*Adults (19+ years)	*38.8	*g	*4	Not included in FS 2006		

				Cosmetics Fact Sheet 2025			Cosmetics Fact Sheet 2006		
Scenario (Section FS 2025 - Section FS 2006)	Selected Exposure Model	Parameter	Age group	Default Value	Unit	Q-factor	Default Value	Unit	Q-Factor
			*Children (14-18 years)						
		*Product amount (in bath) – bath salts	*Adults (19+ years)	*18.9	*g	*3			
			*Children (9-13 years)						
		*Product amount (in bath) – bath oils	*Adults (19+ years)	*14.7	*g	*3			
			*Children (9-13 years)						
		*Product amount (on skin) – bubble/foam bath	*Adults (19+ years)	*Not included in FS 2025			16340	g	1
		*Product amount (on skin) – bath salts							
		*Product amount (on skin) – bath oils							
		*Dilution factor – bubble/foam bath	*Adults (19+ years)	*0.14			Not included in FS 2006		
			*Children (14-18 years)	*0.13					
		*Dilution factor – bath salts and bath oils	*Adults (19+ years)	*0.14					
			*Children (9-13 years)	*0.11					
	Dermal - uptake, diffusion	*Exposure time - Bath foam/bath salts	*Adults (19+ years)	*Not included in FS 2025			30	min	2
		*Exposure time- Bath oil		*Not included in FS 2025			20	min	2

				Cosmetics Fact Sheet 2025			Cosmetics Fact Sheet 2006		
Scenario (Section FS 2025 - Section FS 2006)	Selected Exposure Model	Parameter	Age group	Default Value	Unit	Q-factor	Default Value	Unit	Q-Factor
Creams, face cream (8.1.1 - 3.3.1)	General	Frequency	Adults (19+ years)	*931	*/year	*4	730	/year	3
		*Body weight female		*Not included in FS 2025			61	kg	4
	*Inhalation-exposure to vapour-evaporation-constant release area	*Exposure duration		*9	*h	*4	Not included in FS 2006		
		*Molecular weight matrix		*Pure					
		*Product amount		*2.5	*g	*4			
		*Room volume		*20	*m^3	*3			
		*Ventilation rate		*0.6	*h^{-1}	*3			
		*Application temperature		*32	*°C	*4			
		*Mass transfer coefficient		*10	*m/h	*2			
		*Release area		*600	*cm^2	*3			
		*Emission duration		*9	*h	*4			
	Dermal-direct product contact-instant application	Exposed area		*600	*cm^2	3	565	cm^2	3
		Product amount		*2.5	*g	*4	0.8	g	3
	*Dermal - uptake, diffusion	*Exposure time		*Not included in FS 2025			720	min	3
Creams, hand cream (8.1.2 - 3.3.1)	General	Frequency	Adults (19+ years)	*1165	*/year	*4	730	/year	2
	*Inhalation-exposure to vapour-evaporation-constant release area	*Exposure duration		*8	*h	*4	Not included in FS 2006		
		*Molecular weight matrix		*Pure					
		*Product amount		*2.5	*g	*4			
		*Room volume		*20	*m^3	*3			
		*Ventilation rate		*0.6	*h^{-1}	*3			
		*Application temperature		*32	*°C	*4			

				Cosmetics Fact Sheet 2025			Cosmetics Fact Sheet 2006		
Scenario (Section FS 2025 - Section FS 2006)	Selected Exposure Model	Parameter	Age group	Default Value	Unit	Q-factor	Default Value	Unit	Q-Factor
		*Mass transfer coefficient		*10	*m/h	*2			
		*Release area		*900	*cm^2	*3			
		*Emission duration		*8	*H	*4			
	Dermal-direct product contact-instant application	Exposed area		*900	cm^2	3	860	cm^2	3
		Product amount		*2.5	*g	*4	1.7	g	3
	*Dermal - uptake, diffusion	*Exposure time		*Not included in FS 2025			720	min	3
Creams, body lotion (8.1.3 - 3.3.1)	General	Frequency	Adults (19+ years)	*360	*/year	*4	730	/year	3
			*Infants (0-5 months)	*455	*/year	*4	Not included in FS 2006		
		*Body weight female	*Adults (19+ years)	*Not included in FS 2025			61	kg	4
	*Inhalation-exposure to vapour-evaporation-constant release area	*Exposure duration	*Adults (19+ years)	*24	*h	*4	Not included in FS 2006		
			*Infants (0-5 months)	*19	*h	*4			
		*Molecular weight matrix		*Pure					
		*Product amount	*Adults (19+ years)	*15.4	*g	*4			
			*Infants (0-5 months)	*3.8	*g	*2			
		*Room volume		*20	*m^3	*3			
		*Ventilation rate		*0.6	*h^{-1}	*3			
		*Application temperature		*32	*°C	*4			

				Cosmetics Fact Sheet 2025			Cosmetics Fact Sheet 2006		
Scenario (Section FS 2025 - Section FS 2006)	Selected Exposure Model	Parameter	Age group	Default Value	Unit	Q-factor	Default Value	Unit	Q-Factor
		*Mass transfer coefficient		*10	*m/h	*2			
		*Release area	*Adults (19+ years)	*17000	*cm^2	*3			
			*Infants (0-5 months)	*3090	*cm^2	*3			
		*Emission duration	*Adults (19+ years)	*24	*h	*4			
			*Infants (0-5 months)	*19	*h	*4			
	Dermal-direct product contact-instant application	Exposed area	Adults (19+ years)	*17000	*cm^2	*3	15670	cm^2	4
			*Infants (0-5 months)	*3090	*cm^2	*3	Not included in FS 2006		
		Product amount	Adults (19+ years)	*15.4	*g	*4	8	g	3
			*Infants (0-5 months)	*3.8	*g	*2	Not included in FS 2006		
	*Dermal - uptake, diffusion	*Exposure time	*Adults (19+ years)	*Not included in FS 2025			720	min	3
Face exfoliators (8.2 - 3.3.2)	General	Frequency	Adults (19+ years)	*202	*/year	*4	104	/year	3
			*Children (14-18 years)				Not included in FS 2006		
		*Body weight female	*Adults (19+ years)	*Not included in FS 2025			61	kg	4
		Exposed area	Adults (19+ years)	*600	cm^2	3	565	cm^2	3

				Cosmetics Fact Sheet 2025			Cosmetics Fact Sheet 2006		
Scenario (Section FS 2025 - Section FS 2006)	Selected Exposure Model	Parameter	Age group	Default Value	Unit	Q-factor	Default Value	Unit	Q-Factor
	Dermal-direct product contact-instant application		*Children (14-18 years)	*520	*cm^2	*3	Not included in FS 2006		
		Product amount	Adults (19+ years)	*5.1	*g	*4	0.8	g	2
			*Children (14-18 years)				Not included in FS 2006		
		*Retention factor		*0.1		*1	Not included in FS 2006		
	*Dermal - uptake, diffusion	*Exposure time	*Adults (19+ years)	*Not included in FS 2025			5	min	2
Face packs (8.3 - 3.3.3)	General	Frequency	Adults (19+ years)	*51	*/year	*4	104	/year	3
			*Children (14-18 years)				Not included in FS 2006		
		*Body weight female	*Adults (19+ years)	*Not included in FS 2025			61	kg	4
	Dermal-direct product contact-instant application	Exposed area	Adults (19+ years)	*600	cm^2	3	565	cm^2	3
			*Children (14-18 years)	*520	*cm^2	*3	Not included in FS 2006		
		Product amount	Adults (19+ years)	*15.9	*g	*4	20	g	3
			*Children (14-18 years)				Not included in FS 2006		
		*Retention factor		*0.1		*1	Not included in FS 2006		
	*Dermal - uptake, diffusion	*Exposure time	*Adults (19+ years)	*Not included in FS 2025			20	min	3
	General	Frequency		4	/year	*3	4	/year	2

				Cosmetics Fact Sheet 2025			Cosmetics Fact Sheet 2006		
Scenario (Section FS 2025 ~ Section FS 2006)	Selected Exposure Model	Parameter	Age group	Default Value	Unit	Q-factor	Default Value	Unit	Q-Factor
Body packs (8.4 ~ 3.3.4)		*Body weight female	Adults (19+ years)	*Not included in FS 2025			61	kg	4
	Dermal-direct product contact-instant application	Exposed area		*17000	*cm^2	*3	15670	cm^2	4
		Product amount		*450	*g	*3	416	g	2
		*Retention factor		*0.1		*1	Not included in FS 2006		
	*Dermal - uptake, diffusion	*Exposure time		*Not included in FS 2025			20	min	3
Facial make-up, foundation (liquid/cream/foam) (9.1.1 ~ 3.4.1)	General	Frequency	Adults (19+ years)	*531	*/year	*4	365	/year	2
		*Body weight female		*Not included in FS 2025			61	kg	4
	Dermal-direct product contact-instant application	Exposed area		*600	cm^2	3	565	cm^2	3
		Product amount		*0.86	g	*4	0.8	g	2
	*Dermal - uptake, diffusion	*Exposure time		*Not included in FS 2025			960	min	3
*Facial make-up, foundation (powder) (~9.1.2)	*General	*Frequency	*Adults (19+ years)	*393	*/year	*4	Not included in FS 2006		
			*Children (14-18 years)						
	*Dermal-direct product contact-instant application	*Exposed area	*Adults (19+ years)	*600	*cm^2	*3			
			*Children (14-18 years)	*520	*cm^2	*3			
		*Product amount	*Adults (19+ years)	*0.12	*g	*4			
			*Children (14-18 years)						

				Cosmetics Fact Sheet 2025			Cosmetics Fact Sheet 2006		
Scenario (Section FS 2025 - Section FS 2006)	Selected Exposure Model	Parameter	Age group	Default Value	Unit	Q-factor	Default Value	Unit	Q-Factor
*Facial make-up, blush/contour/highlight (~9.1.3)	*General	*Frequency	*Adults (19+ years)	*365	*/year	*4	Not included in FS 2006		
			*Children (14-18 years)						
	*Inhalation-exposure to spray-instantaneous release	*Exposure duration		*1	*min	*2			
		*Released mass		*0.42	*mg	*1			
		*Room volume	*Adults (19+ years)	*0.00923	*m^3	*1			
			*Children (14-18 years)	*0.00845	*m^3	*1			
		*Ventilation rate		*0	*h^{-1}	*1			
	*Dermal-direct product contact-instant application	*Exposed area	*Adults (19+ years)	*300	*cm^2	*3			
			*Children (14-18 years)	*260	*cm^2	*3			
		*Product amount	*Adults (19+ years)	*21	*mg	*4			
			*Children (14-18 years)						
Facial cleansers (9.2.1 - 3.4.2)	General	Frequency	Adults (19+ years)	*712	*/year	*4	730	/year	3
			*Children (9-13 years)	*577	*/year	*4	Not included in FS 2006		
		*Body weight female	*Adults (19+ years)	*Not included in FS 2025			61	kg	4
		Exposed area	Adults (19+ years)	*600	cm^2	3	565	cm^2	3

				Cosmetics Fact Sheet 2025			Cosmetics Fact Sheet 2006		
Scenario (Section FS 2025 - Section FS 2006)	Selected Exposure Model	Parameter	Age group	Default Value	Unit	Q-factor	Default Value	Unit	Q-Factor
	Dermal-direct product contact-instant application		*Children (9-13 years)	*525	*cm^2	*3	Not included in FS 2006		
		Product amount	Adults (19+ years)	*4.8	*g	*4	2.5	g	3
			*Children (9-13 years)			*2	Not included in FS 2006		
		*Retention factor		*0.01		*1	Not included in FS 2006		
	*Dermal - uptake, diffusion	*Exposure time	*Adults (19+ years)	*Not included in FS 2025			5	min	2
Facial make-up remover (9.2.2 - 3.4.2)	General	Frequency	Adults (19+ years)	*501	*/year	*4	730	/year	3
			*Children (14-18 years)				Not included in FS 2006		
		*Body weight female	*Adults (19+ years)	*Not included in FS 2025			61	kg	4
	Dermal-direct product contact-instant application	Exposed area	Adults (19+ years)	*600	cm^2	3	565	cm^2	3
			*Children (14-18 years)	*520	*cm^2	*3	Not included in FS 2006		
		Product amount	Adults (19+ years)	*6.5	*g	*4	2.5	g	3
			*Children (14-18 years)				Not included in FS 2006		
		*Retention factor		*0.1		*1	Not included in FS 2006		
	*Dermal - uptake, diffusion	*Exposure time	*Adults (19+ years)	*Not included in FS 2025			5	min	2
	General	Frequency		*511	*/year	*4	730	/year	3

				Cosmetics Fact Sheet 2025			Cosmetics Fact Sheet 2006		
Scenario (Section FS 2025 - Section FS 2006)	Selected Exposure Model	Parameter	Age group	Default Value	Unit	Q-factor	Default Value	Unit	Q-Factor
Eye shadow (9.3.1 - 3.4.3)		*Body weight female	Adults (19+ years)	*Not included in FS 2025			61	kg	4
	*Inhalation-exposure to spray-instantaneous release	*Exposure duration		*1	*min	*2	Not included in FS 2006		
		*Released mass		*0.38	*mg	*1			
		*Room volume		*0.00923	*m^3	*1			
		*Ventilation rate		*0	*h^{-1}	*1			
	Dermal-direct product contact-instant application	Exposed area		24	cm^2	*3	24	cm^2	2
		Product amount		*19	*mg	*4	0.01	g	3
	*Dermal - uptake, diffusion	*Exposure time		*Not included in FS 2025			480	min	3
Mascara (9.3.2 - 3.4.3)	General	Frequency	Adults (19+ years)	*410	*/year	*4	365	/year	3
			*Children (9-13 years)	*390	*/year	*4	Not included in FS 2006		
		*Body weight female	*Adults (19+ years)	*Not included in FS 2025			61	kg	4
	Dermal-direct product contact-instant application	Exposed area	Adults (19+ years)	1.6	cm^2	*3	1.6	cm^2	2
			*Children (9-13 years)				Not included in FS 2006		
		Product amount	Adults (19+ years)	0.025	g	*4	0.025	g	3
			*Children (9-13 years)				Not included in FS 2006		
	Dermal - uptake, diffusion	*Exposure time	*Adults (19+ years)	*Not included in FS 2025			960	min	3

				Cosmetics Fact Sheet 2025			Cosmetics Fact Sheet 2006		
Scenario (Section FS 2025 ~ Section FS 2006)	Selected Exposure Model	Parameter	Age group	Default Value	Unit	Q-factor	Default Value	Unit	Q-Factor
Eyeliner (9.3.3 ~ 3.4.3)	General	Frequency	Adults (19+ years)	*413	*/year	*4	365	/year	3
			*Children (9-13 years)	*381	*/year	*4	Not included in FS 2006		
		*Body weight female	*Adults (19+ years)	*Not included in FS 2025			61	kg	4
	Dermal-direct product contact-instant application	Exposed area	Adults (19+ years)	3.2	cm^2	*3	3.2	cm^2	2
			*Children (9-13 years)				Not included in FS 2006		
		Product amount	Adults (19+ years)	*0.013	*g	*4	0.005	g	3
			*Children (9-13 years)				Not included in FS 2006		
	Dermal - uptake, diffusion	*Exposure time	*Adults (19+ years)	*Not included in FS 2025			960	min	3
Eye makeup remover (9.3.4 ~ 3.4.3)	General	Frequency	Adults (19+ years)	*501	/year	3	365	/year	3
			*Children (9-13 years)	*426	*/year	*3	Not included in FS 2006		
		*Body weight female	*Adults (19+ years)	*Not included in FS 2025			61	kg	4
	Dermal-direct product contact-instant application	Exposed area	Adults (19+ years)	50	cm^2	*3	50	cm^2	2
			*Children (9-13 years)				Not included in FS 2006		
		Product amount	Adults (19+ years)	0.5	g	3	0.5	g	3

				Cosmetics Fact Sheet 2025			Cosmetics Fact Sheet 2006		
Scenario (Section FS 2025 - Section FS 2006)	Selected Exposure Model	Parameter	Age group	Default Value	Unit	Q-factor	Default Value	Unit	Q-Factor
			*Children (9-13 years)				Not included in FS 2006		
		*Retention factor		*0.1		*1	Not included in FS 2006		
	*Dermal - uptake, diffusion	*Exposure time	*Adults (19+ years)	*Not included in FS 2025			5	min	2
Lip make-up products (9.4 - 3.4.4)	General	Frequency	Adults (19+ years)	*1092	*/year	*4	1460	/year	3
			*Children (14-18 years)	*1812	*/year	*4	Not included in FS 2006		
		*Body weight female	*Adults (19+ years)	*Not included in FS 2025			61	kg	4
	Oral- direct oral contact- direct oral intake model	Amount ingested	Adults (19+ years)	*0.032	*g	*4	0.01	g	3
			*Children (14-18 years)				Not included in FS 2006		
	Oral - uptake, fraction model	*Uptake fraction	*Adults (19+ years)	*Not included in FS 2025			1		2
Nail cosmetics, nail polish, base coat or top coat (10.1.1 - 3.4.5)	General	Frequency	Adults (19+ years)	*104	*/year	*4	156	/year	3
			*Children (14-18 years)	*119	*/year	*4	Not included in FS 2006		
		*Body weight female	*Adults (19+ years)	*Not included in FS 2025			61	kg	4
	*Inhalation-exposure to vapour-	*Exposure duration	*Adults (19+ years)	*Not included in FS 2025			5	min	2
		*Product amount					0.25	g	3
		*Room volume					1	m^3	1

				Cosmetics Fact Sheet 2025			Cosmetics Fact Sheet 2006		
Scenario (Section FS 2025 - Section FS 2006)	Selected Exposure Model	Parameter	Age group	Default Value	Unit	Q-factor	Default Value	Unit	Q-Factor
	evaporation from constant surface	*Ventilation rate					1	hr^{-1}	1
		*Release area					19	cm^2	2
		*Application duration					5	min	2
		*Temperature					20	°C	4
		*Mass transfer rate					Langmuir		
		*Mol. weight matrix					124	g/mol	2
	*Inhalation - uptake, fraction model	*Uptake fraction		*Not included in FS 2025			1		2
		*Inhalation rate					23.1	l/min	3
	*Inhalation-exposure to vapour-evaporation-increasing release area	*Exposure duration		*35	*min	*2	Not included in FS 2006		
		*Product amount		*1	*g	*4			
		*Room volume		*20	$*m^3$	*3			
		*Ventilation rate		*0.6	$*h^{-1}$	*3			
		*Release area		*52.4	$*cm^2$	*3			
		*Application duration		*35	*min	*2			
		*Application temperature		*32	*°C	*4			
		*Mass transfer coefficient		*10	*m/h	*2			
		*Mol. weight matrix		*124	*g/mol	*2			
	Dermal-direct product contact-instant application	Exposed area	Adults (19+ years)	*5.4	$*cm^2$	*3	4	cm^2	2
			*Children (14-18 years)				Not included in FS 2006		
		Amount upon skin	Adults (19+ years)	*0.206	*G	*4	0.05	g	2

				Cosmetics Fact Sheet 2025			Cosmetics Fact Sheet 2006		
Scenario (Section FS 2025 ~ Section FS 2006)	Selected Exposure Model	Parameter	Age group	Default Value	Unit	Q-factor	Default Value	Unit	Q-Factor
			*Children (14-18 years)				Not included in FS 2006		
	*Dermal - uptake, diffusion	*Exposure time	*Adults (19+ years)	*Not included in FS 2025			3360	min	3
Nail cosmetics, nail polish remover (10.2.1 ~ 3.4.5)	General	Frequency	Adults (19+ years)	*104	*/year	*4	156	/year	3
			*Children (14-18 years)	*119	*/year	*4	Not included in FS 2006		
		*Body weight female	*Adults (19+ years)	*Not included in FS 2025			61	kg	4
	*Inhalation-exposure to vapour-evaporation from constant surface	*Exposure duration	*Adults (19+ years)	*Not included in FS 2025			5	min	2
		*Product amount					0.5	g	2
		*Room volume					1	m^3	1
		*Ventilation rate					1	hr^{-1}	1
		*Release area					25	cm^2	2
		*Application duration					5	min	2
		*Temperature					20	°C	4
		*Mass transfer rate					Langmuir		
		*Mol. weight matrix					75	g/mol	2
	*Inhalation - uptake, fraction model	*Uptake fraction	*Adults (19+ years)	*Not included in FS 2025			1		2
		*Inhalation rate					23.1	l/min	3
	*Inhalation-exposure to vapour-	*Exposure duration		*8	*min	*2	Not included in FS 2006		
		*Product amount		*8	*g	*4			
		*Room volume		*20	*m^3	*3			

				Cosmetics Fact Sheet 2025			Cosmetics Fact Sheet 2006		
Scenario (Section FS 2025 - Section FS 2006)	Selected Exposure Model	Parameter	Age group	Default Value	Unit	Q-factor	Default Value	Unit	Q-Factor
	evaporation-increasing release area	*Ventilation rate		*0.6	*h^{-1}	*3			
		*Release area		*35.7	*cm^2	*3			
		*Application duration		*8	*min	*2			
		*Application temperature		*32	*°C	*4			
		*Mass transfer coefficient		*10	*m/h	*2			
		*Mol. weight matrix		*75	*g/mol	*2			
	Dermal-direct product contact-instant application	Exposed area	Adults (19+ years)	*14.9	*cm^2	*3	11	cm^2	2
			*Children (14-18 years)				Not included in FS 2006		
		Amount upon skin	Adults (19+ years)	*8	*g	*4	0.2	g	2
			*Children (14-18 years)				Not included in FS 2006		
		*Retention factor		*0.42		*1	Not included in FS 2006		
	*Dermal - uptake, diffusion	*Exposure time	*Adults (19+ years)	*Not included in FS 2025			5	min	2
Deodorant, stick/roller (11.2 - 3.5)	General	Frequency	Adults (19+ years)	*573	*/year	*4	365	/year	3
			*Children (14-18 years)	*527	*/year	*4	Not included in FS 2006		
	*Inhalation-exposure to vapour-evaporation-	*Exposure duration	*Adults (19+ years)	*15	*h	*4	Not included in FS 2006		
			*Children (14-18 years)	*17	*h	*4			
		*Molecular weight matrix		*Pure					

				Cosmetics Fact Sheet 2025			Cosmetics Fact Sheet 2006		
Scenario (Section FS 2025 - Section FS 2006)	Selected Exposure Model	Parameter	Age group	Default Value	Unit	Q-factor	Default Value	Unit	Q-Factor
	constant release area	*Product amount	*Adults (19+ years)	*1.5	*g	*4			
			*Children (14-18 years)						
		*Room volume		*20	*m^3	*3			
		*Ventilation rate		*0.6	*h^{-1}	*3			
		*Application temperature		*32	*°C	*4			
		*Mass transfer coefficient		*10	*m/h	*2			
		*Release area	*Adults (19+ years)	*240	*cm^2	*3			
			*Children (14-18 years)	*227	*cm^2	*2			
		*Emission duration	*Adults (19+ years)	*15	*h	*4			
			*Children (14-18 years)	*17	*h	*4			
	Dermal-direct product contact-instant application loading model	Exposed area	Adults (19+ years)	*240	*cm^2	*3	100	cm^2	2
			*Children (14-18 years)	*227	*cm^2	*2	Not included in FS 2006		
		Product amount	Adults (19+ years)	*1.5	*g	*4	0.5	g	3
			*Children (14-18 years)				Not included in FS 2006		
	*Dermal - uptake, diffusion	*Exposure time	*Adults (19+ years)	*Not included in FS 2025			1440	min	3

				Cosmetics Fact Sheet 2025			Cosmetics Fact Sheet 2006		
Scenario (Section FS 2025 - Section FS 2006)	Selected Exposure Model	Parameter	Age group	Default Value	Unit	Q-factor	Default Value	Unit	Q-Factor
Deodorant, spray (11.1 - 3.5)	General	Frequency	Adults (19+ years)	*573	*/year	*4	730	/year	3
			*Children (14-18 years)	*570	*/year	*4	Not included in FS 2006		
	Inhalation-instantaneous release – spraying towards exposed person	Spray duration	Adults (19+ years)	*3.4	*s	*3	0.17	min	2
			*Children (14-18 years)	*3.5	*s	*3	Not included in FS 2006		
		Exposure duration		5	min	2	5	min	2
		Room volume		10	m^3	*4	10	m^3	3
		Room height		2.5	m	4	2.5	m	4
		Ventilation rate		2	h^{-1}	3	2	h^{-1}	3
		Cloud volume		0.0625	m^3	2	0.0625	m^3	2
		Mass generation rate		*0.9	g/sec	3	0.4	g/sec	3
		Airborne fraction		*0.9	g/g	*3	1	g/g	2
		*Weight fraction non-volatile		*Not included in FS 2025			0.03	g/g	2
		Density non-volatile		*1.5	g/cm^3	*2	1.8	g/cm^3	3
		Initial particle distribution (c.v.)		*8.3 (0.84)	µm	3	10 (0.3)	µm	3
		Inhalation cut-off diameter		15	µm	3	15	µm	
	*Inhalation - uptake, fraction model	*Uptake fraction	*Adults (19+ years)	*Not included in FS 2025			1		2
		*Inhalation rate					23.1	l/min	3
		*Oral uptake fraction					1		2
		*Exposure duration		*6.9	*s	*1	Not included in FS 2006		

				Cosmetics Fact Sheet 2025			Cosmetics Fact Sheet 2006		
Scenario (Section FS 2025 - Section FS 2006)	Selected Exposure Model	Parameter	Age group	Default Value	Unit	Q-factor	Default Value	Unit	Q-Factor
	*Inhalation-exposure to spray-instantaneous release	*Released mass		*3.1	*g	*4			
		*Room volume		*1	*m^3	*1			
		*Ventilation rate		*2	*h^{-1}	*1			
	Dermal-direct product contact-instant application	Exposed area	Adults (19+ years)	*240	*cm^2	*3	100	cm^2	2
			*Children (14-18 years)	*227	*cm^2	*1	Not included in FS 2006		
		*Amount upon skin	*Adults (19+ years)	*Not included in FS 2025			2.6	g	2
		*Product amount	*Adults (19+ years)	*3.1	*g	*4	Not included in FS 2006		
			*Children (14-18 years)						
		*Retention factor		*0.85		*1	Not included in FS 2006		
	*Dermal - uptake, diffusion	*Exposure time	*Adults (19+ years)	*Not included in FS 2025			720	min	3
Toothpaste (12.1 - 3.6.1)	General	Frequency	Adults (19+ years)	*1095	*/year	*4	730	/year	3
			Infants (2-3 years) / Child (2.5 year)						
		*Body weight child	*Child (2.5 year)	*Not included in FS 2025			12.5	kg	4
		Amount ingested	Adults (19+ years)	*0.1	*g	*4	0.08	g	3

				Cosmetics Fact Sheet 2025			Cosmetics Fact Sheet 2006		
Scenario (Section FS 2025 - Section FS 2006)	Selected Exposure Model	Parameter	Age group	Default Value	Unit	Q-factor	Default Value	Unit	Q-Factor
	Oral- direct oral contact- direct oral intake model		Infants (2-3 years) / Child (2.5 year)	*0.32	g	3	0.53	g	3
	*Oral - uptake, fraction model	*Uptake fraction	*Adults (19+ years)	*Not included in FS 2025			1		2
			*Child (2.5 year)						
Mouthwash (12.2 - 3.6.2)	General	Frequency	Adults (19+ years)	*479	*/year	*4	1460	/year	3
			*Children (4-8 years)	*500	*/year	*4	Not included in FS 2006		
	Oral- direct oral contact- direct oral intake model	Amount ingested	Adults (19+ years)	*2.3	*g	*4	1	g	3
			*Children (4-8 years)	*1	*g	*2	Not included in FS 2006		
	*Oral - uptake, fraction model	*Uptake fraction	*Adults (19+ years)	*Not included in FS 2025			1		2
*Foot cream/moisturiser (- 13.1)	*General	*Frequency	*Adults (19+ years)	*595	*/year	*4	Not included in FS 2006		
			*Children (14-18 years)						
	*Dermal-direct product contact- instant application	*Exposed area	*Adults (19+ years)	*1200	*cm^2	*3			
			*Children (14-18 years)	*1080	*cm^2	*3			
		*Product amount	*Adults (19+ years)	*6	*g	*4			

				Cosmetics Fact Sheet 2025			Cosmetics Fact Sheet 2006		
Scenario (Section FS 2025 ~ Section FS 2006)	Selected Exposure Model	Parameter	Age group	Default Value	Unit	Q-factor	Default Value	Unit	Q-Factor
			*Children (14-18 years)						
Foot antiperspirant (13.2 ~ 3.7.1)	General	Frequency	Adults (19+ years)	*416	*/year	*4	730	/year	3
			*Infants (2-3 years)			*2	Not included in FS 2006		
	Dermal-direct product contact-instant application	Exposed area	Adults (19+ years)	*1200	cm^2	3	1170	cm^2	3
			*Infants (2-3 years)	*360	*cm^2	*3	Not included in FS 2006		
		Amount upon skin	Adults (19+ years)	*3.9	*g	*4	1.2	g	3
			*Infants (2-3 years)	*1.3	*g	*2	Not included in FS 2006		
	*Dermal - uptake, diffusion	*Exposure time	*Adults (19+ years)	*Not included in FS 2025			720	min	3
Foot anti-fungal cream (13.3 ~ 3.7.2)	General	Frequency	Adults (19+ years)	90	/year	3	90	/year	3
			*Infants (2-3 years)				Not included in FS 2006		
	Dermal-direct product contact-instant application	Exposed area	Adults (19+ years)	*1200	*cm^2	*3	100	cm^2	2
			*Infants (2-3 years)	*360	*cm^2	*3	Not included in FS 2006		
		Amount upon skin	Adults (19+ years)	*1.2	*g	*3	0.1	g	2
			*Infants (2-3 years)	*0.36	*g	*3	Not included in FS 2006		

				Cosmetics Fact Sheet 2025			Cosmetics Fact Sheet 2006		
Scenario (Section FS 2025 - Section FS 2006)	Selected Exposure Model	Parameter	Age group	Default Value	Unit	Q-factor	Default Value	Unit	Q-Factor
	*Dermal - uptake, diffusion	*Exposure time	*Adults (19+ years)	*Not included in FS 2025			720	min	3
*Foot spray, aerosol (-13.4.1)	*General	*Frequency	*Adults (19+ years) *Infants (2-3 years)	*416	*/year	*4	Not included in FS 2006		
	*Inhalation-exposure to spray-spraying	*Spray duration		*8	*S	*2			
		*Exposure duration		*40	*min	*2			
		*Room volume		*20	*m^2	*3			
		*Room height		*2.5	*m	*4			
		*Ventilation rate		*0.6	*/hour	*3			
		*Mass generation rate		*0.9	*g/s	*2			
		*Airborne fraction		*0.9	*g/g	*2			
		*Density non-volatile		*1.5	*g/cm^3	*1			
		*Inhalation cut-off diameter		*15	*µm	*3			
		*Initial particle distribution Median (C.V.)		*8.3 (0.84)	*µm	*2			
	*Inhalation-exposure to spray-instantaneous release	*Exposure duration		*16	*s	*1			
		*Released mass		*7.2	*g	*2			
		*Room volume		*1	*m^3	*1			
		*Ventilation rate		*0.6	*/hour	*1			
		*Exposed Area	*Adults (19+ years)	*1200	*cm^2	*3			

				Cosmetics Fact Sheet 2025			Cosmetics Fact Sheet 2006		
Scenario (Section FS 2025 - Section FS 2006)	Selected Exposure Model	Parameter	Age group	Default Value	Unit	Q-factor	Default Value	Unit	Q-Factor
	*Dermal-direct product contact-instant application		*Infants (2-3 years)	*360	*cm^2	*3			
		*Product Amount	*Adults (19+ years)	*7.2	*g	*2			
			*Infants (2-3 years)						
		*Retention factor	*Adults (19+ years)	*0.85		*1			
*Foot spray, pump (-13.4.2)	*General	*Frequency	*Adults (19+ years)	*416	*/year	*4	Not included in FS 2006		
			*Infants (2-3 years)						
	*Inhalation-exposure to spray-spraying	*Spray duration		*8	*s	*2			
		*Exposure duration		*40	*min	*2			
		*Room volume		*20	*m^2	*3			
		*Room height		*2.5	*m	*4			
		*Ventilation rate		*0.6	*/hour	*3			
		*Mass generation rate		*1.6	*g/s	*3			
		*Airborne fraction		*0.02		*1			
		*Density non-volatile		*1.8	*g/cm^3	*3			
		*Inhalation cut-off diameter		*15	*µm	*3			
		*Initial particle distribution Median (C.V.)		*2.7 (0.73)	*µm	*1			
	*Inhalation-exposure to spray-	*Exposure duration	*Adults (19+ years)	*16	*s	*1			

				Cosmetics Fact Sheet 2025			Cosmetics Fact Sheet 2006		
Scenario (Section FS 2025 - Section FS 2006)	Selected Exposure Model	Parameter	Age group	Default Value	Unit	Q-factor	Default Value	Unit	Q-Factor
	instantaneous release		*Infants (2-3 years)						
		*Released mass	*Adults (19+ years)	*12.8	*g	*2			
			*Infants (2-3 years)						
		*Room volume		*1	*m^3	*1			
		*Ventilation rate		*0.6	*/hour	*1			
	*Dermal-direct product contact-instant application	*Exposed Area	*Adults (19+ years)	*1200	*cm^2	*3			
			*Infants (2-3 years)	*360	*cm^2	*3			
		*Product Amount	*Adults (19+ years)	*12.8	*g	*2			
			*Infants (2-3 years)						
		*Retention factor		*0.85		*1			
*Foot powder (- 13.5)	*General	*Frequency	*Adults (19+ years)	*416	*/year	*4	Not included in FS 2006		
			*Infants (2-3 years)						
	*Dermal-direct product contact-instant application	*Exposed Area	*Adults (19+ years)	*1200	*cm^2	*3			
			*Infants (2-3 years)	*360	*cm^2	*3			
		*Product Amount	*Adults (19+ years)	*0.66	*g	*2			

				Cosmetics Fact Sheet 2025			Cosmetics Fact Sheet 2006		
Scenario (Section FS 2025 - Section FS 2006)	Selected Exposure Model	Parameter	Age group	Default Value	Unit	Q-factor	Default Value	Unit	Q-Factor
			*Infants (2-3 years)	*0.21	*g	*2			
Fragrances (14.1 - 3.8)	General	Frequency	Adults (19+ years)	*730	*/year	*4	1095	/year	3
			*Children (9-13 years)	*644	*/year	*4	Not included in FS 2006		
	Inhalation-instantaneous release – spraying towards exposed person	Spray duration		*4.9	*s	*3	0.08	min	2
		Exposure duration		5	min	2	5	min	2
		Room volume		10	m^3	*4	10	m^3	3
		Room height		2.5	m	4	2.5	m	4
		Ventilation rate		2	h^{-1}	3	2	h^{-1}	3
		Cloud volume		0.0625	m^3	1	0.0625	m^3	1
		Mass generation rate		*0.1	*g/sec	*3	0.14	g/sec	2
		Airborne fraction		*0.02	*g/g	*3	0.2	g/g	2
		*Weight fraction non-volatile		*Not included in FS 2025			0.05	g/g	2
		Density non-volatile		1.5	g/cm^3	*2	1.5	g/cm^3	3
		Initial particle distribution Median (C.V.)		*2.7 (0.73)	*µm	*3	50 (0.6)	µm	1
		Inhalation cut-off diameter		15	µm	*3	15	µm	
	*Inhalation - uptake, fraction model	*Uptake fraction	*Adults (19+ years)	*Not included in FS 2025			1		2
		*Inhalation rate					23.1	l/min	3
	*Inhalation-exposure to spray-	*Exposure duration	*Adults (19+ years)	*9.8	*s	*1	Not included in FS 2006		

				Cosmetics Fact Sheet 2025			Cosmetics Fact Sheet 2006		
Scenario (Section FS 2025 - Section FS 2006)	Selected Exposure Model	Parameter	Age group	Default Value	Unit	Q-factor	Default Value	Unit	Q-Factor
	instantaneous release		*Children (9-13 years)						
		*Released mass	*Adults (19+ years)	*0.49	*g	*4			
			*Children (9-13 years)						
		*Room volume		*1	*m^3	*1			
		*Ventilation rate		*2	*h^{-1}	*1			
	Dermal-direct product contact-instant application	Exposed area	Adults (19+ years)	200	cm^2	2	200	cm^2	2
			*Children (9-13 years)				Not included in FS 2006		
		Amount upon skin	Adults (19+ years)	*0.49	*g	*4	0.61	g	2
			*Children (9-13 years)				Not included in FS 2006		
		*Retention factor		*0.85		*1	Not included in FS 2006		
	*Dermal - uptake, diffusion	*Exposure time	*Adults (19+ years)	*Not included in FS 2025			320	min	3
Shaving soap, cream and foam – face (15.1.1 - 3.9.1)	General	Frequency	Adults (19+ years)	*353	*/year	*1	365	/year	3
			*Children (9-13 years)	*456	*/year	*1	Not included in FS 2006		
		*Body weight male	*Adults (19+ years)	*Not included in FS 2025			74	kg	4
		Exposed area	Adults (19+ years)	*300	cm^2	3	305	cm^2	3

				Cosmetics Fact Sheet 2025			Cosmetics Fact Sheet 2006		
Scenario (Section FS 2025 - Section FS 2006)	Selected Exposure Model	Parameter	Age group	Default Value	Unit	Q-factor	Default Value	Unit	Q-Factor
	Dermal-direct product contact-instant application		*Children (9-13 years)	*263	*cm^2	*3	Not included in FS 2006		
		Product amount	Adults (19+ years)	*10.6	*g	*4	2	g	3
			*Children (9-13 years)	*10.7	*g	*2	Not included in FS 2006		
		*Retention factor		*0.01			Not included in FS 2006		
	*Dermal - uptake, diffusion	*Exposure time	*Adults (19+ years)	*Not included in FS 2025			5	min	2
*Shaving soap, cream and foam – body (15.1.2)	*General	*Frequency	*Adults (19+ years)	*104	*/year	*3	Not included in FS 2006		
			*Children (9-13 years)						
	*Dermal-direct product contact-instant application	*Exposed area	*Adults (19+ years)	*9100	*cm^2	*3			
			*Children (9-13 years)	*7000	*cm^2	*3			
		*Product amount	*Adults (19+ years)	*18.4	*g	*4			
			*Children (9-13 years)	*15.3	*g	*2			
		*Retention factor		*0.01		*1			
*Aftershave, spray – face (- 15.2.1)	*General	*Frequency	*Adults (19+ years)	*353	*/year	*4	Not included in FS 2006		
			*Children (9-13 years)	*456	*/year	*4			
		*Spray duration		*4.9	*s	*2			

				Cosmetics Fact Sheet 2025			Cosmetics Fact Sheet 2006		
Scenario (Section FS 2025 - Section FS 2006)	Selected Exposure Model	Parameter	Age group	Default Value	Unit	Q-factor	Default Value	Unit	Q-Factor
	*Inhalation-exposure to spray-spraying-spraying towards person	*Exposure duration		*5	*min	*2			
		*Room volume		*10	*m^3	*4			
		*Room height		*2.5	*m	*4			
		*Ventilation rate		*2	*h^{-1}	*3			
		*Cloud volume		*0.0625	*m^3	*1			
		*Mass generation rate		*0.1	*g/sec	*2			
		*Airborne fraction		*0.02	*g/g	*2			
		*Density non-volatile		*1.5	*g/cm^3	*1			
		*Initial particle distribution (c.v.)		*2.7 (0.73)	*µm	*2			
		*Inhalation cut-off diameter		*15	*µm	*3			
	*Inhalation-exposure to spray-instantaneous release	*Exposure duration	*Adults (19+ years)	*9.8	*s	*1			
			*Children (9-13 years)						
		*Released mass	*Adults (19+ years)	*0.49	*g	*2			
			*Children (9-13 years)	*0.5	*g	*2			
		*Room volume	*Adults (19+ years)	*1	*m^3	*1			
		*Ventilation rate	*Children (9-13 years)	*2	*h^{-1}	*1			

				Cosmetics Fact Sheet 2025			Cosmetics Fact Sheet 2006		
Scenario (Section FS 2025 - Section FS 2006)	Selected Exposure Model	Parameter	Age group	Default Value	Unit	Q-factor	Default Value	Unit	Q-Factor
	*Dermal-direct product contact-instant application	*Exposed area	*Adults (19+ years)	*300	*cm^2	*3			
			*Children (9-13 years)	*263	*cm^2	*3			
		*Product amount	*Adults (19+ years)	*0.49	*g	*2			
			*Children (9-13 years)	*0.5	*g	*2			
		*Retention factor		*0.85		*1			
After hair removal, lotion – face (15.2.2 - 3.9.2)	General	Frequency	Adults (19+ years)	*353	*/year	*4	365	/year	3
			*Children (9-13 years)	*456	*/year	*4	Not included in FS 2006		
		*Body weight male	*Adults (19+ years)	*Not included in FS 2025			74	kg	4
	*Inhalation-exposure to vapour-evaporation-constant release area	*Exposure duration	*Adults (19+ years)	*24	*h	*1	Not included in FS 2006		
			*Children (9-13 years)	*19	*h	*4			
		*Molecular weight matrix		*Pure					
		*Product amount	*Adults (19+ years)	*3.7	*g	*4			
			*Children (9-13 years)			*2			
		*Room volume		*20	*m^3	*3			
		*Ventilation rate		*0.6	*h^{-1}	*3			

				Cosmetics Fact Sheet 2025			Cosmetics Fact Sheet 2006		
Scenario (Section FS 2025 - Section FS 2006)	Selected Exposure Model	Parameter	Age group	Default Value	Unit	Q-factor	Default Value	Unit	Q-Factor
		*Application temperature		*32	*°C	*4			
		*Mass transfer coefficient		*10	*m/h	*2			
		*Release area	*Adults (19+ years)	*300	*cm^2	*3			
			*Children (9-13 years)	*263	*cm^2	*3			
		*Emission duration	*Adults (19+ years)	*24	*h	*1			
			*Children (9-13 years)	*19	*h	*4			
	Dermal-direct product contact-instant application	Exposed area	Adults (19+ years)	*300	cm^2	3	305	cm^2	3
			*Children (9-13 years)	*263	*cm^2	*3	Not included in FS 2006		
		Product amount	Adults (19+ years)	*3.7	*g	*4	*1.2	*g	3
			*Children (9-13 years)			*2	Not included in FS 2006		
	*Dermal - uptake, diffusion	*Exposure time	*Adults (19+ years)	*Not included in FS 2025			1440	min	2
*After hair removal, spray – body (~15.2.3)	*General	*Frequency	*Adults (19+ years)	*364	*/year	*3	Not included in FS 2006		
			*Children (9-13 years)						
	*Inhalation-exposure to spray-	*Spray duration	*Adults (19+ years)	*3.7	*s	*2			

				Cosmetics Fact Sheet 2025			Cosmetics Fact Sheet 2006		
Scenario (Section FS 2025 - Section FS 2006)	Selected Exposure Model	Parameter	Age group	Default Value	Unit	Q-factor	Default Value	Unit	Q-Factor
	spraying-spraying towards person		*Children (9-13 years)	*2.9	*s	*2			
		*Exposure duration		*5	*min	*2			
		*Room volume		*10	*m^3	*4			
		*Room height		*2.5	*m	*4			
		*Ventilation rate		*2	*h^{-1}	*3			
		*Cloud volume		*0.0625	*m^3	*2			
		*Mass generation rate		*1.2	*g/sec	*3			
		*Airborne fraction		*0.9	*g/g	*2			
		*Density non-volatile		*0.8	*g/cm^3	*2			
		*Initial particle distribution (c.v.)		*10.7 (3.4)	*µm	*2			
		*Inhalation cut-off diameter		*15	*µm	*3			
	*Inhalation-exposure to spray-instantaneous release	*Exposure duration	*Adults (19+ years)	*7.5	*s	*1			
			*Children (9-13 years)	*5.7	*s	*1			
		*Released mass	*Adults (19+ years)	*4.5	*g	*2			
			*Children (9-13 years)	*3.4	*g	*2			
		*Room volume	*Adults (19+ years)	*1	*m^3	*1			

				Cosmetics Fact Sheet 2025			Cosmetics Fact Sheet 2006		
Scenario (Section FS 2025 - Section FS 2006)	Selected Exposure Model	Parameter	Age group	Default Value	Unit	Q-factor	Default Value	Unit	Q-Factor
		*Ventilation rate	*Children (9-13 years)	*2	*h^{-1}	*1			
	*Dermal-direct product contact-instant application	*Exposed area	*Adults (19+ years)	*9100	*cm^2	*3			
			*Children (9-13 years)	*7000	*cm^2	*3			
		*Product amount	*Adults (19+ years)	*4.5	*g	*2			
			*Children (9-13 years)	*3.4	*g	*2			
		*Retention factor		*0.85		*1			
*After hair removal, spray, lotion – body (- 15.2.4)	*General	*Frequency	*Adults (19+ years)	*364	*/year	*3	Not included in FS 2006		
			*Children (9-13 years)						
	*Inhalation-exposure to vapour-evaporation-constant release area	*Exposure duration	*Adults (19+ years)	*24	*h	*3			
			*Children (9-13 years)						
		*Molecular weight matrix		*Pure					
		*Product amount	*Adults (19+ years)	*11.4	*g	*4			
			*Children (9-13 years)	*9.5	*g	*2			
		*Room volume		*20	*m^3	*3			
		*Ventilation rate		*0.6	*h^{-1}	*3			

				Cosmetics Fact Sheet 2025			Cosmetics Fact Sheet 2006		
Scenario (Section FS 2025 - Section FS 2006)	Selected Exposure Model	Parameter	Age group	Default Value	Unit	Q-factor	Default Value	Unit	Q-Factor
		*Application temperature		*32	*°C	*4			
		*Mass transfer coefficient		*10	*m/h	*2			
		*Release area	*Adults (19+ years)	*9100	*cm^2	*3			
			*Children (9-13 years)	*7000	*cm^2	*3			
		*Emission duration		*24	*h	*3			
	*Dermal-direct product contact-instant application	*Exposed area	*Adults (19+ years)	*9100	*cm^2	*3			
			*Children (9-13 years)	*7000	*cm^2	*3			
		*Product amount	*Adults (19+ years)	*11.4	*g	*4			
			*Children (9-13 years)	*9.5	*g	*2			
Hair removal cream/depilatory (15.3 - 3.12.1)	General	Frequency	Adults (19+ years)	*36	*/year	*3	17	/year	2
			*Children (9-13 years)				Not included in FS 2006		
		*Body weight female	*Adults (19+ years)	*Not included in FS 2025			61	kg	4
	Dermal-direct product contact-instant application	Exposed area	Adults (19+ years)	*5900	cm^2	3	5530	cm^2	3
			*Children (9-13 years)	*4210	*cm^2	*3	Not included in FS 2006		
		Product amount	Adults (19+ years)	*46.7	g	*4	5.5	g	2

				Cosmetics Fact Sheet 2025			Cosmetics Fact Sheet 2006		
Scenario (Section FS 2025 ~ Section FS 2006)	Selected Exposure Model	Parameter	Age group	Default Value	Unit	Q-factor	Default Value	Unit	Q-Factor
			*Children (9-13 years)	*39.3	*g	*2	Not included in FS 2006		
		*Retention factor		*0.1		*1	Not included in FS 2006		
	*Dermal - uptake, diffusion	*Exposure time	*Adults (19+ years)	*Not included in FS 2025			15	min	3
*Sun protection spray (~16.1.1)	*General	*Frequency	*Adults (19+ years)	*111	*/year	*4	Not included in FS 2006		
			*Infants (6-11 months)	*120	*/year	*4			
	*Inhalation-instantaneous release – spraying towards exposed person	*Spray duration	*Adults (19+ years)	*7	*s	*3			
			*Infants (6-11 months)	*3.2	*s	*3			
		*Exposure duration		*30	*min	*2			
		*Room volume		*20	*m^3	*3			
		*Room height		*2.5	*m	*4			
		*Ventilation rate		*0.6	*h^{-1}	*3			
		*Cloud volume		*0.0625	*m^3	*2			
		*Mass generation rate		*1.2	*g/sec	*3			
		*Airborne fraction		*0.9	*g/g	*2			
		*Density non-volatile		*0.8	*g/cm^3	*3			
		*Initial particle distribution (c.v.)		*10.7 (3.4)	*µm	*3			
		*Inhalation cut-off diameter		*15	*µm	*3			

				Cosmetics Fact Sheet 2025			Cosmetics Fact Sheet 2006		
Scenario (Section FS 2025 - Section FS 2006)	Selected Exposure Model	Parameter	Age group	Default Value	Unit	Q-factor	Default Value	Unit	Q-Factor
	*Inhalation-exposure to spray-instantaneous release	*Exposure duration	*Adults (19+ years)	*13.9	*s	*1			
			*Infants (6-11 months)	*6.3	*s	*1			
		*Released mass	*Adults (19+ years)	*8.4	*g	*4			
			*Infants (6-11 months)	*3.8	*g	*4			
		*Room volume		*1	*m^3	*1			
		*Ventilation rate		*0.6	*h^{-1}	*1			
	*Dermal-direct product contact-instant application	*Exposed area	*Adults (19+ years)	*17000	*cm^2	*3			
			*Infants (6-11 months)	*3350	*cm^2	*3			
		*Product amount	*Adults (19+ years)	*8.4	*g	*4			
			*Infants (6-11 months)	*3.8	*g	*4			
		*Retention factor		*0.85		*1			
Sun protection cream/milk/lotion (16.1.2 - 3.10)	General	Frequency	Adults (19+ years)	*113	*/year	*4	75	/year	3
			*Infants (6-11 months)	*120	*/year	*4	Not included in FS 2006		
	*Inhalation-exposure to vapour-evaporation-	*Exposure duration	*Adults (19+ years)	*30	*min	*2	Not included in FS 2006		
			*Infants (6-11 months)						

				Cosmetics Fact Sheet 2025			Cosmetics Fact Sheet 2006		
Scenario (Section FS 2025 - Section FS 2006)	Selected Exposure Model	Parameter	Age group	Default Value	Unit	Q-factor	Default Value	Unit	Q-Factor
	constant release area	*Molecular weight matrix		*Pure					
		*Product amount	*Adults (19+ years)	*34	*g	*4			
			*Infants (6-11 months)	*6.7	*g	*4			
		*Room volume		*20	*m^3	*3			
		*Ventilation rate		*0.6	*h^{-1}	*3			
		*Application temperature		*32	*°C	*4			
		*Mass transfer coefficient		*10	*m/h	*2			
		*Release area	*Adults (19+ years)	*17000	*cm^2	*3			
			*Infants (6-11 months)	*3350	*cm^2	*3			
		*Emission duration		*30	*min	*2			
	Dermal-direct product contact-instant application loading model	Exposed area	Adults (19+ years)	*17000	*cm^2	*3	17500	cm^2	4
			*Infants (6-11 months)	*3350	*cm^2	*3	Not included in FS 2006		
		Product amount	Adults (19+ years)	*34	*g	*4	10	g	3
			*Infants (6-11 months)	*6.7	*g	*4	Not included in FS 2006		
	*Dermal - uptake, diffusion	*Exposure time	*Adults (19+ years)	*Not included in FS 2025			150	min	2
	*General	*Frequency	*Adults (19+ years)	*111	*/year	*3	Not included in FS 2006		

				Cosmetics Fact Sheet 2025			Cosmetics Fact Sheet 2006		
Scenario (Section FS 2025 - Section FS 2006)	Selected Exposure Model	Parameter	Age group	Default Value	Unit	Q-factor	Default Value	Unit	Q-Factor
*After sun products, spray (- 16.2.1)			*Infants (6-11 months)	*120	*/year	*3			
	*Inhalation-instantaneous release – spraying towards exposed person	*Spray duration	*Adults (19+ years)	*7	*s	*2			
			*Infants (6-11 months)	*3.2	*s	*2			
		*Exposure duration		*5	*min	*2			
		*Room volume		*10	*m^3	*4			
		*Room height		*2.5	*m	*4			
		*Ventilation rate		*2	*h^{-1}	*3			
		*Cloud volume		*0.0625	*m^3	*2			
		*Mass generation rate		*1.2	*g/sec	*3			
		*Airborne fraction		*0.9	*g/g	*2			
		*Density non-volatile		*0.8	*g/cm^3	*2			
		*Initial particle distribution (c.v.)		*10.7 (3.4)	*µm	*2			
		*Inhalation cut-off diameter		*15	*µm	*3			
	*Inhalation-exposure to spray-instantaneous release	*Exposure duration	*Adults (19+ years)	*13.9	*s	*1			
			*Infants (6-11 months)	*6.3	*s	*1			
		*Released mass	*Adults (19+ years)	*8.4	*g	*2			

				Cosmetics Fact Sheet 2025			Cosmetics Fact Sheet 2006		
Scenario (Section FS 2025 - Section FS 2006)	Selected Exposure Model	Parameter	Age group	Default Value	Unit	Q-factor	Default Value	Unit	Q-Factor
			*Infants (6-11 months)	*3.8	*g	*2			
		*Room volume		*1	*m^3	*1			
		*Ventilation rate		*2	*h^{-1}	*1			
	*Dermal-direct product contact-instant application	*Exposed area	*Adults (19+ years)	*17000	*cm^2	*3			
			*Infants (6-11 months)	*3350	*cm^2	*3			
		*Product amount	*Adults (19+ years)	*8.4	*g	*2			
			*Infants (6-11 months)	*3.8	*g	*2			
		*Retention factor		*0.85					
*After sun products, lotion (- 16.2.2)	*General	*Frequency	*Adults (19+ years)	*113	*/year	*3	Not included in FS 2006		
			*Infants (6-11 months)	*120	*/year	*3			
	*Inhalation-exposure to vapour-evaporation-constant release area	*Exposure duration	*Adults (19+ years)	*17	*h	*4			
			*Infants (6-11 months)	*15	*h	*4			
		*Molecular weight matrix		*Pure					
		*Product amount	*Adults (19+ years)	*20.3	*g	*4			
			*Infants (6-11 months)	*7.8	*g	*4			

				Cosmetics Fact Sheet 2025			Cosmetics Fact Sheet 2006		
Scenario (Section FS 2025 - Section FS 2006)	Selected Exposure Model	Parameter	Age group	Default Value	Unit	Q-factor	Default Value	Unit	Q-Factor
		*Room volume		*20	*m^3	*3			
		*Ventilation rate		*0.6	*h^{-1}	*3			
		*Application temperature		*32	*°C	*4			
		*Mass transfer coefficient		*10	*m/h	*2			
		*Release area	*Adults (19+ years)	*17000	*cm^2	*3			
			*Infants (6-11 months)	*3350	*cm^2	*3			
		*Emission duration	*Adults (19+ years)	*17	*h	*4			
			*Infants (6-11 months)	*15	*h	*4			
	*Dermal-direct product contact-instant application	*Exposed area	*Adults (19+ years)	*17000	*cm^2	*3			
			*Infants (6-11 months)	*3350	*cm^2	*3			
		*Product amount	*Adults (19+ years)	*20.3	*g	*4			
			*Infants (6-11 months)	*7.8	*g	*4			
Baby care products, baby powder (17.1 - 3.11)	General	Frequency	*Adults (19+ years)	*365	*/year	*1	Not included in FS 2006		
			Infants (0-5 months)	*835	*/year	*3	730	/year	2
		Exposed area	*Adults (19+ years)	*3400	*cm^2	*3	Not included in FS 2006		

				Cosmetics Fact Sheet 2025			Cosmetics Fact Sheet 2006		
Scenario (Section FS 2025 - Section FS 2006)	Selected Exposure Model	Parameter	Age group	Default Value	Unit	Q-factor	Default Value	Unit	Q-Factor
	Dermal-direct product contact-instant application		Infants (0-5 months)	*238	*cm^2	*3	190	cm^2	2
		*Product amount	*Adults (19+ years)	*1.9	*g	*3	Not included in FS 2006		
			Infants (0-5 months)	0.8	g	*3	0.8	g	2
	*Dermal - uptake, diffusion	*Exposure time	*Child (4.5 months)	*Not included in FS 2025			720	min	2
Baby care products, diaper cream (17.2 - 3.11)	General	Frequency	Infants (0-5 months)	*975	*/year	*4	730	/year	2
		*Body weight child	*Child (4.5 months)	*Not included in FS 2025			6.21	kg	4
	*Inhalation-exposure to vapour-evaporation-constant release area	*Exposure duration	*Infants (0-5 months)	*9	*h	*4	Not included in FS 2006		
		*Product amount		*12.2	*g	*4			
		*Room volume		*20	*m^3	*3			
		*Ventilation rate		*0.6	*h^{-1}	*3			
		*Application temperature		*32	*°C	*4			
		*Mass transfer coefficient		*10	*m/h	*2			
		*Release area		*238	*cm^2	*3			
		*Emission duration		*9	*h	*4			
	Dermal-direct product contact-instant application	Exposed area	Infants (0-5 months)	*238	*cm^2	*3	190	cm^2	2
		Product amount		*12.2	*g	*4	0.27	g	2
	*Dermal - uptake, diffusion	*Exposure time	*Child (4.5 months)	*Not included in FS 2025			720	min	2

				Cosmetics Fact Sheet 2025			Cosmetics Fact Sheet 2006		
Scenario (Section FS 2025 - Section FS 2006)	Selected Exposure Model	Parameter	Age group	Default Value	Unit	Q-factor	Default Value	Unit	Q-Factor
Baby care products, baby oil (17.3 - 3.11)	General	*Frequency	*Adults (19+ years)	*132	*/year	*3	Not included in FS 2006		
			Infants (0-5 months)	*689	*/year	*4	730	/year	2
		*Body weight child	*Child (4.5 months)	*Not included in FS 2025			6.21	kg	4
	*Inhalation-exposure to vapour-evaporation-constant release area	*Exposure duration	*Adults (19+ years)	*24	*h	*1	Not included in FS 2006		
			*Infants (0-5 months)	*13	*h	*4			
		*Molecular weight matrix		*Pure					
		*Product amount	*Adults (19+ years)	*5	*g	*3			
			*Infants (0-5 months)	*1.3	*g	*3			
		*Room volume		*20	*m^3	*3			
		*Ventilation rate		*0.6	*h^{-1}	*3			
		*Application temperature		*32	*°C	*4			
		*Mass transfer coefficient		*10	*m/h	*2			
		*Release area	*Adults (19+ years)	*17000	*cm^2	*3			
			*Infants (0-5 months)	*2780	*cm^2	*3			
		*Emission duration	*Adults (19+ years)	*24	*h	*1			

				Cosmetics Fact Sheet 2025			Cosmetics Fact Sheet 2006		
Scenario (Section FS 2025 - Section FS 2006)	Selected Exposure Model	Parameter	Age group	Default Value	Unit	Q-factor	Default Value	Unit	Q-Factor
			*Infants (0-5 months)	*13	*h	*4			
	Dermal-direct product contact-instant application	*Exposed a*rea	*Adults (19+ years)	*17000	*cm^2	*3	Not included in FS 2006		
			Infants (0-5 months)	*2780	*cm^2	*3	190	cm^2	2
		*Product amount	*Adults (19+ years)	*5	*g	*3	Not included in FS 2006		
			Infants (0-5 months)	1.3	g	*3	1.3	g	2
	*Dermal - uptake, diffusion	*Exposure time	*Child (4.5 months)	*Not included in FS 2025			720	min	2
*Baby care products, baby cleanser (~17.4)	*General	*Frequency	*Infants (0-5 months)	*356	*/year	*4	Not included in FS 2006		
	*Dermal-direct product contact-instant application	*Exposed area		*3090	*cm^2	3			
		*Product amount		*8.8	*g	4			
		*Retention factor		*0.01					
*Wipes, baby wipes (~18.1)	*General	*Frequency	*Infants (0-5 months)	*5808	*/year	*4	Not included in FS 2006		
	*Dermal-direct product contact-instant application	*Exposed area		*728	*cm^2	3			
		*Product amount		*0.77	*g	4			
*Wipes, facial cleansing/make-up removal wipes (~18.2)	*General	*Frequency	*Adults (19+ years)	*376	*/year	*4	Not included in FS 2006		
			*Children (14-18 years)						
		*Exposed area	*Adults (19+ years)	*600	*cm^2	3			

				Cosmetics Fact Sheet 2025			Cosmetics Fact Sheet 2006		
Scenario (Section FS 2025 - Section FS 2006)	Selected Exposure Model	Parameter	Age group	Default Value	Unit	Q-factor	Default Value	Unit	Q-Factor
	*Dermal-direct product contact-instant application		*Children (14-18 years)	*520	*cm^2	3			
		*Product amount	*Adults (19+ years)	*3.4	*g	4			
			*Children (14-18 years)						
*Wipes, hand cleansing wipes (- 18.3)	*General	*Frequency	*Adults (19+ years)	*473	*/year	*4	Not included in FS 2006		
			*Children (14-18 years)						
	*Dermal-direct product contact-instant application	*Exposed area	*Adults (19+ years)	*900	*cm^2	3			
			*Children (14-18 years)	*750	*cm^2	3			
		*Product amount	*Adults (19+ years)	*1.2	*g	4			
			*Children (14-18 years)						
*Wipes, intimate hygiene wipes (- 18.4)	*General	*Frequency	*Adults (19+ years)	*463	*/year	*4	Not included in FS 2006		
			*Children (14-18 years)						
	*Dermal-direct product contact-instant application	*Exposed area	*Adults (19+ years)	*637	*cm^2	3			
			*Children (14-18 years)	*588	*cm^2	3			
		*Product amount	*Adults (19+ years)	*0.75	*g	4			

				Cosmetics Fact Sheet 2025			Cosmetics Fact Sheet 2006		
Scenario (Section FS 2025 - Section FS 2006)	Selected Exposure Model	Parameter	Age group	Default Value	Unit	Q-factor	Default Value	Unit	Q-Factor
			*Children (14-18 years)						
*Massage oil (- 19.1)	*General	*Frequency	*Adults (19+ years)	*62	*/year	*4	Not included in FS 2006		
			*Infants (0-5 months)	*70	*/year	*4			
	*Inhalation-exposure to vapour-evaporation-increasing release area model	*Exposure duration	*Adults (19+ years)	*8.5	*h				
			*Infants (0-5 months)	*8.25	*h				
		*Molecular weight matrix		*Pure					
		*Product amount	*Adults (19+ years)	*5.7	*g	*4			
			*Infants (0-5 months)	*3.4	*g	*4			
		*Room volume		*16	*m^3	*4			
		*Ventilation rate		*0.6	*h^{-1}	*3			
		*Application temperature		*32	*°C	*4			
		*Mass transfer coefficient		*10	*m/h	*2			
		*Release area	*Adults (19+ years)	*14300	*cm^2	*3			
			*Infants (0-5 months)	*3090	*cm^2	*3			
		*Emission duration	*Adults (19+ years)	*8.5	*hours	*2			

				Cosmetics Fact Sheet 2025			Cosmetics Fact Sheet 2006		
Scenario (Section FS 2025 - Section FS 2006)	Selected Exposure Model	Parameter	Age group	Default Value	Unit	Q-factor	Default Value	Unit	Q-Factor
			*Infants (0-5 months)	*8.25	*hours	*2			
	*Dermal-direct product contact-instant application	*Exposed area	*Adults (19+ years)	*14300	*cm^2	*3			
			*Infants (0-5 months)	*3090	*cm^2	*3			
		*Product amount	*Adults (19+ years)	*5.7	*g	*4			
			*Infants (0-5 months)	*3.4	*g	*4			
*Essential oils, massage (19.2 - 3.12.2)	*General	*Frequency		*See massage oil scenario for FS 2025			24	/year	2
	*Dermal-direct product contact-instant application	*Exposed area					16340	cm^2	4
		*Product amount					8	g	3
	*Dermal - uptake, diffusion	*Exposure time					30	min	2
*Essential oils, bath (19.3 - 3.12.2)	*General	*Frequency		*See bath oil scenario for FS 2025			52	/year	3
	*Dermal-direct product contact-instant application	*Exposed area					16340	cm^2	4
		*Amount upon skin-dilution					16340	g	1
	*Dermal - uptake, diffusion	*Exposure time					20	min	3
*Essential oils, air freshener (- 3.12.2)	*General	*Frequency		*Not included in FS 2025			168	/year	2
	*Inhalation-exposure to	*Exposure duration					240	min	2
		*Product amount					1.08	g	3
		*Room volume					58	m^3	4

				Cosmetics Fact Sheet 2025			Cosmetics Fact Sheet 2006		
Scenario (Section FS 2025 - Section FS 2006)	Selected Exposure Model	Parameter	Age group	Default Value	Unit	Q-factor	Default Value	Unit	Q-Factor
	vapour – evaporation	*Ventilation rate					0.5	h^{-1}	3
		*Emission duration					180	min	1
	*Uptake-fraction model	*Uptake fraction					1		2
		*Inhalation rate					23.1	l/min	3
Face paint (19.3 - 3.12.3)	General	Frequency	Adults (19+ years)	6	/year	*3	6	/year	2
			*Children (2-3 years) / Child (4.5 years)	12	/year	*3	12	/year	2
		*Body weight child	*Child (4.5 years)	*Not included in FS 2025			16.3	kg	4
	*Inhalation-exposure to vapour-evaporation-constant release area	*Exposure duration	*Adults (19+ years)	*16	*h	*4	Not included in FS 2006		
			*Children (2-3 years)						
		*Product amount	*Adults (19+ years)	*1.8	*g	*2			
			*Children (2-3 years)	*1.1	*g	*2			
		*Room volume		*20	$*m^3$	*3			
		*Ventilation rate		*0.6	$*h^{-1}$	*3			
		*Application temperature		*32	*°C	*4			
		*Mass transfer coefficient		*10	*m/h	*2			
		*Release area	*Adults (19+ years)	*600	$*cm^2$	*3			

				Cosmetics Fact Sheet 2025			Cosmetics Fact Sheet 2006		
Scenario (Section FS 2025 - Section FS 2006)	Selected Exposure Model	Parameter	Age group	Default Value	Unit	Q-factor	Default Value	Unit	Q-Factor
			*Children (2-3 years)	*350	*cm^2	*3			
		*Emission duration	*Adults (19+ years)	*16	*h	*4			
			*Children (2-3 years)						
	Dermal-direct product contact-instant application	Exposed area	Adults (19+ years)	*600	*cm^2	3	580	cm^2	3
			*Children (2-3 years) / Child (4.5 years)	*350	*cm^2	3	475	cm^2	3
		Product amount	Adults (19+ years)	*1.8	*g	2	1.7	g	2
			*Children (2-3 years) / Child (4.5 years)	*1.1	*g	2	1.4	g	2
	*Dermal - uptake, diffusion	*Exposure time	*Adults (19+ years)	*Not included in FS 2025			480	min	2
			*Child (4.5 years)						
*Douche (~19.4)	*General	*Frequency	*Adults (19+ years)	*71	*/year	*3	Not included in FS 2006		
			*Children (14-18 years)						
	*Dermal-direct product contact-instant application	*Exposed area	*Adults (19+ years)	*637	*cm^2	*3			
			*Children (14-18 years)	*588	*cm^2	*3			

				Cosmetics Fact Sheet 2025			Cosmetics Fact Sheet 2006		
Scenario (Section FS 2025 - Section FS 2006)	Selected Exposure Model	Parameter	Age group	Default Value	Unit	Q-factor	Default Value	Unit	Q-Factor
		*Product amount	*Adults (19+ years)	*133	*g	*2			
			*Children (14-18 years)						
		*Retention factor		*0.1		*1			

Appendix III Anthropomorphic parameters

The default age groups and body weights in Table AIII.1, surface areas in Table AIII.2, and inhalation rates in Table AIII.3 were derived from the General Fact Sheet (Te Biesebeek et al., 2014*)*. However, for the product exposure scenarios in this document, only adults and the age group that is expected to have the highest exposure are described.

Table AIII.1 Default body weights for all age groups (Te Biesebeek et al., 2014).

Age group	Body Weight (kg)
0-6 months	6.1
6-11 months	8.0
1-<2 years	9.8
2-3 years	12.4
4-8 years	24.3
9-13 years	44.8
14-18 years	59.3
19+ years	68.8

Table AIII.2 Default surface areas for all age groups (Te Biesebeek et al., 2014).

Age group	Body Surface Area (cm^2)						
	Total	Head	Trunk	Arms	Hands	Legs	Feet
0-6 months	3400	620	1210	470	180	700	220
6-11 months	4100	750	1460	560	220	8400	270
1-<2 years	4700	780	1670	610	270	1090	300
2-3 years	5700	700	2120	820	270	1440	360
4-8 years	9300	940	3430	1300	460	2560	620
9-13 years	14000	1050	5170	1980	640	4210	950
14-18 years	16800	1040	6480	2460	750	5010	1080
19+ years	18200	1200	6600	2600	900	5900	1200

Table AIII.3 Default inhalation rates for all age groups (Te Biesebeek et al., 2014).

Age group	Inhalation rate (m^3/hour)			
	Sleep	Rest	Light Exercise	Heavy exercise
0-6 months	0.09	0.12	0.31	1.03
6-11 months	0.11	0.15	0.36	1.16
1-<2 years	0.13	0.17	0.42	1.27
2-3 years	0.15	0.19	0.49	1.42
4-8 years	0.22	0.29	0.76	1.92
9-13 years	0.32	0.42	1.13	2.53
14-18 years	0.38	0.5	1.36	2.87
19+ years	0.42	0.55	1.49	3.07

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Published by

National Institute for Public Health and the Environment, RIVM
P.O. Box 1 | 3720 BA Bilthoven
The Netherlands
www.rivm.nl/en

October 2025

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[016379]